SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

Proceedings of the International Conference

Date: April 10

Beijing, China 2024

上合组织国家的科学研究：协同和一体化
国际会议

参与者的英文报告

International Conference
"Scientific research of the SCO countries: synergy and integration"

Part 5

2024 年 4 月 10 日。中国北京
April 10, 2024. Beijing, PRC

Proceedings of the International Conference
"Scientific research of the SCO countries: synergy and integration" - Reports in English

(April 10, 2024. Beijing, PRC)

这些会议文集结合了会议的材料 – 研究论文和科学工作者的论文报告。 它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

作者对所引用的出版物，事实，数字，引用，统计数据，专有名称和其他信息的准确性负责

These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examine technical, juridical and sociological aspects of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

Authors are responsible for the accuracy of cited publications, facts, figures, quotations, statistics, proper names and other information.

CONTENTS

MEDICAL SCIENCES

TECHNICAL SCIENCES

PHYSICAL AND MATHEMATICAL SCIENCES

ARCHITECTURE

再工业化：通过创新实现工业现代化的道路
REINDUSTRIALISATION: THE PATH TO INDUSTRIAL MODERNISATION THROUGH INNOVATION

Barunova Anastasia Aleksandrovna
Collaborator
Institutional Analysis Laboratory, Southern Federal University

Demakhina Olesia Vladimirovna
Collaborator
Institutional Analysis Laboratory, Southern Federal University

注解。 本文探讨了俄罗斯再工业化的话题，并建议借鉴中国的成功经验来解决这个问题。 中华人民共和国是有效再工业化和实施社会主义现代化进程的生动例子，使该国成为世界领先的工业强国之一。 本文分析了中国模式成功的原因以及该机制的哪些要素在创新方面最有效。

关键词：再工业化、创新发展、社会主义现代化、工业、国家创新体系、维勃伦二分法、制度经济学。

Annotation. This article considers the topic of reindustrialisation in Russia and suggests turning to the successful experience of China to solve it. The People's Republic of China is a vivid example of effective reindustrialisation and implementation of the process of socialist modernisation, which allows the country to become one of the leading industrial powers in the world. The paper analyses the reasons for the success of the Chinese model and what elements of this mechanism work most effectively on the innovation side.

Keywords: reindustrialization, innovative development, socialist modernization, industry, national innovation system, Veblenian dichotomy, institutional economics.

In Russian economics, attention to the new industrialization began to grow at the beginning of the tenth years of the XXI century, which was due to objective economic processes, as well as the ongoing state economic policy. On the global agenda, the economies of developed countries are characterized by deindustrialization processes (Benanav, 2022). In Russia in recent decades, this process has also been accompanied by radical changes in the structure of the economy.

Although deindustrialization is an objective economic trend, it affects the fundamental principle of modern economic development – mechanisms of increasing

returns (Volchik, 2022). Moreover, industrial production itself has undergone significant changes and has increasingly used digital and information technologies, which, in particular, strongly affect productivity and working conditions in the industrial sector of the economy. The negative effects of deindustrialization have caused processes that have been called "new industrialization" in the scientific literature.

New industrialization is considered in the scientific literature along with industrialization, deindustrialization and reindustrialization (Razvadovskaya, 2020), and in some studies it is identified with reindustrialization (Yudina, 2015). It is associated with changing technologies and strategic innovations, as well as the evolution of institutions. The asynchrony of changes creates contradictions and conflicts, most clearly expressed in the concept of Veblen's dichotomy, which, in turn, prompts attention to the nature of the institutional adaptation of society to these various changes, including technological ones.

The modernization of the Russian economy remains relevant in modern conditions. Russia's industrial policy, in addition to other mechanisms, should also primarily contribute to the process of reindustrialization, and the creation of new "good jobs" with high wages and requiring skilled labor. In this context, it is necessary to refer to the experience of the People's Republic of China, a developing country currently implementing the general strategic plan approved by the 20th National Congress of the Communist Party of China, according to which it is envisaged to "mainly implement socialist modernization" in the period from 2020 to 2035. The concept of "socialist modernization" is the correlation of universal modernization patterns with unique Chinese characteristics, including factors of Marxist theory and the heritage of Chinese culture. The prioritization of development directions here is based on the need to redouble efforts in self-reliance, produce their own innovations and improve the situation with social justice (The Institute of China and modern Asia of the Russian Academy of Sciences (Eds.), 2023).

Considering innovation, it is worth mentioning the government's program of growing "small giants" in the field of high technology: micro, small and medium-sized enterprises in China create over 60% of GDP, 90% of domestic and about 50% of foreign trade, 75% of technical innovations and more than 80% of the annual output of new products (The Institute of China and modern Asia of the Russian Academy of Sciences (Eds.), 2023). This potential is highly justified by one of Deng Xiaoping's slogans "Let some people get rich first", said during his southern tour in 1992 – people strive to be innovative and entrepreneurial, regularly offer new products in the domestic market. Moreover, due to the openness of Chinese customers to testing new domestic brands, as well as their willingness to join joint development, inexperienced manufacturers can test and adapt their

products to the changing needs of consumers with less cost and risk. The existing institutional determinants play a huge role here. For example, the state is constantly searching for new sources of economic growth in the face of rising wages, increasing youth unemployment and a decrease in the working-age population. The "14th five-year plan for the development of small and medium-sized enterprises" for 2021-2025 assumes prioritization of increasing innovation activity, improving environmental indicators, strengthening social stability through better management of the urbanization process and poverty reduction, the achievement of which obviously leads to stabilization of the growth in the number and quality of small and medium-sized enterprises, in particular creation of new high-tech innovative enterprises. This effect is also demonstrated by the already well-known results of digitalization - the emergence of new digital technologies such as big data, artificial intelligence (AI) and blockchain, business-oriented Internet applications, 5G generation communication networks - which have expanded opportunities for the development of innovative entrepreneurship of small and medium-sized enterprises in various sectors of industry and services, new types of business (Pikover, 2023). Large-scale production, in turn, having been developed even before the adoption of reforms to activate the activities of private entrepreneurship, is now also supported by the Communist Party of China through various benefits, bank loans. Currently, the greatest returns are observed from the production of our own semiconductors and microcircuits.

The Striver deep-sea exploration mission, an international manned deep-sea exploration mission in Oceania, has been successfully completed. This achievement demonstrates China's advanced deep-sea exploration capabilities and represents a new landmark in the development of China's deep-sea technology and ocean exploration capabilities. The underwater world holds many unexplored and mysterious mysteries, and its exploration is becoming more feasible and productive every year. Maybe experts from China will be able to determine whether it is possible to create conditions for human life underwater (China's Striver manned deep-sea research mission, 2024).

Another example of innovative achievement is the first commercial flight of the C919 large airliner. This goal was accomplished through comprehensive strategic cooperation in the development of a domestically developed large aircraft model, which is a significant achievement for China's domestically developed airliner. These industrial advancements have created new opportunities in the field of civil aviation (C919 – Together we are witnessing the growth of domestic large aircraft production, 2024).

The field of space exploration is an area of rapid development that deserves attention. At present, Chinese space stations are busy building and developing applications for space exploration. In addition, scientists are conducting research

on the solar system. The launch of the Kuafu-1 satellite, designed to observe solar flares and the Sun's magnetic field, will provide mankind with more knowledge about solar activity and space weather. During the study, a large number of observations plans of various types were submitted and a significant amount of raw data - about 120 TB - was processed (China's Kuafu-1 solar probe launched for scientific observation, 2023).

When considering ways to improve the population's quality of life, it may be worth noting the recent developments in transport infrastructure. One such example is the Ruoqiang-Hetian Railway, which has been successfully constructed and is now in operation. This railway is a crucial element of the regional road network, as outlined in the national medium- and long-term railway network plan, and it offers a convenient transportation route. The railway can be considered both an impressive engineering achievement and a valuable contributor to the development of the regional economy (Ruoqiang-Hotan Railway in Xinjiang, China, n.d.).

As a final example, it is worth mentioning the field of computer technology and quantum computing. The quantum Chinese satellite 'Mozi' is used for the most secure form of data transmission and is also utilized in joint cooperation with the Russian Federation. China has made significant achievements in quantum communication, which demonstrates its leading position in the global field of quantum science (Russia and China successfully test quantum communication via satellite, 2024).

Thus, the examples illustrated above demonstrate the innovative achievements of the PRC and support the thesis that the CII is a leader in producing innovations in various industrial fields, such as semiconductor and electronic components and chips, energy vehicle and parts development, intelligent manufacturing, biomedicine, new infrastructure, unmanned driving, commercial aerospace, and other areas. It is worth mentioning that the successes mentioned above are just a small part of the achievements within China's ever-changing innovation system.

The People's Republic of China is recognised for its diligent work ethic, strong social cohesion, reverence for tradition, and dedication to economic prosperity. The country has established favourable conditions for innovation, such as the construction of large-scale laboratories, allocation of grants to support scientists, and the development of educational and scientific programmes. Furthermore, special taxation policies have been implemented to encourage innovation. China's experience in analysing the innovation and industrial sector of the Russian Federation can serve as a valuable example.

It is worth noting that Russia's level of innovation development is considered average, including in the industrial sector. While the country has taken steps to increase innovation levels, it appears that these measures have not yet had a significant impact on the system as a whole. Therefore, it may be beneficial to

consider knowledge of innovation policies and achievements in other countries, as this could potentially contribute to the creation of a more effective mechanism.

With regards to the labour market, it is important to acknowledge the growing trend of 'fast and non-trivial education' among the population. This type of education is obtained through online courses and seminars, where learners can acquire practical skills in various fields in a short period of time. The training usually lasts no more than a year and sometimes only a few months. This approach to education has gained popularity due to its efficiency and practicality, which can be beneficial for both individuals and employers. The current format of classes may not be conducive to live communication or personalized attention. Learners are provided with general streaming video materials, which may not cater to their individual preferences in the educational process. It has been observed that advertising websites tend to be quite noisy, with many 'loud' headlines promising a successful professional future after completing marathons. It is important to acknowledge that even the largest and most prominent universities in Russia cannot guarantee their students employment. While basic courses may provide a foundation of knowledge, they may not necessarily lead to job prospects, which can create misunderstandings (Volchik, V. V., Maslyukova, E. V., Demakhina, O. V. & Barunova, A. A., 2023).

Therefore, the increasing gap between skilled workers and superficially educated labour force is a characteristic feature of today's labour market. However, by focusing on fundamental education, developing practical skills and acquiring relevant experience, an individual can improve his or her chances of success in the labour market. Consequently, an important task for the state should be to pay special attention to educational and scientific institutions, because they are the driving force of innovation. By creating quality conditions, investing in these spheres and creating effective mechanisms, we will be able to confidently and diplomatically promote the innovative development of the country.

The Russian Federation faces challenges in science and the current political situation, which leads to lagging behind leading countries in terms of innovative products, but this trend is not irreversible. By solving these problems, Russia can increase the level of innovation activity and become a more competitive player in the global market.

However, while Russia faces such challenges, in this study we will analyse the import structure of the Russian Federation. The country buys a significant amount of nuclear reactors, equipment, electrical machinery, means of land transport, pharmaceutical products, plastics, optical and measuring instruments and other goods (Annual Statistics of International Trade in Goods, n.d.). These statistics confirm the underdevelopment of the industrial sector and the need for a policy of reindustrialisation. A policy of reindustrialisation would allow the country to

produce these goods on its own and be less dependent on resource exports, which would be good for the country's economy in the long run.

Clustering can serve as a confirmation of the above, which will reflect the average level of technological development in the context of modernization across the regions of the Russian Federation. As indicators revealing the production process, including innovations, the "Labor Productivity Index for the Russian Federation, for the subjects of the Russian Federation in 2008-2022" was taken. (in % of the previous year) (LPI)" and "The level of innovative activity of organizations (in %) (LIA)". The statistical data used are taken from the database published by the Federal Service of the Russian State Statistics, all these analyses and computational operations are performed in the software package for statistical analysis Statistica. The cluster analysis was carried out on the basis of pre-standardized data. The analysis will be carried out on the basis of data for 2021 due to the lack of information on subjects in 2022. 81 subjects of the Russian Federation, available in the sources, the Russian Federation was admitted to the subsequent study.

Based on the constructed graph of average values to characterize each of the formed clusters, the conclusions presented below are drawn.
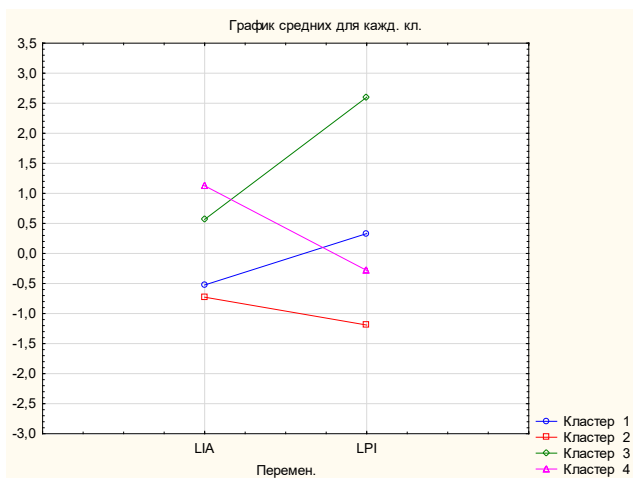
Figure 1. *A graph of the average values for each cluster according to the indicators of 2021 (standardized data)*

The first, and largest, cluster includes 36 observations, representing the city of Sevastopol, the subjects of the Far Eastern Federal District (excluding the Sakhalin region, Chukotka Autonomous Okrug and the Republic of Sakha (Yakutia)), the Northwestern Federal District (except for the Republic of Karelia), 5 subjects

from the Siberian Federal District, all regions of the North Caucasus (except the Republics of Dagestan and Chechnya), 5 regions from the Central Federal District, three regions from the Southern Federal District, as well as the Kirov region (from the Volga Federal District) and the Tyumen region (from the Ural Federal District). This cluster has an average position, with an average level of labor productivity, which is above the average level of innovation activity. Innovation in this cluster is progressing at a relatively slow rate. It can be assumed that this is due to an undeveloped institutional framework that does not adequately regulate innovation activities.

The second cluster includes 15 observations. These include 3 subjects from the Southern, Siberian, and Volga regions, the Republic of Karelia in the Northwestern Autonomous Region, the Tambov Region in the Central Federal District, and two subjects from the Far Eastern and North Caucasus Federal Districts. This cluster is characterized by a lower position. The average level of labor productivity is very low, but the level of innovative activity is closer to the position of the first cluster. There is a trend in this cluster that is opposite to that in cluster 1 - lower labor productivity leads to greater innovation activity. This could be due to a higher demand for innovation and its more affordable implementation.

The third cluster consists of 5 observations: Moscow, St. Petersburg, the Republic of Sakha (Yakutia) in the Far Eastern Federal District, and the Moscow and Vladimir regions in the Central Federal District. Based on the clustering, these regions are characterized by a high level of technological development compared to the other three clusters. It is worth noting that the average levels of some indicators are high. For example, the level of labor productivity is very high, while the level of innovation activity is slightly below that of cluster 4. In general, despite the high average level of labor productivity and industrial development, the production of new technologies remains average. This may be due to insufficient demand for innovations and the incorrectness of existing institutional factors.

The fourth cluster consists of 25 observations, including all subjects of the Volga Federal District except for the Kirov, Orenburg, and Saratov regions, as well as the Republic of Mari El. It also includes 9 subjects from the Central Federal District, the Rostov region from the Southern Federal District, and the Altai Territory and Tomsk region of the Siberian Federal District. All subjects of the Ural Federal District are included except the Tyumen region. This cluster has an average level of technological development characterized by the highest average level of innovation activity compared to other clusters, but a lower average labor productivity index compared to cluster 1. The trend of technological development in this cluster is similar to that of cluster 2. It can be assumed that a mechanism for increasing returns has been initiated, as the products produced provide a higher level of knowledge-based production.

Before concluding remarks, it is worth noting that through the consideration of China's success story, its innovative development, the latest scientific and technological achievements to characterise the ongoing socialist modernisation. Thus, by analysing the level of industry in Russian regions and determining China's position in the field of innovation, the thesis of the need for Russian researchers to consider the Chinese experience is confirmed.

References

1. Annual Statistics of International Trade in Goods. - URL: https://trendeconomy.ru/data/h2/Russia?time_period=2021, 2020,2019,2018,2017,2016 ,2015,2014,2013,2012,2011,2010

2. Benanav, A. (2022). Automation and the future of work. M.: Publishing House of the Gaidar Institute.

3. C919 - Together we are witnessing the growth of domestic large aircraft production. (2024). - URL: https://baijiahao.baidu.com/s?id=178969356413819 0900&wfr=spider&for=pc

4. China's Kuafu-1 solar probe launched for scientific observation. (2023). - URL: https://english.cas.cn/newsroom/cas_media/202310/t20231010_378652. shtml

5. China's Striver manned deep-sea research mission. (2024). - URL: https://export.shobserver.com/baijiahao/html/732091.html

6. Pikover, A.V. (2023). The leading trends in the informatization of China. In I. A. Maksimtseva (Ed.), X International Forum "Eurasian Economic Perspective": Collection of materials on December 1-2, 2022 (pp. 97-101). St. Petersburg: St. Petersburg State University Publishing House.

7. Razvadovskaya, U.V. (2020). New industrialization: phases, dominants and patterns. Bulletin of Tomsk State University. Economics (52): 291–307.

8. Ruoqiang-Hotan Railway in Xinjiang, China. - URL: https://baike.baidu. com/item/若和铁路/59245952?fr=ge_ala

9. Russia and China successfully test quantum communication via satellite. (2024). - URL: https://www.tomshardware.com/tech-industry/quantum-computing/russia-and-china-successfully-test-quantum-communication-over-satellite-encrypted-communication-for-brics-countries

10.The Institute of China and modern Asia of the Russian Academy of Sciences (Eds.). (2023). The People's Republic of China: politics, economics, culture: a monograph. Moscow: ICA RAS.

11.Volchik, V. V., Maslyukova, E. V., Demakhina, O. V., Barunova, A. A. (2023). Technological and institutional change in the context of Veblen's dichotomy. Journal of Economic Regulation, 14(1), 86-99. Doi: 10.17835/2078-5429.2023.14.1.034-048

12.Volchik, V.V. (2022). Increasing returns and the Russian innovation system. Science Management: Theory and Practice 4(4): 88–116.

13.Yudina, T.N. (2015). Deindustrialization and new industrialization (reindustrialization): Russia and China. Theoretical Economics (1): 76–78.

从古代习俗到现代科技: 文化对中国经济发展的影响
FROM ANCIENT CUSTOMS TO MODERN TECHNOLOGY: THE INFLUENCE OF CULTURE ON CHINA'S ECONOMIC DEVELOPMENT

Demakhina Olesia Vladimirovna
Collaborator
Laboratory of Institutional Analysis, Southern Federal University

Li Xiangyu
Student
Southern Federal University

注释。在中国的经济发展问题上，文化的意义何在--这个问题是本研究的重点。本文从回溯的角度进行分析：既考虑了儒家思想和道家思想对古代科学技术的影响，为科技进步提供了精神支持，又考虑了现代社会的特点。文章还指出，创新精神、集体主义价值观和对其他文化的开放性一直是并将继续是促进经济发展和国际合作的文化特征。通过分析中国人对工作、教育和宗教的态度，该研究表明了文化在塑造中华人民共和国和任何其他国家的生产力和经济命运方面的重要作用。

关键词: 文化、社会价值观、经济发展、中国经济、民族和历史特点、创新精神、回顾性分析

Annotation. *What is the significance of culture in the issue of economic development in China - this question is the focus of this study. The paper analyses retrospectively: it considers both the influence of Confucianism and Taoism, which promoted science and technology and provided spiritual support for scientific and technological progress in ancient times, and the characteristics of modern society. The article also notes that the spirit of innovation, collectivist values and openness to other cultures have been and continue to be cultural traits that promote economic development and international co-operation. By analysing the attitudes of the Chinese population towards work, education and religion, the study demonstrates the important role of culture in shaping the productivity and economic fortunes of both the People's Republic of China and any other nation.*

Keywords: *culture, social values, economic development, Chinese economy, national and historical particularities, innovative spirit, retrospective analysis.*

The relationship between social culture and economic development is a complex and important area of research. From a humanistic economic perspective, there is an essential connection between the shaping of social culture and economic development. From the perspective of the relationship between science, technology, and culture, it is important to note that science and technology are always developed within a specific cultural context. As a result, they are inevitably influenced by the prevailing cultural norms and values of a given period.

Ancient Chinese science and technology, which once held a leading position in the world, developed within the context of traditional Chinese culture and were therefore influenced by it in many ways. Confucian culture, as the mainstream of Chinese traditional culture, played a significant role in this development. Confucian and Taoist cultures had significant impacts on the development of ancient Chinese science and technology, both positively and negatively. It is important to note that while Confucian culture played a major role, Taoist culture also held a significant position in traditional Chinese culture (Le, 2004).

The impact of Confucian culture, which is the dominant aspect of Chinese traditional culture, on the development of Chinese science and technology has been a topic of debate in the history of science. This debate can be traced back to Dr. Needham's views on science and technology in the UK, which he later documented in his book 'History of Science and Technology in China'. Due to the appearance of this work, scholars have increasingly focused on studying the relationship between Confucian culture and science. In Joseph Needham's 'History of Scientific Thought in Ancient China', the author argues that Confucianism exhibits two fundamentally contradictory tendencies. Some argue that Confucianism prioritizes people and society over other aspects, potentially impeding scientific progress. However, others contend that Confucianism values rationality, which may actually facilitate scientific development (Needham, 1954).

The pre-Qin Confucian culture promotes self-improvement and positivity, providing valuable spiritual support for the development of science and technology. Confucianism emphasizes the humanistic spirit, the alleviation of worries, and the improvement of moral quality through personal effort and action towards reality. Most Confucian classics emphasize practice, and most Confucian figures advocate for it.

Confucius once said, 'It is not enough to be a scholar if you are only a scholar' (Confucius, n.d.). This means that intellectuals with ideals and ambitions should have unlimited responsibilities and careers, and should serve society. Otherwise, coveting comfort, eating all day long, and having no intention is the shame of a 'scholar,' and they are not worthy of being an intellectual. Moral cultivation, also known as moral practice, aims to achieve the goal of 'inner saintliness' through self-cultivation or self-reform. Social and political practice, on the other hand,

aims to achieve the goal of 'external kingship' through meritorious service or social transformation. It distinguishes between the inner sage, which depends on establishing virtue through self-cultivation of body and mind to establish moral personality, and the outer king, which depends on making meritorious services in society to establish political personality. "The Great Learning" emphasizes the importance of cultivating one's moral character and managing one's family, as well as ruling a country and bringing peace to the world (Confucius, 2018). Confucianism believes that both aspects, practice and theory, are equally important and cannot be neglected. Therefore, Confucianism opposes empty talk and sitting around talking about Tao, and particularly emphasizes the importance of practice.

Therefore, scientific and technological progress in ancient China was due, among other things, to the unique Confucian cultural spirit. This led to rapid development and even world leadership in technology in ancient times.

It is important to note that China has also demonstrated an innovative spirit since ancient times, which is evident in various aspects of society.

For example, the proverb "'Heaven moves vigorously, and a gentleman strives to constantly strive for self-improvement" encourages people to emulate the dynamic movements of the natural world, confront reality and overcome obstacles to transform themselves and society. It stresses the importance of perseverance, determination and hard work, relying on personal strength to achieve self-improvement and promote social progress.

China has always been open to learning about other cultures, which is reflected in the symbiosis of religions and the willingness to co-operate with foreign colleagues and friends. It is important to note that many achievements have been made possible through co-operation and exchange of ideas. This has contributed to many discoveries including the decimal number system, systems of linear equations, gunpowder, rockets, paper, printing, the compass, greenhouses, rice cultivation, alcoholic beverages, silkworm breeding and astronomical notes.

It is impossible not to mention such a trait of Chinese society as collectivism. This value and trait is extremely characteristic of the people and has a significant impact on the nation's way of life.

From an early age, educational institutions develop collective consciousness and team spirit in students. This fosters the ability to come together and solve common problems, even if individual development has to be sacrificed in order to do so. Although modern companies are becoming more relaxed about personal development and are moving away from group tasks as the most important goal, most still have a collectivist philosophy.

Among other things, collectivism gives a special attitude to labour. The approach values teamwork, cooperation and shared responsibility, recognising that individual success is the result of collective effort. By developing a sense of com-

munity and common purpose, companies can increase motivation and efficiency. This attitude enhances cohesion and fosters a responsible work ethic, which contributes to a country's economic and innovative development.

To confirm the aforementioned theses and the initial hypothesis, statistical data collected by World Social Value was analysed. Survey data from the Chinese population was used to determine the impact of cultural characteristics on labour productivity and the subsequent development of the manufacturing sector. The data analysed included religion, cultural values, and attitudes towards labour. Data was collected between 2017 and 2021 in the People's Republic of China through a survey that requested participants to express their opinions and attitudes on various issues.

To improve the visualisation of the collected data, graphs were created by combining certain questions. The first graph illustrates people's opinions on the importance of religion and work in their lives. A multidirectional trend is noticeable, with the majority of respondents indicating that religion is not important to them. Only 3.78% of respondents reported that religion occupies a significant part of their life. In contrast, the responses regarding work were diametrically opposed. According to the survey, it is evident that work holds great importance for the majority of people, while only a small percentage of 2.76% do not consider it to be significant. This trend underscores the crucial role that work plays in the lives of Chinese.
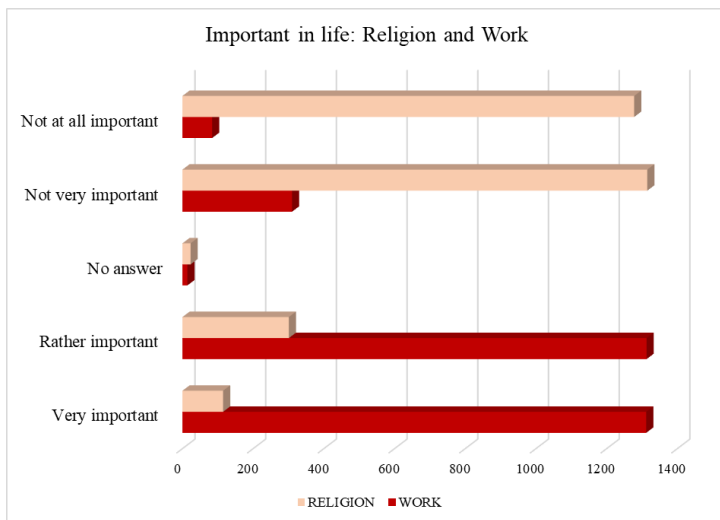
Figure 1. *Survey results on the importance of religion and work in life*
Source: compiled by the authors from World Social Values

The following graph analyzed different questions regarding the public's attitudes toward work. Thus, the first diagram shows people's opinion on the question "Work should always come first, even if it means less free time". We can see that 81.47% of the sample respondents agree or strongly agree with this statement. The next fact used to analyze this table "Work is a duty to society". More people have a positive attitude to this statement than to the first one, namely by 2.89%. Whereas only 14.69% disagree or do not agree with the phrase at all. The last third expression reflected in the graph is as follows: "People who do not work become lazy". Only 14.53% disagreed with this phrase, the rest of the people had a positive attitude towards the phrase and 3 people did not answer the question.
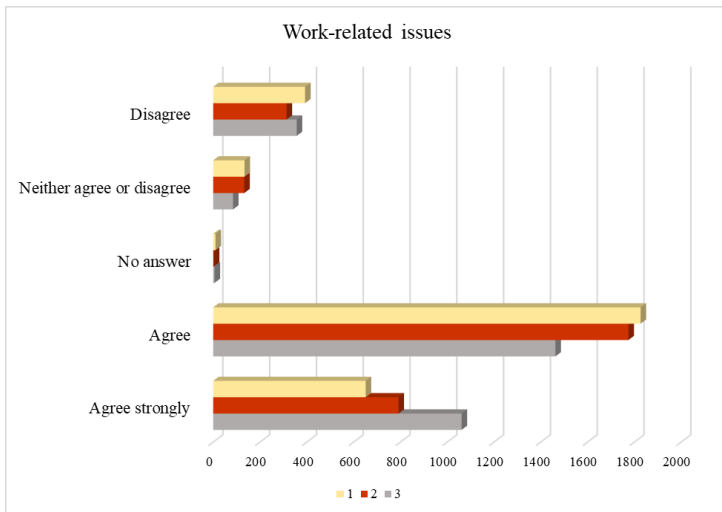
Figure 2. *Results of the survey on work-related issues*
Source: compiled by the authors from World Social Values

The statistical analysis conducted has allowed us to examine the attitude of the population of the People's Republic of China towards work and religion as a cultural aspect. Based on the data, we can confidently state that there is a correlation between the two factors. The topic of religion is of great significance for this study because it plays a crucial role in shaping the cultural identity of individuals. Religious ideas and norms have a direct impact on people's thoughts and actions, which in turn affects e development of the country, including the industrial sector.

Attitudes towards education and science are an integral part of culture. In China, education is highly valued and plays a crucial role in the lives of young people (The worship of knowledge is one of the fundamental spirits of the Chinese peo-

ple, 2020). As schoolchildren, kids may experience considerable pressure from parents, teachers and the education system. After all, education is considered one of the main means of mobility and personal development. Although today's generation and companies are striving to eliminate gender discrimination, it is important to recognise that society still largely adheres to patriarchal norms. It is worth noting that some boys may grow up in families where they experience excessive control and sanctions. For example, adolescents may often be restricted in their free time and opportunities for clubs, sports and creative activities due to the demands of the school timetable. As a result, this can affect their level of engagement in life, potentially leading to a lack of motivation to seek new experiences, although they will also continue to study and subsequently work throughout their lives.

In China, the opinion of the older generation is highly valued and often plays an important role in shaping the future of the younger generation. However, it is worth noting that this opinion should not be the sole determining factor in decision-making. Nevertheless, adults tend to have conservative attitudes towards education; they believe that university education is necessary for success in life and in the marriage market (Becker, 1991). Due to the unbalanced gender distribution caused by the former "one family - one child" policy, an informal marriage market has developed in the country (Bogayevskaya, 2020). Therefore, certain high standards are expected of men, including education and various scientific degrees, because the status of scientist, engineer and researcher fulfils social expectations extremely well.

What is also important about education is that the person inheriting the business has the necessary skills and knowledge to sustain it. In this regard, we will elaborate on a cultural trait that has a significant impact on business: family-owned companies (About social networks and family-type corporate governance, 2022). In addition, we will look at the corporate culture prevalent in such organisations. Family companies are widespread in China, ranging from large business empires to small enterprises. From its inception, the company maintains a record that becomes a historical monument that reflects the past and offers hope for a bright future. The family heritage is passed on to the most outstanding and competitive family member who can maintain the brand image. It is worth noting that family businesses are characterised by mutual support and encouragement, which stimulate entrepreneurship and promote development. However, they also have external ties formed in the course of "communication" with other companies. Through these relationships, the companies benefit from each other, namely by obtaining the necessary assistance, financial resources, information and resources. These interactions are sometimes critical to business success.

The previously mentioned morality, interest, openness and loyalty of the people facilitate China's participation in international co-operation. This enables

the country to attract foreign investment, conquer new markets and expand its knowledge in all fields (One Belt and One Road Initiative: New ideas and practices to deepen international cooperation, 2023). China's cultural foundations and principles also contribute to the continuous development of its economy and the building of relations with friendly countries. Thus, the aspect of culture plays an important role in the economy, especially in the context of the global market.

In summary, the analysis shows that China's rich historical and cultural heritage not only shapes the country's social structure and values but also profoundly influences economic development. China's past, present and future are closely linked, and the integration of ancient traditions and modern science and technology has given a unique impetus to China's economic growth. Understanding how cultural factors influence the economy not only helps us better understand China's rapid development, but also provides valuable experience and inspiration for other countries and regions.

References

1. *About social networks and family-type corporate governance (2022). - URL: https://wenku.baidu.com/view/e9059f92950590c69ec3d5bbfd0a79563c1ed409. html?_wkts_=1712607217323&bdQuery=*家族企业和关系网络的作用%2C小企业精神*&needWelcomeRecommand=1*

2. *Bogayevskaya V. (2020). Social impact of "one family-one child" policy in China // Modern oriental studies. №5.*

3. *Confucius (2018). A great teaching. AST: Philosophy on the fingers*

4. *Confucius (n.d.). The Analects of Confucius - Book 3. Confucius-1. https://www.confucius-1.com/analects/analects-3.html*

5. *Gary S. Becker. (1991). Assortative Mating in Marriage Markets. Cambridge; London: Harvard University Press, ch.4, p.108–134.*

6. *Le A. (2004). On the influence of Confucian culture on the development of science and technology in ancient China. Journal of Harbin Institute of Technology: Social Science Edition, 6(6), 5.*

7. *Needham J. (1954). Science and Civilisation in China. Cambridge at the university press.*

8. *One Belt and One Road Initiative: New ideas and practices to deepen international cooperation (2023). - URL: https://baijiahao.baidu.com/s?id=1781506062401512544&wfr=spider&for=pc*

9. *The worship of knowledge is one of the fundamental spirits of the Chinese people, (2020) - URL: https://baijiahao.baidu.com/s?id=1676684171417083526&wfr=spider&for=pc1.3*

俄罗斯联邦法医语言专业知识在涉及组织非法移民的案件中的应用
APPLICATION OF FORENSIC LINGUISTIC EXPERTISE IN THE RUSSIAN FEDERATION IN CASES INVOLVING THE ORGANIZATION OF ILLEGAL MIGRATION

Gevorgyan Marine Gagikovna
Translator, Postgraduate
Peoples' Friendship University of Russia named
after Patrice Lumumba

注解。　目前，在侦查组织非法移民案件时，已经开始积极使用法医语言检验等工具。　在法医语言检验中，对与非法移民的行为、性格特征以及犯罪伴随情况有关的材料进行分析。　本文讨论了在组织非法移民案件调查中运用法庭语言专业知识的主要方法和实例。　根据研究结果，文章提出了改进文件调查检查策略和法医语言检查任命的方法。
关键词: 法证语言检查、移民、非法移民组织、外语、移民。

Annotation. *Currently, when investigating cases of organizing illegal migration, a tool such as forensic linguistic examination has begun to be actively used. In forensic linguistic examination, materials related to the characteristics of the behavior and personality of illegal migrants and the accompanying situation of the crime are analyzed. The article discusses the main approaches to the use of forensic linguistic expertise in the investigation of cases of organizing illegal migration, practical examples. Based on the results of the study, the article suggests ways to improve the tactics of investigative examination of documents and the appointment of forensic linguistic examination.*

Keywords: *forensic linguistic examination, migration, organization of illegal migration, foreign language, migrant.*

Today, for criminal proceedings in Russia, forensic linguistic examination has become one of the popular tools in the investigation of cases. This tool is becoming in demand not only in criminal cases such as insult, extremism, terrorism, etc., but is also actively used in the investigation of cases related to the organization of illegal migration.

The organization of illegal migration, as a latent crime that may not be included in crime statistics, can be classified as a crime of minor gravity. However, in fact, this activity can have colossal social and economic negative consequenc-

es. At the same time, many sources[4,5] note an increase in the number of these crimes in the Russian Federation, which ultimately leads to an increase in crimes committed by migrants.

A peculiarity of the investigation into the organization of illegal migration is the negative attitude of migrants towards law enforcement agencies. Migrants are subjects of counteraction to the investigation of these crimes. While maintaining family and other ties in their homeland, migrants have interests that are contrary to the investigation. In general, this has a negative impact on the investigation process, including the interaction of the participants in the crime with the investigator.

The investigator is forced to look for additional tools for investigating crimes: video recordings, communication in instant messengers, telephone conversations, etc. If the information obtained in this way is obvious, the inspection report becomes independent evidence. The investigator (inquiry officer), judge, based on common sense and existing life experience, independently determines the presence or absence of information confirming the organization of illegal migration[4].

However, in practice, there are very often situations when participants in a crime deliberately disguise information. In such situations, it is forensic linguistic examination that becomes an effective tool for determining the hidden meaning of the text. Establishing signs of text masking, identifying the meaning and characterizing the elements are the main circumstances determined by forensic linguistic examination when investigating the organization of illegal migration.

Let's consider an example [1] - the use of linguistic examination of sound recordings of telephone conversations gr. A. and gr. M., suspected of committing a crime (organizing illegal migration). The examination showed that the text contains signs of masking content elements associated with migration cards, called "papers" or "notification" by the communicants, which citiz. A conveyed cit. M. for monetary reward [1].

Examples of the subject of forensic linguistic examination are information about the method and procedure for illegal migrants crossing the State Border; route of illegal migrants; creating conditions for illegal entry (exit) from the territory of the Russian Federation, or illegal stay in it.

There are different approaches to the term "camouflage". Legal literature notes the theoretical uncertainty of the term [4]. In this regard, it should be noted that the concept of "masking" is borrowed from the methodology of judicial investigation, which refers to the deliberate distortion by the authors of the text of the semantic and linguistic structures of speech in order to hide information important for the investigation or to provide deliberately false information.

To disguise the prohibited meaning, instead of the usual concepts corresponding to the context of the text, alternative terminology is used, which does not have a logical correspondence to the content of the text and was previously agreed upon by the subject of communication.

The task of forensic linguistic examination when investigating cases of organizing illegal migration is to use special language knowledge to identify evidentiary facts. The study of texts makes it possible to establish the presence or absence of verbal constructions, with the help of which it is possible to determine the involvement of persons in the commission of a crime, as well as their implementation of actions to create conditions for illegal border crossing, residence and employment.

Illegal migration is a transnational crime, the purpose of which is communication between the subject of the crime and his accomplice in a remote territory. Dialogue speeches differ from monologues in that they have a more limited content of language and allow the choice of linguistic means for use in communication, as well as facial expressions and gestures. They are characterized by short remarks, which are most often of an everyday nature. The form of speech expression largely depends on the expert methodology used to study it[5].

Due to this feature, communication on cases of illegal migration can be conducted in different languages: Russian, various foreign languages. The legal literature says that in most cases, participants in illegal migration are Russian, Uzbek, Kyrgyz and Kyrgyz citizens, less often - representatives of other nationalities in the near foreign space, including Ukrainians, Kazakhs, and Chinese.

Another problem when investigating crimes is that the conversation of foreign citizens and stateless persons in Russian, which is not their native language, has linguistic, semantic features, and non-standard vocabulary. Committing lexical errors leads to the need to use the services of a translator.

One of the most important problems when conducting forensic linguistic examination is the lack of methods for studying text written in a foreign language in state forensic institutions. The lack of a qualified translation of the text complicates the forensic linguistic examination.

Let's look at an example. During the preliminary investigation, a comprehensive psychological and linguistic examination was carried out to establish the presence of speech signs indirectly indicating the criminal activities of the citizen. S. Materials for research: phonograms of telephone conversations, video recordings, interrogation reports cit. S., which were partially conducted in Ukrainian. Defender of citiz. S. filed a petition to recognize the experts' conclusions as inadmissible evidence, due to the linguist experts' erroneous understanding of the Ukrainian language. The court considered the defense's arguments untenable due to the multiplicity of materials for the study, most of which do not require translation [2]. Thus, the judge, we believe, could recognize the expert's conclusion as insignificant evidence if the materials of the expert research were limited only to recordings of telephone verdicts.

To solve this problem, it is recommended to organize the involvement of a translator, as a "knowledgeable person with special linguistic knowledge" for con-

sultations during the forensic linguistic examination. This will have a positive effect on the study of a text, or part of a text, written in a foreign language. Foreign practice is characterized by the involvement of a native speaker as a consultant without direct involvement in the research. In general, the involvement of a translator will increase the capabilities of forensic linguistic examination.

Another way to solve this problem could be to provide a ready-made translation of a controversial text or part of it, made in another language, for forensic examination. This translation can be compiled with the participation of both the translator and the participant in the crime. But this option is not always acceptable. It is possible to involve a specialist in the field of foreign linguistics, since the criminal procedural status of the translator has some features that prevent his participation in criminal proceedings without another participant.

So, for example, during the operational-search activities, a video recording of the negotiations of citiz. S. and citiz. M. [3], in which the latter discussed the details of the planned crime in the Tatar language. As evidence, these materials were presented to the investigator, who invited a teacher of Tatar language and literature to examine the video file as a specialist, who confirmed the correctness of the initial translation and assisted in comparing the preliminary translation with the video recording. A forensic linguistic examination established that the conversation between the interlocutors was about the transfer or planned transfer of funds. Evaluating the expert's opinion, the court indicated that taking into account the direct study of video recordings with the involvement of a specialist, the conclusion of the forensic linguistic examination has sufficient clarity and completeness, and there is no doubt about its validity [3].

In this case, to ensure high-quality translation, investigators need to assess the competence of the translator. To do this, it is necessary to determine the place and level of his spoken language training, as well as the areas of activity.

If an investigator uses an interpreter to communicate with suspects or witnesses, they may be asked to speak with the accused or witness for a few minutes to ensure they understand each other and to check their proficiency in the language and geographic dialect of the area where the suspect is believed to be from.

Due to the rapid development of information technology, there is an increase in the number of telephone conversations and information exchange on social networks, as well as through messenger communications. The form of text transmission is changing, and the method of special study is improving. In cases where the object of research is video and audio recordings that contain text with clear signs of concealment of information, a comprehensive language and phonographic assessment is usually used.

The semantic content of the text in the process of communication is determined by the emotional components of the text, the emotional orientation of the message,

the socio-psychological characteristics of the text, as well as the psychology of the person, which may be associated with hiding information. If questions related to linguistics and psychology arise, a psycholinguistic or complex psychological and linguistic examination is required.

Thus, forensic linguistic expert research during the investigation of the organization of illegal migration is traditionally subject to audio and video recordings of dialogue speech with the participation of suspects (accused), less often witnesses from among illegal migrants, containing signs of masking information about the method, procedure and conditions of crossing the state border, registration of forged documents, etc. At the same time, the dialogue may be fully or partially conducted in a foreign language, which makes it difficult to study its content. Studying the semantic content of a text that has signs of disguise during a forensic linguistic examination when investigating the organization of illegal migration makes it possible to expand the possibilities of proof in situations where the text is not obvious to the average person and raises doubts among the law enforcement officer.

References

1. Sentence No. 1-322/2017 of October 25, 2017 in case No. 1-322/2017 Judicial and regulatory acts of the Russian Federation SudAkt.ru // URL: https://sudact.ru/regular/doc/r5RDEj2SOsgC/?regular (access date: 07/21/2022)

2. Archive of the Donetsk City Court of the Rostov Region, criminal case No. 1-5/2016, verdict dated March 21, 2016.

3. Archive of the Lyambirsky District Court of the Republic of Mordovia for 2019, criminal case No. 1-26/2019, verdict dated July 22, 2019.

4. Grishina E.P. Special knowledge in the context of criminal procedural science and law enforcement practice: monograph / Ed. V.M. Bozrova. M.: Yurlitinform, 2022. 326 p.

5. Sekerazh T.N., Kuznetsov V.O. Research of information materials is a current area of forensic activity. Law. 2019. No. 10. pp. 80–89.

在 CIS 成人非正式教育背景下使用人工智能进行数字内容创建
THE USING OF AI FOR DIGITAL CONTENT CREATION IN THE CONTEXT OF CIS ADULT INFORMAL EDUCATION

Meretskov Oleg Vadimovich
Corresponding member of the Academy of Informatization of Education, PhD in Pedagogy, Associate Professor
Academy for Standardization, Metrology and Certification (Training), Moscow, Russia

抽象的。　本文讨论了应用端到端数字技术"人工智能"在满足现代教学和技术要求的数字多语言教育环境中创建双语内容的应用方面。　分析了使用人工智能创建的双语内容对计量和标准化领域专家进行专业培训的潜在可能性。

关键词：在线课程、电子学习、远程学习技术、数字化、人工智能、数字教育内容、数字教育环境、双语内容、双语者、端到端技术。

Abstract. *The article discusses the applied aspects of the application of end-to-end digital technology "artificial intelligence" to create bilingual content in a digital multilingual educational environment that meets modern pedagogical and technological requirements. The potential possibilities of using bilingual content for professional training of specialists in the field of metrology and standardization, created using artificial intelligence, are analyzed.*

Keywords: *online course, e-learning, distance learning technologies, digitalization, artificial intelligence, digital educational content, digital educational environment, bilingual content, bilinguals, end-to-end technologies.*

Researchers in Russia and the CIS note the practical effectiveness of organizing bilingual and multilingual adult education in the context of corporate training and advanced training, pointing to a faster perception of information compared to learning in one language. At the same time, the psychophysiological process itself, in which a different activation of neural connections of the human brain probably occurs in the process of bilingual learning compared to monolingual, has not yet been sufficiently studied by scientists and needs additional research. [2, 3, 5, 6, 10, 11]

Modern e-learning technologies make it possible to switch from monolingual to bilingual learning in a variable way (at the student's choice). Potentially, we can

offer two options for combining languages in the process of studying theoretical materials:

1. As part of a video lecture, save the original presentation of the material in the official language of the CIS (Russian) in the auditory and visual perception channels, and additionally apply captions generated automatically in the national language chosen by the student in the visual perception channel.

2. As part of the slide course – give oral explanations of Russian-language slides in the national language of the student's choice.

The disadvantages of the first method include the complexity of technical implementation as well as information overload of the visual perception channelприятия, which actually displays twice as much information as it originally was posted by the author (stream in Russian and credits in national). Another disadvantage of this solution is manifested when there is a need to display formulas, diagrams, and drawings that require careful analysis in the specifics of the issue under study, since captions or a running line in the visual channel can overlap some of the original information or significantly limit the visible area of the screen available for its placement.

The second method is devoid of the disadvantages of the first, because it allows you to use third-party (not built into the digital educational environment) generative services with artificial intelligence, a balanced reference summary of the topic in the form of slides in Russian does not require changes, the available information field on the screen of digital devices does not decrease or overlap, and the distribution of information perception is carried out approximately symmetrically. At the same time, this method has another drawback, which makes it difficult to apply it in cases of creating digital educational content in the form of video lectures, when the auditory information transmission channel is the leading one compared to the visual one. In fact, in this case, digital educational content is completely translated using film dubbing technology into the corresponding national language, and Russian is excluded from training, which is unacceptable in the context of current legal CIS restrictions and the goal setting of the task itself.

In the conditions of the above limitations, it is proposed to use electronic lectures, in which the visual series (slides) explaining the process (phenomenon) being studied are given in Russian (the official language of instruction, the official language of the CIS), and the oral explanation of slides by voice-over can vary and Russian, English, or the national state language of the student, depending on their choice.

The basic technology of organizing the production and acceptance of e-learning courses is considered in the work "E-learning courses as a tool for digital transformation of vocational education" [12], and in more detail – in the mono-

graph "Pedagogical and technological approaches to creating digital educational content by geographically distributed teams" [8]. In accordance with the above studies, the typical composition of the development team is represented by 14 roles, and there are 10 main phases in the production process.

Within the framework of this technology, the author-teacher, together with the methodologist, distributes his research material into educational forms, after which a slide-by scenario of an electronic course is compiled for transmission to other members of the author's team as a source task for production. Based on this scenario, the design and animation of slides is created, video editing is performed, and voice-over text is voiced by an announcer.

The mentioned variations of the standard technology for producing e-learning courses do not provide for their multilingual content – the original author's materials, script and technical implementation are assumed to be in the same language. In our case, for bilingual learning based on the principles formulated above, it is necessary to produce content that contains variable trajectories using several languages. At *the same time, each trajectory involves broadcasting oral explanations in one selected language, synchronized with the Russian-language visual series* on the student's screen. To complete this task, the team of developers should be expanded with the roles of translators and announcers for each of the national state languages of the CIS (with the exception of Russian). There are about 20 more should be added to the 14 basic roles of a typical development team (since the CIS formally includes 11 states, including the Russian Federation). It is obvious that such an approach cannot be justified economically, due *to the critical increase inmpam* production costs to provide, in fact, *additional consumer properties* of the object (digital educational content in Russian). Additional difficulties should also include the need to manage a more than twofold increase in the number of employees, taking into account the factors of human errors, deadlines, temporary disability, etc.

Therefore, to implement the idea of increasing the availability of digital educational content through its variable bilingual representation at the student's choice, it is proposed to use *generative artificial intelligence* (AI) [1, 9]

In accordance with this approach*, a two-stage application of AI tools is performed*, replacing the roles of translators and announcers in the development team. *At the first stage*, an automated translation of the speaker's text is performed, which should sound off-screen in national languages. Many paid and free services are suitable for this purpose. Based on the conducted testing, the most adaptive translation of specific vocabulary of the Russian language, in our opinion, is implemented by the «Yandex.Translate», which is probably due to a significantly larger (compared to foreign analogues) database of translations performed that affect the Russian language and, accordingly, a proportionally larger amountом of AI training based on the collected feedback from users in their expert opinion regarding the correctness of the pro-

posed translation options. The choice of this service is also conditioned by its support for translation into all national state languages of the CIS countries (and, accordingly, the service's representation in these countries and continuous training of AI algorithms from native speakers of these languages).

As a result of performing machine translation of texts, the screenwriter at this stage of production receives a two-dimensional matrix of texts, each row of which corresponds to the slide being voiced, and the column corresponds to the language.

At the second stage, this matrix enters the input of the editor's work, which must output a set of synthesized audio files (mp3 format), which are received at subsequent stages in the work of the layout designer of the electronic course, together with which the programmer programmatically implements the logic of selecting the voice-over language.

To generate audio files within the framework of the described approach, the editor is invited to use speech synthesis services that are also built on AI algorithms.

The editor preprocesses the text received at the previous stage of machine translation by placing intonation tags, as well as tags before numerals and abbreviations-based on the syntax of the corresponding service.

The proposed approach to using AI technologies to reduce the labor intensity of digital educational content production, as well as the idea of using bilingual content to train CIS citizens in advanced engineering programs, was repeatedly discussed in the academic community in the form of reports at the Institute for Educational Development Strategy of the Russian Academy of Education, the Academy of Informatization of Education and the Academy of Computer Science. We received the recommendation to continue research and conduct practical testing of this method in the framework of a pedagogical experiment involving control groups of students.

In conclusion, we would like to note once again the *expected effect* of using bilingual education in the digital educational environment of the CIS. Within *the framework of formal education*, the effect is to reduce the percentage of errors due to incorrect perception of similar spelling words of the Russian language that have fundamentally different meanings. In *the framework of informal education* – to improve students ' understanding of the Russian language, professional terminology in Russian, and documentation in Russian.

Literature

1. Analysis of the possibilities of using end-to-end digital technology "artificial intelligence" in the context of educational activities/ N. V.Gerova, O. V. Meretskov, A.V. Klochkov // Human Science: Humanitarian research - 2023. - Vol. 17, No. 3. - pp. 122-130.

2. *Andragogy as a basis for multilingual corporate training / A. S. Lazareva, K. E. Bezukladnikov // Language and Culture. - 2023. - No. 62. - pp. 263-276.*

3. *Kabenova D. M., Urunbasarova E. A., Shaknabi A. V. On the concepts of "secondary linguistic personality" and "bilingual" Series: Pedagogy. – 2022. – № 4(108). – pp. 115-121.*

4. *Key requirements to the digital educational environment of the Basic organization of the CIS / O. V. Meretskov, T. T. Mansurov // Competence. - 2023. - No. 9-10. - pp. 5-10.*

5. *Cognitive processing of binomials of the Russian language by Turkic-Russian bilinguals / A. S. Bub, E. D. Artemenko // Language and culture. - 2019. - No. 48. - pp. 32-45.*

6. *Models of inclusion of native words in oral speech in Russian by bilinguals-residents of the Ulyanovsk region / E. F. Galushko // The Company. – 2019. – № 4(15). – pp. 45-49.*

7. *Model Law "On Languages", adopted by Resolution No. 24-6 of the Interparliamentary Assembly of the CIS Member States of December 4, 2004*

8. *Pedagogical and technological approaches to the creation of digital educational content by geographically distributed collectives: a monograph / O. V. Meretskov // Moscow: Direct-Media, 2023. - 156 p.*

9. *Legal regulation of the use of end-to-end digital technologies in the Russian Federation: a methodological guide / O. V. Meretskov. - Moscow: LitRes, 2023. - 50 p..*

10. *Speech culture of bilingua / T. V. Zherebilo // Lingua-Universum. - 2016. - No. 3. - pp. 3-10.*

11. *Speech behavior of bilinguals in everyday discourse / G. R. Galiullina // Philology and Culture. – 2023. – № 2(72). – p. 25-32.*

12. *Meretskov O. V. E-learning courses as a tool for digital transformation of additional professional education training / Competence. - 2023. - No. 5. - pp. 17-25.*

游戏密度作为体育课教学分析的综合指标

GAME DENSITY AS AN INTEGRATED INDICATOR OF PEDAGOGICAL ANALYSIS OF A PHYSICAL EDUCATION LESSON

Kuzekevich Vladimir Robertovich
Candidate of Pedagogical Sciences, Assistant Professor

Rusakov Alexander Albertovich
Candidate of Pedagogical Sciences, Associate Professor

Romanova Svetlana Vladimirovna
Candidate of Biological Sciences, Associate Professor
Irkutsk State University, Irkutsk, Russia

Introduction. In the scientific and pedagogical environment, there is no disagreement about the fact that the game acts as the main and leading type of activity for primary schoolchildren. Therefore, it is obvious that the use of technology based on gaming activity underlies the successful development of physical qualities, the formation of motor skills, activation and launch of basic mental processes that are the basis of motor activity. At the same time, the use of gaming technologies based on the use of age-related characteristics is relevant during the entire period of education [1, 4].

The use of gaming technologies in the primary school system is a universal means that contributes to solving the interrelated problems of educating the physical culture of the individual of a junior schoolchild, and the comprehensive education of various motor skills and qualities. The development of creativity, attention, imagination, initiative, the formation of adequate self-esteem and independence, the ability to observe and follow the rules, act as the basis for successful social adaptation [3, 7].

Considering the system of physical education for primary schoolchildren, we can highlight the position that the leading type of activity for them is gaming, therefore, the content of physical education classes should be built in the context of this very gaming activity [5, 8].

At the same time, based on our survey among physical education teachers, it can be noted that the game does not always act as the basic basis for physical edu-

cation classes, although the indicators of general and motor density of the classes conducted in most cases correspond to age characteristics and existing requirements .

Purpose of the study. Development of diagnostic tools that meet the requirements of simplicity, accessibility, objectivity and the ability to compare results for a more objective assessment of the use of gaming technologies in physical education lessons.

Materials and methods of research. We found that, in general, gaming technologies do not always occupy their appropriate place and position in the educational process, but the results obtained did not allow us to assess how specifically, whether sufficiently or not, they are used.

We believe that the basis for an objective assessment of the quality of a physical education lesson in an elementary school should be a separate, integrated information indicator, which we called the game density of the lesson or lesson.

Game density acts as the ratio of the duration of the lesson to the time spent on gaming activities, and includes the sum of such indicators as time for organization (selection of drivers, assistants and judges, division into groups or teams) and explanation (summarizing) of the game and time, directly spent on the motor component of the game and expressed as a percentage [2, 6].

We believe that the use of this indicator gives us the opportunity to objectively assess how widely, sufficiently or not, gaming technologies are used in practical activities, to correlate and compare different activities, including those conducted in the context of the type of activity (game, studying or consolidating material, etc.) .P.).

The assessment was subject to such an indicator as the quantitative level of use of gaming technologies (**QLUGT**), which was calculated based on the gaming density indicator (**DI**), since the higher the DI, the greater this indicator. In our research, we identified the following levels:

- pre-nominal level of QLUGT, at which DI is less than 30%;
- nominal level of QLUGT, with DI ranging from 30 to 45%;
- optimal, level of QLUGT DI in the range from 46 to 70%;
- creative level of QLUGT, when DI is over 70%.

If you set a goal and carry out a more in-depth analysis, you can additionally highlight such individual indicators as organizational gaming density, by which we mean the total time spent on preparation, storytelling, showing, summing up, etc. and motor play density, reflecting directly the motor component of the game.

We proceeded from the statement that if the teacher knows effective ways to organize and conduct the game, then the organizational density of the game and the time spent on explanation and demonstration will allow him to save more time directly on the game itself.

For understanding, we will give examples of unproductive waste of time, which include unnecessary changes in lanes, long and confusing, methodologically illiterate explanations, unproductive choice of drivers, assistants and judges, suboptimal division into teams, maintaining an appropriate level of discipline, etc.

If, for example, after explaining and starting the game, the teacher is forced to stop it, in case of misunderstanding or gross violation of the rules, to repeat the explanation, then this time is summed up with the time spent on the explanation that was used earlier.

Assessing the positive aspects of this diagnostic technique, we note that it allows for a comparative analysis of the results of different teachers, identifying the strengths and weaknesses of each, and tracking changes in the dynamics of organizational and methodological skills over a long period.

If we talk about the disadvantages of this technique, then we can make such a significant argument that a short and quick explanation of the game is not always a positive thing; it is important that in the organizational and methodological aspect the requirements that are necessary and necessary for the implementation of modern technology for playing the game are met.

We identified five requirements; each of them was assessed in the form of a manufacturability coefficient of 0.2, which in total, if all requirements were met, was 1:

1. Optimal formation of students to explain and communicate the name of the game.

2. Creating interest in the game and motivational support.

3. Appointment of drivers, assistants and judges, division into groups.

4. Explanation of the tasks, content and course of the game; addition and clarification of the rules, organized start of the game.

5. Refereeing the game and regulating the workload, and summing up the results of the game.

By game technology coefficient (hereinafter referred to as GTC), we understand the compliance of the actual use and implementation of the requirements that form the basis of the game technology with the requirements themselves, i.e. The more requirements are met, the higher the game's technology quotient (GTC).

GTC value equal to one means a certain balance level, when the time for organization and implementation is approximately the same; if it is higher than one, then this indicates a high level; if lower, then this is an indicator of insufficiently developed organizational and methodological abilities and skills.

We conducted a pedagogical experiment in which we solved the following problems:

- find out how widely games and gaming technologies based on them are used in work;

- the total number of games that are used in the educational process;
- establish the level of organizational and methodological skills;
- analyze the dynamics of changes in organizational and methodological skills, and their changes with age and the acquisition of practical experience;
- test in practice and determine the effectiveness of the assessment methodology we have developed.

Physical education instructors from preschool educational organizations, as well as physical education teachers working in primary classes, totaling 46 people, took part in the experiment.

We were aware that the assessment of gaming density and gaming coefficient for one lesson or lesson would be biased, therefore, each of those taking part in the experiment was asked to conduct from three to five lessons of various directions, after which the obtained indicators were summed up and the average value of gaming density and gaming coefficient was calculated. coefficient, after which the results were distributed by level and ranked.

As a result of analyzing the obtained indicators, we determined that the pre-nominal level of use of gaming technologies was observed by 19.7% of teachers, the nominal level was noted by 34.9% of teachers, the optimal level by 31.6%, and the creative level by 13.8% of teachers.

The distribution of the level of use of gaming technologies among teachers with different teaching experience had quite large differences: teachers with work experience of up to 3 years: pre-nominal - 28.7%, nominal - 37.6%, optimal - 28.1%, creative - 5 .6%; teachers with work experience from 4 to 10 years: pre-nominal - 11.2%, nominal - 28.2%, optimal - 34.6%, creative - 26.0%; teachers with work experience from 11 to 20 years: pre-nominal - 10.7%, nominal - 24.9%, optimal - 39.7%, creative - 14.7%; teachers with over 20 years of experience: pre-nominal - 20.1%, nominal - 40.2%, optimal - 30.1%, creative - 9.6%.

As can be seen, the lowest rates were observed among teachers with work experience of up to 3 years and over 20 years. This is because some have insufficient professional experience, while others experience the effect of "professional burnout."

Was separately defined technological efficiency coefficient among physical education teachers before and after methodological recommendations (Table 1).

Table 1

Manufacturability coefficient of physical education teachers before and after the experiment

Work experience		1	2	3	4	5	Coef. tech.	R
work experience up to 3 years	before	0.17	0.47	0.41	0.45	0.47	0.394	≤0.01
	after	0.47	0.68	0.74	0.71	0.75	0.670	
from 4 to 10 years	before	0.63	0.74	0.78	0.74	0.83	0.744	≤0.05
	after	0.89	0.92	0.97	0.90	0.86	0.908	

from 11 to 20 years	before	0.72	0.76	0.81	0.75	0.86	0.780	≤0.05
	after	0.87	0.83	0.95	0.82	0.91	0.876	
over 20 years	before	0.69	0.61	0.68	0.69	0.77	0.688	≥0.05
	after	0.70	0.70	0.74	0.71	0.80	0.730	

1. Optimal formation of students to explain and communicate the name of the game.

2. Creating interest in the game and motivational support.

3. Appointment of drivers, assistants and judges, division into groups or teams.

4. Explanation of the tasks, content and course of the game; addition and clarification of the rules, organized start of the game.

5. Refereeing the game and regulating the workload, and summing up the results of the game.

Based on the results obtained, individual methodological recommendations were developed for each teacher, which indicated the level of quantitative use of gaming technologies: insufficient use of gaming technologies; errors in the technology of the game; certain aspects and features of the use of gaming technologies.

The greatest increase in the technology coefficient was noted among physical education teachers whose experience was up to 3 years (≤0.01). Statistically reliable results of an increase in the Technology Coefficient were noted among teachers with experience from 4 to 20 years (≤0.05). There were certain positive dynamics among physical education teachers with over 20 years of experience, but the results did not differ significantly.

To summarize, we can draw the following conclusions:

1. The diagnostic tools we propose allow us to determine the effectiveness of physical education lessons for primary schoolchildren from the point of view of the principle of conformity to nature (game is the leading type of activity).

2. The lowest level of use of gaming technologies was shown by teachers with little teaching experience. We believe that this is due, on the one hand, to insufficient arsenals of mastery of the content of outdoor games, and on the other, to the insufficiency and immaturity of methodological experience in organizing gaming activities. At the same time, this category of teachers was the most open to improving their gaming professionalism (the increase in the technology coefficient was 71.8%).

3. The low level of use of gaming technologies was demonstrated by teachers with more than 20 years of experience. On average, they used no more than 2 outdoor games in a lesson, making methodological errors (the pre-nominal and nominal level of use of gaming technologies was 60.3%, the increase in the technology coefficient was 5.8%).

References

1. *Alekseeva E.N. Outdoor games as a means of increasing the effectiveness of physical education lessons / E.N. Alekseeva, G.A. Ketserov // Science and education today. 2019. No. 12 (47). pp. 60-62.*

2. *Ikromov I.A. Methodology for conducting physical education lessons / I.A. Ikromov // Theory and practice of modern science. 2023. No. 2 (92). pp. 64-67.*

3. *Kuzekevich V.R. Outdoor games as a form of teaching junior schoolchildren the rules of safe behavior in physical education lessons / V.R. Kuzekevich, A.A. Rusakov // Scientific Notes of the University. P.F. Lesgafta. 2023. No. 3 (217). pp. 251-254.*

4. *Kurlov A.I. Outdoor games in physical education class / A.I. Kurlov // Current research. 2023. No. 34 (164). pp. 69-70.*

5. *Rusakov, A.A. New types of physical culture and sports activities as a means of increasing motivation for physical education / A.A. Rusakov, V.R. Kuzekevich // Scientific Notes of the University. P.F. Lesgafta. 2022. No. 3 (205). pp. 416-420.*

6. *Smertina L.A. Studying the dynamics of motor density indicators in physical education classes / L.A. Smertina L.A., Makarevich G.V., Tenyatova E.N. // collection: Current issues of physical culture and sports. Materials of the XXV All-Russian Scientific and Practical Conference dedicated to the memory of Professor Yu.T. Revyakina. Rep. editor A.N. Vakurin. Tomsk, 2023. pp. 121-124.*

7. *Sharkova N.I. Outdoor games as a method of raising a child / Sharkova N.I. // Pedagogical science and practice. 2019. No. 2 (24). pp. 136-139.*

8. *Abduvaliyev HA The role of mobile games in the lessons of physical culture in the initial classes / Abduvaliyev HA // Science and World. 2019. No. 7-2 (71). pp. 34-36.*

数字化转型背景下中国高等职业教育教学伦理异化现象研究
RESEARCH ON THE ALIENATION PHENOMENON OF TEACHING ETHICS IN CHINESE HIGHER VOCATIONAL EDUCATION UNDER THE BACKGROUND OF DIGITAL TRANSFORMATION

Cao Shuya
Ph.D. Student in Education
Ural Federal University named after the First President of Russia B. N. Yeltsin

Zhou Zhenhua
Ph.D. Student in Philosophy
Ural Federal University named after the First President of Russia B. N. Yeltsin

摘要：近五年，数字化已经渗透到社会科学的各领域，从信息化到数字化，人类完成了系统性的变革。诸多研究学者热衷于教育数字化的应用，但是忽略了教育数字化过程中的教学伦理问题。实际上，数字化在职业教育中的应用时引发了一系列的教学伦理问题，在教学过程中不仅影响了教师与学生的关系，还影响了教学管理者的管理效益，这些是容易被忽视的问题。而本研究使用哲学中的现象分析方法，通过对道德伦理异化的现象分析，希望对数字化教育背景下的高等职业教育伦理内容形成体系化的研究成果。因此，本研究在以下四个方面对职业教学中存在的伦理异化现象进行了分析和探讨。一、教师权威地位的丧失和指导性角色的弱化；二、知识产权相关法律意识的淡薄和诚信道德危机；三、个人隐私权利尊重和捍卫的缺失；四、网络正义的缺席和网络暴力现象的催生。研究目的是为了实现职业教育高质量发展以适应新时代经济社会发展对于高等职业技术技能人才的培养和需求，从而帮助职业教育领域制定适宜的防范政策，构建全面伦理道德教育体系，帮助教师、学生的基本伦理准则的确立和培养，防止异化现象为职业教育领域带来的消极影响，因此，重点研究和分析教学伦理异化成为完善职业教育内容和培养社会所需人才的必要手段。
关键词：职业教育、教学伦理、伦理异化、职业道德、道德危机、数字化。

Abstract. *All social science domains have experienced digitalization throughout the last five years. From digitization to informatization, humanity has undergone comprehensive transformations. While many researchers are interested in the use of digitalization in education, they have not given much thought to the ethical*

concerns that arise while doing so. Actually, a number of ethical concerns with teaching have arisen as a result of the use of digitalization in vocational education. It influences not just the rapport between instructors and students during the teaching process, but also the effectiveness of teaching managers' management. These are problems that are simple to ignore. By examining the phenomena of moral and ethical alienation, this study employs the phenomenon analysis approach in philosophy in an effort to produce methodical research findings on the ethical content. Thus, the four components of ethical alienation in vocational education are examined and discussed in this paper. In order to help the field of vocational education develop effective preventive policies, a comprehensive system of moral and ethical education, and support for teachers and students in establishing and cultivating fundamental ethical principles, the research aims to achieve high-quality development of vocational education that can adapt to the cultivation and demand for higher vocational and technical talents in the new era of economic and social development. Therefore, focusing on the research and analysis of teaching ethics alienation has become a necessary means to improve the content of vocational education and cultivate the talents needed by society.

Keywords: vocational education, teaching ethics, ethical alienation, professional ethics, moral crisis, digitalization.

前言

在中国大众的社会观念中认为教育是一个人安身立命的根本。随着科技的发展，教育数字化也越来越受到官方政府的重视，中国国家主席习近平在2022年强调了"推进教育数字化，建设全民终身学习的学习型社会、学习型大国"的要求[3]。

按照类型属性，职业教育横跨职业、技术、教育和社会等范畴，是一种跨界融合型教育，教育数字化在该领域的发展更为明显。职业教育的数字化转型已成为必然趋势。学者朱德全和熊晴基于对数字技术的学理认识，提出职业教育数字化转型是一种基于数字技术的系统性创 新发展过程，包含技术迭代、秩序生成与范式转变的内涵特征，最终指向重塑职业教育健康新生态[8]。

中国学者杨淑萍、苏超举和朱星辰在其研究中提到，中国高职教育的数字化转型不仅实现了高等教育信息化程度的提升，更是将助力构建终身学习体系、推动高质量充分就业、促进公共服务均等化纳入自身的目标体系，显示了中国数字教育领域的巨大进展[4]。而学者袁振国则指出，当今中国的数字教育仍然是"冷数字教育"，即数字化和教育的简单组合，而不是有温度的融合[5]。中国高职教育数字化转型的粗放性特点具体表现为对教学伦理问题的忽视。

职业教育数字化转型的问题，在人、科技以及人与科技的关系等方面尤为明显。智能技术对整个世界的全方位改造和智能技术范式对人类的主宰

和控制，让人们轻易就会丧失使用技术的自信和能力，只能配合这种技术的逻辑习惯性地前进。这里印证了马尔库塞的科技异化理论。在马尔库塞的科技理论中存在"二元对立"的现象，一方面科技对人类社会的发展有巨大作用，另一方面科技对于人有异化影响。中国学者李桂花和张媛媛提出了消除科技异化的途径，即建立 "艺术的理性"，这个新理性必须包括价值、艺术和否定的因素，使人重新回归到辩证逻辑的维度中，以解决科技异化问题[2]。

教育的目的是促进全面、自由和个性化的发展。科技在教育领域的应用本应具有积极的影响。而科学技术的发展不仅影响了人们的物质层面，也影响了人们的精神世界，改变了人们的道德认识、道德情感、道德动机、道德行为和道德观念等。

科学技术的发展很显然已经给传统的教学伦理道德带来了巨大的冲击，包括教学过程中的道德意识、道德活动和道德关系等方面[1]。但在中国高职教育数字化转型的过程中存在一些具体的教学伦理异化现象。

张莉提出伦理道德教育在高等职业教育中具有重要的地位[6]。因此，数字化转型背景下高等职业教育教学伦理异化现象的研究更具有理论意义和现实意义。

一、教师权威地位的丧失和指导性角色的弱化

1. 缺乏师生互动和交际的学习形式容易导致技术对职业道德情感的异化；

教师的职业榜样作用是形成学生职业道德情感的重要路径。而技术的使用可能分散学生对老师的关注，学生在教学过程中体会教师职业精神和态度的机会相应地减少。教和学在一定程度上因教师与学生大幅减少的相处时间和空间而被动地分离开[4]。

2. 技术的规定逻辑造成非真实的情感体验，学生道德情感认识的发展被限制。

在现阶段的数字化教育中要求技术体现相当程度的人文主义精神是不现实的要求。由于创造性缺失，按照设定投入运行的数字技术暂时无法带来模拟的情感体验，这对学生道德情感的认识和发展产生了不利影响。同时，人与人之间的知识交流与学习互动往往受限于机器界面与虚拟学习社区，阻碍学生道德修养的养成与情感体验的增强[7]。

二、知识产权相关法律意识的淡薄和诚信道德危机

1. 教育资源在未经许可的情况下被复制、传播和二次创作利用，导致职业法律意识淡薄[4]；

数字时代的知识往往以数字资源的形式存在。开放性的资源获取、传播和存储为职业教育资源偷盗提供了便利，甚至用于获取商业利益的目的，然而获取资源的代价和损失却可以忽略不计。这对学生、教师和教育机构的知识产权造成了严重侵害。

2. 教育资源数字化助长抄袭和学术造假等诚信问题的出现。

学生面对数字化的海量教育资源，难以自主形成网络知识产权意识，进而引发诚信问题，如分享和传播教师的教学视频和课件，抄袭学生的作业和学术论文等。对职业伦理和法律意识培养的忽视可能会导致严重的法律后果。

三、个人隐私权利尊重和捍卫的缺失

1. 开放式的数字平台、第三方人员的建设和维护以及平台安全漏洞隐患滋生了个人隐私泄露的土壤[4]；

个人信息的读取已经成为了教育数字化的通行证。高等职业教育系统的外部人员可以轻易获取教师和学生的私人信息，造成了实施网络犯罪的隐患。同时，数字平台安全漏洞的可能性和第三方技术人员的参与不能保证资源传输的安全和合法性，因此个人隐私权利无法得到保障。

2. 教师和学生个人时间和空间的隐私权利容易受到侵害。

传统的教育环境表现为离线形式，教师和学生之间的教学活动受限于实体空间。教育环境的数字化增加了教学主体互动和交际的平台，间接削弱了教学活动的权威性和个人隐私权利的重要性。学生由于隐私权意识的缺乏可能无视教师的个人空间和职业距离而产生骚扰和侵犯的行为。

四、网络正义的缺席和网络暴力现象的催生

1. 网络暴力和欺凌挑战人权的尊重和法律正义；

网络课程是教育环境数字化中常见的网络教学形式，也为网络暴力的发生提供了便利空间。"网课暴力和欺凌"属于网络暴力的一种，是数字化教育背景下的新式暴力，主要以入侵网络课堂的极端方式恶意扰乱教学秩序。"网课爆破"不仅发生在高职领域，在其他教育活动中也时常发生[4]。

2. 市场压力下的网络恶性竞争难以抑制。

高职教育以就业为导向、以培养技术型人才为目标满足社会和劳动市场的需求。因此学生面临一定的竞争压力。学生为了个人利益极易通过数字平台恶意攻击竞争对手，甚至引发网络暴力，而在数字化教育背景下该操作是具有较高隐蔽性的，维护人权和捍卫法律的难度很高[4]。

研究结论：

数字化转型背景下高等职业教育的教学伦理问题需要从教学主体和教学技术管理两个层面进行思考。在教学主体层面，应当促进形成教师对数字职业技术应用与学生道德培养共同发展的良性态度，如教师数字职业素养的形成。而教学技术管理层面的解决更为重要，需加强对开放网络数字资源的产权保护意识，实施个人隐私保护的技术性方法，以及建立网络暴力等犯罪的监管机制等。数字职业教育作为一个新的教育生态环境，需要确保它的动态平衡和良性发展。而如何建立新的教师职业道德规范是职业教育数字化转型过程中极具理论和实践价值的问题。最后，建立合理的职业教育道德理念体系，适当的采取合理的管理手段是教育管理者应当积极相应和引起重视的方面。

参考文献

1. 曹惠芳.科技行为的伦理思考 / 曹惠芳 // 沧桑. – 2010. – № 02. – С. 76-77.

2. 李桂花，张媛媛. 超越单向度的人 – – – 论马尔库塞的科技异化批判理论/ 李桂花，张媛媛 // 社会科学战线. – 2012. – № 7. – С. 30–32.

3. 习近平. 高举中国特色社会主义伟大旗帜，为全面建设社会主义现代化国家而团结奋斗（在中国共产党第二十次全国代表大会上的报告）. [网络资源] // 中国共产党新闻网 [网站]. URL: http://cpc.people.com.cn/GB/64162/448633/.

4. 杨淑萍,苏超举,朱星辰.高职教育数字化转型下的伦理问题及其超越 / 杨淑萍,苏超举,朱星辰 // 现代教育管理. – 2023. – № 10. – С. 106-115.

5. 袁振国. 教育数字化转型：转什么，怎么转 / 袁振国 // 华东师范大学学报(教育科学版). – 2023. – № 41 (3). – С. 1-11.

6. 张莉.试论高等职业教育中的伦理道德教育 / 张莉 // 扬州大学学报（高教研究版）. – 2006. – № 1. – С. 48-50.

7. 赵磊磊,赵玉洁,张黎.数字化转型背景下教育技术伦理观照与风险消解 / 赵磊磊,赵玉洁,张黎 // 中国远程教育. – 2023. – № 43(12). – С. 46-58.

8. 朱德全，熊晴. 数字化转型如何重塑职业教育新生态 / 朱德全，熊晴 // 现代远程教育研究. – 2022. – № 34(4). – С. 12–20.

基于情感共鸣的学前教育声乐教学策略研究
RESEARCH ON VOCAL TEACHING STRATEGIES FOR PRESCHOOL EDUCATION BASED ON EMOTIONAL RESONANCE

Mo Ruran
Guizhou Normal University, Guiyang, China

Zhou Xiaolong
Postgraduate
Chuvash State Pedagogical University named after I.Y. Yakovlev,
Cheboksary, Russia;
Senior Lecturer
Guizhou Normal University, Guiyang, China

[摘要]本研究旨在探究基于情感共鸣的学前教育声乐教学策略的有效性。通过文献综述，分析了情感共鸣在学前教育声乐教学中的研究现状，内容聚焦于情感共鸣理论在学前教育声乐教学中的应用，构建了基于情感共鸣的教学策略，为学前教育声乐教学提供新的思路和方法。
关键词：学前教育 声乐教学 情感共鸣

Abstract. This study aims to explore the effectiveness of vocal teaching strategies in preschool education based on emotional resonance. Through literature review, this paper analyzes the current research status of emotional resonance in vocal teaching in preschool education, focusing on the application of emotional resonance theory in vocal teaching in preschool education. A teaching strategy based on emotional resonance is constructed, providing new ideas and methods for vocal teaching in preschool education.

Keywords: preschool education, vocal teaching, emotional resonance.

在学前教育领域，声乐教学一直被视为一种有效的教育手段，它不仅能够培养儿童的音乐素养和审美能力，更能在情感层面与儿童产生深刻的共鸣。近年来，随着教育理念的更新和教学方法的创新，基于情感共鸣的学前教育声乐教学策略逐渐受到研究者和教育者的关注。

在国外，学者们主要从心理学、教育学和音乐学等多学科视角出发，探讨情感共鸣在学前教育声乐教学中的作用机制。例如，有研究者通过实验法发现，当教师在声乐教学中运用富含情感的教学策略时，儿童的情感参与度和学习效果会显著提高。此外，还有学者关注到了情感共鸣对于儿

童创造力、合作意识和自我表达能力等方面的积极影响。相比之下，国内关于情感共鸣在学前教育声乐教学中的研究起步较晚，但发展势头迅猛。近年来，国内研究者开始关注到情感共鸣在儿童音乐教育中的重要性，并尝试将其应用于实际教学中。例如，一些幼儿园在声乐课程中引入了情感教育的元素，通过歌曲的选择、教学方式的创新以及师生互动的增强等手段，激发儿童的情感共鸣，从而提升教学效果。

一、情感共鸣理论在学前教育声乐教学中的应用

在学前教育阶段，声乐教学不仅是为了传授音乐知识，更重要的是通过音乐激发幼儿的情感，使其在学习的过程中体验到音乐的魅力，从而达到情感与认知的双重发展。情感共鸣理论在学前教育声乐教学中的应用，就是要找到教学策略与幼儿情感之间的契合点，使教学更加贴近幼儿的实际需求，提高其学习兴趣和效果。

歌曲选择是情感共鸣理论应用的首要环节。在选择歌曲时，教师应充分考虑幼儿的年龄特点、兴趣爱好和认知水平，选择那些旋律优美、歌词简单易懂、情感真挚的歌曲。这样的歌曲更容易引起幼儿的共鸣，使其在听、唱的过程中感受到音乐的情感表达，从而激发其学习音乐的兴趣。

教学方法的运用是实现情感共鸣的关键。在教学过程中，教师应注重情感的引导，通过生动形象的教学语言、丰富的肢体动作和面部表情，将歌曲中的情感表达出来，传递给幼儿。同时，教师还可以运用游戏、律动等多样化的教学方式，让幼儿在轻松愉快的氛围中感受音乐的魅力，体验到学习声乐的乐趣。

师生互动是情感共鸣不可或缺的通路。在教学过程中，教师应注重与幼儿的互动交流，鼓励幼儿大胆表达自己的感受和想法。当幼儿遇到困难时，教师应给予及时的关心和鼓励，帮助其克服畏难情绪，增强其学习信心。同时，教师还可以通过与幼儿一起合唱、对唱等形式，增进师生之间的感情，使幼儿在轻松愉悦的氛围中学习声乐知识。

二、基于情感共鸣的学前教育声乐教学策略构建

在学前教育中，声乐教学不仅是传授音乐知识和技能的过程，更是激发幼儿情感、培养审美能力和创造力的重要途径。基于情感共鸣的学前教育声乐教学策略，旨在通过情感引导，使幼儿在声乐学习中产生共鸣，从而增强学习兴趣和动力，提高教学效果。

教学策略的设计应首先关注幼儿的心理特点和情感需求。幼儿期是情感发展的关键时期，他们对外界事物充满好奇，情感表达直接而强烈。因此，教师在设计声乐教学策略时，应注重创设富有情感色彩的学习环境，选择贴近幼儿生活的音乐作品，以引发幼儿的情感共鸣。

实施步骤方面，教师可采用情境导入、情感体验、情感表达和情感升华四个环节来构建声乐教学过程。首先，通过创设生动的音乐情境，引导幼儿进入音乐世界，激发他们的学习兴趣。接着，教师带领幼儿深入体验音乐作品中的情感，引导他们感受音乐的美妙和魅力。在此基础上，鼓励幼儿用自己的方式表达情感，如歌唱、舞蹈、表演等，以培养他们的创造力

和表现力。最后，通过情感升华，使幼儿在音乐学习中获得积极的情感体验，促进他们情感的健康发展。

结语：基于情感共鸣的学前教育声乐教学策略应该是全方位的，它不仅着眼于提升儿童的声乐技能，更重视丰富他们的情感体验，促进了他们的个性发展。这种教学策略体现的教育学中"以人为本"的教育理念，将为学前儿童的声乐学习开辟了一条新的道路。

[参考文献]

1.李秋萍.情感共鸣在学前教育声乐教学中的应用[J].音乐时空，2022(04):167-168.

2.张晓梅.基于情感共鸣的幼儿声乐教学策略研究[J].当代音乐，2021(07):46-48.

3.王丽娟.情感共鸣在学前教育声乐课堂中的实践与探索[J].黄河之声,2020(20):102-103.

4.陈燕.论情感共鸣在学前儿童声乐教育中的重要性[J].北方音乐，2019(19):138-139.

5.刘阳.学前教育声乐教学中情感共鸣的培养策略[J].艺术评鉴，2022(14):100-102.

6.高婧.情感共鸣视角下的学前教育声乐教学方法创新[J].参花(上)，2023(03):117-119.

7.何晓玲.情感共鸣：学前教育声乐教学的灵魂[J].音乐生活，2021(09):84-85.

8.马蓓蓓.基于情感共鸣的学前教育声乐课程构建与实践[J].艺术大观，2023(05):63-65.

9.郭清波.情感共鸣在学前教育声乐教学中的作用及实施策略[J].北方音乐,2020(02):195-196.

10.孙晓梅.学前教育声乐教学中情感共鸣的培育路径[J].音乐天地，2022(10):28-30.

11.赵红梅.论情感共鸣在学前教育声乐课堂中的运用[J].参花(下)，2023(02):77-78.

12.李晶晶.情感共鸣视角下的学前教育声乐教学研究[J].黄河之声，2021(17):62-64.

13.张瑜.学前教育声乐教学中如何引发学生的情感共鸣[J].北方音乐，2019(17):146-147.

14.王晓芳.情感共鸣在学前教育声乐教学中的实践与思考[J].艺术评鉴，2020(14):115-116.

15.杨柳.基于情感共鸣的学前教育声乐教学创新研究[J].音乐时空，2023(03):188-189.

KI Podyma 精神和道德遗产的特点
FEATURES OF KI PODYMA'S SPIRITUAL AND MORAL HERITAGE

Yakovleva Elena Vladimirovna
Graduate student
Armavir State Pedagogical University,
Armavir, Russia

注解。 文章描述了 K.I. 的精神和道德遗产。 波迪米。 他的精神和道德遗产的各个方面都有其特点。 揭示了公众人物教育理念的主要特征。 强调波德马的创新性，他对国内外思想家、理论家和实践者的教学理念的创造性发展； 确定了影响 Podyma 多方面精神和道德遗产形成的因素。

关键词：Podyma、精神和道德遗产、文学和爱国俱乐部、公民教育、教育、三部曲。

Annotation. *The article describes the spiritual and moral heritage of K.I. Podymy. Various aspects of his spiritual and moral heritage are characterized. The main features of the concept of educating a public figure are revealed. The innovation of Podyma, his creative development of pedagogical ideas of domestic and foreign thinkers, theorists and practitioners are emphasized; the factors that influenced the formation of the multifaceted spiritual and moral heritage of Podyma are identified.*

Keywords: *Podyma, spiritual and moral heritage, literary and patriotic club, civic education, education, trilogy.*

Konstantin Ivanovich Podyma was born on September 16, 1948 in Primorsko-Akhtarsk, in the Kuban region, into a family of journalists. In 1954, the family moved to Novorossiysk. In 1958, his first article appeared in the newspaper "Novorossiyskiy Rabochiy" - about how the Chinese writer Gao Shi Tsi, paralyzed and blind like N. Ostrovsky, corresponded with the students of the 10th Communal Class from School No. 62, where Konstantin studied. After finishing school, Podyma, while working at "Novorossiyskiy Rabochiy," organized a literary-patriotic club "Shkhuna Rovesnikov" affiliated with the newspaper. Initially, it was just an author's idea, which was successfully implemented later [Buravkin, 2015, p. 371]. The published books "Fair Winds," "Shkhuna Rovesnikov!," and "Let Us

Rise First" highlight the club's activities. The author pays special attention to the research work of the club members. Podyma's poems, written in the 60s and 70s, are characterized by vivid romantic imagery, a yearning for goodness and justice, and easily lend themselves to music becoming songs.

After graduating from the All-Union State Institute of Cinematography, Konstantin Ivanovich worked in Moscow at Goskino of Russia, while continuing his active work in his hometown. In 1988, Podyma co-authored the book "Named in the Name of Russia" about the history of Novorossiysk. One of the main themes of Podyma's poetry has always been the memory of war, often focusing on events that took place in 1942-1943 on the shores of Tsemesskaya Bay [Lapin, 2021].

Konstantin Ivanovich was a member of the Union of Cinematographers of Russia, a member of the Union of Writers of Russia, and a laureate of the Nikolai Ostrovsky Award in 2011, as well as the M.V. Lomonosov Award and the Grand Prix named after Lieutenant General Nikolai Raevsky Jr. in 2005. In 2017, K.I. Podyma posthumously received the title - "Spiritual Name of Kuban" [Novikov, 2017, p. 403].

The relevance of addressing this topic is due to the need for a comprehensive revival and innovative application of Konstantin Ivanovich Podyma's spiritual and moral legacy. In modern conditions, his ideas for fostering citizenship and patriotism among youth and adolescents in regional settings are becoming increasingly relevant. Podyma's legacy includes books, publicistic works, documentary and popular science films, archival materials located in the Novorossiysk Historical Museum-Reserve, as well as in the school museum of Secondary School No. 18 in Novorossiysk where he studied. Researchers believe that his ideas can be useful for those who are currently exploring modern, interesting, and effective forms and methods of civic and patriotic education for youth.

The uniqueness of Podyma's spiritual and moral legacy lies in combining elements of communal methodology of creative education in I.P. Ivanov's collective, cooperation pedagogy, collaborative education by S.L. Solovyichik, and implementing his own authorial form of education based on regional specifics. This is what determines the viability of Podyma's civic education system.

Konstantin Ivanovich Podyma's creative work received high praise from the Higher Council of the International Union "Courage and Humanism." A documentary film "Shkhuna Rovesnikov" Sets Course was made about the literary-patriotic club's activities, as well as a series of films about heroic deeds during the Great Patriotic War: "Novorossiysk Remembers," "Routes of Valor," "Guardians of Our Memory," "Light of Our Memory," "Captain."

Podyma wrote books about the activities of his organization such as "Fair Winds," "Shkhuna Rovesnikov!" "Let Us Rise First," "Bescasque: Through Years and Centuries," "Eternal Flame, Burn Without Burning." These stories are filled with high romance devoid of official pathos.

Podyma has written over 200 materials about the city and its heroes, prominent fellow countrymen, the activities of the city's youth, which were published in newspapers such as "Novorossiysk Worker," "Komsomolskaya Pravda," "Sovetskaya Kultura," "Sovetskaya Rossiya," "Komsomolskaya Zhizn" from 1958 to 2008. While working in Moscow, Podyma remained an active participant in the "Peers' Schooner" club, and thanks to his initiative, the Nikolai Ostrovsky House-Museum was opened in Novorossiysk, and the "Letters to the Future" campaign (1967) was conducted, sending messages to the third millennium, submerging a special capsule-container to the bottom of the Black Sea, near the foot of the Sujuk lighthouse.

It should be noted that Novorossiysk can be proud of its unique traditions, the ideological inspirer of which was Podyma, leading to nationwide actions such as Operation "Beskozyrka" (in memory of the heroic landing under the command of Major C.L. Kunikov), "Sea Soul" (in memory of the young patriot Vitya Novitsky), "Blade" (in honor of writer N.A. Ostrovsky), and others. The literary-patriotic youth association "Peers' Schooner," created by Podyma over 50 years ago, gathered the first volunteers of the hero city under its sails. Over half a million people from 340 settlements of the USSR, CIS, and Russian Federation participated in operations, gatherings, and activities initiated by "Peers' Schooner." Schools in Novorossiysk, where school museums are organized, traditionally invite the first participants of "Peers' Schooner" for meetings with the younger generation in February. Students listen to invited guests who talk about how the foundations of various patriotic actions were laid and how various events of patriotic orientation began. The historical-patriotic association "Peers' Schooner" continues its activities at the Admiral F.F. Ushakov State Maritime University.

In the 1990s, Podyma worked on an artistic-pedagogical trilogy: "The Honest Mirror of Youth," "Testament to the Son," and "Island of Childhood," consisting of didactic chapters-instructions using historical examples and addressed to young readers. The meticulous work of writer and publicist K.I. Podyma in the archives of the State Historical Library became the basis for the studied trilogy. The collective image of a citizen and patriot is shown: a citizen must receive education, work honestly, contribute to the country's development; a patriot must defend their homeland, know history, be proud of their country's achievements.

In the first part of the trilogy "The Honest Mirror of Youth-99," Podyma precedes excerpts from historical documents with colorful stories, followed by author's comments. In this first part, documents from 833 AD to 1942 are explored and quoted by Podyma. The overall idea of the trilogy is to foster respect for elders, parents, honesty, loyalty, courage, politeness, virtue, truthfulness, and defending the homeland. The archival documents examined by the author allow us to learn how rulers, writers, philosophers, clergymen, military leaders reflected on

questions of citizenship and patriotism in their time. The book includes excerpts from letters (Suvarov A.V., Stendhal, Kutuzov M.I., Romain Rolland), treatises (Vincent, Chertaldo, Bruni), teachings (Monomakh), instructions (Pososhkov, Tatishchev), sayings (Franklin), advice (D'Anglèzi), instructions (Catherine II), notes (Dürer), books (Iskander), and others. The researcher notes characteristic forms of presenting citizenship issues depending on the year of writing and country. Tractates, rules, and advice were popular in France and Italy in the 13th-17th centuries. In Russia in the 18th-19th centuries, letters, advice, and instructions were common. Summing up the first part, Podyma calls on readers to remember their country's heroes' deeds and live life honorably and honestly as it is short [Podyma, 1999, p. 124].

In the second part of the trilogy "2000: Testament to the Son" by K.I. Podyma, documents from 2500 BC to 1912 are explored and quoted. As the author himself writes, these are words transferred from clay tablets, papyrus, wax tablets, parchment to sheets of ordinary paper [Podyma, 2000, p. 3]. The author examines archival documents from Babylon, Ancient Egypt, Ancient Jerusalem, China, India, Greece, Ancient Rome, Byzantium, Assyria, Gaul, Spain, Ancient Iceland, Italy, Tibet, Germany, Ancient Russia, Czechia, England, Hungary, and others. By citing records from ancient times, K.I. Podyma suggests taking with oneself all the good and bright things that ancient authors, the best minds of humanity, wished for sincerely and from the heart so that young people can pass on clear and reverent thoughts to their children through the centuries [Podyma, 2000, p. 125].

In the third part "The Island of Childhood," the author continues to narrate about what people thought about and dreamed of, whose names are in history textbooks and on book covers [Podyma, 2003, p. 3]. In the concluding part of the trilogy by K.I. Podyma, documents from 1677 to 1955 are explored and quoted. The book includes excerpts from letters, notebooks of Peter the Great, D. Fonvizin, M. Y. Lermontov, M. P. Lazarev, Charles Dickens, Anton Chekhov, Alexander Green, Maxim Gorky. The artistic stories tell about famous compatriots, their mentors, deeds as citizens and patriots of their homeland. The final book also includes stories about A. Griboyedov, A. Pushkin, H.C. Andersen, the Grimm brothers. K.I. Podyma believes that the heroes of his books are life teachers, faithful companions, prophets, and martyrs [Podyma, 2003, p. 68]. They advise to respect others' time, keep secrets, believe and help good people, cherish friends.

Based on the analysis conducted, it can be concluded that there is a possibility of developing the content of the modern concept of citizenship education by using the fundamental ideas of Podyma, including the following: it is necessary to contribute to preserving historical continuity between generations, developing Russian national culture and the cultures of the peoples of Russia, fostering a careful attitude towards the historical and cultural heritage of all peoples inhabiting

our country, shaping schoolchildren's understanding of the values of a democratic society and the most important personal qualities: civic position, morality, sense of duty and personal responsibility for the entrusted task.

References

1. Buravkin V.A. Prose legend - "The Saga of the Schooner" Novorossiysk, "Odyssey", 2015.-385 p.

2.Lapin E. Konstantin Podyma was the first to try on the "Beskozyrka" for Novorossiysk. Novorossiysk worker. URL:https://novorab.ru/2021/09/20/ konstantin-podyma-pervym-primeril-novorossijsku-beskozyrku/(access date 04/23/2023)

3. Novikov, S.G. (Ed.). Persons of Novorossiysk: Large illustrated dictionary. Novorossiysk: LLC Publishing House "Persona Press", 2017. -608 p.

4. Podyma, K. I. An honest mirror of youth - 99 or instructions and teachings to small children and young boys, extracted from time immemorial by Konstantin Podyma / Konstantin Podyma; Rice. Andrey Glotov. - Moscow: Charity. society org. "Courage and Humanism": UNPRESS, 1999. - 128 p. : ill., portrait; 21 cm. - (Library "Courage and Humanism"; Issue 2)

5. Podyma, K. I. 2000: testament to a son, or Instructions and teachings for small children and young boys, extracted from time immemorial by Konstantin Podyma / Konstantin Podyma. - Moscow: Charity. society org. "Courage and Humanism": UNPRESS, 2000. - 127 p. : ill., portrait; 21 cm. - (Library "Courage and Humanism" Issue 7)

6. Podyma, K. I. 2003: Islands of Childhood / Konstantin Podyma. - Moscow: Charity. society org. "Courage and Humanism": UNPRESS, 2003. - 70 p. : ill., portrait; 21 cm - (Library "Courage and Humanism" Issue 12)

7. Pakhomov V.B. Literature of Novorossiysk: Literary research. at 15t. T.15. Novorossiysk: Odyssey, 2021.380 p.

教育评估和自我评估：现代方法和技术
ASSESSMENT AND SELF-ASSESSMENT IN EDUCATION: MODERN APPROACHES AND TECHNIQUES

Kazikhanov Bulat Rafilevich
Student
Kazan State Power Engineering University,
Kazan, Russia

Andreeva Elena Anatolyevna
Candidate of Pedagogical Sciences
Kazan State Power Engineering University,
Kazan, Russia

抽象的。 在不断发展的教育格局中，评估仍然是评估学习成果和指导教学策略的基石。 传统上，评估主要是教师主导的活动，教育工作者使用标准化测试和作业来衡量学生的理解程度。 然而，这种范式正在转向更加以学生为中心的方法，强调自我评估作为培养自主性、反思和终身学习的关键工具。 本文深入探讨了教育中评估和自我评估的现代方法和技术，强调了创新方法、其好处以及对教育实践的影响。

关键词：评估、自我评估、教育、现代方法、技术、以学生为中心、自主性、反思、终身学习。

Abstract. *In the evolving landscape of education, assessment remains a cornerstone for evaluating learning outcomes and guiding instructional strategies. Traditionally, assessment was predominantly a teacher-led activity, where educators used standardized tests and assignments to gauge students' understanding. However, the paradigm is shifting towards a more student-centered approach, emphasizing self-assessment as a pivotal tool for fostering autonomy, reflection, and lifelong learning. This article delves into modern approaches and techniques of assessment and self-assessment in education, highlighting innovative methods, their benefits, and the implications for educational practices.*

Keywords: *assessment, Self-assessment, Education, Modern Approaches, Techniques, Student-centered, Autonomy, Reflection, Lifelong Learning.*

For the beginning, assessment and self-assessment are both processes used to evaluate and measure various aspects of an individual's performance, skills,

knowledge, or abilities. While they share similarities, they differ in terms of who is conducting the evaluation and the purpose of the evaluation.

Assessment refers to the systematic process of gathering, analyzing, and interpreting information to make judgments or decisions about an individual's performance, skills, knowledge, or abilities. It can be conducted by educators, employers, or other professionals to evaluate a person's proficiency in a particular subject, job-related skills, or overall capabilities.

–   The Shift towards Student-Centered Assessment. Historically, assessment in education has been characterized by its top-down nature, with educators as the primary arbiters of students' competencies. However, contemporary pedagogical theories emphasize the importance of involving students actively in the assessment process. This shift towards student-centered assessment recognizes learners as active participants rather than passive recipients of knowledge. Mini-Development: Implement workshops and training sessions for educators to familiarize them with student-centered assessment strategies. Provide resources and case studies showcasing successful implementations, emphasizing the benefits of this approach for both educators and students.

–   The Role of Self-assessment in Fostering Autonomy. Self-assessment empowers students to take ownership of their learning, promoting autonomy and self-regulation. By reflecting on their performance and identifying areas for improvement, students develop metacognitive skills and a deeper understanding of their learning process. Moreover, self-assessment cultivates a growth mindset, where challenges are viewed as opportunities for learning rather than obstacles to success. Mini-Development: Introduce structured self-assessment templates and tools that guide students in evaluating their work effectively. Organize peer-review sessions where students can practice giving and receiving constructive feedback, enhancing their self-assessment skills and collaborative abilities.

–   Innovative Techniques in Assessment and Self-assessment. With advancements in technology and pedagogical research, educators have access to a myriad of innovative techniques for assessment and self-assessment. Digital portfolios, peer assessment, and reflective journals are among the tools gaining traction in modern classrooms. Digital Portfolios: Digital portfolios allow students to compile and showcase their work, providing a holistic view of their learning journey. They encourage reflection, self-evaluation, and the integration of multimedia elements to demonstrate understanding.

Peer Assessment: Peer assessment promotes collaborative learning and fosters a supportive learning environment. By evaluating their peers' work, students develop critical thinking skills, enhance their understanding of assessment criteria, and receive valuable feedback from multiple perspectives.

Reflective Journals: Reflective journals encourage students to articulate their thoughts, experiences, and insights throughout the learning process. By regularly documenting their reflections, students enhance their metacognitive awareness, identify patterns in their learning, and set goals for future growth.

Mini-Development: Collaborate with edtech companies to develop customized digital platforms tailored to specific subject areas or learning objectives. Encourage students to create multimedia-rich digital portfolios that incorporate videos, podcasts, and interactive presentations to demonstrate their learning creatively.

– Implications for Educational Practices. Incorporating student-centered assessment and self-assessment techniques into educational practices has profound implications for teaching and learning. It requires educators to adopt a facilitative role, providing guidance, resources, and opportunities for students to engage actively in the assessment process. Additionally, it necessitates a shift in mindset among educators, recognizing students as partners in learning and valuing their perspectives, insights, and contributions. Mini-Development: Foster a culture of continuous professional development among educators, encouraging them to share best practices, collaborate on assessment strategies, and reflect on their teaching methods. Establish mentorship programs where experienced educators guide their peers in adopting student-centered assessment approaches.

– Embracing Student-Centered Assessment. Traditional assessment methods, predominantly instructor-driven, are increasingly being re-evaluated and redefined to align with the principles of student-centered learning. This shift acknowledges students as active participants in the learning process, valuing their perspectives, experiences, and contributions. Student-centered assessment emphasizes personalized learning, catering to diverse learning styles and needs, fostering inclusivity, and promoting a deeper understanding and engagement with content. Mini-Development: Involve students in the co-design of assessment methods and criteria, ensuring that they feel valued and heard in the assessment process. Implement flexible assessment options that allow students to choose from a variety of formats (e.g., presentations, projects, portfolios) based on their strengths and preferences.

– Rethinking Assessment: A Shift towards Student-Centered Approaches. The traditional paradigm of assessment, characterized by standardized testing and instructor-led evaluations, is gradually giving way to more student-centered approaches. This shift is rooted in the recognition of students as active agents in the learning process, capable of reflecting on their learning, setting goals, and taking ownership of their educational journey. Student-centered assessment strategies emphasize personalized learning experiences, cater to diverse learning needs, and foster engagement, mo-

tivation, and deeper understanding of content. Mini-Development: Create interdisciplinary assessment projects that encourage students to apply knowledge and skills from multiple subject areas to real-world problems. Offer workshops on metacognitive strategies and goal-setting to help students develop a deeper understanding of their learning processes and take ownership of their educational journey.

– Leveraging Technology for Enhanced Assessment and Self-assessment. The digital revolution has ushered in a plethora of opportunities for enhancing assessment and self-assessment practices through the integration of technology. Technology-enhanced assessment tools and platforms, such as online quizzes, interactive simulations, digital portfolios, and learning analytics, offer educators and students innovative ways to gather, analyze, and utilize assessment data to inform teaching and learning. Mini-Development: Explore emerging technologies such as artificial intelligence and machine learning to develop adaptive assessment tools that tailor questions and content to individual students' learning needs and progress. Implement learning analytics dashboards that provide real-time feedback and insights to both educators and students, facilitating data-driven decision-making and personalized learning experiences.

Conclusion: assessment and self-assessment in education are undergoing transformative changes, moving towards student-centered approaches that prioritize autonomy, reflection, and lifelong learning. By embracing innovative techniques and fostering collaborative partnerships between educators and students, we can create inclusive learning environments that empower learners, nurture their potential, and prepare them for success in the 21st-century world.

References

1. Black, P., & William, D. (1998). Inside the black box: Raising standards through classroom assessment. Phi Delta Kappan, 80(2), 139-148.

2. Boud, D., & Falchikov, N. (2006). Aligning assessment with long-term learning. Assessment & Evaluation in Higher Education, 31(4), 399-413.

3. Dweck, C. S. (2006). Mindset: The new psychology of success. Random House.

4. Barrett, H. (2007). Researching electronic portfolios and learner engagement: The REFLECT Initiative. Journal of Adolescent & Adult Literacy, 50(6), 436-449.

5. Topping, K. (1998). Peer assessment between students in colleges and universities. Review of Educational Research, 68(3), 249-276.

6. Moon, J. A. (1999). Reflection in learning and professional development: Theory and practice. Kogan Page.

7. Falchikov, N., & Goldfinch, J. (2000). Student peer assessment in higher education: A meta-analysis comparing peer and teacher marks. Review of Educational Research, 70(3), 287-322.

商业游戏作为中等教育机构职业教育学生教学的积极方法
BUSINESS GAME AS AN ACTIVE METHOD OF TEACHING STUDENTS OF SECONDARY EDUCATIONAL ORGANIZATIONS VOCATIONAL EDUCATION

Bocharova Marina Alexsandrovna
Master of Pedagogy, Advisor to the Director of Education and Interaction with Children's public associations Bobrovsky Agricultural and Industrial College named after M.F. Timashova

抽象的。 文章揭示了商业游戏应用在中等职业教育（以下简称SVE）组织的教育过程中的重要性。 重点阐述了商业游戏应用的方向、实现阶段。 给出了进行商业游戏每个阶段的练习示例。 提供了在 SVE 组织的教育过程中实际使用商业游戏的建议。

关键词：商业游戏； 积极的教学方法； 学生；中等职业教育组织。

Abstract. the article reveals the importance of business game application in the educational process of the organization of secondary vocational education (hereinafter - SVE). The directions of business game application, stages of its realization are highlighted. Examples of exercises for conducting each stage of the business game are given. Recommendations for the practical use of business games in the educational process of the organization of SVE are provided.

Keywords: business game; active teaching methods; students; organizations of secondary vocational education.

Carrying out teaching activities at the State Budgetary Professional Educational Institution in Voronezh Oblast "Bobrovsky agrarian-industrial college" in disciplines "Foreign language (English)", "Native literature" and interdisciplinary course "Psychological foundations of legal training of drivers of category C" we noted that students have difficulties in the discussion and analysis of practical situations in the field of future professional activity, which actualized the importance of the application of business games in the educational process of the organization of vocational education and training.

During the study of psycho-pedagogical and methodological literature it was found out that business games are quite a universal tool for studying and analyzing practice-oriented educational tasks in SVE organizations. Within the framework of business games it is possible to simulate pedagogical processes and situations, to analyze possible solutions to emerging problems in training. At the same time, within the framework of one game it is often possible to implement several different methodological techniques for finding effective solutions, combining analytical and experimental methods, modeling and expert evaluations. Hence, the purpose of business games application in the educational process of SVE organization is to create conditions for the formation of a professionally competent, socially active, creatively independent personality of a student [1; 2; 6; 7; 11].

I. A. Babanova singled out the following directions of business game application in the educational process:

- maximum involvement of students in the learning process;
- manifestation and development of initiative and creative abilities of students;
- displaying organizational skills to develop a collective thought and transform it into a concrete solution in practice, as well as finding a compromise in the interests of the cause, setting aside one's ambitions;
- good consolidation of the discipline material [3].

Having analyzed the scientific literature on the topic of research, we found out that it is possible to use business games to test the results of learning in both exact and social humanities disciplines. For example, at the lesson of foreign language (English) on the topic: "Future career: Your future depends on your right choice" by means of a business game it is possible to familiarize students with the main problems of choosing a profession, to activate professional and business vocabulary in a foreign language, to help improve the speech skills of dialogical speech.

It should be noted that the purpose and objectives of the business game must necessarily coincide with the practical need to accumulate professional experience of SVE students. With the help of games, students develop skills of social interaction and professional communication.

The above-mentioned directions of using business games in training contribute to the successful formation of the personality of a professional. Let us concretize this statement:

- the game provides an opportunity to significantly reduce the time for students to gain experience in the field of professional activity;
- the game develops non-standard and creative thinking, which allows solving problem situations and creates an artificial model of the experiment;
- business game allows to apply theoretical knowledge in practice and helps to assimilate information in the process of game actions;
- the game forms an image of the future profession in students;

- business game allows learners to accumulate knowledge, skills and skills of communication, culture, socialization and others.

In order for the work on the application of the method of "business game" to proceed logically, dynamically and give results, it is necessary to determine in advance the theme, purpose and objectives of the training session. Accordingly, it is necessary to establish the nature, scope and conditions of the activity.

To correctly formulate the purpose of the business game, the teacher should formulate several questions according to the scheme in the figure (according to N. V. Vasina) [5].
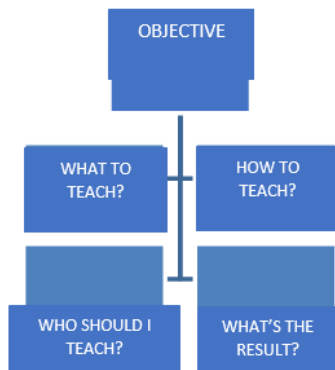
Designing the goal of the game according to N. V. Vasina

It is not necessary to identify the educational (learning) goals and action goals of the game participants, they are formulated according to the game role, which is defined in the group.

The peculiarities of developing a flow chart of a training session with the use of a business game allow forming a model of the game and actually describing its course.

The analysis of methodological literature [3; 9] allowed us to formulate the stages of conducting a business game, presented in the table.

Stages of the business game

№ n\a	Stage name	Stage characterization
1	Problem identification	Participants should conceptualize the concepts that collectively define the goals and are formulated by the participants in a joint action
2	Optimization (goal setting)	At this stage, the optimal event pattern

| 3 | Finding a solution | Finding available resources that can solve problems that are meaningful to the participants of the game |
| 4 | Design organization | The use of resources by the participants of the game aimed at solving the problems and/or achieving the goals of the lesson |

Let's consider each stage. At the stage of problem identification, students establish the boundaries of the problem situation determine the essence of the problem and formulate ways out of it. According to V.S. Yukaeva, students identify and analyze problems in several stages:

- compartmentalizing the problem;
- highlighting the major and minor characteristics of the problem;
- establishing cause-and-effect relationships across all possible options for solving the problem;
- predicting and analyzing required actions;
- developing recommendations for action [12].

At the stage of optimization (goal setting), the results can be achieved in various ways. For example, the analysis of N. V. Borisova's works has shown that the following types of exercises for creating and retaining the initiative of the students will help them to formulate the problem and purpose of the lesson more quickly:

1. Exercise "Fascinating story". The aim is to overcome difficulties in problem solving, to form skills of independence. Instructions: during the lesson or before the lesson, a case should be presented to the trainees with the inclusion of a specific participant in the situation, containing goals and ways to achieve them. The main thing is that the story should be short and memorable, and the participant should be a peer. Then the information will be accessible and solving similar problems will be easier.

2. Exercise "Visualization". The aim is to develop attention. Instruction: it is necessary to use maps, illustrations, presentations and videos during the lesson to help the teacher keep interest in the topic of the lesson.

3. Exercise "Interesting questions". The aim is to form the skills of independent work. Instructions: the teacher should formulate a question in such a way that the intrigue remains during the lesson, the answer to which can be obtained only after the knowledge gained during the lesson [4].

At the stage of searching for a solution, students who are able to take initiative independently, will be able to independently and smoothly extract the necessary knowledge from the educational material and operate them in everyday life. To develop skills in working with normative acts, as well as using their provisions in practice, N. V. Pelevina recommends applying the following exercises:

1. The exercise "Read carefully the title of the document" contributes to the formation of the ability to give a general characteristic of a normative-legal act, its place in the system of law.

2. The exercise "Read the text carefully" forms the ability to extract and generalize knowledge from several normative acts; to explain the meaning of a legal norm, to comment on it; the ability to identify the essential features of legal concepts contained in the text of a normative act.

3. The exercise "Write out concepts" contributes to the formation of the ability to use excerpts from the text of the act when answering to illustrate theoretical points [10].

Organization of design is the final stage of the game. Accordingly, at this stage it is advisable to use practical exercises to consolidate the knowledge gained during the game. A. A. Danilova, P. V. Uvarov refers to such exercises as:

1. Exercise "Round Table". The exercise is used to discuss and highlight the problem in the class by a group of students in order to solve the set tasks.

2. Exercise "Resolution". The exercise is used to record the actions taken in the process of solving problems and/or achieving the goals of the session.

3. Exercise "Rating system". The exercise is used to evaluate the actions of students by a group of experts on the application by the participants of the game of resources aimed at solving the problems [8].

Thus, we can formulate recommendations for the practical use of business games in the educational process of an SVE organization:

1. It is advisable to use business games only in cases when other interactive methods are not used at the training session, as a business game is a rather organizationally complex method.

2. The business game should be carefully thought out, as a poorly prepared organizational base requires constant intervention from the teacher and deprives the students of autonomy of action.

3. The conditions of the game should simulate as much as possible the real conditions of professional activity, in which the trainees find themselves immediately after graduating from college.

4. The business game should continue or conclude a specific learning theme of the discipline being studied.

So, business game is a complex, multilevel method, which includes a whole set of active learning tools. It should also be noted that the business game is a means of implementing the systemic-activity approach, which determines the use of game technologies in the educational process of SVE organization.

List of references

1. Andreeva, E. V. The principle of biplanarity in a business game as a form of contextual learning : 13.00.01 : thesis abstract for the degree of Candidate of Pedagogical Sciences / E. V. Andreeva. - Moscow, 1999. - 26 p.

2. Atamanova, R. I. Business game : essence, methodology of designing and conducting : textbook / R. I. Atamanova. - Moscow : Higher School, 2004. - 120 p.

3. Babanova, I. A. Business games in the educational process / I. A. Babanova // Research in Education. - 2012. - № 6. - P.1-7. - URL :https : //cyberleninka.ru/article/n/delovye-igry-v-uchebnom- protsesse/viewer (date of address : 14.02.2022).

4. Borisova, N. V. Business game "Report and discussion in scientific and technical propaganda" : methodical manual / N. V. Borisova, A. A. Solovyova. - Moscow : IPKIR, 1981. - 59 p.

5. Vasina, N. V. Business games and game exercises in the educational process / N. V. Vasina, O. A. Mishchenko. - Khabarovsk : TOGU, 2016. -253 p.

6. Verbitsky, A. A. Developing whether business games: The problem of classification of game procedures / A. A. Verbitsky // Problems of psychology of education : a collection of articles. - 1994. - № 2. - P. 12-26. - URL : https : // cyberleninka.ru/article/n/delovaya-igra-kak-forma-kontekst nogo-obucheniya-i-kvaziprofessionalnoy-deyatelnosti-studentov/viewer (date of reference : 07.02.2022).

7. Geronimus, Yu. V. Game, model, economy : textbook / Yu. V. Geronimus. - Moscow : Znanie, 1989. - 280 p.

8. Danilova, A. A. Game space in the design of business games / Danilova P. V. Uvarov // Training and education : methods and practices. -2014. - №30-2. - P. 1-5. -URL: https : //cyberleninka.ru/article/n/igrovoe-prostranstvo-v-proektirovanii- delovyh-igr-opyt-organizatsii-v-vuze (date of reference : 05.02.2022).

9. Review of the methodology "Business Games" based on the research work of C. R. Harris / E. V. Ezhova. - URL : https://hr-portal.ru/article/obzor-delovyh-igr (date of reference : 05.02.2021).

10. Pelevina, N. V. Formation of skills work with normative-Legal acts / H. V. Pelevina. -URL : https : //infourok.ru/doklad-formirovanie-umeniy-umeniy-raboti-s-normativno pravovimi-aktami-u-uchaschihsya-na-urokah-obschestvoznaniya-694689.html (date of address : 07.02.2022).

11. Popov, D. Yu. The problem of tolerance education among students of professional education organizations / D . Yu. Popov, E. E. Plotnikova // Actual issues of modern science and education : proceedings of the Scientific Session 2021 Borisoglebsk branch of FSBEU VO "VSU". -Moscow : Pero, 2021. - P. 308-312.

12. Yukaeva, V. S. Management decision-making / V. S. Yukaeva, E. V. Zubareva [et al.]. - Moscow : Dashkov & Co, 2011. - 325 p.

公民爱国教育的中国模式作为国家发展的全球载体
THE CHINESE MODEL OF CIVIC-PATRIOTIC EDUCATION AS A GLOBAL VECTOR FOR THE COUNTRY'S DEVELOPMENT

Averkov Aleksandr Nikolaevich
Applicant, director
Secondary school No. 42, Mogilev,
Mogilev, Republic of Belarus

抽象的。 本文考察了中国爱国主义形成的问题。 对这个问题的研究特别有趣，因为几千年来，中华人民共和国一直是一个强大而伟大的国家，具有一定的国家制度和爱国主义。 描述的概念和计划将使中国迈向新的全球水平。
关键词：爱国主义、社会主义、混乱、小康、大同、"中国梦"、"一带一路"。

Abstract*. This article examines the problems of the formation of patriotism in China. The study of this issue is of particular interest, because For many millennia, the PRC has been a strong and great country with a certain system of statehood and patriotism. Concepts and programs are described that will allow China to move to a new global level.*

Keywords: *patriotism, socialism, Hunluan, Xiaokang, Datong, "Chinese Dream", "One Belt - One Road".*

The formation of patriotism is one of the urgent tasks of any state, since it is it that acts as a kind of "cement" of society. The special significance of patriotic values lies in the fact that they are highly characterized by a focus on establishing and strengthening the principles of community, unity and consolidation, and on realizing the strong interrelation of key public and state interests.

Patriotism in China has received a special form of expression, and for several millennia it has been the basis of the power and unity of the multinational country. For example, in ancient times, the patriotic feelings of the people restrained external aggressors and more than once revived a state fragmented into small principalities. During the period of New History, China had to fight expansion from Western countries, and patriotism was the source of strength. After the formation of the PRC, patriotism was perceived as one of the main pillars of the development of "socialism with Chinese characteristics."

The essence of the Chinese vector of history is three successive periods:

1. The pacification of "chaos" (hunluan) fragmentation and civil war by force, which was done by the founder of the People's Republic of China, Mao Zedong, in 28 years.

2. Building a society of "small prosperity" (xiaokang), which was started in 1979 by the "architect of the Chinese miracle" Deng Xiaoping and 40 years later in 2019 should be accomplished by his followers - the builders of "socialism with national specifics of a middle state."

3. The transition to building a society of "Great Unification" (Datong), the initiative of which was announced in Geneva by the "standard bearer of the Chinese Dream" about the revival of the greatness of the Chinese nation, Xi Jinping.

All three periods called for the creation of a strong and powerful country with a special system of statehood and patriotism.

All the leaders of the People's Republic of China spoke about the importance of patriotic feelings. President Xi Jinping called on Chinese people to love their country, the Chinese Communist Party (CCP) and socialism. "In modern China, the essence of patriotism is love for the country, the party and socialism at the same time," Xi Jinping said. He clarified that love for the fatherland, a sense of devotion and attachment to the homeland are the "duty and responsibility" of every Chinese. "This is the foundation on which young Chinese in the new era can become winners in life," the Chinese president added.

Going forward, Xi Jinping noted, "we should fully promote patriotism, cultivate a strong sense of national dignity and confidence among our people, and strengthen the sense of community of the Chinese nation."

On November 29, 2012, Xi Jinping announced the concept of the "Chinese Dream", naming three main conditions for its implementation:

1. It is imperative to follow the Chinese path, that is, the path of socialism with Chinese characteristics. The Chinese nation is a nation of extraordinary creativity.

2. It is necessary to uplift the Chinese spirit, the core of which is patriotism, as well as the spirit of the era, the core of which is reform and innovation.

3. It is necessary to unite the forces of the nation, which are born of the great unity of the nationalities of the country. The Chinese Dream is the dream of the entire nation and of every Chinese individual [3].

Contemporary Chinese philosopher Zhao Tingyang believes that the «Chinese Dream» serves as a tool for both the preservation and development of the Chinese state, in order to prevent economic collapse, its main task is to unite Chinese society, which will experience social problems such as unemployment and social inequality [12].

According to Chinese specialist Wang Wei, despite the fact that the "Chinese Dream" is a breathtaking long-term program, the Chinese leadership is actively using this idea to internally govern the country and promote its authoritarian ideas.

The goals of the "Chinese Dream" by 2049 should be:

1. strong economy, politics, science and defense;

2. social stability, friendship between all nationalities;

3. the wealth of the Chinese people;

4. great culture, high spirituality;

5. developed infrastructure of Chinese cities, nature, new innovative cities, environment;

6. great innovation;

7. peaceful coexistence with other peoples of the world.

Xi Jinping's "Chinese Dream" has ambitious goals; it has absorbed all the best that happened under the previous leaders of China. If "socialism with Chinese characteristics" aims to increase material wealth and achieve social equality, then the "Chinese Dream" is not so much an evolutionary continuation of all old political lines, but rather a spiritual addition due to the fact that it raises the problem of raising the spirit of tradition and patriotism.

Chinese specialist Wang Wei believes that the historical leap of the Chinese nation is impossible without the implementation of another idea put forward by Xi Jinping, which is called "One Belt - One Road", or "The Great Silk Road". According to the Chinese scientist, China lacks sufficiently high rates of economic growth from internal resources, so the Chinese economy needs to enter the global market. The spirit of the Silk Road is the mutually beneficial common development of humanity.

The combination of two policies - the «Chinese Dream» and the «One Belt - One Road» - not only creates a new development model that differs from the Western one, but also contributes to prosperity in China when interacting with other countries. China offers the whole world its global mutually beneficial economic project [2].

The New Silk Road doctrine is implemented by the Made in China 2025 strategy announced in 2015. The goal of which is the complete technological independence of the Chinese "factory of the 21st century" from the Western World and the ousting of the United States from the market of the Belt and Road countries. The strategy covers 10 cutting-edge research, design and manufacturing sectors: new materials, artificial intelligence, 5G communications, large-scale integrated circuits, biopharmaceuticals, robotics, electric vehicles, high-speed rail, aircraft and shipbuilding. The strategy is provided with personnel, including those trained in the West and introduced to Western technologies.

The success of the Great Unity of Nations project - Datong lies on the path to the implementation of the "program for building international relations of a new type." The essence of the program is the transition from the struggle of opposites, confrontation and isolationism to trinary harmony in the triangle China - USA

- Russia; with the creation of a network of partnerships around the world as a strategic support for the Belt and Road. At the same time, economic globalization in the Chinese way provides for "constructive interaction" with the United States regarding technologies of the 6th economic structure (NBIC-convergence) and "effective distribution of natural resources" with Russia [4].

With the adoption of the new Law on Patriotic Education, which came into force on January 1, 2024, patriotic education in China has received a powerful impetus for development.

According to the law, patriotic education covers such areas as ideology and politics, history and culture, national symbols, the beauty of the Motherland, the Constitution and the law, national unity and ethnic cohesion, national security and defense, exploits of heroes and role models.

The main innovations include expanding the concept of patriotic education, improving the education system to create a sense of community of the Chinese nation, provisions for the development of traditional Chinese culture, strengthening cultural trust, and building modern Chinese civilization.

"Patriotic education should develop China's traditional culture, promote socialist core values, promote the construction of a socialist culture with Chinese characteristics, strengthen cultural trust, and build the modern culture of the Chinese nation," the law states.

The law specifies that patriotic education should be aimed at all citizens, and pays special attention to the patriotic education of youth and children in educational institutions and at home.

The law requires full use of all kinds of resources for carrying out patriotic education, including resources related to the heritage of the Chinese Communist Party, cultural monuments, patriotic education bases and various cultural venues [5].

School plays one of the most important roles in the patriotic education of the Chinese. In elementary school, young Chinese are taught the laws and traditions of the state, history and culture of China. From the age of 9, school students attend military training classes, which are compulsory in Chinese schools. The program includes military practice, team skills, education of will and readiness for self-sacrifice, self-defense techniques, and familiarization with military equipment and weapons.

In the morning before classes, they always raise the flag and do exercises to the accompaniment of patriotic music. In Chinese schools, very strict attention is paid to political science; in class, the teacher talks about the party and what contribution it has made to the development of China. The Chinese actively use industrial practice.

The state assigns one of the main roles to school in the educational process, and therefore has prepared a number of documents that specify the features of the formation of the patriotic consciousness of the younger generation:

1. Law on Education.

2. Resolution of the CPC Central Committee.

3. "Regulations on military training of students."

The first assistants of the Chinese Party in the patriotic education of students are children's and youth organizations and the largest organization - the Young Pioneers of China, which has 130 million members aged 6 to 14 years. The Young Pioneers are led by the Communist Youth League. It is from the leaders of the Communist Youth League that the party leaders are chosen upon reaching adulthood.

In China, the Nanjing Massacre Memorial Museum, the Liaoshen Operation Memorial Museum and the Chinese People's War Memorial Museum have been opened, where commemorative events are organized. To maintain patriotism and national spirit, traditional holidays and political holidays play a huge role: Youth Day, Founding Day of the CPC, Founding Day of the People's Republic of China, etc. [1].

Great importance is attached to the development of patriotism through the Internet.

The Internet space for patriotic education of students in China is represented by several large Internet projects:

1. China's largest search engine Baidu.com. This search engine in China was created in 2000 in the likeness of the largest search engines (Google, Yahoo, etc.). Since 2006, the system has its own online encyclopedia - Baidupedia. In the Baidu search engine, you can not only find information, images and videos of a patriotic nature, but also ask your own questions and receive answers from network users [6].

2. International and national messengers. The Chinese instant messengers QQ and WeChat are the most popular among Chinese youth. These messengers are actively used not only in China, but throughout the world. According to Bloomberg, the QQ service is used by 843 million people (it is the world leader), the number of users of the WeChat messenger is 600 million people (4th place in the world ranking of instant messengers). Messengers not only serve as a conductor of social life, but also allow the rapid exchange of information between students, between students and teachers, and help strengthen the sense of collectivism [7].

3. Social communities, forums and blogs of international and national format.

Among the main Internet projects in this area, the following should be highlighted:

1. General international and national Internet projects discussing topics of patriotic education in groups and blogs (Facebook.com, Qzone.com, pengyou.com, weibo.com - an analogue of Twitter in China, renren.com, etc.).[9].

2. Thematic Internet projects dedicated to patriotic education. Among them, several Internet projects stand out: the portal "Chinese Patriotic Education", the portal "House of the Patriot", etc.

The national large-scale integrated portal "Chinese Patriotic Education" was established on the initiative and with the support of Chinese government leaders, relevant government ministries and commissions, created with the support of government bodies with the participation of famous experts, scientists, entrepreneurs from various fields of activity, leaders of overseas Chinese communities, approved in in accordance with the established procedure by the State Ministry [10].

The "House of Patriot" portal is the most characteristic website of our time about patriotism in China, dedicated to the theme of developing the spirit of patriotism and revolutionary heroism, created for instant and comprehensive coverage of the latest news in politics, military affairs, science and technology and education [11].

We can conclude that in order to realize the dream of the great revival of the nation, the PRC government needs to ensure national unity, the basis of which is patriotism, as one of the "key values of socialism" [8].

Therefore, the significance of patriotism at the beginning of the third millennium lies in the fact that it acts as a powerful mobilization resource for the development of the individual, the collective, society and the state, activating the energy of citizens in solving problems of social and state development to high dedication in order to achieve a common goal - the preservation and development of the country, desire to preserve and promote the development of statehood, the socio-economic and spiritual sphere, social ideals and values in the PRC.

References

1. Bychkova, N. D. Principles of the management system for patriotic education in the PRC and the USA / N. D. Bychkova. – Text: immediate // Young scientist. – 2021. – No. 5 (347). – pp. 329-331.

2. Wang Wei. Goals and content of the political courses "The Chinese Dream of the Great Revival of the Chinese Nation" and "One Belt – One Road" // Society: politics, economics, law, 2018, No. 6. –P. 41–45.

3. Gurov, D. V. "Chinese Dream" of Xi Jinping: theory and practice / D. V. Gurov. – Text: direct // Young scientist. – 2019. – No. 25 (263). – pp. 386-389.

4. Long live globalization Datong. Official website of A.P. Dyatlov [Electronic resource]: https://devyatov.su/articles/251-nebopolitika/29809-519-da-zdravstvuet-globalizatsija-datun

5. People's Daily online The Law of the People's Republic of China on Patriotic Education comes into force on January 1, 2024 [Electronic resource]. Access mode: https://actualcomment.ru/ukreplenie-traditsionnoy-kultury-obzor-kitayskogo-zakona-o-patrioticheskom-vospitanii-2311031438.html

6. Kabanov N. Chinese company and search engine - BAIDU (BIDU). How much do you know about her? [Electronic resource]: Victory investors. Access mode: http://www.victoryinvestors.com/kitajskaja-kompaniya-i-poiskovik-baidu.

7. Chinese instant messengers lead the world ranking [Electronic resource]: http://www.internox.com/%D0%BA%D0%B8%D1%82%D0%B0%D0%B9%D1%81%.

8. Kulikova A.A. The role of patriotism in the realization of the "Chinese Dream" // International Student Scientific Bulletin. – 2017. – No. 5.

9. Osipov N. 7 most popular social networks in China [Electronic resource]: "EnteI»SYm opening China for business." Access mode: http://enterchina.ru/2015/07/13/7-samyh-populyarnyh- socialnyh-setey-v-kitae/.

10. About us. [Electronic resource]: portal "Chinese Patriotic Education. Access mode: http://www.china-efe.org/efe/mdex/about/.

11. About us. [Electronic resource]: Portal "House of the Patriot". Access mode: http://www.agzzj.com/aboutus.asp?id=58/.

12. Zhao Tingyan. A modern view of the Chinese dream // International processes, 2015, V. 13, No. 2. -P. 21–34.

词组 "肝"、"胆" 的语义分析
SEMANTIC ANALYSIS OF THE PHRASEOLOGICAL UNIT CHENGYU WITH THE COMPONENTS "LIVER" (肝) AND "GALL BLADDER" (胆)

Khudaev Mikhail Mikhailovich
Master's student
North-Eastern Federal University

注解。 在本研究中，作者分析了67个带有 "肝" 成分的特殊词单位和34个带有 "胆" 成分的特殊词单位。 作者将PU分类为语义组，并继续分析成语字面意义的内部结构和模式。 结论是，"成语" 的含义主要包括一个人的高级认知活动的特征，以及对他的性格和行为特征的描述。
关键词: 成语，汉语，词组，语义，体码。

Annotation. *In this research, the authors analyzed 67 special phraseological units chengyu with component "liver" and 34 with component "gallbladder". The authors classified said PU into semantic groups and continued analyzing internal structure and patterns in literal meaning of chengyu. The conclusion is that chengyu's meaning mostly include characteristics of the higher cognitive activity of a person, as well as a description of his character and behavioral characteristics.*

Keywords: *Chengyu, Chinese language, phraseological units, semantics, somatic code.*

Phraseologisms are a large part of any culture. After all, their semantic composition reveals the most important features of culture, from thinking and perception of reality, to historical development, rites and rituals of a particular ethnos. One of the important aspects of culture revealed by phraseology is cultural codes - a certain collection of understanding, associations and evaluations formed in a certain society associated with certain objects and aspects of reality. There are many different codes, such as gastronomic code, architectural code, subject code, etc. However, one of the largest and most important codes is the somatic (body) code. It includes the names of any parts of the body, internal organs, as well as any actions associated with them (for example, keep your head in the game, land a hand, pointing fingers, etc.). The somatic code is equally important and widespread in

all cultures of the world, because knowledge of the world first of all begins with knowledge of oneself and one's own body [2], however, in Chinese linguistic culture somatisms occupy a special place, since they are closely related to the traditional understanding of medicine, as well as the universe in general. Therefore, somatic phraseological units are ubiquitous in the Chinese language; they are used both in live speech and in writing. As a result, such research may be useful for the development of intercultural communication between Russia and China. This research will also be useful for the development of linguoculturology, a science that studies the relationship between culture and language.

The famous linguist Ma Guofan identified 5 main types of phraseological units in the Chinese language: guanyunyu, xiehouu, chengyu, yanyu, suiyu. Chengyu is a set phrase or sentence, built according to the rules of the ancient Chinese language, semantically monolithic and indivisible, with a generalized, metaphorical figurative meaning.[1] Of all five phraseological units, chengyu is the most common and frequently used in the Chinese language. This phraseological unit is used in almost any text, from colloquial to political. This is due to the fact that Chengyu originated from classical canons and treatises, which have a huge influence on modern Chinese culture.[3] There is also other reason which is it's minimalistic and easy to use size of structure. It only consists of four components that are usually correlated within chnegyu itself making it very easy to memorize and handy to utilize in speech as it usually has a meaning of a very long and complex sentence but can operate in a sentence as a usual word.

For this research, we selected 34 chengyu with the "liver" component and 34 with the "gallbladder" component and 31 chengyu that include both of the components. This means that there is a definite correlation between the two components, which is also the reason why we are combining them in our study.

Even though we are only two components "liver" and "gall bladder" there will be names of other internal organs, as it is common for chengyu to combine two organs in its internal structure.

Starting with chengyu with the "gallbladder" component, we can say that globally they are divided in two big semantic groups: "courage" and "cowardice" (14 - courage, 12 - cowardice and the remaining 4 do not have common semantic motives). "Courage" is usually expressed through combination of two hieroglyphs 胆大(dà dǎn) which means big gallbladder. For example:大胆包身dà dǎn bāo shēn – to be full of courage, courageous. On the opposite, cowardice is described through combination of two hieroglyphs 胆小(dǎnxiǎo) which means small gallbladder. For example: 胆小鬼dǎnxiǎoguǐ – coward, chicken. Cowardice is also shown as a state of mind: 胆裂魂飞dǎnlièhúnfēi – to be afraid, to be scared. Such meaning is usually achieved through description of physical influence on the organs themselves (as shown in the previous example胆裂 – gallbladder is tearing up).

In addition, it can be noted that in the chengyu group, which describe courage, such meanings are often supplemented by other positive characteristics, usually affecting a person's mental abilities. For example, 有胆有识yǒu dǎn yǒu shì - brave and experienced, 琴心剑胆qínxīn jiàndǎn - the soul of a musician and the courage of a warrior (poet and warrior, brave and gentle), 艺高人胆大yìgāorén dǎndà - talented and courageous etc. Sometimes courage is described with a negative connotation: 胆大妄为dǎndà wàngwéi - to become insolent, insolent. As for the second group, it can be noted that all Chengyu semantics of cowardice, in the literal sense, always mean an unfavorable characteristic or action carried out on the gallbladder itself (as in the example above). From this we can assume that 胆 (gall bladder) itself is synonymous with the word "courage", and any negative impact takes away this characteristic. Additionally, some chengyu of the second group, unlike the first, can act as a description of an action, for example: 魂惊胆丧Sàngdǎn xiāohún - to lose courage, to be afraid.

Moving on to chengyu with the "liver" component. We can distinguish several groups, the first of which is called "not about a person" (12) and is most associated with the description of food. Usually, it is a description of the quality of food: 龙肝凤髓lónggān fèngsuǐ - dragon liver and phoenix bone marrow (meaning: exquisite dishes, delicacies, very tasty food). We can notice that all the chengyu in this group are metaphorical comparisons of food with animal organs. Basically, these are mythological animals such as dragon, qilin (unicorn), phoenix: 麟肝凤髓lín gān fèng suǐ – qilin liver, phoenix bone marrow, lit., delicacy, delicious food (麟 – qilin, unicorn). The literal and figurative meanings of chengyu have a positive connotation, since these animals are described as positive and rare in Chinese mythology. From here, we can highlight that the "liver" component in Chinese linguistic culture can act as part of a metaphorical description of not only a person, but also food. Furthermore, there is a separate subgroup of chengyu, in which liver is meant as food only in the literal sense, but not figuratively. Basically, these are multiple variations of this chengyu: 不食马肝bùshí mǎgān – lit., do not eat horse liver. Here the horse's liver is equivalent to poison. Therefore, the meaning of this chengyu should be perceived as follows: one should not study something that is known to be dangerous, do not do or touch something that is already known to be dangerous. However, food is not the only thing included in this group. We can also notice another subgroup of chengyu, in which descriptions of things are given: 鼠肝虫臂shǔgānchóngbì - rat liver, insect legs (about a worthless thing). Typically, these chengyu have a negative connotation, which, much like in the description of food, is achieved by metaphorically comparing the characteristics of a thing with the entrails of animals (mainly small animals, rats and insects). Another group of chengyu describes the psychological states of a person (10). Basically, these are states such as sadness, grief, severe suffering: 摧心剖肝cuīxīn pōugān - Heart

and liver are torn to shreds, severe sadness, bitterness. We can again note that the meanings of this group are created by describing negative physical effects on human organs, with the approximate semantics of "destruction, deformation", which are associated with such negative psychological states.

Now let's look at chengyu, which have both components in their structure. As stated above, there are only 31 units. Many of them form one large group, which can be called "human characteristics" (25). Considering this group, let us clarify that the characteristics of a person mean the characteristics of a person's psychology, behavior and thinking, that is, the characteristics of higher cognitive processes. Unlike other groups we have identified, this group is not narrowly focused on a specific topic, but is a collection of descriptions of various characteristics of a person. The predominant characteristics are "sincerity" and "devotion". Moreover, such meanings are expressed by describing physical manipulations of the liver and gall bladder themselves, mainly such as "tearing, opening": 披肝沥胆pīgān lìdǎn - frank, faithful (披 - split, separate, open., that is, literally open the liver). However, unlike the chengyu from the "psychological state" group, here they are perceived as positive, and not vice versa. The difference is that in the first group it is specified that this is precisely the destruction (both direct and figurative) of organs, hence the figurative meanings of the first group. At the same time, in this group, the organs are "opened," which is equivalent to the expression in Russian: "visible through and through." There may also be other positive characteristics: 义 胆忠肝yìdǎn zhōnggān - fair and loyal. Here, characteristics are given to organs themselves (忠-fidelity, sincerity, i.e., literally the faithful liver). Also, in both groups of chengyu with one component there are meanings associated with the description of a person's perseverance (4 with the "liver" component and 4 with the "gallbladder" component): 雕肝琢肾diāogānzhuóshèn - engrave on the liver and carve on the kidneys (arr. meaning: to give all the strength of the soul, not to spare one's spiritual energy); 坐薪悬胆zuòxīn xuándǎn - 1) endure hardships; 2) put in all your strength, give it your all.

Thus, chengyu with the "gall bladder" component in Chinese linguistic culture is somehow associated with courage, either its absence or its presence. Meanings with this characteristic are created by describing the size of the organ, or by describing any action related to the gallbladder. Courage is usually complemented by other positive characteristics, such as experience and dexterity.

Next, we identified the following groups of chengyu with the "liver" component: "not about a person" and "psychological state". The first group is special in that in it the chengyu describe not a person, but food. Moreover, such descriptions are created using a metaphorical comparison of food with the already designated organ of animals from Chinese mythology, such as the dragon and qilin. It is also interesting to note the Chengyu subgroup, in which liver (of a horse) can

be translated as poison. The next group is a description of human psychological states, mainly such negative states as "sadness, melancholy, grief." Here, such psychological states are highlighted through a negative psychical effect on the liver and other organs, the pain from which is associated with grief and an unpleasant sensation.

Finally, chengyu with both components "liver" and "gallbladder". Here the meanings are centered around such characteristics as loyalty, sincerity, as well as perseverance and responsibility. They (sincerity and devotion) are shown through a description of the physical impact on the paired organs of the gallbladder and liver, with the approximate semantics of "opening, putting out," as well as through a direct description of the organs themselves (responsibility).

In general, we can say that both components, together, are associated with the best qualities of a person. At the same time, individually they have a wide semantic spectrum.

Literature

1. *Voitsekhovich, I. V. Practical phraseology of the modern Chinese language: textbook. M., 2007.*

2. *Merzhoeva, Z. A. Somatic code - one of the main codes of linguistic culture / Z. A. Merzhoeva, Kh. I. Nalgieva // Current scientific research in the modern world. – 2021. – No. 3-7(71). – pp. 141-145. – EDN OUPYFN.*

3. *Razina, A. S. Origin of Chengyu: interaction of cultures in interlingual communication / A. S. Razina // Young scientist. – 2018. – No. 36(222). – pp. 130-132. – EDN XZATSP*

现代文明空间整合过程中的公共关系
PUBLIC RELATIONS IN THE INTEGRATION PROCESS OF THE MODERN CIVILIZATIONAL SPACE

Lugutsenko Tatyana Valentinovna
Doctor of Philosophy, Professor, Head of Department
Lugansk State Pedagogical University

Germanenko Olga Nikolaevna
Candidate of Philosophy, Assistant
Lugansk State Pedagogical University

Lyaskovskaya Evgeniya Mikhailovna
Postgraduate
Donetsk National University of Economics and Trade named
after Michael Tugan-Baranovsky

注解。 本文探讨了社会关系在社会中的作用和地位，个人和社会的重点是理解社会性的基础作为人类生活最重要的领域之一。 通过人与社会互动的人类社会发生的棱镜，将社会关系纳入现代文明空间的整合过程。
关键词：社会关系、整合过程、文明空间、人类社会发生、人、社会。

Annotation. The article examines the role and place of social relations in society, the focus of the individual and society on understanding the foundations of sociality as one of the most important areas of human life. Inclusion of social relations in the integration process of modern civilizational space through the prism of anthroposociogenesis in the interaction of man and society.

Keywords: social relations, integration processes, civilizational space, anthroposociogenesis, man, society.

The modern development of socio-philosophical thought actualizes the comprehensive study of society as a conglomerate of ethnic, political, economic and other interactions in the socio-cultural space, which is manifested in interconnection and mutual influence in the process of social relations. This shifts research emphasis to the interaction between individuals, social groups and society. This is due to the turning point of different eras, fundamental shifts in the social life of individual countries and peoples. At present, attention to socio-philosophical problems of social relations is increasing, which is intensified by attempts to un-

derstand and understand the causes of the crisis that has gripped the social system of society.

Under the influence of objective factors, research interests in the study of social relations are formed, which becomes an urgent need to analyze social relations as a social phenomenon. Thus, identifying the essential foundations of social relations, revealing the axiological determinants of their development to determine their role as a value mechanism for the development of society through socio-philosophical analysis makes it possible to solve the problem of the multi-unity of man and society in the aspect of social relations. At the same time, it is necessary to analyze the comprehensive content profile of the negative aspects of adaptation strategies in modern society, and determine the likely directions of development of such trends and the possibility of their correction.

We emphasize that the problems of studying social relations are interdisciplinary in nature and are studied by philosophers, historians and political scientists. At the same time, there is no unambiguous understanding regarding ideas about social relations, since civil society is rather perceived as an ideological way to guide public interests and, as a consequence, public relations. Such studies are aimed at understanding classical ideas about social relations in modern trends in understanding the phenomenon of modern society, which determines the relevance of the topic and helps to identify the patterns of the formation of society in history.

A special place in the problematic field of research on social relations is occupied by the philosophical and anthropological context of the study of society and social relations:

− through the prism of man as a social being (A.F. Losev, I.T. Frolov, E. Fromm, T. Chardin);

− issues of human involvement in the system of social relations in the works of I.L. Andreev, K. Marx, G.S. Pomerants and others, who argued that a person cannot realize himself outside of society;

− issues of subjective individualism as a specific form of human existence in society: U. Barretta, G.V.F. Hegel, R. Dahrendorf, S. Kierkegaard, K. Marx, E. Toffler, L. Feuerbach, W. Stern.

In the system of social and humanitarian knowledge, several areas can be distinguished on the topic of research by scientists of the Lugansk People's Republic, Donetsk People's Republic in the study of social relations:

− social relations in the historical development of society (V.M. Sheluto);

− normative and value basis for understanding the issues of development of social relations; culture of public relations in the context of virtuality; ethical aspects of globalization and problems of communication in modern society (T.V. Lugutsenko);

− spiritual socialization of the individual as the basis of being in social practice (N.V. Berezhnaya, I.A. Chernykh, O.N. Germanenko), when social processes in

society require determining the laws of the influence of spiritual traditions on society in order to overcome the spiritual crisis (person is at the same time an object and a controlling subject in society, its spiritual renewal).

In understanding the essence of society, it is this aspect – the relationship between society and the individual – that is most important. Society functions because of natural processes and within the boundaries of nature, but these processes in society lose their qualities, which is associated with the purposeful nature of social processes, the presence of freedom of choice and variability, and value-semantic orientation. Nevertheless, constant interchange would be impossible if there were nothing in common between nature and society. Society appears to be a continuation of natural-cosmic processes, and therefore cannot but be consistent with its general laws.

Society is a complex social system, a structurally organized integrity, which is formed by different elements, components, and divisions. In turn, they also have a certain level of organization and orderliness of their own structure. This gives grounds to assert that the social structure of society is a complex, multidimensional formation.

A holistic vision of social relations is characterized by social development and, from the standpoint of philosophical methodology, cannot ignore the everyday ideas and views on the problems of society that have developed in the public consciousness. Social relations in the understanding implemented in practice ("ME-ME", "ME-WE", "I-SOCIETY") can fulfill the role of basic social relations in the sphere of economics, politics, and spirituality.

At the present stage, society reveals itself as an objective system of social circumstances, connections and relationships that were historically created by previous generations, into which the individual is included from the moment of birth, and which become an objective condition of his existence. Society as an objective system and society as inter-individual connections - all this is a single social reality, but at its different levels, in different dimensions of social existence.

The specificity of social relations lays in the unification of people in different social communities, of different levels and significance, in accordance with the principle of equal conditions and standard of living, social equality and preferences, socio-territorial, ethnic characteristics.

We emphasize that the main stages of interaction between man and society are:

– a system of personal dependence of a person (the need to unite many people into a common technological chain as a result of historical changes in the construction of society and the formation of the state). The formation of a system of social connections, characterized by the personal dependence of a person on a person and tradition as the main form of social reproduction;

– society as a system of material dependencies (technologization of society in the social aspect of relations), ways of realizing interpersonal connections and

relationships. Social practices (a system of social connections), when a person himself turns into a certain kind of commodity, and his powers and abilities are increasingly subordinate to the logic of the reproduction of things, lead to the emergence of a "one-dimensional" person (G. Marcuse);

– the stage of personal reconstruction (sociality as a new stage in the evolution of relationships), which characterizes new relationships of "free individuals", can give a new impetus to the development of new qualities.

Thus, the process of socialization is characterized by the integration of a new type of activity into the existing structure of social, cultural, production, economic and other relations. This approach (E. Toffler) in understanding equivalence or the inequivalence of social exchanges in the activities of social actors made it possible to unite individuals and their groups into a single whole, thereby strengthening their role in modern society. Consequently, the relationship between the individual and the general social in the modern world demonstrates the specific relationship between the individual and the social in human life. That is why ensuring the social prerequisites for the formation of the individual, preserving his individuality and his desire for freedom, both social and individual, is the main goal of society.

We observe the philosophical status of the anthropic and sociocultural in the key principles of constructing both society and culture:

– analogue principle (through the use of culture to a visible image or analogue);

– the principle of the dominant component in relations between society and culture.

In our opinion, the patterns of the process of development of the subject's abilities make it possible to outline effective ways to determine the mechanism of cultural self-regulation of the subject, which includes:

– accumulation of individual and social experience of life, communication, behavior, which determines social relations in society;

– consolidation of the experience of cultural self-organization in sign systems, attitudes of consciousness, traditions, standardized forms of behavior;

– development of generally binding normative instructions and evaluative concepts, criteria, standards of behavior and unique codes in social relations.

It is shown that it is important that cultural values become a canon, a set of rules and mandatory norms of everyday reality of modern society. At the same time, one cannot ignore the nationally specific, individual coloring, which directly affects the values of the spiritual culture of each member of society. Spiritual life, the development and formation of the moral culture of the individual, as an integral component of society, is the most important element of its life, the development of which depends on general progress.

Knowing a person through culture is essentially his self-knowledge. Culture has always played a special role in the formation of human existence, therefore

the relationship between man and culture is an inextricable unity. The planetary system strives to absorb all individual, personal spaces, and at the same time, the spiritual world of man turns into one existential problem: how to preserve the integrity of one's locality. At the same time, a possible way out of this situation can only be sociocultural interaction, intercultural dialogue, cultural communication, when representatives of different cultures cannot have identical value orientations in all spheres of life, but can develop common tendencies to achieve optimal results in the communication process, recognizing the equality of all subjects public relations in this area.

Thus, based on the analysis of the connection between the dehumanization of subject-subject relations, it can be argued that the source of self-development of society is social relations, their spiritual potential, which is the basis for the self-development of social relations in the process of self-realization and interdependence of man and society. Today, public relations during the period of transformation of society and culture can contribute to the formation of cooperation between representatives of different ethnic groups and cultures on the principles of tolerant behavior. Subjects of public relations, recognizing the equality of all participants, create an atmosphere of openness and trust between them, showing respect for the traditions, customs and way of life of representatives of different ethnic groups. The development and adoption of common goals that are significant for all participants is defined as the main condition for overcoming difficult interethnic problems. It has been established that social relations should only follow the path of harmonization based on the principles inherent in a civilized society.

References

1. Germanenko, O.N. Public relations in the context of the conditionality of spiritual culture / O.N. Germanenko //Vestnik Leningrad State University named after. V. Dahl. – 2022. –No. 11 (65).– pp. 165–168.

2. Losev, A.F. Dialectics of myth / A.F. Losev Philosophy, Mythology, Culture. – M.: AST, 2012. – 187 p.

3. Lugutsenko, T.V. Spiritual and value foundations of the culture of personal life / T.V. Lugutsenko // Spiritual production in the era of late capitalism: materials of the International. scientific conf. (Apr 252020.) / Donetsk: DONNTU, 2020. – Issue. 6. – pp. 295−298.

4. Marx, K. Works/ K. Marx// K. Marx and F. Engels. Essays. – T.46. – M.: Politizdat, 1968. – 317 p.

5. Marcuse G. Eros and civilization. One-dimensional man: a study of the ideology of a developed industrial society / G. Marcuse; [transl. from English Afterwards, note. A.A. Yudina] – M.: AST, 2023. – 526 p.

6. Morphogenesis of the cultural space of modern society: monograph / team of authors: Atoyan, A.I., Barkova, E.V., Berezhnaya, N.V., Isaev, V.D., Kolesnikova, G.I. and etc.; [under general ed. Doctor of Philosophy, Prof. Lugutsenko, T.V.]. – Lugansk: Knowledge Publishing House, 2020. – 294 p.

7. Toynbee, A. J. Civilization before the court of history/ A. J. Toynbee. – M.: Progress-Culture; Yuventa, 2005. – 480 p.

8. Toffler, E. The Third Wave / E. Toffler - M.: ACT Publishing House LLC, 1999. - 784 p.

9. Frolov, I.T.Towards the comprehension of a reasonable and humane person / I.T. Frolov // Multidimensional image of a person: a comprehensive interdisciplinary study of a person. – M.: Republic, 2001. – 230 p.

10. Fromm, E. Flight from freedom. A man for himself / E. Fromm. – Minsk, 1998. – 272 p.

11.Chardin, P. Human phenomenon: Sat. sketches and essays / P. Chardin; [comp. and preface V.Yu. Kuznetsov].–M.: OOO Publishing House ACT, 2002.– P. 230.

12. Shelyuto, V. M. Personal guidelines in the process of historical knowledge: from premodern to postmodern / V. M. Shelyuto // Anthropos: Logos and Theos. – 2021. – No. 7. – P. 118–130.

现代奥林匹克运动作为国家战略的社会政治哲学分析

THE SOCIAL AND POLITICS PHILOSOPHICAL ANALYSIS OF THE MODERN OLYMPIC MOVEMENT AS NATIONAL STRATEGY

Zhou Zhenhua
Ph.D. Student in Philosophy
Ural Federal University named after the First President of Russia B. N. Yeltsin

Cao Shuya
Ph.D. Student in Education
Ural Federal University named after the First President of Russia B. N. Yeltsin

摘要. 本研究探讨了中国将现代奥林匹克运动作为国家战略所带来的社会变化，在卢梭的现代社会的批判理论基础上对其进行了社会政治哲学分析。考虑了由发展现代奥林匹克运动所引发的后现代主义思潮，作为国家宏观的国际叙事，它引起了对于国家政党将其作为国家战略的统一的理性观念的观点的另一种思考。提出了体育与政治进行相关联所引起的后现代主义的哲学反思。

关键词：现代奥林匹克运动；国家战略；社会哲学；政治哲学；卢梭；北京冬奥会；国际发展。

Abstract. *This research explores the social changes caused by China accomplish the Modern Olympic Movement (OMO) as a national strategy, and conducts a socio-politics philosophical analysis based on Rousseau's critical theory of modern society. Consideration is given to the postmodernist currents arising from the development of the OMO as a national macro-international narrative, which invites another reflection on the view of national parties as a unified rational idea of national strategy. It puts forward the philosophical reflection of postmodernism caused by the correlation between sports and politics.*

Keywords: *Modern Olympic Movement; National strategy; Social Philosophy; Political Philosophy; Rousseau; Beijing Winter Olympics; International Development.*

前言

在2008至2022年的15年间，中国举办了两次奥运会，在世界体育史上标注了中国符号。现代奥林匹克运动也因为国家政治发展的需要成为世界上独一无二的为了国家荣誉而进行的竞争。在申办、举办奥运会期间通过对中国国家政治生活秩序、社会公共生活的渗透和影响导致新一轮的公民基本权利与公共政治权力之间的关系变化[1]。作为人类社会的罕见杰作，现代奥林匹克将体育运动的多种功能发挥得淋漓尽致，影响力远远超出了体育的范畴，在当代世界的政治、经济、哲学、文化、艺术和新闻媒介等诸多方面产生了一系列连锁的影响。例如，北京冬奥会»一起向未来»的倡议，在人类命运共同体价值观下将奥林匹克精神、办赛理念和奥运愿景与中华民族的文明相结合，向世界传达了中国解读、中国诠释和中国表达[2]。

近现代以来，作为人类社会生活的一种重要现象，随着国家间交往的不断打一大和深入，体育已经成为国际社会文化交流的重要途径。尽管体育具有突出的社会与文化属性，国际间的体育交流活动强调体育所承载的公正、和平、友谊、健康等普世价值，但是体育与政治的联系仍然显而易见。正如经济与政治密不可分，体育也深受政治的影响，人们不难注意到体育与政治难以撇清的关系。某种意义上，奥运会定期地为国际政治活动提供了重要的舞台，并反映了当时国际政治竞争的大背景。

奥运会百年来的生存与发展始终受到政治的影响，比如上世纪70年代的国际奥委会主席基拉宁直言："我作为国际奥委会主席的90%的问题都与国内和国际政治有关"。前国际奥委会主席萨马兰奇同样坦承他每天处理的问题90%是政治问题，10%才是体育问题。尽管体育与国际政治有着如此密切的联系，但长期以来，由于体育的社会文化属性标签，体育在国际政治中属于"低级政治"的范畴，国际政治研究一直忽视体育，国际政治学界较少将体育作为国际政治研究的一个专门议题来进行学术考察[3]。

奥林匹克运动不仅构成了现代社会所特有的体育文化景观，以其特有政治、文化属性带动全世界人们的关注和重视。无论欧美国家还是亚洲国家，社会的变化发生得非常快，文化冲击的发生并不少见[4]。作为时代的产物，科技革命、政治改革大扩展了世界各民族之间在经济、政治和文化等方面的联系，各国交往日益密切，迫切需要以各种沟通手段来加强国际间的相互了解与合作，奥林匹克运动的出现满足政治需求和社会需求，它成为人类社会发展到一定阶段的必然产物，自然成为国家战略发展中的一部分。

著名社会理论、城市理论研究学者Elena Trubina提出奥运文献通常将城市作为主要的分析单位，并调查某些城市如何以及为什么举办奥运会[5]。国际大型活动的规划和执行，对城市空间的发展使得城市和国家之间的地方竞争变得更加明显，他们寻求通过国家发展模式和国家战略实施更紧密地融入国际市场[6]。国家政策、城市政策的使用成为影响该国城市发展的关键问题，这些问题不仅涉及奥运遗产的可持续发展，更在中国举办两次奥运会后所吸取的诸多的经验教训。

在举办北京冬奥会的社会背景下，以中国国务院、国家体育总局为引领的体育行政部门颁布了多项体育政策和实施措施。本研究在这些行政政策基础之上分析了中国将现代奥林匹克运动作为国家战略的性质，论述了中国体育的国家战略结构，概括了在中国与体育相关的政治哲学分析。第一次使用卢梭的现代社会的批判理论，对中国将现代奥林匹克运动作为国家战略所进行的的政治哲学分析。由发展现代奥林匹克运动所引发的后现代主义思潮，它引起了对于国家政党将其作为国家战略的统一的理性观念的观点的另一种思考[7]。

后现代主义的哲学思想及其文化表达与现代中国社会政治状况之间的因果关系，本研究从积极的社会作用为切入点描述了现代奥林匹克运动对现代社会文明的作用[8]。作为本研究的出发点，国家战略与现代奥林匹克运动的融合，成为一种国家的宏大叙事后，使得后现代主义侵入在国家层面、社会层面，更会深刻的影响到人民层面。并且引发、推动政府通过体育外交，进一步作为影响他国的手段，从而达到再造国际关系的目的[9]。本研究的目的是揭示体育与政治进行相关联所引起的后现代主义的哲学思考。

研究结论：

以现代奥运会为核心代表的体育给中国国家战略的实施带来了积极的影响，主要体现在两个方面，一是国内在经济、科技、文化等方面的积极影响，二是后疫情时代的国际化的发展。其次，由于冬季体育项目的广泛的普及和提倡，使得人人享有了体育运动的权利，提高人们体育运动的意识，丰富了大众的生活内容，促进了健康的生活方式，这些既符合人民的意志，实现人民追求幸福生活的权利，也符合了新时代国家发展的需要。

参考文献

1. 万俊人. 所谓政治哲学 / 万俊人 // 中国社会科学评价. – 2022 – № 4. – C.27-41+155-156.

2. 钟新, 金圣钧, 林芊语. "一起向未来"：人类命运共同体视域下冬奥口号倡议的意义嬗变、价值追溯与国际诠释 / 钟新, 金圣钧, 林芊语 // 武汉体育学院学报, – 2022 – № 56(02). – C.12-19.

3. 程晓勇. 国际政治视阈中的体育：基于奥运会的考察与分析 / 程晓勇 // 体育与科学. – 2017 – № 38(05). – C.50-56.

4. Wigena, Ida & Sumilat, Grystin & Wibowo, Arif. Social Studies In The Postmodernism Era. / Wigena, Ida & Sumilat, Grystin & Wibowo, Arif. // Technium Social Sciences Journal. – 2023 – № 49. – C.158-165.

5. Trubina, Elena. The Sochi 2014 olympics: nationalism, globalized place-making and multiscalar legitimacy. / Trubina, Elena. // Urban Geography. – 2017. – № 40. – C. 1-22.

6.Trubina, Elena.Mega-events in the context of capitalist modernity: The case of 2014 Sochi Winter Olympics. / Trubina,Elena. // Eurasian Geography and Economics.– 2015. – № 55. – C. 1-18.

7.Turner,Bryan.Postmodernism,Globalisation and Religion. / Turner,Bryan. // In book: Understanding Islam– 2023. – C. 76-91.

8. Лукасик,Ярослав.Postmodernism / Лукасик,Ярослав. // The Main Ideas and Their Social and Polotical Implications. – 2023. – №1. – C. 30-38.

9. 王创业, 张德胜. 作为"双重交往过程"的体育外交：概念与模型 / 王创业, 张德胜. //上海体育学院学报. – 2022. – № 46(09). – C. 1-8+29.

心肌应激过度条件下实验模型中心肌细胞病理形态学损伤中心脏特异性自身抗体的研究

INVESTIGATION OF CARDIOSPECIFIC AUTOANTIBODIES IN PATHOMORPHOLOGICALLY CONFIRMED DAMAGE TO CARDIOMYOCYTES IN AN EXPERIMENTAL MODEL UNDER CONDITIONS OF STRESS OVERSTRAIN OF THE MYOCARDIUM

Belyaev Nikolay Georgievich
Doctor of Biological Sciences, Professor
North Caucasus Federal University, Stavropol, Russian Federation
ORCID ID: 0000–0003–1751–1053

Levochkina Elvira Dautovna
Postgraduate student
North Caucasus Federal University;
Biologist
State Medical Institution of the Stavropol Regional Oncological Dispensary,
Stavropol, Russian Federation
ORCHID ID: 0000-0002-1996-0920

注解。 本研究的目的是将自身抗体（抗 cTnI、抗 ACTC1、抗 MYH7B）的测定结果与实验模型中心肌的病理形态学变化进行比较。 该研究是在处于慢性身体过度紧张（CFS）状态的实验室老鼠身上进行的。 研究中使用了多种方法和途径，包括体外、离体和体内研究。 组织学研究表明，CFS 患者可观察到心肌的病理变化，这是慢性心力衰竭（CHF）的特征。 心肌细胞中这些变化的严重程度与心脏特异性自身免疫抗体水平的增加相关。 在没有明显病理症状的情况下，注册了抗 cTnI、抗 ACTC1、抗 MYH7B 的早期指征。 与此同时，传统的心肌坏死实验室标志物并未显示动物组之间存在统计学上的显着差异。 数据分析揭示了抗 cTnI、抗 ACTC1 和抗 MYH7B 在心脏病早期诊断中的潜在意义。

关键词：压力过度紧张； 心肌细胞蛋白自身抗体； 信号蛋白； 针对收缩蛋白的自身免疫抗体； 缺血标志物，实验室分析。

Annotation. *The aim of the study was to compare the results of the determination of autoantibodies (anti-cTnI, anti-ACTC1, anti-MYH7B) with pathomorphological changes of the myocardium in an experimental model. The study was conducted on laboratory rats in a state of chronic physical overstrain (CFS). A variety of*

methods and approaches were used in the study, including in vitro, ex vivo and in vivo studies. Histological studies have shown that with CFS, pathological changes in the myocardium are observed, characteristic of chronic heart failure (CHF). The severity of these changes in myocardial cardiomyocytes correlates with an increase in the level of cardiospecific autoimmune antibodies. Early indication of anti-cTnI, anti-ACTC1, anti-MYH7B was registered in the absence of obvious pathological symptoms. At the same time, traditional laboratory markers of myocardial necrosis did not reveal statistically significant differences between animal groups. Data analysis revealed the potential significance of anti-cTnI, anti-ACTC1, and anti-MYH7B in the early diagnosis of cardiac pathologies.

Keywords: *Stress overstrain; auto-antibodies to cardiomyocyte proteins; signaling proteins; autoimmune antibodies to contractile proteins; markers of ischemia, laboratory analysis.*

Conduction. There are "signaling" markers, such as autoimmune immunoglobulins to myocardial contractile proteins, which reflect both pathophysiological changes in cardiomycetes under conditions of stressful physical overload (hypertrophy, aptosis, fibrosis, disruption of normal cell organization, interstitial edema, dystrophy, etc.) and the reaction of the immune system to biochemical processes [1-4]. The breakdown of the cardio-contractile apparatus with myofibril filaments, under conditions of sensory exposure, leads to the inevitable death or injury of myocytes, where intracellular proteins, including molecular fragments ACTC1, MYH7B and cTnI are released from the cytoplasm of cardiomyocytes [4-8]. These molecules serve as signals to surrounding cells and activate the immune response [9-10]. The recognition using a laboratory method of these signaling auto-immune antibodies reflecting the mechanisms of structural changes in the myocardium is a clinical need with effective evidence and a high level of persuasiveness for the selection of diagnostic and therapeutic measures and the provision of medical care to persons, including those conducting professional sports activities [11-13]. A persistent increase in the extracellular content of endogenous antigen will inevitably be accompanied by quantitative shifts in the content of cardiospecific autoantibodies. These markers reflect the relationship between quantitative dynamics and pathophysiological processes that occur in the muscles of the heart. They can serve as predictors of adverse events in the cardiovascular system [14]. In this regard, the method of determining the serum content of autoantibodies (auto-AT) to cardiomyocyte proteins may be an informative method of prenosological diagnosis of formed myocardial disorders [15-16]. The prospects of using this method for early diagnosis of the heart condition of people involved in sports are determined by the fact that in an organism with high physical and potential capabilities, the disorders formed in the early stages may not affect the general and special performance of an athlete [17].

The aim of the study was to compare the results of determining autoantity with pathomorphological changes in the myocardium in an experimental model under CFP conditions. The main objective of the study is to determine the prospects of a laboratory method for determining cardiospecific autoantibodies for early diagnosis of pathomorphological changes in the heart associated with damage to cardiomyocytes

Research methods and materials. Laboratory rats (males of the Wistar line) in a state of chronic physical overstrain were used in the experiment. The phenotypic formation of CFP occurred in experimental animals previously subjected to a 9-week training cycle in accordance with the method of N.G. Belyaev (2004; 2022), by gradually increasing the intensity and duration of running loads. Laboratory animals were divided into groups: I–experimental and II–control, which were kept in accordance with the standards established in the "Guidelines for the maintenance and use of laboratory animals" (National Academympress. Washington, D.C. 1996), as well as according to GOST R 53434-2009 and SP 2.2.1.3218-14, SP 2.2.1.3218-1 and GOST 51232, the research was approved by the independent Commission on Bioethics of the North Caucasus Federal University (Protocol No. 002). To assess the pathomorphology of the myocardium, the preparation of histological preparations and their evaluation were guided by the order of the Ministry of Health of the Russian Federation No. 179n. After decapitation of the animals, the heart was extracted, weighed and then fixed in a 10% formalin buffer solution for 72 hours. The drug was rinsed with tap water for 24 hours, dehydrated in isopropyl alcohol and embedded in Histomix medical paraffin (Biovitru, Russia). Histological sections with a thickness of 3-4 microns were obtained using a rotational microtome NM 325 (Termo, Germany). The finished sections were stained with hematoxylin and eosin. The micro-preparations were evaluated using an Axio Imager 2 (A2) laboratory microscope with the AxioCam MRc5 image visualization system and Zen 2012 Pro software (Carl Zeiss Microscopy, Oberkochen, Germany).

Laboratory blood parameters: The level of antibodies to cTnI, ACTC1 and MUN7B in blood serum was determined by ELISA using a semi-automatic photometer hermo Scientific Multiskan FC (Thermo Fisher Scientific. Finland) using Cloud Clone Corp reagents (China).

The biological material for laboratory analysis was obtained in accordance with GOST R 53079.4-2008. Work with biological material was carried out in accordance with the requirements and regulatory documents of the Ministry of Health; SanPiN 2.1.3.2630-10; SP 1.3.2322-08; SP 2.1.5.2826-10; SanPiN 2.1.7.728-99; GOST 526 23.4-2015.

Statistical analysis. Descriptive statistics in Microsoft Excel on an IBM PENTIUM computer were used to create a one-dimensional statistical report on the

central trend and variability of input data. The variation series obtained in the experiment were characterized by the arithmetic mean (M), the square deviation (*) and the error of the arithmetic mean (m). To determine the statistical significance of the differences, an indicator of a significant difference (t) was used, taking into account the number of measurements. The difference was considered statistically significant at $p<0.05$, which means that the differences were confirmed in 95% of cases. To assess the reliability of differences in the mean values of the variation series, a graphical method was used with the calculation of the boundaries of the confidence interval.

The results of the study and their discussion. The results of previous studies have established that the indicator of fluttering CFP was a drop in performance, a decrease in body weight by more than 30%, a decrease in red blood cells by 50.0%, a decrease in hemoglobin by 32.0%, hematocrit by 30.0% and testosterone by more than 2.69 times ($p<0.001$), as well as an increase in heart weight to 440.4 mg/100 g . A decrease in the R-R interval was recorded, especially noticeable after 25 days of the experiment and in 10% of animals with increasing load up to a violation of repolarization of the left ventricle at a heart rate of 472.0 ± 23.6 beats/min in the period from 30 to 35 days ($p<0.01$).

Histological assessment. During the first 20 days of the experiment, histological assessment in animals of the experimental group did not reveal pathomorphological changes in the heart and cardiomyocytes. However, after day 25 of modeling of chronic heart failure (CFS), thickening of the myocardium due to blood filling of blood vessels, hypertrophy of individual cardiomyocytes, as well as the presence of pathologies such as myocardiodystrophy and interstitial fibrosis were noted (Fig. 1-2).
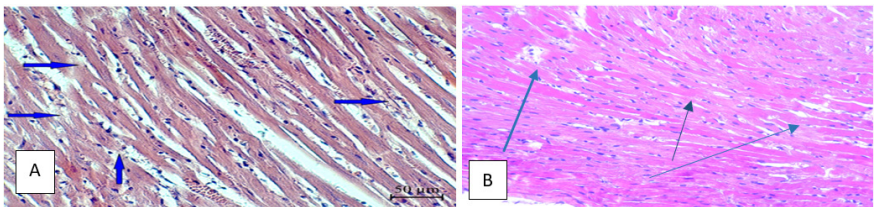
Figure 1. Histological picture of the myocardium (A,B) in the simulation of CFP in the experimental group (day 25). The myocardial fragment is mostly represented by cardiomyocytes with preserved transverse striation. There are signs of dystrophy with a violation of the normal organization of cells. In the sections, small groups of cardiomyocytes are distinguished with alternating mild hypertrophy (focal) and atrophy (focal) indicated by arrows. Hematoxylin-eosin staining ×50, ×200
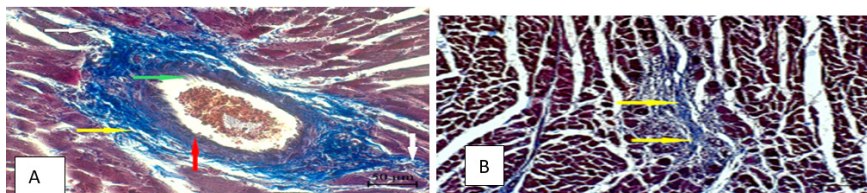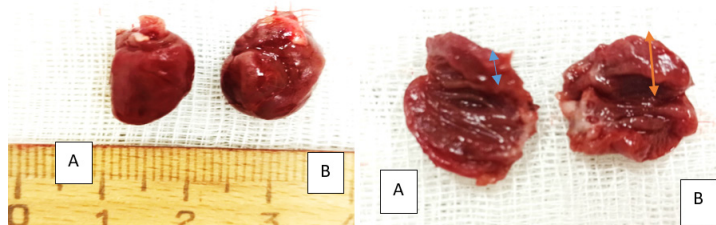
Figure 2. *Histological picture of the myocardium in the simulation of CFP in the experimental group (day 25). A fragment of a myocardium with a blood vessel. The picture of fibrosis around the vessels (colored blue), expanding and penetrating into the area between the muscle fibers, indicating the formation of connective tissue structures around the vessel. Fibrosis of the perivascular region, passing into the interstitial field between myofibrils (marked with white arrows). Adventitia (marked with a yellow arrow), Media (marked with a red arrow), Intimacy (marked with a green arrow). B – Mesh structures of connective tissue fibers between cardiomyocytes (marked with yellow arrows) Masson trichrome coloring. ×50, ×200*

The most significant pathomorphological changes in the myocardium of rats were recorded at the last stages of simulated muscle loads – 30 to 35 days of the experiment. During this period, myocardial hypertrophy, dilation of ventricular cavities, pronounced interstitial and paravascular myocardial fibrosis were recorded (Fig. 3).

Figure 3. *Macroscopic description of rat heart preparations on day 35 of CFP. A is a test. The heart has a normal size and shape. On the incision (blue arrow), the myocardium is pink, without visible foci of necrosis, fibrosis and hypertrophy. B- experimental. The heart is enlarged in size. The myocardium is presented with whitish and yellowish areas. In the incision (orange arrow), the myocardium is hypertrophied, the walls of the ventricles are thickened, the heart cavities are dilated (marked with an orange arrow).*

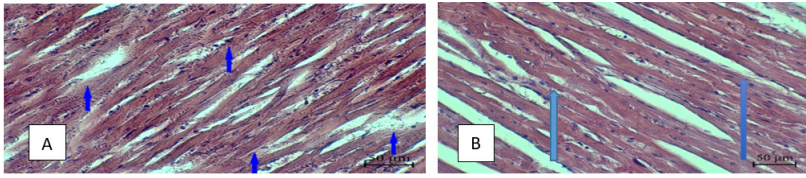**Figure 4.** *Histological picture of the myocardium in the simulation of CFP in the experimental group (day 35). The myocardial fragment (A,B) is presented with cardiomyocyte hypertrophy (an increase in the size and volume of cardiomyocytes) with interstitial edema. Signs of dystrophy, violation of structural regularity in cross sections, expressed in heterogeneity and vagueness of the texture of the tissue and heterogeneity of color. Hematoxylin-eosin staining. ×50, ×200*
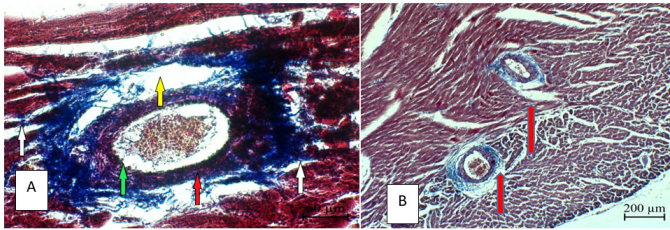
Figure 5. *Histological image of the myocardium in the simulation of chronic heart failure (CKD) of the experimental group (day 35). A fragment of the myocardium (A,B) is represented with blood vessels, along the periphery of which there is a connective tissue structure (colored blue), which demonstrates an increase in fibrosis areas around the vessels and their expansion into the gaps between muscle fibers. These changes are characterized by a more pronounced formation of connective tissue around the vessels penetrating into the space between the muscle fibers and signs of interstitial edema. Masson trichrome coloring. ×50, ×200.*
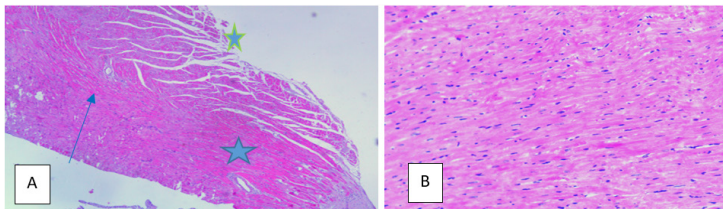
Figure 6. *Histological picture of the heart of rats in the control group without signs of a pathological condition. A) Cross section of the heart: green asterisk - epicardium, blue asterisk - myocardium, blue arrow - arteriole. B) The longitudinal section of the myocardial fragment is mostly represented by cardiomyocytes with preserved transverse striation, with normal cell organization. Hematoxylin-eosin staining. ×50, ×200.*
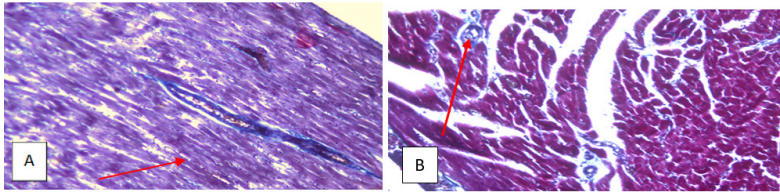
Figure 7. *Histological image of the myocardium of the control group. A is a longitudinal section, B is a transverse section. A fragment of the myocardium is presented with blood vessels without pathological changes. Masson trichrome coloring. ×50, ×200.*

The research results indicate progressive changes in the myocardium due to stressful physical activity, which is also confirmed by studies by foreign authors [27-28]. These changes include cardiomyocyte hypertrophy, dilation of ventricular cavities, fibrosis around blood vessels, disruption of normal cell organization, interstitial edema and signs of dystrophy that are characteristic of chronic heart failure.

Antibodies to troponin I began to react on day 10, reaching a maximum on days 25, 30 and 35 (17.2±0.51 ng/ml, 16.5±0.35 ng/ml and 22.7±2.6 ng/ml, respectively). A similar dynamics was observed for auto-antibodies to actin - the level increased from 10 to 35 days. Autoantibodies to the beta-myosin 7B heavy chain did not change in the first 15 days, then increased significantly from days 20 to 35 (from 62.5% to 176.0%).
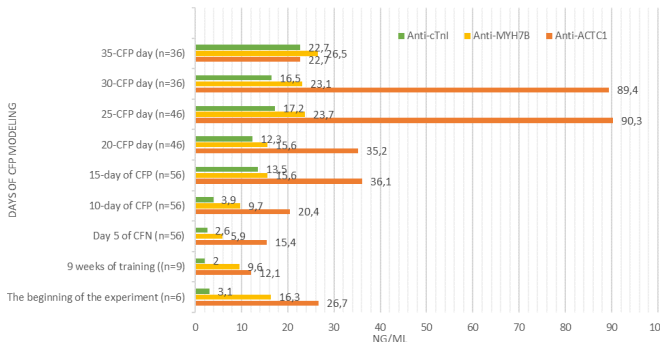
Figure 8. *Dynamics of autoantibodies to proteins of cardiomyocytes of laboratory animals at the beginning of the experiment and the days of observation of modeling chronic physical overstrain.*
Note: The data presented is expressed as an average value with the corresponding standard deviation (SD). The statistical significance of the differences was assessed using the Student's t-test and calculating the p-value (confidence level (P<0.05)).

At the maximum threshold values of the level of auto-antibodies (Fig. 6), with concomitant pronounced myocardial pathology, a violation of depolarization during the days of CFP modeling, changes in concentration and expression in laboratory markers (AST, CK, CK-MV and troponin I) were not registered (Fig.8)
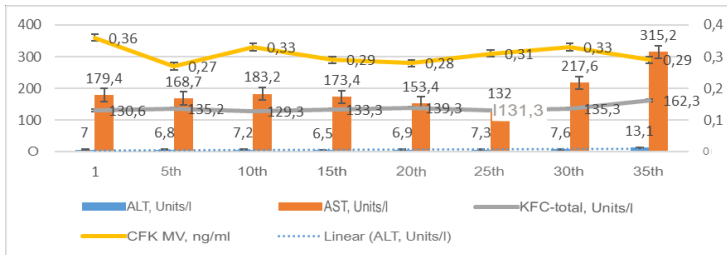
Figure 9. *Results of biochemical analysis of blood serum of laboratory animals in different periods of modeling the condition*
Note: The data presented is expressed as an average value with the corresponding standard deviation (SD). The statistical significance of the differences was assessed using the Student's t-test and calculating the p-value (P<0.05).

The lack of high results in the presence of confirmed histological changes in the early stages of the pathological process of CVD may be due to several factors: heterogeneity of myocardial damage, low sensitivity of markers as early signaling proteins and uneven release of markers [20-23].

Conclusion. An association has been recorded between the level of autoantibodies and changes in the structure of the heart muscle in chronic heart failure. The more pronounced the histological signs of dystrophy, hypertrophy and disorders of the normal organization of cardiomyocytes, the higher the level of anti-cTnI, Anti-ACTC1 and anti-MYH7B. When comparing the results of histological, instrumental and laboratory studies, autoantibodies have a higher informative value for diagnosing the condition of cardiomyocytes under prolonged exposure to adverse factors.

References

1. Pecherina T. B. Kutikhin A. G. Biomarkers of myocardial fibrosis and their genetic regulation in patients with heart failure. Russian journal of cardiology. 2020. No. 10. pp. 139-144. (In Russian).

2. Kuhl U, Noutsias M,Seeberg B, Schultheiss HP. Imunohistological evidence for a chronic intramyocardial inflammatory process in dilated cardiomyopathy. Heart. 1996. № 75. pp. 295-300.

3. El-Kased R.F. Immuno-analytical approach and its application for cardiac disease marker detection. //Journal of Immunoassay and Immunochemi. 2018. pp. 1—13.

4. Deryugin M.V., Kositskaya L.S., Kuznetsova S.A., Zhitnukhin, Yu.L., Sukhov V.Yu., Freidlin I.S., Boitsov S.A. Clinical and immunological characteristics of low-symptomatic non-rheumatic myocarditis. Medical Immunology. 2001. no. 3. pp. 99-103. (In Russian).

5. Müller D., Klamt T., Gentemann L., Heisterkamp A., Kalies SMK. Evaluation of laser induced sarcomere micro-damage: Role of damage extent and location in cardiomyocytes. PLoS One. Evaluation of laser induced sarcomere micro-damage: Role of damage extent and location in cardiomyocytes. PloS one. 2021. no.16

6. Hu Y.Z., Cheng B.C., Wang H.P., Hu S. The ultrastructure change of cardiomyocyte in Athlete's Heart. Zhonghua Xin Xue Guan Bing Za Zhi. 2005. vol. 33, no. 10. pp. 936-939.

7. O'Donohoe T.J., Ketheesan N., Schrale R.G. Anti-troponin antibodies following myocardial infarction. Journal of cardiology. 2017. no.69. pp. 38–40.

8. Nussinovitch U., Shoenfeld Y. The clinical and diagnostic significance of anti-myosin autoantibodies in cardiac disease. Clinical reviews in allergy & immunology. 2013. no. 44. pp. 98–108.

9. Kurylyak M.M., Ozhgibesova M.A., Ganeeva E.R. Laboratory markers of myocardial injury in modern cardiology. Scientific Review. Pedagogical sciences. 2015. no. 5. pp. 85-89.

10. Gumanova N.G. Analytical complex of biochemical markers for preclinical diagnosis and prevention of cardiovascular diseases. Cardiovascular therapy and prevention. 2019. no. 18. pp. 117-127.

11. Caforio A. L., Goldman J. H., Haven A. J., Baig K. M., Libera L. D., McKenna, W. J. Circulating cardiac-specific autoantibodies as markers of autoimmunity in clinical and biopsy-proven myocarditis. The Myocarditis Treatment Trial Investigators. European heart journal. 1997. vol. 18, no 2. Pp. 270-275.

12. Levochkina E. D. Diagnostic and prognostic role of multicomplex autoimmune biological markers of cardiac pathology. Bulletin of the Peoples' Friendship University of Russia. Series: Medicine. 2023. vol. 27, no. 1. pp. 71-82. (In Russian).

13. Tereshchenko S.N., Skvortsov A.A., Shchedrina A.Yu., Narusov O.Yu., Zykov K.A., Safiullina A.A., Sychev A.V., and Zhirov I.V. Diagnostic significance of immunological markers in patients with inflammatory cardiomyopathy. Russian Journal of Cardiology. 2027. vol. 142, no. 2. pp. 22-29.

14. Zaichik A.M., Poletaev A. B., Churilov L. P. Natural autoantibodies, immunological theories and preventive Medicine. Bulletin of St. Petersburg University. Medicine. 2013. no. 2. pp. 3-16.

15. Gavrilova E.A. Features of the immune status of athletes with myocardial dystrophy of physical overstrain in combination with foci of chronic infection. Collection of abstracts of reports of the scientific and practical conference "Actual problems of sports medicine, physical therapy and physical therapy" 2000. p.17 (In Russian).

16. Ryabkova V.A., Churilov L.P., and Shubik Yu.V. "THE role of autoantibodies against cardiomyocyte antigens in the development of cardiac arrhythmias and SUDDEN cardiac death. Bulletin of Arrhythmology. 2019. vol. 26, no. 4. pp. 21-31. (In Russian).

17. Belyaev N.G., Levochkina E.D., Gadzhimurad A.S. Innovative transformations in the field of physical culture. sports and tourism. Collection of materials of the XXIV All-Russian scientific and practical conference. 2021. pp. 210-213. (In Russian).

18. Belyaev N.G., Levochkina E.D., Baturin V.A., Rzhepakovsky I.V., Abasova T.V., and Piskov S.I. Dynamics of autoantibodies to cardiomyocyte proteins at different stages of simulated muscle loads" Bulletin of the Peoples' Friendship University of Russia. Series: Medicine. 2022. vol. 26, No. 1. pp. 51-61.

19. Belyaev, N.G. Structural changes in muscle fiber during the period of adaptation to physical exertion of varying intensity. Nauka. Innovation. Technologies. Scientific Journal of the North Caucasus Federal University. 2014. No. 2. pp. 179-189. (In Russian).

20. Chauin A. The Main Causes and Mechanisms of Increase in Cardiac Troponin Concentrations Other Than Acute Myocardial Infarction (Part 1): Physical Exertion, Inflammatory Heart Disease, Pulmonary Embolism, Renal Failure, Sepsis. Vascular health and risk management. 2021. № 17. pp. 601–617.

21. Djakpo D.K., Wang Z.Q., Shrestha M. The significance of transaminase ratio (AST/ALT) in acute myocardial infarction. Archives of medical sciences. Atherosclerotic diseases. 2020. №5. pp. 279–283.

22. Guzy P.M. Creatine phosphokinase-MB (CPK-MB) and the diagnosis of myocardial infarction. The Western journal of medicine 1977. №127. pp. 455–460.

23. Chen X., You J., Zhou M., Ma H., Huang C. The association between serum uric acid and creatine phosphokinase in the general population: NHANES 2015-2018. BMC cardiovascular disorders. 2023. № 23. pp. 296-297.

基于实时PCR的猴腺病毒25型特异性检测检测系统的研制

DEVELOPMENT OF A TEST SYSTEM FOR SPECIFIC DETECTION OF SIMIAN ADENOVIRUS TYPE 25 BASED ON REAL-TIME PCR

Shingaryova Anastasia Aleksandrovna
Practical student
National Research Center for Epidemiology and Microbiology named after the honorary academician N. F. Gamaleya

Vavilova Irina Viktorovna
Research Assistant
National Research Center for Epidemiology and Microbiology named after the honorary academician N. F. Gamaleya

Ozharovskaia Tatiana Andreevna
Senior Researcher, PhD in Biology
National Research Center for Epidemiology and Microbiology named after the honorary academician N. F. Gamaleya

抽象的。 基于猿腺病毒的载体广泛应用于疫苗开发和癌症治疗，使其成为生物医学研究和治疗药物开发的重要工具。 25 型腺病毒载体的类型特异性检测是癌症治疗药物和疫苗制剂创建和监测过程中的关键步骤。 这种诊断不仅可以识别载体的存在和类型，还可以评估其浓度和质量。 本研究对实时聚合酶链反应（real-time PCR）方法进行了优化：选择针对猿猴腺病毒25型（SAd25）六邻体基因的引物，建立了实时PCR程序，动态范围（确定了模板浓度的 8 对数）和检测下限（每个反应 1000 个六邻体基因拷贝），并证明了该分析的高特异性。 所开发的测试系统可以显着提高样本中SAd25测定的准确性、速度和效率，这对于使用腺病毒载体的医学实验室和研究中心具有实际意义。

关键词：特异性腺病毒检测，猿猴腺病毒25型，实时荧光定量PCR，检测系统。

Abstract. Simian adenovirus-based vectors are widely utilized in vaccine development and cancer therapy, making them crucial tools in biomedical research and therapeutic drug development. The type-specific detection of adenovirus vector type 25 is a critical step during creation and monitoring of cancer therapy agents and vaccine preparations. Such diagnosis not only identifies the presence and type of vector but also assesses its concentration and quality. In this study, we optimized the real-time polymerase chain reaction (real-time

PCR) method: primers targeting the hexon gene of simian adenovirus type 25 (SAd25) were selected, a real-time PCR program was established, the dynamic range (8 logs of template concentration) and the lower limit of detection (1000 hexon gene copies per reaction) were determined, and the high specificity of this analysis was demonstrated. The developed test system can significantly improve the accuracy, speed, and efficiency of SAd25 determination in samples, which is of practical importance for medical laboratories and research centers working with adenovirus vectors.

Keywords: type-specific adenovirus detection, simian adenovirus type 25, real-time PCR, test system.

Introduction. Simian adenovirus-based vectors are highly effective and safe in vaccine and anti-tumor therapy development. Several vaccine platforms based on simian adenoviruses, belonging to group E, have been developed, including the ChAdOx1 platform from the University of Oxford (based on simian adenovirus type Y25) [1] and the ChAdOx2 platform (based on simian adenovirus type 25 (SAd25)) [2]. The ChAdOx1 vector is particularly important as it forms the basis of the Oxford-AstraZeneca vaccine for COVID-19 prevention, administered to over 500 million people [3].

At various stages of obtaining a vaccine preparation based on the adenovirus serotype 25 platform, such as vector acquisition, analysis, amplification, and purification, it is important to control the amount of SAd25 genomes. Moreover, if a facility is involved in developing two or more adenovirus vectors of different serotypes, there is a risk of cross-contamination. A notable example is the recall of several batches of the JNJ-78436735 COVID-19 vaccine based on human adenovirus type 26 due to mixing with components of the AZD1222 vaccine based on monkey adenovirus Y25, which were produced at the same facility [4].

Therefore, type-specific detection of vectors based on adenovirus type 25 is one of the key steps in the development and quality control of vaccine preparations. Using the real-time polymerase chain reaction (real-time PCR) method for this task has several advantages: high sensitivity, absence of a stage for checking results in gel electrophoresis, analysis accuracy and speed, automation, and the ability for multiplex analysis [5]. Optimization of real-time PCR to enhance the sensitivity and specificity of virus diagnostics involves several key aspects, such as selecting optimal target genes and optimizing amplification conditions. It is important to note that these approaches may vary depending on the specific diagnostic task and virus type [6-8].

Materials and Methods. Search for adenovirus genome sequences was conducted in the international GenBank NCBI database (http://www.ncbi.nlm.nih.gov/GenBank). Multiple alignment of adenovirus hexon nucleotide sequences

was performed using the Geneious Prime program. Primer selection, analysis of their parameters (complementarity to hexons of different serotypes of human and animal adenoviruses, dimer formation, % GC, etc.), and *in silico* specificity verification were carried out using the Geneious Prime program. Primers synthesis was conducted at ZAO "Evrogen" (Russia).

Plasmid DNA samples containing recombinant genomes of simian adenoviruses (types 22, 23, 24, and 25), as well as plasmid DNA samples containing recombinant genomes of human adenoviruses (serotypes 1, 2, 5, 19, 26, 37, 41, 55), were used as research objects in the study. These samples were obtained from the plasmid bank of the immunobiotechnology laboratory of N.F. Gamaleya National Research Center. The purity and concentration of plasmid DNA were determined using the NanoDrop 2000c spectrophotometer (Thermo, USA).

Cell lines used for specificity analysis included: HEK293 – human embryonic kidney cells (obtained from the Russian Collection of Vertebrate Cell Cultures); A549 – human adenocarcinoma epithelial cells (obtained from the Russian Collection of Vertebrate Cell Cultures); Vero B – African green monkey kidney epithelial cells (obtained from the Collection of Continuous Cell Cultures, D.I. Ivanovsky Institute of Virology, N.F. Gamaleya National Research Center), HEP-G2 – human hepatocellular carcinoma cells, and HELA – Henrietta Lacks' uterine endothelial cells (obtained from the cell culture bank of the immunobiotechnology laboratory of the N.F. Gamaleya National Research Center). DNA from cell cultures was isolated using the Wizard Genomic DNA Purification Kit (Promega, USA).

The plasmid pKan-T-SAd25 was obtained by cloning a PCR fragment carrying a part of the hexon gene of simian adenovirus type 25 into the commercial plasmid vector pKan-T (ZAO "Evrogen", Russia) using standard genetic engineering methods. The resulting positive clone was grown in a 100 ml overnight culture of DH5a cells and purified using the QIAGEN® Plasmid Midi Kit (QIAGEN, Germany).

Real-time PCR was performed in automatic mode on the CFX 96 Real-Time PCR Detection System (Bio-Rad, USA) using the SYBR channel. For analysis, the qPCRmix-HS SYBR reaction mixture was used (ZAO "Evrogen", Russia). The real-time PCR program included an initial denaturation step at 95°C for 5 minutes; followed by 35 cycles of denaturation at 95°C for 15 seconds, annealing at 55°C for 15 seconds, and extension at 72°C for 15 seconds. To select the annealing temperature of the primers, RT-PCR was carried out according to the same program, with the exception of annealing (a temperature gradient in the range from 55.0°C to 63.3°C was used). Calibration curve construction and DNA concentration calculations were carried out using the CFX Manager Software (Bio-Rad, USA).

Results and Discussion. For the development of a real-time PCR test system for detection of simian adenovirus type 25, we selected the hexon gene as the target gene, a key component of the adenovirus capsid, because the nucleotide composition of this gene varies significantly compared to other genes in the adenovirus genome. To ensure primer specificity to the hexon sequence of SAd25 and prevent annealing to hexon sequences of other serotypes within group E (22, 23, 24), primer selection took into account the sequences of hexons from other serotypes. Sequences of adenoviruses types 22, 23, 24, and 25 were obtained from the international GenBank database, aligned using Geneious Prime software, and based on this alignment, primers were selected showing 100% specificity only to the SAd25 hexon sequence (Figure 1). Primers were chosen to have 100% complementarity to the target gene, a melting temperature within the range of 55-60°C, absolutely no internal homology exceeding 3 bp, and a GC content between 45% and 65%. Characteristics of the selected primers are presented in Table 1.

Figure 1. *The selection of the primers specific to the hexon gene of SAd25*

<div align="right">

Table 1.
</div>

Primer Characteristics. GC % – the percentage of either guanine (G) or cytosine (C) in a DNA. Tm – melting temperature.

Name	Nucleotide Sequence	Length	Dimer formation	GC %	Tm °C
hexon Ad25 F	GCC GAT GGT GAA ACT GCC	18	No	61,1	59
hexon Ad25 R	AGT AGT GCC TGT TCC TGT	18	No	50	55

The constructed primers were tested for specificity *in silico* using the Geneious Prime program. According to the analysis, the primers specifically interact only with the sequence of the hexon gene of simian adenovirus serotype 25.

Next, we constructed a positive control sample by cloning the PCR fragment limited by the primers hexon Ad25 F and hexon Ad25 R into a commercial vector pKan-T using standard molecular cloning methods. The resulting plasmid was named pKan-T-SAd25, the positive clone was checked by multiple restriction digestions and conventional PCR analysis.

To optimize reaction components, a commercial kit (qPCRmix-HS SYBR) was used, as it allows obtaining results with a high signal and low background noise. Furthermore, the use of ready-made commercial PCR mixes reduces reaction preparation time, decreases the risk of contamination, and minimizes errors during PCR reaction component mixing. To optimize primer annealing temperature, real-time PCR was performed with the annealing in the range of 55.0°C to 63.3°C. Based on the results of the experiment (Table 2), it was established that the primers have an optimal annealing temperature at 55°C. At this temperature, the highest fluorescence level (1435.5 rfu) was observed, with a low background level (542 rfu). This temperature was used in subsequent experiments.

Table 2.

Primer Annealing Temperature Selection Results. Cq mean – mean quantification cycle, rfu – relative fluorescent unit

Temperature (°C)	Cq Mean		RFU Mean	
	Positive control	Negative control	Positive control	Negative control
55,0	20,06	30,54	1435,5	524
57,0	20,11	30,39	1214,5	645
59,0	20,10	30,19	1325,5	676,5
61,4	21,24	31,25	1099	420,5
63,3	23,65	33,17	876,5	224

The selection of the optimal primer concentration was empirically conducted using different primer concentrations in the reaction mixture: 5, 7.5, 10, 12, and 15 picomoles (pmol) of primers per reaction. It was established that an excess of primers resulted in the amplification of the maximum amount of PCR product, but this concentration could lead to the formation of nonspecific amplification products. When there was an insufficient amount of primers (5 pmol/ reaction), a very low signal level was observed (Table 2). The optimal primer concentration of 12.5 pmol/reaction was chosen based on the signal intensity in positive and negative control samples.

Table 3.

Primer Concentration Selection

Concentration, pmol	Cq Mean		RFU Mean	
	Positive control	**Negative control**	**Positive control**	**Negative control**
5	16,63	32,38	641	65,4
7,5	14,96	32,60	861	137
10	14,83	33,44	765,5	99,35
12,5	14,06	30,33	837,5	327
15	13,87	30,58	810	329,5

The assessment of the dynamic range and the lower limit of detection was performed using 8 consecutive dilutions of positive control (pKan-T-SAd25 plasmid) ranging from 10^3 to 10^{10} copies/reaction. As a result, the dynamic range was 8 logs of the template (Figure 2). The PCR efficiency was 90.0%, with linearity $R^2 = 0.998$. The lower limit of detection appeared to be 1000 copies per reaction. Such a detection range is sufficient for detecting the presence of adenovirus type 25 in the samples and is comparable to other adenovirus detection systems. Thus, the presented PCR system has adequate analytical characteristics: a dynamic measurement range of 8 logs, and PCR efficiency within the standard range of 90% to 110%.
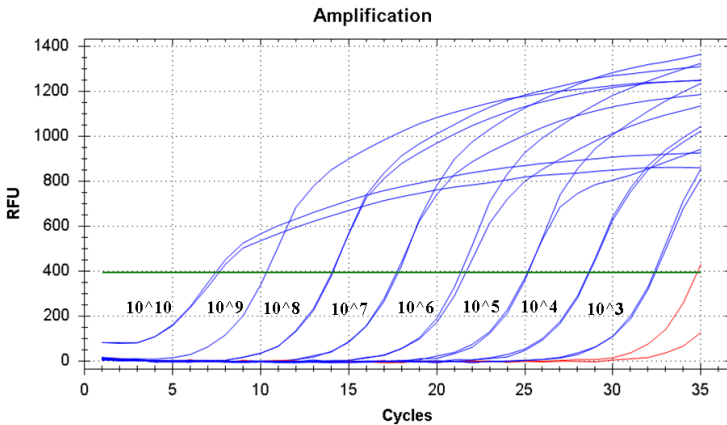
Figure 2. The dynamic range and the lower limit of detection of the real-time system for detecting the presence of simian adenovirus type 25. The green line – the baseline, the blue curves – tenfold dilutions of the positive control sample, the red lines – the negative control sample

Subsequently, the specificity of real-time PCR was analyzed to detect adenovirus type 25 *in vitro*. Ideally, the primer should have 100% complementarity to the target site and should not recognize other sequences, even those very close in nucleotide composition. However, practice shows that primers with less than 100% complementarity and with a sufficiently high degree of homology (but not exceeding 70%) to other nucleotide sequences can also be effective.

On the next step, the specificity of primers to cell cultures, which are frequently used in the production or analysis of biotechnological preparations, was assessed. Genomic DNA was extracted from the following cell cultures: Vero B, A549, HEP-G2, HEK293, and HELA, and was analyzed at two concentrations: 1 ng and 10 ng per reaction. The results obtained indicate that the primers do not recognize the DNA from these cell cultures (according to PCR results, the signal level in all tested samples was below the detection limit).

Further specificity assessment of the primers was conducted using the DNA of various types of human adenoviruses: 1, 2, 5, 19, 26, 37, and 55 (1 ng and 10 ng per reaction). It was found that these primers did not react with any of the genomes of the studied types of human adenoviruses.

In the final stage, the specificity of the primers was evaluated using the DNA of adenoviruses of simian serotypes 22, 23, 24, and 25 (1 ng and 10 ng per reaction). It was established that these primers specifically reacted only with the DNA of simian adenovirus type 25.

Thus, optimization of the real-time PCR method has been performed: primers targeting the hexon gene of adenovirus type 25 has been selected, a real-time PCR program has been established, the dynamic range (8 logs of template concentration) and the lower limit of detection (1000 copies per reaction) has been determined, and the high specificity of this analysis has been demonstrated.

Literature

1. Dicks MD, Spencer AJ, Edwards NJ, et al. A novel chimpanzee adenovirus vector with low human seroprevalence: improved systems for vector derivation and comparative immunogenicity. PLoS One. 2012;7(7):e40385. doi:10.1371/journal.pone.0040385

2. Morris SJ, Sebastian S, Spencer AJ, Gilbert SC. Simian adenoviruses as vaccine vectors. Future Virol. 2016;11(9):649-659. doi:10.2217/fvl-2016-0070

3. Berg A, Wright D, Dulal P, et al. Stability of Chimpanzee Adenovirus Vectored Vaccines (ChAdOx1 and ChAdOx2) in Liquid and Lyophilised Formulations. Vaccines (Basel). 2021;9(11):1249. Published 2021 Oct 28. doi:10.3390/vaccines9111249

4. FDA: Decision memorandum to Janssen COVID-19 Vaccine № 27205 [утверждён 11 июня 2021 года]. – Food&drug administration

5. Sakharov Readings 2017: environmental problems of the XXI century: materials of the 17th International Scientific Conference, May 18-19, 2017, Minsk, Republic of Belarus : at 2 p.m. / International State Environmental A. D. Sakharov Institute of the White State University; editorial board : S. E. Golovaty [et al.] ; edited by Dr. Ph.D., Prof. S. A. Maskevich, Dr. S.-H. N., Prof. S. S. Poznyak. – Minsk : IVC of the Ministry of Finance, 2017. – Part 1. – 324 p.

6. Bustin SA, Benes V, Garson JA, et al. The MIQE guidelines: minimum information for publication of quantitative real-time PCR experiments. Clin Chem. 2009;55(4):611-622.

7. Mackay IM, Arden KE, Nitsche A. Real-time PCR in virology. Nucleic Acids Res. 2002;30(6):1292-1305.

8. Wittwer CT, Herrmann MG, Moss AA, Rasmussen RP. Continuous fluorescence monitoring of rapid cycle DNA amplification. Biotechniques. 1997;22(1):130-131,134-138.

伴有肿瘤病理的冠状动脉疾病患者冠状动脉搭桥手术后心理情绪状态和生活质量的变化

CHANGES IN PSYCHOEMOTIONAL STATUS AND QUALITY OF LIFE AFTER CORONARY ARTERY BYPASS SURGERY IN PATIENTS WITH CORONARY ARTERY DISEASE WITH CONCOMITANT ONCOLOGICAL PATHOLOGY

Zhelikhazheva Madina Vladimirovna
Doctor of Medical Sciences, Senior Researcher
A.N. Bakulev National Medical Research Center of cardiovascular surgery
ORCID ID: 0000-0001-5344-4842

Merzlyakov Vadim Yurievich
Doctor of Medical Sciences, Head of Department
A.N. Bakulev National Medical Research Center of cardiovascular surgery
ORCID ID: 0000-0002-5638-3723

Kaabak Alexey Mihailovich
Doctor of Medical Sciences, cardiovascular surgeon
A.N. Bakulev National Medical Research Center of cardiovascular surgery
ORCID ID: 0000-0003-2357-8115

概括。 对于治疗冠心病（CHD）和预防心绞痛反复发作，冠状动脉旁路移植术（CABG）被认为是最有效的方法。 该手术使 75-80% 的病例的心脏功能得到显着改善。 该手术使 75-80% 的病例的心脏功能得到显着改善。 伴有肿瘤病理学的冠心病患者的术后过程通常伴有焦虑抑郁状态。 为了提高手术治疗效果，采用心理矫正方法。 尽管对心脏病患者的精神状态特征进行了大量的研究，但这个问题的许多方面仍然没有得到充分的研究。 很大一部分研究人员将心脏病患者生活质量的恶化与该疾病的临床病程特征联系起来。 压力的来源是被诊断出患有严重的、危及生命的疾病，而这种疾病与肿瘤病理学无法治愈的根深蒂固的观念有关。 此外，手术干预还伴随着负面的情绪体验。 他们的结果是不同性质和严重程度的神经精神障碍，主要是神经衰弱、焦虑和抑郁障碍。 与此同时，诸如患者人格的认知领域（CS）特征及其动态等心理方面通常仍然不受关注。 以上就确定了本研究的问题。

关键词：冠心病、肿瘤病理学、跳动心脏的冠状动脉旁路移植术、焦虑抑郁状态。

Summary. *For the treatment of coronary heart disease (CHD) and the prevention of recurrent attacks of angina, coronary artery bypass grafting (CABG) is considered the most effective method. This operation provides a significant improvement in heart function in 75-80% of cases. This operation provides a significant improvement in heart function in 75-80% of cases. Often the course of the postoperative period in patients with coronary heart disease with concomitant oncological pathology is accompanied by an anxiety-depressive state. To improve the results of surgical treatment, psychological correction methods are used. Despite a significant amount of work on the study of the characteristics of the mental state of cardiac patients, many aspects of this problem remain insufficiently studied. A significant portion of researchers associate the deterioration in the quality of life of cardiac patients with the characteristics of the clinical course of the disease. The source of stress is the fact of being diagnosed with a serious, life-threatening disease in connection with entrenched ideas about the incurability of oncological pathology. In addition, surgical interventions are accompanied by negative emotional experiences. Their result is neuropsychic disorders of varying nature and severity, primarily asthenoneurotic, anxiety and depressive disorders. At the same time, such psychological aspects as the characteristics of the cognitive sphere (CS) of the patient's personality and their dynamics, as a rule, remain out of focus. The above determined the problem of this study.*

Keywords: coronary heart disease, oncopathology, coronary artery bypass grafting on a beating heart, anxiety-depressive state.

Currently, in the structure of morbidity and mortality of the population of Russia, as well as the whole world, the leading positions are occupied by cardiovascular and oncological diseases. In Russia in 2018, the number of deaths from CVDs amounted to 856.1 thousand (contribution of coronary heart disease - 453.3 thousand (52.9%)), from cancer - 297.9 thousand people [1,2,3] . According to experts from the World Health Organization (WHO), a further increase in the number of heart and vascular diseases and an increase in mortality from them is possible throughout the world. This is due to the increase in life expectancy of the population and lifestyle characteristics [4, 5, 6, 7, 8]. Numerous studies completed in the late 90s of the 20th century made it possible to prove that stress and the conditions caused by it, primarily anxiety and depression, are independent risk factors for the development of cardiovascular diseases [9, 10, 11, 12]. The course of cancer and its treatment significantly affects the well-being of patients and, as a result, necessitates a clear understanding by the doctor of the rehabilitation needs of patients. This necessitates the use of special tools for assessing QoL. One such tool that reflects patients' subjective assessment of symptoms and life functioning in cancer is developed by the Study Group of Quality of Life at the European

Organization for Research and Treatment Cancer (EORTC). "Fatigue" question-naire ("Fatigue", FA12) [11], which is a module of a specialized questionnaire for the quality of life in cancer pathology (Quality of Life Questionnary – Core 30, QLQ-C30), created by the same organization [13]. The original text of the ques-tionnaire in English and the request form for the Russian version are presented on the EORTC website (https://qol.eortc.org / questionnaire / qlq-fa12). This method can also be used to study the dynamics of these indicators during the process of re-storative treatment and rehabilitation of patients after surgery and chemotherapy. The largest number of specific survey forms have been created for patients with chronic and oncological diseases, as well as various conditions [14, 15].

In connection with the above, the purpose of this study was to assess the possi-bility of psychological correction of anxiety and depression to improve the results of surgical treatment of cancer patients with coronary artery disease.

Materials and methods

We examined 82 patients with coronary artery disease (average age 61.1 ± 6.0 years) with concomitant oncological pathologies of various localizations who underwent planned coronary artery bypass surgery on a beating heart (OPCAB - Off-pump coronary artery bypass). The share of men was 70.7%, women – 29.3%. A history of myocardial infarction was noted in 62 (75%) patients. According to the results of the analysis of the submitted medical documentation, the pres-ence of comorbid pathology was noted in all patients. Thus, arterial hypertension was detected in 68 (83%) patients, type 2 diabetes mellitus (DM) - in 22 (26%) patients, chronic obstructive pulmonary disease (COPD) - in 19 (23%), chronic kidney disease (CKD) - in 13 (15%), dyslipidemia – in 60 (73%), a history of gastric and duodenal ulcers was noted in 16 (19%) patients. It should be noted that the proportion of active smokers (n=27) before hospitalization exceeded 33%. Quetelet's formula was used to calculate body mass index (BMI). Obesity was diagnosed according to the WHO classification (2007) [16].

The clinical characteristics of the analyzed patients were aggravated by an in-creased level of anxiety (in all cases without exception) and a depressive state (in 1/3 of the patients). All patients underwent traditional preoperative preparation, however, despite optimal drug therapy (b-blockers, statins, antiplatelet agents), modifiable risk factors for the development of CVD continued to be determined: dyslipidemia - in 11.4% of cases, diabetes mellitus - in 7.9%, arterial hypertension - in 7.3%. The level of clinical depression was assessed using the Beck Depres-sion Inventory-BDI, which is designed to determine the severity of depressive symptoms. A total result of 0-9 points indicated the absence of depressive symp-toms, a result of 10-19 points was assessed as mild depression (subdepression) and moderate depression, more than 19 points - clinically significant depression. The level of situational and personal anxiety was assessed using a test developed by

Ch. Spielberger and L. Khanin; This test allows you to identify the patient's level of anxiety at the time of the study and anxiety as a personality trait. An anxiety level of less than 30 points was assessed as low, 31-44 points - moderate, 45 or more points - high.

In all patients, the quality of life was studied, determined in points using the SF-36 questionnaire, the Minissota questionnaire. The control examination included: ECG, EchoCG, assessment of quality of life using questionnaires (Seattle Angina Questionnaire - SAQ, specific questionnaire for cancer patients EORTC QLQ-C30 and general questionnaire SF - 12). All studies were carried out on an outpatient basis at the Federal State Budgetary Institution "National Medical Research Center for Cardiovascular Surgery named after. A.N. Bakulev" of the Ministry of Health of the Russian Federation.

Statistical processing of the results was carried out in the SPSS 23.0 software environment (IBM Inc., USA). The results are presented as arithmetic mean (M) and standard deviation (SD). To compare the quantitative indicators of two independent groups with a normal distribution of the trait, the Student's test (t) was used. Differences were considered significant at $p < 0.05$. Clinical and psychological examination was carried out before surgery, 1, 2 and 2.5 years after surgery. For statistical processing of the results, methods of descriptive statistics were used, the Kolmogorov–Smirnov test to assess the distribution of variables, the Wilcoxon test, the Mann–Whitney test, correlation analysis according to Pearson and Spearman.

Results and discussion

Long-term mortality after treatment of concomitant malignant neoplasms was 8.5% - 3 patients died 1, 2 and 2.5 years after minimally invasive myocardial revascularization surgery on a beating heart. The cause of death was a competing oncological pathology. This is especially true for the indicator "Physical activity", which in its value in the postoperative period approaches the maximum possible (100%).

Data obtained using the Beck Depression Inventory demonstrate that 65% of patients have scores below 10 points (mean score 4.8 ± 2.7), which indicates the absence of depression in these patients. However, 26% of patients have a score from 10 to 19 points (average score 14.1 ± 3.7), which does not exceed normal values, but raises concerns about the prospects for developing depression. 9% of patients showed signs of clinically significant depression with a score of more than 20 (average score 27.4 ± 5.8), which indicates the need for correction of the treatment. As a result of correlation analysis, positive relationships were revealed between quality of life and the level of depression ($r = 0.51$, $p < 0.001$). The quality of life in patients with concomitant depression is 1.5 times worse than in persons with normal psycho-emotional status.

The results of using the Spielberger-Khanin anxiety scale showed that the level of situational anxiety in patients is significantly lower than the level of personal anxiety. Thus, a low level of situational anxiety was noted in 9% of patients (average score 29.3±3.7); a low level of personal anxiety was not recorded in any of the examined patients. The average level of severity of situational anxiety was observed in 69% of patients (average score 40.4±3.2), and personal anxiety – in 50% (average score 40.8±5.4). A high level of situational anxiety was detected in 22% of patients (average score 53.6±8.0), personal anxiety – in 50% (average score 53.8±8.1). Correlations were found between the quality of life and the level of situational anxiety (r=0.46, p<0.001), as well as between the quality of life and the level of personal anxiety (r=0.59, p<0.001). The quality of life in patients with concomitant high levels of personal anxiety is 1.6 times worse than in persons with normal psycho-emotional status.

Thus, increased situational anxiety is maladaptive in nature. A high level of personal anxiety requires the help of specialists and long-term psychotherapy, since somatic manifestations of anxiety (rapid heartbeat and pulse, disorders of the gastrointestinal tract, breathing problems) can cause the development of various diseases or aggravate the course of existing ones. In our study, an increased level of anxiety characterized the patient's reaction to the upcoming surgical procedure. A number of authors interpret increased anxiety and depression as a condition caused by stress and an additional risk factor for the development of cardiovascular complications in the postoperative period [19, 20, 21]. According to meta-analyses, preoperative screening of mental disorders allows assessing the risk of postoperative anxiety and depression in patients undergoing coronary artery bypass grafting (CABG) surgery [22, 23]. Data on the prevalence of depression in patients before and after coronary artery bypass grafting are comparable to the results of foreign register studies [24, 25, 26, 27].

Conclusion

According to the results of the study, even in the long-term period after CABG surgery, patients with concomitant oncological diseases retain signs of psycho-emotional instability, the quality of life of patients significantly worsens in the presence of anxiety or depression. In patients undergoing elective CABG surgery, the spectrum of pre- and postoperative emotional disturbances consists of preoperative anxious and depressive reactions to the situation (subclinical or clinical severity), the level of which decreases after surgery. The severity of anxiety and depression significantly determines both the psychological and physical components of the quality of life of patients. Thus, the identified changes indicate the need for correction of psycho-emotional disorders in complex treatment, in order to improve the clinical condition and improve the quality of life of these patients. Studying this issue is important to improve the quality of medical care for this category of patients.

Conflict of interest: none
Financing. The study had no sponsorship.

References

1. *Lunina A.N. Evaluation of the clinical effectiveness of complex rehabilitation of patients with coronary heart disease in the early postoperative period after coronary artery bypass grafting with the study of the state of microcirculation and cytokine pattern. Dissertation. Candidate of Medical Sciences... 2023*

2. *Demograficheskij ezhegodnik Rossii. 2019: Statisticheskiy sbornik. Rosstat. M. 2019. Accessed September 17, 2021. (In Russ.). https://rosstat.gov.ru/folder/210/document/13207*

3. *Shalenkova MA, Ivanov AV, Klimkin PF. Features of comorbidities and their effect on prognosis in cancer patients hospitalized with acute coronary syndrome. Russian Cardiology Bulletin. 2021;16(3):53–59. (In Russ.). https://doi.org/10.17116/Cardiobulletin20211603153*

4. *Aronov, D.M., Atherosclerosis and coronary heart disease / D.M. Aronov, V.P. Lupanov // - Ed. 2nd, revised – Moscow: Triada-X, 2009. – 245 p.*

5. *Salavati, M. Comparison Between Effects of Home Based Cardiac Rehabilitation Programs Versus Usual Care on the Patients' Health Related Quality of Life After Coronary Artery Bypass Graft / M. Salavati, G. Fallahinia, A.E. Vardanjani, H. Rafiei, S. Mousavi, M. Torkamani // Glob J Health Sci.- 2015.- Vol. 19, №4.-P.196-202.*

6. *Nenarokomov A.Y., Speransky D.L., Arevshatov E.V., Mudryy A.Y. A Modern concept quality of life research in oncology. Fundamental research №2, 2012. P.421-425.;*

7. *Balabukha O.C. Mezhdunarodyj medicinskij zhurnal, 2010, no. 4, pp. 11–13.*

8. *Ionova T.I., Novik A.A., Suhonos Ju.A. Onkologija, 2000, Vol.2, no. 1–2, pp. 25–27.*

9. *Shestopalova I. M., Tkachenko G. A. Physcologic Correction of anxiety and depression in patients with toracoabdominal cancer and concurrent ischemic heart disease // Вестник РОНЦ им. Н. Н. Блохина РАМН, т. 20, №2, 2009. C.48-51*

10. *Novik A.A., Ionova T.I. Guidelines for the study of quality of life in medicine. 2nd ed. Ed. by acad. RAMS Yu.L. Shevchenko. Moscow: OLMA Media Group, 2007. 320 p. (In Russ.)*

11. *Usmanova E.B., Shchelkova O.Yu., Yakovleva M.V. et al. Validation of the Russian version of the fatigue module of the EORTC Quality of Life Questionnaire for cancer patients. Sarkomy kostej, myagkikh tkanej i opukholi kozhi = Bone and soft tissue sarcomas, tumors of the skin 2022;14(1):33–9. (In Russ.). DOI: 10.17650/2782-3687-2022-14-1-33-39.*

12. Aaronson N.K., Ahmedzai S., Bergman B. The European Organisation for Research and Treatment of Cancer QLQ-C30: a quality of life instrument for use in international clinical trilas in oncology. J Natl Cancer Inst 1993; 85(5):365–75. DOI: 10.1093/jnci/85.5.365. Fayers P., Aarson N., Bjordal K., Sullivan M. QLQ C-30 Scoring Manual. EORTC Study Group on Quality of Life. Brussels, 1995. 50 p.

13. Weis J., Tomaszewski K., Hammerlid E. et al. International psychometric validation of an EORTC quality of life module measuring cancer related fatigue (EORTC QLQ-FA12). J Nat Cancer Inst 2017;109(5). DOI: 10.1093/jnci/djw273.

14. Australian Commission on Safety and Quality in Health Care (the Commission). Available at: https://www.safetyandquality.gov.au/our-work/indicators-measurement-and-reporting/patient-reportedoutcomemeasures. Accessed: 08.12.2021.

15. Khatkov IE, Minaeva OA, Domrachev SA, Priymak MA, Solovyev NO, Tyutyunnik PS. PROM a contemporary approach to assessing the quality of life of patients with cancer. Terapevticheskii Arkhiv (Ter. Arkh.). 2022; 94 (1):122–128. DOI: 10.26442/00403660.2022.01.201343

16. Chumakova GA, Pokutnev AP, Veselovskaya NG. Specifics of myocardial infarction in obesity. Rossiyskiy kardiologicheskiy jurnal. 2017;144(4):75-80. (In Russ.). https://doi.org/10.15829/1560-4071-2017-4-75-80

17. Mach F, Baigent C, Catapano AL, Koskinas KC, Casula M, Badimon L, Chapman MJ, De Backer GG, Delgado V, Ference BA, Graham IM, Halliday A, Landmesser U, Mihaylova B, Pedersen TR, Riccardi G, Richter DJ, Sabatine MS, Taskinen M, Tokgozoglu L, Wiklund O. 2019 ESC/EAS Guidelines for themanagement of dyslipidaemias: lipid modification to reduce cardiovascular risk. Rossiyskiy kardiologicheskiy jurnal. 2020;25(5):3826. (In Russ.). https://doi.org/10.15829/1560-4071-2020-3826

18. Batiushin MM. Chronic Kidney Disease: Current State of the Problem. Racional'naya farmakoterapiya v kardiologii. 2020;16(6):938-947. (In Russ.). https://doi.org/10.20996/1819-6446-2020-11-06

19. Pogosova G.V. Depressija – novyj faktor riska ishemicheskoj bolezni serdca i prediktor koronarnoj smerti // Kardiologija. 2002. T. 4. S. 86–91 (in Russian).

20. Anda R., Williamson D., Jones D. Depressed affect, hopelessness, and risk of ischemic heart disease in cohort of US adults // Epidemiology. — 1993. — Vol. 4. — P. 285—294.

21. Shestopalova I.M., Tkachenko. Diagnosis and treatment of stable angina: Russian recommendations. Developed by the Committee of Experts of the All-Russian Scientific Society of Cardiologists. Section of coronary heart disease. - M., 2004.

22. McKenzie L.H., Simpson J., Stewart M. A systematic review of pre-operative predictors of post-operative depression and anxiety in individuals who have undergone coronary artery bypass graft surgery // Psychol Health Med. – 2010. – V. 15. – № 1. – P. 74–93.

23. Correa-Rodríguez M., Ejheisheh M.A., Suleiman-Martos N. et al. Prevalence of depression in coronary artery bypass surgery: a systematic review and meta-analysis // J Clin Med. – 2020. – V. 9. – № 4. – P. 909

24. Stanicki P., Szarpak J., Wieteska M. et al. Postoperative depression in patients after coronary artery bypass grafting (CABG) – a review of the literature // Pol Przegl Chir. –2020. – V. 92. – № 6. – P. 32–38.

25. Kovaltsova R.S., Zadvorev S.F. , Petrova N.N. Anxiety and depression in cardiac surgical patients. 2022; 1: P. 32–35DOI: 10.26269/g23m-qn47 (In Russ.)

26. Korbmacher B., Ulbrich S., Dalyanoglu H. et al. Perioperative and long-term development of anxiety and depression in CABG patients // Thorac Cardiovasc Surg. – 2013. – V. 61. – № 8. – P. 676–681.

27. Marinelli V., Danzi O.P., Mazzi M.A. et al. PREPARE:PreoPerative Anxiety REduction. One-year feasibility RCT on a brief psychological intervention for pancreatic cancer patients prior to major surgery // Front Psychol. – 2020. – V. 11. – P. 62.

妊娠期冠状病毒感染血栓患者一般临床血液分析指标的变化
CHANGES IN THE INDICATORS OF GENERAL CLINICAL BLOOD ANALYSIS IN PATIENTS WITH THROMBOSIS WITH CORONAVIRUS INFECTION THAT OCCURRED DURING PREGNANCY

Spiridonova Natalya Vladimirovna
Doctor of Medical Sciences, Professor, Head of Department
Institute of Professional Education, Samara State Medical University,
Samara, Russia
ORCID ID: 0000-0003-3928-3784,
Scopus Author ID: 56089251400

Gritsenko Taras Alekseevich
Candidate of Medical Sciences, Associate Professor
Samara State Medical University,
Samara, Russia
ORCID ID: 0000-0002-2794-5122,
Scopus Author ID: 57190667679

Khurtova Elena Fedorovna
Graduate Student
Samara State Medical University,
Samara, Russia;
Obstetrician-gynecologist
LLC "Consultative Clinic "Panacea",
Samara, Russia
ORCID ID: 0009-0007-4323-9563

注解。　怀孕期间，血液的血栓形成潜力在生理上增加，发生血栓的风险增加。　大量研究表明，新型冠状病毒感染往往伴有血栓并发症。　妊娠期间的生理性免疫抑制以及新型冠状病毒感染的出现，决定了孕妇被分配到血栓高危人群。

研究目的：确定妊娠期间感染冠状病毒感染血栓并发症的女性一般临床血液检测参数的变化，并跟踪其日常动态。

材料和方法：对 99 名接受冠状病毒感染住院治疗的孕妇的一般临床血液检测数据进行回顾性分析。　纳入该研究的标准是通过 PCR 验证是否存在冠状病毒感染以及妊娠晚期。　在 99 名女性中，有 5 名在治疗期间出现血栓并发症。　患

有血栓并发症的女性是主要研究组。 作为对照组，一般临床血液检测数据取自2014-2018 年登记怀孕的 46 名生理妊娠女性。

结果：在患有血栓并发症的患者中，血红蛋白水平显着降低 （Me99.50 ［Q1-Q3 90.25-109.75］ g/1, p<0.001）红细胞 （Me 3.43 ［Q1-Q3 3.18-3.70］ *109/1），p<0.001）和血细胞比容（Me 29.00 ［Q1-Q3 26.23-31.08]%, p<0.001）与健康孕妇相比。 此外，感染患者的血小板水平较低（Me 196.00 ［Q1-Q3 130.25-254.00] *109/1, p ＜0.022），平均血小板体积增加（Me 10.70 ［Q1-Q3 9 .70-11.80］ ］ f1, p<0.001） 与健康女性相比。 感染冠状病毒的孕妇的白细胞水平高于生理妊娠的女性（Me 10.55 ［Q1-Q3 7.63-13.15］ *109/1, p ＜0.021）。 在具有复杂感染过程的女性的白细胞计数中，记录了绝对和相对中性粒细胞增多（Me 8.85 ［Q1-Q3 6.70-12.15］ * 109/1, p ＜0.001 和 Me 84.30 ［Q1-Q3 78 .70-88.50］]%, p<0.001）。 与正常妊娠患者相比，复杂感染患者淋巴细胞的绝对和相对水平显着降低（Me 1.00 ［Q1-Q3 0.70-1.80］ *109/1, p<0.001 和 Me 10 .60 ［Q1-Q3 7.20］ -15.10]%, p<0.001）。 还揭示了所研究参数值的波动与疾病发病日期和血栓形成时刻之间的联系。所有血栓并发症均在患者分娩后出现，并因感染冠状病毒而继续住院。

关键词：冠状病毒感染、妊娠、血栓并发症、一般临床血液检查。

Annotation. *During pregnancy, the thrombogenic potential of the blood physiologically increases and the risk of developing thrombosis increases. The new coronavirus infection, according to numerous studies, is often accompanied by thrombotic complications. Physiological immunosuppression during pregnancy and the emergence of a new coronavirus infection determines the allocation of pregnant women to a group at high risk of thrombosis.*

Purpose of the study: *to identify changes in general clinical blood test parameters in women with thrombotic complications of coronavirus infection infected during pregnancy and track their daily dynamics.*

Materials and methods: *A retrospective analysis of data from a general clinical blood test of 99 pregnant patients undergoing inpatient treatment for coronavirus infection was carried out. The criterion for inclusion in the study was the presence of a coronavirus infection verified by PCR and the third trimester of pregnancy. Of the 99 women, 5 developed thrombotic complications during treatment. Women with thrombotic complications comprised the main study group. As a control group, data from a general clinical blood test were taken from 46 women with physiological gestation who were registered for pregnancy in 2014-2018.*

Results: *in patients with thrombotic complications, significantly low hemoglobin levels were recorded (Me99.50 [Q1-Q3 90.25-109.75] g/l, p<0.001) erythrocytes (Me 3.43 [Q1-Q3 3.18-3.70] *109/l, p<0.001) and hematocrit (Me 29.00 [Q1-Q3 26.23-31.08] %, p<0.001) compared with healthy pregnant women. In addition, infected patients had a lower platelet level (Me 196.00 [Q1-Q3 130.25-254.00] *109/l, p <0.022) and an increase in the average platelet volume (Me 10.70 [Q1-Q3 9 .70-11.80] fl, p<0.001) compared with healthy women. The leukocyte level in pregnant women with coronavirus infection was higher than*

in women with physiological gestation (Me 10.55 [Q1-Q3 7.63-13.15] *109/l, p <0.021). In the leukocyte count of women with a complicated course of infection, absolute and relative neutrophilia was recorded (Me 8.85 [Q1-Q3 6.70-12.15] * 109/l, p <0.001 and Me 84.30 [Q1-Q3 78 .70-88.50] %, p<0.001). The absolute and relative level of lymphocytes in patients with complicated infection was significantly lower compared to patients with normal pregnancy (Me 1.00 [Q1-Q3 0.70-1.80] *109/l, p<0.001 and Me 10 .60 [Q1-Q3 7.20-15.10] %, p<0.001). A connection was also revealed between fluctuations in the values of the studied parameters with the day from the onset of the disease and the moment of thrombus formation. All thrombotic complications developed after the patients had given birth and continued to be hospitalized for coronavirus infection.

Keywords: coronavirus infection, pregnancy, thrombotic complications, general clinical blood test.

The incidence of thrombosis during pregnancy and the postpartum period continues to remain high. The incidence of maternal mortality associated with embolic complications ranges from 0.4 to 1.6 per 100,000 pregnancies in developed countries and is one of the most common causes of maternal death [1]. With the advent of the new coronavirus infection, reports began to appear almost immediately about the development of hypercoagulability syndrome and thrombotic complications in infected patients. [2-4]. There is currently no clear data on the increased susceptibility of pregnant women to coronavirus infection. However, physiologically during pregnancy, there is a decrease in the activity of the immune system, and therefore pregnant women increase their susceptibility to infectious diseases. Considering this feature, Wastnedge EAN, et al. (2020) [5] and Subbaraman N. et al. (2021) [6] propose to identify pregnant women as a special risk group for complications of coronavirus infection.

Purpose of the study: to identify changes in general clinical blood test parameters in women with thrombotic complications of coronavirus infection infected during pregnancy and to track their daily dynamics.

Materials and methods: A retrospective analysis of data from a general clinical blood test of 99 pregnant patients undergoing inpatient treatment for coronavirus infection was carried out. The criterion for inclusion in the study was the presence of a coronavirus infection verified by PCR and the third trimester of pregnancy. Of the 99 women, 5 developed thrombotic complications during treatment: thrombosis of the veins of the upper and lower extremities, massive thromboembolism of the pulmonary artery, thrombosis of the splenic vein at the hilum of the spleen, thrombus of the left atrium. Women with thrombotic complications comprised the main study group. As a control group, data from a general clinical blood test were taken from 46 women with physiological gestation who were registered for

pregnancy in 2014-2018. For statistical analysis of the obtained data, specialized software was used: IBM SPSS Statistics software Version 25.0 (IBM Corporation, USA, license No. 5725-A54). The correspondence to the normal distribution of platelet parameters was studied using the Shapiro–Wilk criterion. Comparison of groups and observation periods was performed using the nonparametric Mann–Whitney test. The description of the results is presented in the form of medians and interquartile range (Me [Q1; Q3]). The results were found to be statistically significant at $p \leq 0.05$.

In patients with thrombotic complications, significantly low levels of hemoglobin (Me 99.50 [Q1-Q3 90.25-109.75] g/l, p <0.001) and erythrocytes (Me 3.43 [Q1-Q3 3.18- 3.70] *109/l, p<0.001) and hematocrit (Me 29.00 [Q1-Q3 26.23-31.08] %, p<0.001) compared with healthy pregnant women. In addition, infected patients had a lower platelet level (Me 196.00 [Q1-Q3 130.25-254.00] *109/l, p <0.022) and an increase in the average platelet volume (Me 10.70 [Q1-Q3 9 .70-11.80] fl, p<0.001) compared with healthy women. The leukocyte level in pregnant women with coronavirus infection was higher than in women with physiological gestation (Me 10.55 [Q1-Q3 7.63-13.15] *109/l, p <0.021). In the leukocyte count of women with a complicated course of infection, absolute and relative neutrophilia was recorded (Me 8.85 [Q1-Q3 6.70-12.15] * 109/l, p <0.001 and Me 84.30 [Q1-Q3 78 .70-88.50] %, p<0.001). The absolute and relative level of lymphocytes in patients with complicated infection was significantly lower compared to patients with normal pregnancy (Me 1.00 [Q1-Q3 0.70-1.80] *109/l, p<0.001 and Me 10 .60 [Q1-Q3 7.20-15.10]%, p<0.001). When conducting a daily analysis of the dynamics of cellular blood components in patients with coronavirus infection on days 16-23 from the onset of the disease, a sharp decrease in the number of platelets was recorded (Me120.00 [Q1-Q3 96.00-176.00] *109/l) and minimum thrombocrit values (Me 0.13 [Q1-Q3 0.11-0.20]%). Also, in the period from 16 to 23 knocks in patients with a complicated course of infection, the highest values of platelet volume (Me 11.00 [Q1-Q3 10.80-11.80] f) and platelet distribution by volume (Me 16.50) were recorded [Q1-Q3 16.40-16.60]%) for the entire observation period. In addition, the number of large platelets in the specified period, on the contrary, was minimal (Me 55.00 [Q1-Q3 42.00-78.00] * 109/l). Not all of the indicated values went beyond the normative values, but there was a clearly defined dynamics and connection with the same time. During the analysis, dynamic changes were also revealed in the leukocyte formula. The highest values of leukocyte level (Iu 13.00 [Q1-Q3 10.70-15.60] * 109/l), the highest levels of absolute number (Iu 11.20 [Q1-Q3 10.00-14.20] * 109/l) and percentage (Me 88.60 [Q1-Q3 83.40-93.00] %) of neutrophils were also obtained in the period from 16 to 23 days from the onset of the disease. These values were above normal levels. When studying the level of lymphocytes in patients with thrombotic complica-

tions, lymphopenia was recorded with a minimum level of absolute number (Me 0.60 [Q1-Q3 0.50-1.00] *109/l) and percentage (Me 7.70 [Q1- Q3 5.30-10.40]%) lymphocytes in the period from 12 to 15 days from the onset of the disease. When analyzing the identified patterns, it was noted that in the period from 12 to 23 days the largest number of thrombotic complications occurred. At the time of the occurrence of thrombotic complications, all patients had already given birth and continued to be hospitalized due to the presence of coronavirus infection.

A decrease in hemoglobin levels, hematocrit and a decrease in the number of red blood cells can be explained by the presence of a pronounced inflammatory process, massive infusion therapy followed by hemodilution. The decrease in platelet levels detected in patients with thrombotic complications of coronavirus infection may be due to the provision of heparin therapy to all women for preventive and therapeutic purposes. Academician Makatsaria et al [7] suggest the same reason for this phenomenon. Another possible reason for a decrease in platelet levels may be consumption thrombocytopenia, which occurs because of the thrombotic process. Koupenova M. et al. suggests that the reason for the decrease in platelet levels may be the penetration of the virus into the platelet with subsequent triggering of apoptosis [8]. An increase in the number of large platelets and dynamic changes in platelet volume according to Tsikalenko E.A. et al. [9] may be due to activation of platelets during the development of coagulopathy and thrombus formation. An increase in the level of leukocytes in infected patients can be explained by the presence of an inflammatory process; however, there are studies in which an increase in the level of leukocytes is considered as a prognostic biomarker for the development of thromboembolic complications [10]. The increase in the number of neutrophils in women with coronavirus infection can also be explained by the presence of an infectious and inflammatory process, however, the dynamic fluctuations of this indicator and the connection with the moment of thrombus formation suggests that this phenomenon is another manifestation of coagulopathy. So Middleton EA et al. [11] suggest that this phenomenon may be due to the participation of neutrophils in the formation of blood clots through the formation of neutrophil traps. G. M. Galstyan [12] shares a similar point of view. A decrease in the level of lymphocytes against the background of coronavirus infection has been recorded by a large number of researchers and seems quite strange, given the fact that during viral infections, because of the immune response, an increase in the level of lymphocytes is often observed. When trying to explain the decrease in the level of lymphocytes, researchers in Greece concluded that, the cause may be the development of a "cytokine storm" with an increase in the levels of inflammatory mediators, which can trigger the processes of lymphocyte apoptosis [13]. Russian researchers report a possible viral infection of the lymphocytes themselves, resulting in their destruction [14].

Conclusion. In patients with thrombotic complications of coronavirus infection, a decrease in the level of red blood cells and hemoglobin was observed. It was not possible to identify a clear dependence of changes in these indicators on the day of illness. The level of leukocytes was practically within the normal range for pregnant women, but was higher relative to the values obtained in women with physiological pregnancy. In addition, at the time of thrombosis development, leukopenia was recorded. Noteworthy is the presence of pronounced neutrophilia and a decrease in the level of lymphocytes in infected women and the connection with the moment of thrombus formation identified during dynamic observation. Of interest is the decrease in platelet levels against the background of coronavirus infection in pregnant women and the dynamic fluctuations in platelet indices depending on the process of thrombus formation. It should also be noted that all thrombotic complications occurred in patients in the postpartum period. The data obtained are of interest and require further study in order to subsequently identify prognostic markers of thrombus formation and the prevention of thrombotic complications in pregnant and postpartum women with coronavirus infection.

References

1. *Ministry of Health of the Russian Federation. Clinical guidelines (protocol) Venous complications during pregnancy and the postpartum period. Obstetric thromboembolism. 2022-2023-2024*

2. *Danzi GB, Loffi M., Galeazzi G., Gherbesi E. Acute pulmonary embolism and COVID-19 pneumonia: a random association. Eur Heart J 2020;41(19):1858. https://doi.org/1010.1093/eurheartj/ehaa254.*

3. *Helms J., Tacquard C., Severac F. et al.; CRICS TRIGGERSEP Group (Clinical Research in Intensive Care and Sepsis Trial Group for Global Evaluation and Research in Sepsis). High risk of thrombosis in patients with severe SARS-CoV-2 infection: a multicenter prospective cohort study. Intensive Care Med. 2020;46(6):1089–98.https://doi.org/10.1007/s00134-020-06062-x.*

4. *Klok FA, Kruip MJHA, van der Meer NJM et al. Incidence of thrombotic complications in critically ill ICU patients with COVID-19. Thromb Res. 2020;191:145–7.https://doi.org/10.1016/j.thromres.2020.04.013.*

5. *Wastnedge EAN, Reynolds RM, van Boeckel SR, Stock SJ, Denison FC, Maybin JA, Critchley HOD Pregnancy and COVID-19. Physiol Rev. 2021 Jan 1;101(1):303-318. https://doi: 10.1152/physrev.00024.2020*

6. *Subbaraman N. Pregnancy and COVID: what the data say. Nature. 2021; 7849(591): 193-5.https://doi.org/10.1038/d41586-021-00578-y*

7. *Makatsaria A.D., Slukhanchuk E.V., Bitsadze V.O. Thrombotic storm, hemostasis disorders and thromboinflammation in the context of COVID-19.*

Obstetrics, Gynecology and Reproduction. 2021;15(5):499-514.https://doi.org/10.17749/2313-7347/ob.gyn.rep.2021.247

8. Koupenova M., Freedman JE Platelets and immunity: going viral. Arterioscler Thromb Vasc Biol. 2020;40(7):1605–7.https://doi.org/10.1161/ATVBAHA.120.314620.

9. Tsikalenko E.A., Dorn O.Yu., Stepanova E.G. and others. Large platelet fraction as a marker of activation of platelet hemostasis during pregnancy. Medicine and education in Siberia. 2014;(2):17.

10.Johannes Thaler, Cihan Ay, Alexandra Kaider, Eva-Maria Reitter, Johanna Haselböck, Christine Mannhalter, Christoph Zielinski, Christine Marosi, Ingrid Pabinger, Biomarkers predictive of venous thromboembolism in patients with newly diagnosed high-grade gliomas, Neuro-Oncology, Volume 16 , Issue 12, December 2014, Pages 1645–1651.

11.Middleton EA, He XY, Denorme F, Campbell RA, Ng D, Salvatore SP, Mostyka M, Baxter-Stoltzfus A, Borczuk AC, Loda M, Cody MJ, Manne BK, Portier I, Harris ES, Petrey AC, Beswick EJ, Caulin AF, Iovino A, Abegglen LM, Weyrich AS, Rondina MT, Egeblad M, Schiffman JD, Yost CC. Neutrophil extracellular traps contribute to immunothrombosis in COVID-19 acute respiratory distress syndrome. Blood. 2020 Sep 3;136(10):1169-1179. https://doi:10.1182/blood.2020007008.

12.G.M. Coagulopathy in COVID-19. Pulmonology. 2020;30(5):645-657.

13.E. Terpos et al., "Hematological findings and complications of COVID-19", Am. J. Hematol., p. ajh.25829, May 2020, https://doi: 10.1002/ajh.25829.

14.Abdullaev A., Odilov A., Ershler M., "Viral load and patterns of spread of SARS-CoV-2 in the lungs, mediastinal lymph nodes and spleen of patients with lymphopenia associated with COVID-19." Viruses. 2021; 13(7):1410.

使用抗氧化药物治疗慢性卡他性牙龈炎
COMPLEX THERAPY OF CHRONIC CATARRHAL GINGIVITIS USING AN ANTIOXIDANT DRUG

Bagdasaryan Nina Petrosovna
Candidate of Medical Sciences, Assistant
Kuban State Medical University

Aksenova Tatyana Viktorovna
Candidate of Medical Sciences, Associate Professor
Kuban State Medical University

Mafagel Fatima Aslanovna
Assistant
Kuban State Medical University

Erichev Valeriy Vasilevich
Candidate of Medical Sciences, Professor
Regional Clinical Dental Clinic, Krasnodar, Russia

抽象的。 这项工作评估了额外使用 Kudesan 药物治疗慢性牙龈炎患者的临床效果。 在 70 名慢性卡他性牙龈炎患者的动态治疗中，确定了所提出的方法的临床有效性的增加。 在对照组和主要组中，7 天后平均出现改善。 然而，6 个月后，对照组中 60% 的患者出现牙周恶化的临床症状，12 个月后，这一比例为 76%。 在主要组中，6个月后，所有观察患者均达到临床缓解； 12个月后，与对照组相比，复发次数减少了4.3倍。
关键词。 慢性卡他性牙龈炎，kudesan。

Abstract. *The work evaluates the clinical effectiveness of treatment of patients with chronic gingivitis with the additional use of the drug Kudesan. An increase in the clinical effectiveness of the proposed method in the dynamics of treatment of 70 patients with chronic catarrhal gingivitis was determined. In the control and main groups, improvement was noted on average after 7 days. However, after 6 months, 60% of those observed in the control group showed clinical signs of exacerbation in the periodontium, and after 12 months – in 76% of patients. In the main group, after 6 months, all observed patients were in clinical remission; after 12 months, the number of relapses was 4.3 times less compared to the control group.*

Keywords: *Chronic catarrhal gingivitis, kudesan.*

Introduction.

The prevalence of periodontal diseases, according to modern statistics, reaches 90% in all age groups of the population. Catarrhal gingivitis accounts for up to 30% [4]. The generally accepted point of view is that in the case of timely, high-quality and complete treatment of gingivitis, recovery occurs [7]. However, a number of questions remain regarding the effectiveness of the complex treatment of gingivitis and the achievement of a lasting therapeutic effect in this pathology.

One of the factors in the occurrence of the inflammatory process is a violation of microcirculation and deterioration of trophism in periodontal tissues [2], which is the basis for the use of antioxidant drugs [8, 5]. In everyday dental practice, it is possible to use the drug Kudesan [1, 6] with an active ingredient in the form of ubiquinone, which prevents the formation of free radicals, reduces markers of oxidative stress, stimulates the respiratory function of mitochondria and ATP synthesis, which neutralizes inflammatory changes in tissues [3] .

Purpose of the study.

To increase the effectiveness of treatment and reduce the time of onset of stable remission of chronic catarrhal gingivitis.

Materials and methods of research.

An examination and complex treatment of 70 patients aged 19 to 35 years with chronic catarrhal gingivitis were carried out.

To assess the condition of the oral cavity and periodontal tissues, a comprehensive dental examination was carried out, including basic clinical and radiological methods, an index assessment of the hygienic status and periodontal condition with the determination of the oral hygiene index (OHI-S), plaque index (PI), PMA index and bleeding gingival sulcus (SBI). The diagnosis of chronic catarrhal gingivitis in accordance with the ICD-10 classification was established based on the results of clinical and radiological studies.

In the control group (25 people), treatment was carried out according to the traditional scheme: professional oral hygiene, including ultrasonic removal of dental plaque, as well as the appointment of medications with an antimicrobial effect on the gum mucosa for 7 days: chlorhexidine solution 0.2%, metronidazole (Metrogil Denta gel).

In the main group (45 people), complex treatment of chronic catarrhal gingivitis was carried out, which, in addition to professional oral hygiene and the use of antibacterial drugs, additionally included the prescription of local antioxidant therapy. For this purpose, from the 3rd to the 7th day of treatment, the drug Kudesan was applied to the affected gum area in the form of a 3% solution. Exposure duration - 10 minutes.

In both groups, in addition to therapeutic measures, preventive measures were also carried out aimed at teaching patients about oral hygiene with individual se-

lection of hygiene products and correction of hygienic skills, as well as motivating them to maintain proper hygienic condition of the oral cavity. Patients were followed for 1 year with follow-up examinations every 6 months.

Research results.

Before the start of therapy, all patients had complaints of bad breath, bleeding gums during eating and brushing teeth, as well as symptoms of inflammation of periodontal tissue: swelling and hyperemia of the marginal and papillary gums. The clinical picture of the disease was characterized by severe bleeding upon probing (SBI - 3.85±0.04), hyperemia, swelling and cyanosis in the area of the apices of the interdental papillae (PMA - 3.9±0.13), the presence of a large amount of soft dental plaque and hard dental plaque (OHI-S – 3.7±0.03; PI – 33.8±0.02).

In all observations, probing determined that the integrity of the dentogingival junction was preserved. According to the results of an X-ray examination on targeted dental photographs and an orthopantomogram, the height of the interalveolar septa is preserved, the integrity of the cortical plates at their apexes is not compromised.

In the control group, elimination of the inflammatory process in the periodontium was noted immediately after treatment. However, after 6 months, the hygienic status and periodontal condition of the vast majority of patients worsened (Table 1, 2). In 15 patients, clinical signs of exacerbation of catarrhal gingivitis were noted (SBI - 4.2±0.03; PMA - 2.75±0.04). After 12 months, 19 patients (76%) had unsatisfactory hygienic status (OHI-S – 4.02±0.03) and bleeding on probing (SBI – 3.82±0.01), which corresponded to clinical signs of exacerbation of inflammatory process in periodontium (Table 1, 2)

Table 1.

Dynamics of indicators of the hygienic state of the oral cavity in patients with chronic catarrhal gingivitis (M±m).

Indicator	Observation period	Patient groups	
		Control n=25 people.	Main n=45 people
OHI-S	Before treatment	3,92±0,23	4,15±0,12
	7 days	1,83±0,34	1,22±1,06*
	6 months	2,7±0,3	2,1±0,81*
	12 months	1,84±0,65	1,53±1,2
PI	Before treatment	39,5±0,02	35,6±0,02
	7 days	0,9±0,02	0,1±0,02*
	6 months	2,9±0,02	3,3±0,02*
	12 months	3,4±0,02	2,89±0,02*

*Note: *p≤0.05 (relative to the control group data)*

Table 2.

Dynamics of treatment effectiveness indicators for patients with chronic ca-
tarrhal gingivitis (M±m).

Indicator	Observation period	Patient groups	
		Control n=25 people.	Main n=45 people
PMA	Before treatment	3,63±0,24	4,1±0,13
	7 days	1,58±0,15	0,52±0,02*
	6 months	1,75±0,02	0,72±0,18*
	12 months	1,71±0,02	0,36±0,18*
SBI	Before treatment	2,13±0,04	2,85±0,04
	7 days	1,9±0,09	0,2±0,03*
	6 months	2,2±0,02	0,3±0,07*
	12 months	2,4±0,16	0,2±0,03*

Note: *$p \leq 0.05$ (relative to the control group data)

By the end of the course of treatment, all patients in the main group had a significant improvement in their hygienic status and no clinical signs of inflammation. After 6 months, relapses were noted in 10 (22.2%) patients (SBI - 2.7±0.01; PMA -1.55±0.04), and at the end of follow-up - in 8 (17.7%) (SBI - 2.9±0.06; PMA - 1.81±0.03).

Conclusions.

Thus, the inclusion of the antioxidant drug Kudesan in the scheme of complex therapy for chronic catarrhal gingivitis makes it possible to exclude the recurrence of the inflammatory process in the periodontium after 6 months and to achieve stable remission of the disease in 82% of patients 1 year after the end of the course of treatment.

References

1. Akimov V.V. Comparative assessment of the effectiveness of laser and antioxidant therapy for chronic generalized periodontitis / V.V. Akimov, D.A. Kuzmina, T.I. Vlasova, A.S. Fedoskina // Bulletin of postgraduate education in the field of health care . – 2021. – No. 1. – P. 5-10. – EDN DPANRK.;

2. Bagdasaryan N. P. Efficiency of complex treatment of patients with chronic catarrhal gingivitis / N. P. Bagdasaryan, V. V. Erichev, T. V. Aksenova, M. N. Mitropanova // Modern problems of science and education. – 2018. – No. 5. – P. 79. – EDN YMRKYX.;

3. Erichev V. V. Efficiency of therapy for inflammatory periodontal pathology in patients with various nonspecific adaptive reactions of the body / V. V. Erichev, T. V. Aksenova, E. S. Ovcharenko [etc.] // Clinical dentistry. – 2021. – V. 24, No. 4. – P. 42-49. – DOI 10.37988/1811-153X_2021_4_42. – EDN RQZZGV.;

4. Zagryadskaya, V.V. Ubiquinone and its influence on the human body / V.V. Zagryadskaya, V.R. Avdeeva // Science of the young: materials of the regional interuniversity student scientific and practical conference, Orel, June 15, 2023 / Compiled by: Voronkova M.V., Ermakova N.V., Konoshina S.N. - Orel: Limited Liability Company Printing Company "Kartush", 2023. - P. 94-99. – EDN DSFKHA.;

5. Kalinina E. A. Evaluation of the results of directed bone regeneration against the background of the use of hypoxen in chronic periodontitis / E. A. Kalinina, L. V. Tsokova, A. N. Litvinov [et al.] // Head and Neck / Head and neck. Russian edition. Journal of the All-Russian public organization "Federation of Specialists in the Treatment of Head and Neck Diseases". – 2023. – V. 11, No. 4. – P. 65-68. – DOI 10.25792/HN.2023.11.4.65-68. – EDN THOLGC.;

6. Maychub I. Yu. Improvement of complex therapy of hypertrophic gingivitis in patients with malocclusion pathology / I. Yu. Maychub, E. S. Ovcharenko, N. V. Lapina, N. Yu. Taranova // Medical and pharmaceutical journal Pulse. – 2023. – V. 25, No. 6. – P. 68-73. – DOI 10.26787/nydha-2686-6838-2023-25-6-68-73. – EDN YOMYIQ.;

7. Patent No. 2643589 C1 Russian Federation, IPC A61K 31/122, A61K 36/28, A61P 1/02. Method for the treatment of acute nonspecific gingivitis and chronic marginal simple gingivitis: No. 2017127083: application. 07/27/2017: publ. 02.02.2018 / N. P. Bagdasaryan, V. V. Erichev, T. V. Aksenova [etc.]; applicant Federal State Budgetary Educational Institution of Higher Education "KUBAN STATE MEDICAL UNIVERSITY" of the Ministry of Health of the Russian Federation (FSBEI HE Kuban State Medical University of the Ministry of Health of Russia). – EDN CBPSUD.;

8. Uspenskaya O. A. Dynamics of markers of lipid peroxidation of oral fluid in chronic periodontitis / O. A. Uspenskaya, E. V. Kondyurova, S. A. Spiridonova // Institute of Dentistry. – 2021. – No. 2(91). – P. 74-75. – EDN MATKKM.

日光作为同步因素和昼夜节律的变化
DAYLIGHT AS A SYNCHRONIZATION FACTOR AND CHANGES IN CIRCADIAN RHYTHMS

Boldyreva Yulia Viktorovna
Candidate of Medical Sciences, Associate Professor
Tyumen State Medical University

Gubin Denis Gennadievich
Doctor of Medical Sciences, Professor
Tyumen State Medical University

抽象的。 日光是来自太阳的直接和间接电磁辐射，经过各种反射而改变，并通过大气传播和过滤。 日光的持续时间和可用性取决于纬度、一年中的时间和大气条件。 阳光的主要作用是将身体器官和系统的工作协调成一个整体。
关键词：日光、自然光、光、生物节律、生物节律、昼夜节律。

Abstract. Daylight is direct and indirect electromagnetic radiation from the sun, which is modified by various reflections, transmitted and filtered through the atmosphere. The duration and availability of daylight depends on latitude, time of year and atmospheric conditions. The main role of sunlight is to coordinate the work of the organs and systems of the body into a single whole.

Keywords: *daylight, natural light, light, biological rhythms, biorhythms, circadian rhythms.*

Each of us is surrounded by sources of natural and artificial light every day. In the body, one of the important functions of light - the classical function of light - is the synchronization and change of circadian rhythms. Most organisms on the planet synchronize their "daily life" with a 24-hour cycle. This rhythm is called the circadian rhythm. The circadian rhythm not only regulates sleep-wake cycles, but also influences the molecular biology of individual cells and organ systems. The molecular mechanism of the circadian rhythm itself was discovered around 1970 in the common fruit fly Drosophila melanogaster and described in humans shortly thereafter. Genes including clock and period have been identified as important regulators of circadian rhythm due to protein expression patterns that oscillate approximately every 24 hours. The expression of these proteins reflects the circadian rhythm at the molecular level in all mammals. The molecular machinery

of circadian rhythm involves a complex and autonomous transcriptional-translational feedback loop that consists of a core set of oscillating, ubiquitously expressed genes, including Clock, Bmal1, period homologs 1 and 2 (Per1 and Per2), and cryptochromes 1 and 2 (Cry1 and Cry2). This transcriptional-translational feedback loop takes approximately 24 hours to complete. In addition to this classical transcriptional and post-translational mechanism, many interacting pathways have been described, but the complete regulatory system is not yet fully understood [1, 2].

Although circadian rhythms are theoretically endogenously self-sustaining, powerful external stimuli regularly influence and adjust the timing of the circadian system. These external stimuli alter the expression profile of circadian proteins to synchronize the endogenous circadian rhythm with the environment. While in some species (e.g. Drosophila melanogaster) circadian rhythms are synchronized by temperature and other environmental factors, in humans the most powerful of these external stimuli is daylight.

Light reaching the retina is critical for vision (movement, spatial detail, color), and the light pulses are converted into electrical signals in the rods and cones. Retinal ganglion cells (ipRGCs) express the short-wavelength-sensitive photopigment melanopsin. Daylight stimulates melanopsin receptors in retinal ganglion cells. These cells convert the physical signal into an electrical signal (neurotransmission), which excites neurons in the suprachiasmatic nucleus (SCN) of the hypothalamus. In these neurons, the electrical signal activates circadian proteins first in the SCN and then in all peripheral organs [3, 4].

Forced circadian disruptions due to shift work, nighttime illumination, and transmeridian flights contribute to mood symptoms in vulnerable individuals. Animal models show that even short-term exposure to night light can cause symptoms associated with depression; Irregular lighting schedules act directly through the ipRGC to increase depression, which is reversible with antidepressants. Moreover, bright light is a recognized antidepressant for seasonal and other depression. In addition, increased electric lighting or mixed lighting can improve mood when neurodegenerative diseases. Due to the Covid-19 pandemic, daylight may be useful in limiting both the psychiatric consequences of hospitalization and reducing the likelihood of infection: due to the antidepressant effect of bright light and its disinfecting properties [5-8].

Thus, daylight and biological rhythms are important components of the body's internal environment, changes in which can affect human comfort and well-being. In addition, it can lead to the development of various pathological conditions (metabolic syndrome, diseases of the cardiovascular system, etc.). In order to avoid the development of these diseases, circadian light hygiene should be maintained. Because it is now established circadian light hygiene promotes stable circadian rhythms, which in turn maintains overall health by regulating the production of immune cells, cytokines and other biologically important compounds.

References

1. Alfredsson L., Armstrong BK, Butterfield DA et al. Insufficient Sun Exposure Has Become a Real Public Health Problem. Int J Environ Res Public Health. 2020 Jul 13;17(14):5014. doi: 10.3390/ijerph17145014.

2. Brainard J., Gobel M., Scott B. et al. Health implications of disrupted circadian rhythms and the potential for daylight as therapy. Anesthesiology. 2015 May;122(5):1170-5. doi: 10.1097/ALN.0000000000000596.

3. Brown TM Recommendations for daytime, evening, and nighttime indoor light exposure to best support physiology, sleep, and wakefulness in healthy adults. 4. PLoS biology vol. 20.3 e3001571. 17 Mar. 2022, doi:10.1371/journal. pbio.3001571.

4. Heiskanen V. et al. Sunlight and health: shifting the focus from vitamin D3 to photobiomodulation by red and near-infrared light. Ageing research reviews vol. 61 (2020): 101089. doi:10.1016/j.arr.2020.101089.

5. Heiskanen V., Pfiffner M., Partonen T. Sunlight and health: shifting the focus from vitamin D3 to photobiomodulation by red and near-infrared light. Aging Res Rev. 2020 Aug;61:101089. doi: 10.1016/j.arr.2020.101089.

6. Izmir TG, Altamirano H., Unwin TJ et al. Evaluation of Daylight Perception Assessment Methods. Front. Psychol. 13:805796. doi: 10.3389/fpsyg.2022.805796.

7. Korman M, Tkachev V, Reis C, et al. COVID-19-mandated social restrictions unveil the impact of social time pressure on sleep and body clock. Sci Rep. 2020;10(1):22225. doi:10.1038/s41598-020-79299-7.

8.Miller AJ, Bingaman SS, Mehay D.et al.(2020) Angiotensin-(1-7) improves integrated cardiometabolic function in aged mice. Int J Mol Sci 21:5131.

Sputnik V 疫苗接种后志愿者中 SARS-CoV-2 病毒 IgG 特异性抗体与腺病毒中和抗体效价之间的相关性

CORRELATION BETWEEN THE TITER OF IGG-SPECIFIC ANTIBODIES TO THE SARS-COV-2 VIRUS AND ADENOVIRUS-NEUTRALIZING ANTIBODIES IN VOLUNTEERS AFTER SPUTNIK V VACCINATION

Zubkova Olga Vadimovna
Leading Researcher, PhD in Biology
National Research Center for Epidemiology and Microbiology named after the honorary academician N. F. Gamaleya

Ozharovskaia Tatiana Andreevna
Senior Researcher, PhD in Biology
National Research Center for Epidemiology and Microbiology named after the honorary academician N. F. Gamaleya

Popova Olga
Junior Researcher
National Research Center for Epidemiology and Microbiology named after the honorary academician N. F. Gamaleya

抽象的。 "Sputnik V"疫苗是预防 COVID-19 最有效的药物之一。 血清转化率超过90%，流行病学有效率超过70%。 然而，腺病毒载体的病毒中和抗体对疫苗接种有效性的影响仍未解决。 本研究评估了对人类腺病毒 26 型和 5 型的预先存在的免疫力与"Sputnik V"疫苗接种诱导的免疫反应的发展之间的相关性。
关键词：Ad26、Ad5、Sputnik V、SARS-CoV-2、预先存在的免疫力。

Abstract. The "Sputnik V" vaccine is one of the most effective agents for preventing COVID-19. The seroconversion rate exceeds 90%, with epidemiological efficacy surpassing 70%. However, the impact of virus-neutralizing antibodies to adenoviral vectors on vaccination effectiveness remains unresolved. This study evaluated the correlation between pre-existing immunity to human adenoviruses 26 and 5 types and the development of immune responses induced by "Sputnik V" vaccination.

Keywords: Ad26, Ad5, Sputnik V, SARS-CoV-2, pre-existing immunity.

Introduction. Recombinant adenoviral vectors have been utilized in clinical research long before the development and registration of vaccines for COVID-19 prevention.

rAd26-S-CoV2 and rAd5-S-CoV2 are replication-deficient recombinant vectors based on human adenoviruses types 26 (Ad26) and 5 (Ad5), respectively, encoding the full-length S protein of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in its native form. These vectors are components of the "Sputnik V" vaccine intended for COVID-19 prevention [1, 2, 3]. The "Sputnik V" vaccine is one of the most effective agents for preventing COVID-19, with a seroconversion rate exceeding 90%, and epidemiological efficacy surpassing 70% [2]. Additionally, an increase in IgG-specific antibodies to the S protein of the SARS-CoV-2 virus has been demonstrated following revaccination after 6 months.

To date, the question remains relevant as to whether pre-existing immunity to these viruses, from which replication-deficient vectors rAd26-S-CoV2 and rAd5-S-CoV2 are derived, could diminish their immunogenicity. In Russia, at the start of the COVID-19 vaccination program, seroprevalence to Ad26 and Ad5 in the population was relatively low, approximately 13% and 29%, respectively [1]. Following vaccination with "Sputnik V," induction of an immune response not only to the S protein of the SARS-CoV-2 virus but also to the capsid proteins of the adenovector occurs. Phase 1-2 clinical trials of the "Sputnik V" vaccine demonstrated no influence of antibodies to Ad26 and Ad5 on vaccination effectiveness [1]. Clinical trials of the Janssen Pharmaceuticals' Ad26.COV2.S vaccine, based on a recombinant human adenovirus type 26, also showed no influence of immunity to Ad26 on the development of immune responses induced by vaccination [4]. The vaccine's effectiveness against severe COVID-19 outcomes was consistent across all countries, regardless of the presence of virus-neutralizing antibodies to Ad26 in human population [5]. However, clinical trials of the CanSino's Ad5-nCoV vector vaccine reported reduced immunogenicity of the adenoviral vector in individuals with high levels of pre-existing immunity to Ad5 [6].
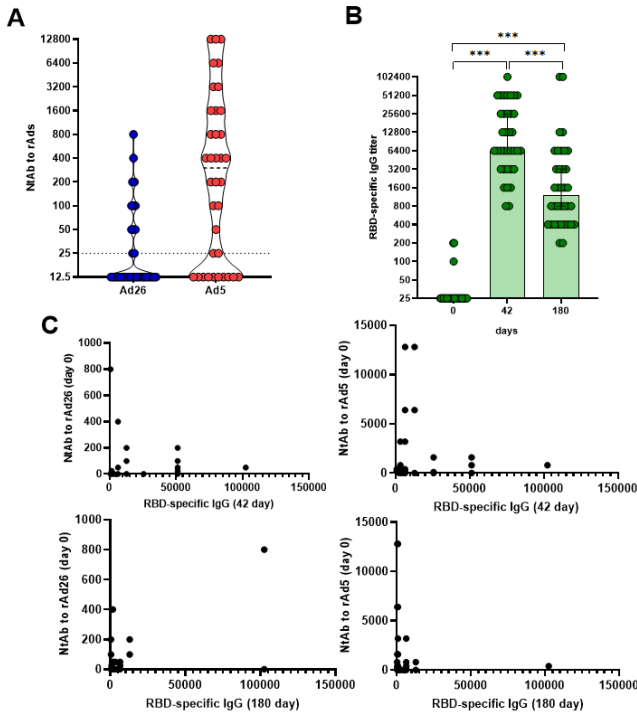
In this study, we analyzed the correlation between the titer of IgG-specific antibodies to the SARS-CoV-2 virus and virus-neutralizing antibodies to adenovectors in volunteers vaccinated with "Sputnik V."

Methods. The titer of IgG-specific antibodies to the SARS-CoV-2 virus was determined using an ELIZA test system manufactured by Medgamal branch of N.F. Gamaleya National Research Center. The VNAs to adenoviruses were determined in a virus neutralization reaction by micro-method. Serum samples were obtained from volunteers (n=36) participating in the clinical trial of the "Sputnik V" vaccine (NCT04530396). Samples were taken before vaccination (day 0) and at 42 and 180 days post-vaccination.

Results and Discussion. Out of 36 tested samples, VNAs to Ad26 were detected in 12 volunteers, and to Ad5 in 26 volunteers (Figure 1A). The seroconversion

rate to Ad26 and Ad5 before vaccination was 33.3% and 72.2%, respectively. The reciprocal titer of VNAs to Ad26 was 4.6, and to Ad5 was 111.3. The difference in titer values between adenoviral vectors is due to their different immunogenicity, which directly depends on the serotype [8]. Adenoviruses of subgroup C, which include human adenovirus type 5, are highly immunogenic and effectively activate the immune system, thereby enhancing the immune response to the target antigen [9]. Despite Ad26 clearly lagging in immunogenicity compared to Ad5 in animal models [10, 11], it demonstrates sufficiently high effectiveness in humans [12].

Figure 1. *A. Titers of virus-neutralizing antibodies to adenoviral vectors types 26 and 5 in volunteers before immunization (day 0). B. Titers of neutralizing antibodies to the SARS-CoV-2 virus on days 0, 42, and 180 of the study after immunization of volunteers with the "Sputnik V" vaccine. Columns represent the reciprocal geometric mean titer for each group with a 95% CI. Statistically significant differences between values are indicated by brackets and the symbol *** (p<0.0001). C. Correlation between the titer of IgG-specific antibodies to the SARS-CoV-2 virus and virus-neutralizing antibodies to adenovirus.*

At Day 42 post-"Sputnik V" vaccination, the seroconversion rate to the S protein of the SARS-CoV-2 virus was 100% (Figure 1B), with a geometric mean titer (GMT) of IgG-specific antibodies equal to 1:9776. No significant correlation was found between the titer of S-specific antibodies and VNAs to Ad26 and Ad5 (r=0.2608, p=0.1245 and r=-0.1335, p=0.4377, respectively). At Day 180 after vaccination with Sputnik V, the seroconversion rate to the SARS-CoV-2 virus remained 100%. The GMT significantly decreased (p<0.0001) to 1:1631. No significant correlation was found between the titer of S-specific antibodies and VNAs to Ad26 and Ad5 (r=0.2527, p=0.1370 and r=-0.3096, p=0.0331, respectively).

The correlation between pre-existing titers of VNAs to Ad26 and Ad5 and titers of IgG-specific antibodies to the SARS-CoV-2 virus after vaccination was insignificant. The obtained results, along with data from previous studies, indicate that pre-existing immunity to Ad26 or Ad5 prior to vaccination does not influence the development of humoral immune responses against the vaccine's target immunogen [1]. Levels of neutralizing antibodies to Ad26 did not correlate with levels of neutralizing antibodies to SARS-CoV-2 on the 29th or 71st day post-vaccination [4]. Results from phase 1 clinical trials of the CanSino's Ad5-nCoV vaccine showed that despite the presence of high pre-existing immunity to Ad5, immune responses to the SARS-CoV-2 virus were observed in 60%, 84%, and 100% of volunteers receiving doses of 5×10^{10}, 1×10^{11}, and 1.5×10^{11} viral particles, respectively, on the 28th day of the study [13]. The presence of neutralizing antibodies to Ad26 or Ad5 induced by "Sputnik V" vaccination is expected to have minimal impact on subsequent doses of the same vaccine, which is consistent with the enhancement of immune responses after revaccination.

Literature

1. Logunov DY et al. "Safety and immunogenicity of an rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine in two formulations: two open, non-randomised phase 1/2 studies from Russia." Lancet (London, England) vol. 396,10255 (2020): 887-897.

2. Logunov DY et al. "Safety and efficacy of an rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine: an interim analysis of a randomised controlled phase 3 trial in Russia." Lancet (London, England) vol. 397,10275 (2021): 671-681.

3. Tukhvatulin AI et al. "Safety and immunogenicity of rAd26 and rAd5 vector-based heterologous prime-boost COVID-19 vaccine against SARS-CoV-2 in healthy adolescents: an open-label, non-randomized, multicenter, phase 1/2, dose-escalation study." Frontiers in immunology vol. 14 1228461. 1 Aug. 2023.

4. Le Gars M et al. "Impact of Preexisting Anti-Adenovirus 26 Humoral Immunity on Immunogenicity of the Ad26.COV2.S Coronavirus Disease 2019 Vaccine." The Journal of infectious diseases vol. 226,6 (2022): 979-982.

5. Sadoff J et al. "Final Analysis of Efficacy and Safety of Single-Dose Ad26. COV2.S." The New England journal of medicine vol. 386,9 (2022): 847-860.

6. Zhu F et al. "Immunogenicity and safety of a recombinant adenovirus type-5-vectored COVID-19 vaccine in healthy adults aged 18 years or older: a randomised, double-blind, placebo-controlled, phase 2 trial." Lancet (London, England) vol. 396,10249 (2020): 479-488.

7. Drapkina OM et al. First real-world experience of Gam-COVID-Vac Sputnik V vaccine use. Russian Journal of Preventive Medicine and Public Health. 2021;24(10):53-60. (In Russ.).

8. Wang X et al. "Comparative analysis of the impact of 40 adenovirus types on dendritic cell activation and CD8+ T cell proliferation capacity for the identification of favorable immunization vector candidates." Frontiers in immunology vol. 14 1286622. 17 Oct. 2023.

9. Marquez-Martinez S et al. "Cell entry and innate sensing shape adaptive immune responses to adenovirus-based vaccines." Current opinion in immunology vol. 80 (2023): 102282.

10. Liu J et al. "Magnitude and phenotype of cellular immune responses elicited by recombinant adenovirus vectors and heterologous prime-boost regimens in rhesus monkeys." Journal of virology vol. 82,10 (2008): 4844-52.

11. Abbink P et al. "Comparative seroprevalence and immunogenicity of six rare serotype recombinant adenovirus vaccine vectors from subgroups B and D." Journal of virology vol. 81,9 (2007): 4654-63.

12. Sadoff J et al. "Safety and Efficacy of Single-Dose Ad26.COV2.S Vaccine against Covid-19." The New England journal of medicine vol. 384,23 (2021): 2187-2201.

13. Zhu FC et al. "Safety, tolerability, and immunogenicity of a recombinant adenovirus type-5 vectored COVID-19 vaccine: a dose-escalation, open-label, non-randomised, first-in-human trial." Lancet (London, England) vol. 395,10240 (2020): 1845-1854.

工业安全文化定量评估的新科学方法
A NEW SCIENTIFIC METHODOLOGICAL APPROACH TO QUANTITATIVE ASSESSMENT OF INDUSTRIAL SAFETY CULTURE

Glebova Elena Vitalyevna
Doctor of Technical Sciences, Head of Department
Russian State University of Oil and Gas (National Research University) named after I.M. Gubkina

Volokhina Alla Tagironva
Doctor of Technical Sciences, Professor
Russian State University of Oil and Gas (National Research University) named after I.M. Gubkina

Baklazhenko Kristina Vadimovna
Assistant
Russian State University of Oil and Gas (National Research University) named after I.M. Gubkina

注解。 本文介绍了使用神经网络评估和分析俄罗斯联邦一家石油和天然气生产企业工人的工业安全文化水平的新想法的实施情况。 最初的数据基于对工人进行的调查结果，该调查采用的是俄罗斯国立石油天然气大学（NRU）工业安全与环境保护部员工开发的方法，该部门以 I.M. Gubkina 的名字命名。 本文介绍了对一家石油和天然气生产企业员工的调查结果。 首次显示了根据工人的社会传记特征评估工业安全文化（ISC）水平的可能性。 传统研究获得的 ISC 水平与神经网络确定的 ISC 水平之间已经建立了相关性。 这项工作使用了基于神经网络算法的 Loginom 软件产品。
关键词: 工业安全文化； 安全； 工业安全； 职业安全与健康； 方法； 神经网络。

Annotation. *The paper describes the implementation of a new idea for using a neural network to assess and analyze the level of industrial safety culture of workers at one of the oil and gas producing enterprises of the Russian Federation. The initial data was based on the results of a survey of workers using a methodology developed by employees of the Department of Industrial Safety and Environmental Protection of the Russian State University of Oil and Gas (NRU) named after I.M. Gubkina. The article presents the results of a survey of employees of an oil and gas*

production enterprise. For the first time, the possibility of assessing the level of industrial safety culture (ISC) based on the socio-biographical characteristics of workers has been shown. A correlation has been established between the level of ISC obtained because of a traditional study and determined by a neural network. The work used the Loginom software product, which is based on neural network algorithms.

Keywords: industrial safety culture; safety; industrial safety; occupational Safety and Health; methodology; neural networks.

An important task of the Russian oil and gas industry is the implementation of the Vision Zero concept (zero injuries), including through improving the culture of industrial safety. In the period from 2009 to the present, there has been a steady downward trend in the number of accidents at enterprises of the fuel and energy complex [1]. However, the number of deaths and injuries because of these incidents remains high. Improving the industrial safety culture is aimed at timely identification and elimination of the causes of industrial injuries.

Currently, the legislation of the Russian Federation does not contain a methodology for assessing the level of ISC. Therefore, the purpose of this work is to use a new methodological approach - the use of a neural network to quantify the industrial safety culture of workers at an oil and gas production enterprise.

Assessing the safety culture

Particular attention to safety culture began to be paid after the disaster at the Chernobyl nuclear power plant in 1986. Experts have devoted many studies to this issue [2]. Today, there are a number of methodological approaches to assessing the maturity of the industrial safety culture in companies. The most popular internationally recognized models are the Dupont-Bradley curve, the R. Westrum model and the P. Hudson model. Each of the models is created based on the experience of many leading companies and demonstrates the stages of evolution of the industrial safety management system, allowing you to analyze in detail and find areas for improving the level of industrial safety culture.

Based on an analysis of international practices in assessing and developing a culture of industrial safety, employees of the Department of Industrial Safety and Environmental Protection developed a methodology for assessing the culture of industrial safety using a two-stage survey (using two questionnaires) with subsequent processing of the results according to specified criteria. The algorithm of the technique is presented in Figure 1.

Figure 1. *Algorithm for assessing the level of ISC*

As part of the ongoing research, a model for assessing the level of development of ISC was adapted and refined by introducing a five-level classification (IOGP 5-level classification) with corresponding numerical indicators (Fig. 2).
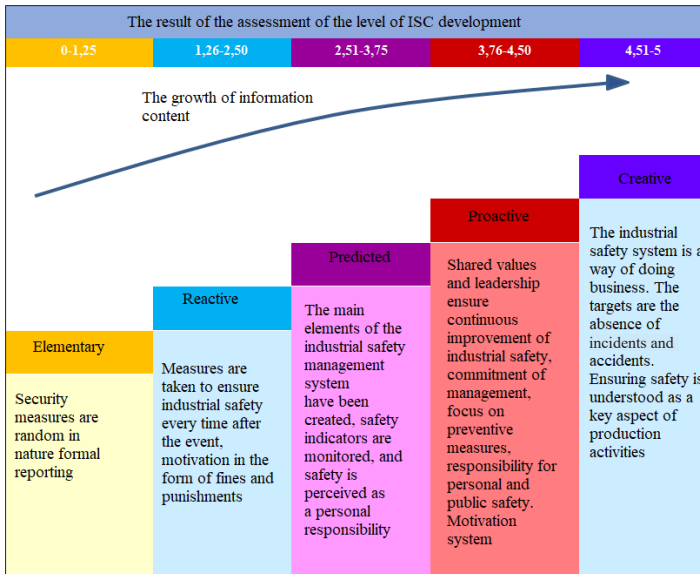
Figure 2. *Assessment of the level of ISC*

Questionnaire No. 1 consisted of 10 questions and included an assessment of the socio-biographical characteristics of workers based on the assumption that the age of workers, their experience and level of position directly influence the awareness of the importance of safety, understanding and compliance with the requirements of production instructions.

Questionnaire No. 2 contained questions to assess 16 individual indicators - components of safety culture. For each of the components, 4 statements were made, two of which were positive and two of which were negative. Thus, the questions in questionnaire No. 2 are presented in the form of 64 statements. The workers' task was to choose one of the answer options for each statement ("strongly disagree," "disagree," "hard to say," "agree," "completely agree"). For further data processing, the respondents' responses were translated into a 5-point scale from 1 point for the answer "strongly disagree" to 5 points for the answer "completely agree" for positive statements, and, conversely, from 5 points for the answer "strongly disagree" to 1 point for a "strongly agree" response for negative statements.

As part of this study, a survey was conducted 419 employees. The main objective of the survey was to establish the general level of ISC at oil and gas producing enterprise.

Figure 3 shows a histogram of the assessment of the level of safety management by all employees of the enterprise based on 16 safety culture indicators. The overall level of the industrial safety management system based on the results of the calculation was 3.66, which corresponds to the "predicted" level, where the main elements of the industrial safety management system have been created, safety indicators are monitored, and safety is perceived as personal responsibility.
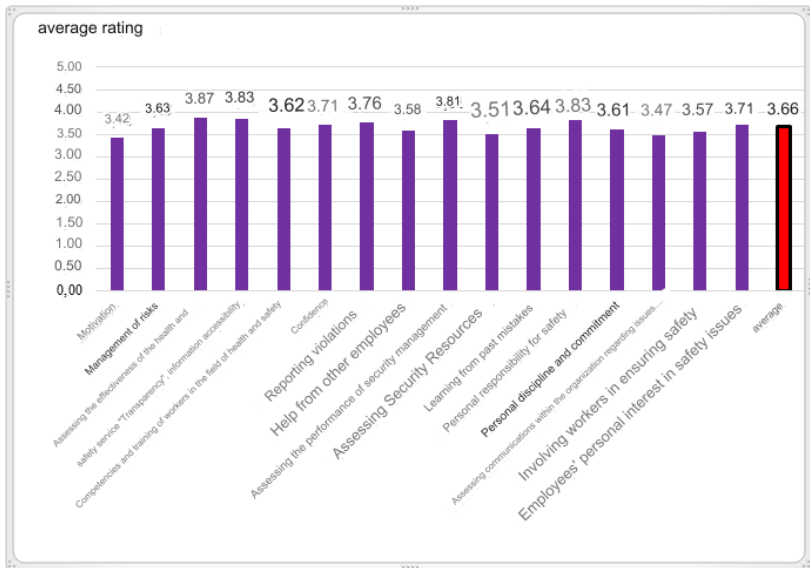

Figure 3. *Assessment of the level of ISC by all employees*

Predicting the level of ISC using a neural network

During the analysis of the results, for the first time, a hypothesis was put forward that there is a correlation between socio-biographical characteristics and the level of employee ISC. The socio-biographical characteristics of the employee were analyzed in accordance with the questions from Table 1 and were not used when calculating the overall level of industrial safety culture.

Table 1.
*Social and biographical characteristics of the employee*

Name of the survey question
1. What is your age?
2. How long have you worked in your profession?
3. Indicate the level of your position.
4. Do you think it is possible to comply with all safety requirements in the course of your work?
5. Have you made mistakes during your work that could have resulted in a decrease in the level of safety?
6. Is it possible, in your opinion, to achieve zero injuries under the current working conditions?
7. Please rate on a scale from 1 to 5 the general state of safety in your work activity.
8. How do you assess your contribution to ensuring and developing the company's security (in %, from 0 to 100)?
9. Have you previously taken part in a behavioral security audit?
10. Are you ready to take responsibility for interrupting the technological process in the event of a pre-emergency situation or if unsafe actions of colleagues are detected?

To test this hypothesis, it was necessary to establish a relationship and find a correlation between the socio-biographical characteristics and the level of ISC of each employee. In this work, a neural network model was used as a tool for predicting the level of ISC.

The module of the analytical platform Loginom [4] was used as a neural network algorithm, which made it possible to compare the actual level of the ISC established using the technique with the level obtained using the neural network.

The results of the analysis are presented in Figure 4 in the form of a graph. The obtained results of assessing the level of ISC based on the predicted values of the neural network are correlated with the actual values obtained using the method. That is, the hypothesis put forward is confirmed by the results obtained. Thus, instead of assessing the ISC using 64 indicators, it is possible to use 10 indicators - responses from a socio-biographical questionnaire.
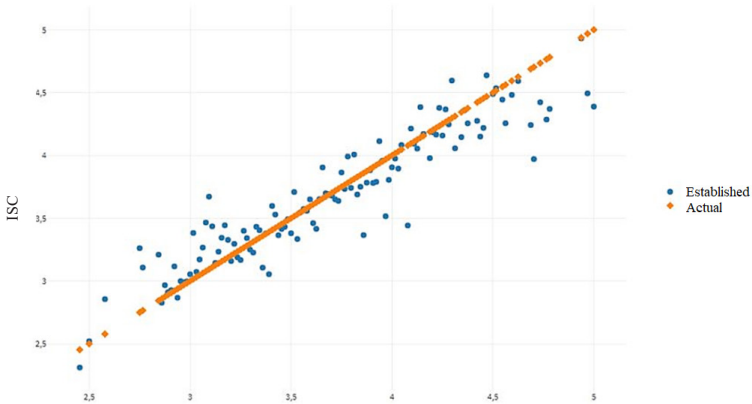
Figure 4. *Dispersion of values of the actual level of the ISC and the level using a neural network*

Conclusions

The work implemented a new idea of using a neural network to determine the level of industrial safety culture by surveying workers on 10 indicators of a socio-biographical questionnaire. The research results presented in this work showed a correlation between the actual values obtained using the developed method and those determined using a neural network. However, for an accurate quantitative assessment of the level of ISC using socio-biographical characteristics, it is necessary to develop your own neural network with its subsequent training.

References

1. Federal State Statistics Service. – URL: https://www.gks.ru/ accessed 03/10/2024);

2. Houette B., Mueller-Hirth N. Practices, preferences, and understandings of rewarding to improve safety in high-risk industries //. – 2022. – Vol. 80. – P. 302–310. –DOI: 10.1016/j.jsr.2021.12.01.

3. Ayob AN, Che Hassan Che R., Hamid M. Safety culture maturity measurement methods: A systematic literature review //. – 2022. – Vol. 80. – Article 104910. – DOI: 10.1016/j.jlp.2022.104910.

4. Analytical platform Loginom. – URL: https://loginom.ru/ (access date 02/15/2024).

微小线性运动的电容式测量仪
CAPACITIVE MEASURER OF THE SMALL LINEAR MOVEMENTS

Mamikonyan Boris Mamikon
Doctor of Technical Sciences, Professor
National Polytechnic University of Armenia

Avetisyan Hamlet Arshak
Graduate Student
National Polytechnic University of Armenia

注解。 考虑了使用差动电容转换器开发小型线性位移计的特点。 已经分析了测量电路，使得可以实现用于确定测量位移的线性算法。 测量电路的元件和电源、控制测量过程、执行测量和处理测量结果的可编程微控制器的选择是合理的。 给出了测量误差的研究结果，并分析了各种因素对测量精度的影响。
关键词：测量、电容式转换器、正弦信号、相位法、微控制器、测量误差。

Annotation. *The features of the development of a small linear displacement meter using a differential capacitive converter are considered. A measuring circuit has been analyzed that makes it possible to implement a linear algorithm for determining the measured displacement. The choice of elements and power supply of the measuring circuit, a programmable microcontroller that controls the measuring process and performs measurements and processes measurement results is justified. The results of a study of measurement error are presented, and the influence of various factors on measurement accuracy is analyzed.*

Keywords: *Measurement, capacitive converter, sinusoidal signal, phase method, microcontroller, measurement error.*

Introduction. For measuring small linear displacements, differential capacitive measuring transducers (CMTs) have the greatest sensitivity, in which the input quantity is the change in the distance between the moving and stationary electrodes. CMTs have high metrological characteristics; their primary conversion error does not exceed ±0.1% [1]. Therefore, the main direction for increasing the accuracy of modern information-measuring systems based on the capacitive method is the use of new methods for converting the CMTs capacitance into an electrical signal.

Object of study. For CMTs with a plane-parallel system of electrodes based on a change in the gap d between the electrodes, the static conversion characteristic is determined by the well-known expression

$$C_X = \varepsilon_0 \varepsilon S / d \, ,$$

where $\varepsilon_0 = 8,854 \cdot 10^{-12}$ F/m - dielectric constant of vacuum (air) - physical constant, ε - relative dielectric constant of the medium, located between the electrodes, S - overlap area between the electrodes. From (1) it follows that the sensitivity of the CMTs to the gap

$$K = \frac{\partial C_X}{\partial d} = -\frac{\varepsilon_0 \varepsilon S}{d^2},$$

therefore, an increase in sensitivity is achieved by reducing the initial gap between the electrodes and increasing the size of the CMTs. With modern technology for manufacturing sensors, the initial gap between the CMTs plates can be increased to 5...10 μm [2], and the sensitivity threshold for movement is estimated at values of the order of 10-6 μm [1].

The linear motion differential CMTs is a flat capacitor with electrodes 1, 2 and 3 (Fig. 1). Electrodes 1 and 2 are fixed motionless, and electrode 3 is the reproducing organ of the measured displacement x. The static characteristic of the transformation is the dependence $\Delta C = C_1 - C_2 = f(X)$.
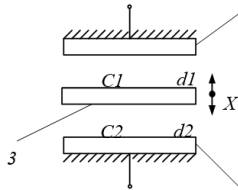
Figure 1. *Differential CMTs with variable clearance*

In the initial position of the movable electrode, when the measured displacement $X = 0$, we have $d_1 = d_2 = d$, $C_1 = C_2 = C_0 = A/d$, $\Delta C = C_1 - C_2 = 0$, $A = \varepsilon_0 \varepsilon S$. Under the influence of movement X CMTs capacities change:

$$C_1 = A/(d - X), C_2 = A/(d + X),$$

and a nonlinear displacement transformation function is obtained

$$\Delta C = \frac{2A \cdot X}{d^2 - X^2} = \frac{2A \cdot X}{d^2 \left(1 - X^2/d^2\right)} \cdot$$

In this regard, to limit the nonlinearity error, the measurement range is limited to the value $X \le 0,1d$. Then the maximum nonlinearity obtained at the end of the measurement range and determined by the deviation from unity of the value $1 - X^2/d^2$, is equal $1 - X_m^2/d^2 = 1 - 0,01$, that is, does not exceed 1.0%. For accurate measurements, this error value is also unacceptable; moreover, such a limitation

of the measurement range is not always desirable. Thus, in the measuring circuit (MC), in which the conversion is carried out ΔC into an electrical signal, the additional problem of ensuring a linear relationship between the output signal and the measured displacement must also be solved.

The main methods for increasing the accuracy of CMTs measuring circuits have been most thoroughly researched, developed and presented in [1]. It is substantiated that the advantages obtained due to the differential design of the CMTs are fully manifested only in the case when the relative change in capacitance is used as an informative parameter

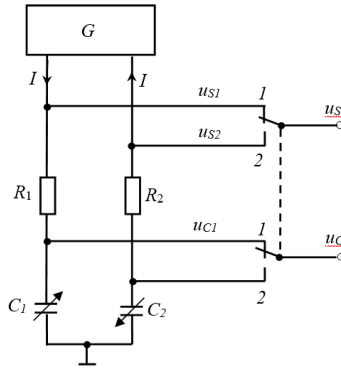$$K(C) = \frac{C_1 - C_2}{C_1 + C_2}. \tag{1}$$

Such a conversion automatically provides a ratiometric correction of the CMTs error, which makes it possible to significantly reduce its temperature error, increase the dynamic range, and eliminate the influence of the dielectric constant of the interelectrode medium on the conversion result. The output signal obtained when this measurement method is implemented is called ratiometric [3].

The essence of the measurement method. In known meters with a ratiometric output signal, the conversion of the informative parameter CMTs into potential-current signals is usually used [1, 4-6], which, without additional corrective circuits, cannot provide an invariant measurement, since these signals are influenced by changes in the supply voltage of the MC, bias voltages and zero drift of the operational amplifiers used, internal noise and external interference. In order to eliminate the influence of the listed interfering factors in this development, instead of analog signals Only the phase shift angle is used as the output signal of the MC φ between voltages u_S and u_C (Fig. 2). Reference resistors are connected in series with the CMTs $R_1 = R_2 = R$, which form voltage dividers with parts of the CMTs, powered by the current of a sinusoidal voltage generator (G).

In positions 1 and 2 of electronic switches

$$\dot{U}_{S1} = \dot{I}\left(R + 1/j\omega C_1\right); \dot{U}_{C1} = \dot{I}/j\omega C_1 ; \dot{U}_{S1}/\dot{U}_{C1} = 1 + j\omega R C_1;$$

$$tg\varphi_1 = \frac{\text{Im}\left(\dot{U}_{S1}/\dot{U}_{C1}\right)}{\text{Re}\left(\dot{U}_{S1}/\dot{U}_{C1}\right)} = \omega R C_1 = \frac{\omega R A}{d - X}; \tag{2}$$

$$\dot{U}_{S2} = -\dot{I}\left(R + 1/j\omega C_2\right); \dot{U}_{C2} = -\dot{I}/j\omega C_2 ; \dot{U}_{S2}/\dot{U}_{C2} = 1 + j\omega R C_2;$$

$$tg\varphi_2 = \omega R C_2 = \frac{\omega R A}{d + X}. \tag{3}$$

Figure 2. *Simplified diagram of the measuring circuit*

To obtain a ratiometric output signal in the form (1), we use the relation

$$K(C) = \frac{tg\varphi_1 - tg\varphi_2}{tg\varphi_1 + tg\varphi_2} = \frac{C_1 - C_2}{C_1 + C_2} = \frac{X}{d}$$

and taking into account (2) and (3) we obtain the IC transformation function in the form

$$X = d \cdot \frac{\sin(\varphi_1 - \varphi_2)}{\sin(\varphi_1 + \varphi_2)}. \qquad (4)$$

From (4) it is clear that the measurement result does not depend on the voltage and current of the generator, and the accuracy of the displacement measurement depends only on the accuracy of the angle measurement φ, which is the most accurately measured quantity in digital electrical measuring technology.

In the developed device (Fig. 3) the voltage u_S and u_C are supplied through voltage repeaters-buffers 3 (so as not to load the MC) to the analog inputs of a programmable microcontroller (PM) 4. The PM controls the measurement process, measures angles φ_1 and φ_2, calculates the value X according to formula (4) and displays the measurement result on a digital reading device 5. To increase the accuracy of measurements, the PM repeats each measurement 10 times and determines the average value of the results. If necessary, digitized angle signals can be obtained from the PM φ_1 and φ_2 send them through an interface converter (for example, AVR309) to a computer, where they are processed and the measurement results are displayed on the computer monitor.

Selection of circuit components. The MC was used as a power source RC-oscillator based on an op-amp with a Wien measuring bridge and a transformer output. Generation frequency selected $f = 50$ kHz, output voltage $U = 5$ B. The self-oscillator produces an almost pure sine wave, the distortion of which does not

exceed 0.15%, and the temperature change in frequency is $\Delta\omega/\Delta t = 4,5 \cdot 10^{-4}$ rad/deg [7]. Note that instability of the source frequency does not affect the measurement accuracy, because to calculate the angle φ in PM the period is also measured T measuring current.
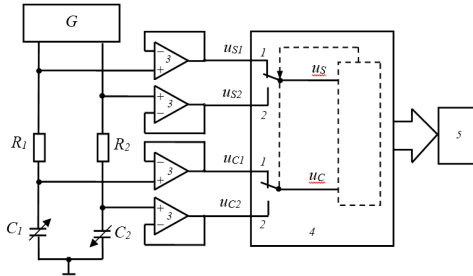
Figure 3. *Functional diagram of a small linear displacement meter*

Reference resistor resistance $R_1 = R_2 = R$ is selected in such a way as to ensure maximum sensitivity of converting the UIP parameter into angle φ. This occurs if at the starting point of the transformation, when $C_1 = C_2 = C_0$, the condition is ensured $\varphi_1 = \varphi_2 \approx 45^0$. Therefore, from the condition $tg\varphi = 1$ should $R = X_{C0} = 1/\omega C_0$, and with the values used in the development $C_0 = C_3 = 50\,\text{pF}$, $f = 50\,\text{kHz}$ we get $R \approx 63,7$ kOhm With these parameter values, the range of capacitance changes $\Delta C = \pm 30$ pF corresponds to the change in angle φ within $\varphi \approx 21,8^0...58^0$.

Highly stable precision metal foil resistors of type C5-61 were selected as reference resistors. They are produced only with a power of 0.25 W, minimal deviation $\pm 0,005\%$ from the nominal resistance and the minimum value of the temperature coefficient of resistance (TCR) $\alpha_t = \pm 10 \cdot 10^{-6}\ {}^0C^{-1}$.

When choosing a microcontroller, it should be taken into account that it should have the highest possible frequency f_0 clock generator and, more importantly, there must be two analog inputs with comparators, the inputs of which will receive voltages u_S and u_X to convert angle φ in time interval τ. Using analog inputs of PM with internal ADCs is impractical, because the value of the conversion (sampling) period of the ADC limits the minimum possible value τ, thereby significantly increasing the sensitivity threshold of the meter. Taking these circumstances into account, a high-performance 32-bit MCU of the PIC32MX695F512H type was selected. The PM has two analog inputs with built-in comparators, and these inputs are equipped with choppers, which are used in the development as switches for the output voltages of the MC. The choppers are controlled from the MK by the "SWCX" signal and carry out angle measurement modes φ_1 or φ_2.

The PM central processor can operate up to maximum frequency 80 MHz. To create this frequency, in order to increase the measurement accuracy, an external quartz resonator with a frequency of 8 MHz. This frequency is multiplied inside the MK by 10, resulting in $f_0 = 80$ MHz at which the PM, its core, counters and all peripheral devices operate.

In order to select an op-amp for buffers, a comparative analysis of the electrical characteristics of a number of precision op-amps was performed. The main selection criterion is the values of the input resistance, zero offset voltage and its temperature drift, normalized to the input noise voltage and current. As a result of the analysis, an op-amp chip of the LF355 brand with an input stage based on field-effect transistors was selected.

The digital readout device is implemented on seven-segment LED indicator brand QCA-56.

Assessment of measurement accuracy. A method for theoretical research of the metrological characteristics of the meter has been developed. Expression of relative displacement measurement error X received as

$$\delta(X) = \frac{f}{f_0} \cdot (\varphi_1 - \varphi_2) \cdot ctg(\varphi_1 - \varphi_2) \cdot \qquad (5)$$

It can be seen that the higher the frequency, the smaller the measurement error f_0 PM clock generator and the lower the frequency f MC power generator. Moreover, with increasing difference $(\varphi_1 - \varphi_2)$ the error is reduced. Calculations using formula (5) show that in the range of movement $X = 0 \ldots \pm 0,4d$ the relative measurement error does not exceed the value $\delta(X) \leq 0,1\%$.

Conclusions. The developed capacitive measuring device can be used for digital measurement of microdisplacements and other physical quantities (pressure, force, deformation, acceleration, thermal expansion of bodies, etc.) that cause microdisplacements, with a relative error not exceeding 0.1%. This accuracy is ensured by using phase signals instead of potential current signals.

References

1. Arbuzov V.P. Structural methods for increasing the accuracy of measuring circuits of capacitive and inductive sensors: Monograph. - Penza: Inf.-ed. center of Penz. State University, 2008. - 230 p.

2. Topilsky V.B. Microelectronic measuring transducers. – M.: BINOM, 2013. – 493 p.

3. Raspopov V.Ya. Lecture 8. Measuring circuits and transfer functions of direct conversion accelerometers // Sensors and systems. 2006. – No. 5. – P. 30–33.

4. Arbuzov V.P., Mishina M.A., Belyntseva P.N., Ananina I.Yu. Measuring circuits of high-temperature capacitive pressure sensors // Measurement. Monitoring. Control. Control. - 2015. - No. 1. - P. 81–88.

5. Arbuzov V.P., Mishina M.A. Measuring transducers of capacitive micromechanical gyroscopes // Izv. universities Instrumentation. – 2017. - No. 12. – pp. 1138-1145.

6. Arbuzov V.P. Direct conversion measuring circuits for capacitive accelerometers and gyroscopes // Izv. universities Instrumentation. – 2019. - No. 11. – pp. 997-1004.

7. Mamikonyan B.M., Melikyan T.A. Power supply for measuring circuits with phase output signals // NPUA Bulletin: Electrical engineering, energy. – 2020. - No. 1. – pp. 62-73.

电路电磁参数不变测量的相位法
PHASE METHOD OF INVARIANT MEASUREMENT OF ELECTROMAGNETIC PARAMETERS OF ELECTRIC CIRCUITS

Mamikonyan Boris Mamikon
Doctor of Technical Sciences, Professor
National Polytechnic University of Armenia

Ghazaryan Sergey Armen
Lecturer, Graduate Student
National Polytechnic University of Armenia

注解。　考虑了各种电磁装置复杂电阻分量的不变测量问题，结果表明，采用相位法可以显着简化测量装置，实现测量过程自动化，并通过有效利用测量结果对测量结果进行处理。　可编程微控制器。
关键词：复电阻、不变测量、相位法、正弦电压、相移角、微控制器。

Annotation. *The problem of invariant measurement of the components of the complex resistance of various electromagnetic devices is considered and it is shown that the use of the phase method can significantly simplify the measuring device, automate the measurement process and process the measurement results through the effective use of programmable microcontrollers.*

Keywords: *complex resistance, invariant measurement, phase method, sinusoidal voltage, phase shift angle, microcontroller.*

Introduction. Inductors, many types of inductive converters, coils with mutual inductance, ferromagnetic cores in AC electrical circuits are presented in the form of passive two-element two-terminal networks, which are characterized by a complex resistance consisting of active and inductive components: $Z = R + jX$. In the process of manufacturing and operating electromagnetic devices, in many scientific studies the problem of invariant (including separate) measurement of these components arises. For such measurements, the most widely used are balanced AC bridges, resonant methods, the method of dynamic measurements based on the characteristics of the transient process, etc. [1-3]. The disadvantages of existing methods are the complexity of implementation, the use of potential-current signals in them, which are subject to the influence of various types of noise and interfer-

ence, the difficulty of interfacing with modern computer technology for automated processing of measurement information and its use in control systems.

These disadvantages can be eliminated by using the phase measurement method, in which the carrier of information about the measured parameters is not current, or voltage, but the phase shift angle between the two output sinusoidal voltages of the measuring circuit [4, 5]. The development of this direction is largely due to the widespread use of microcontrollers (MCs) in measuring technology.

The essence of the phase method. In Fig. Figure 1 shows a diagram of the measuring circuit (MC) of a microcontroller device for invariant measurement of the parameters of inductors (PI) using the phase method [6]. In series with CI with active resistance R_X and inductance L_X exemplary resistors are connected R_1 and $_2$. The IC is powered by the sinusoidal current of the generator G frequency $f = 1000$ Hz The output voltages of the MC are the voltage $\dot{U}_S$ in two switch positions and reference voltage U_N, which is formed in the feedback circuit of the operational amplifier OA on a resistor R_N. An informative parameter is the angle φ phase shift between voltages $\dot{U}_S$ and $\dot{U}_N$. Resistor resistance values R_1 and R_2 angle scale is agreed upon φ with measurement ranges of PI parameters.
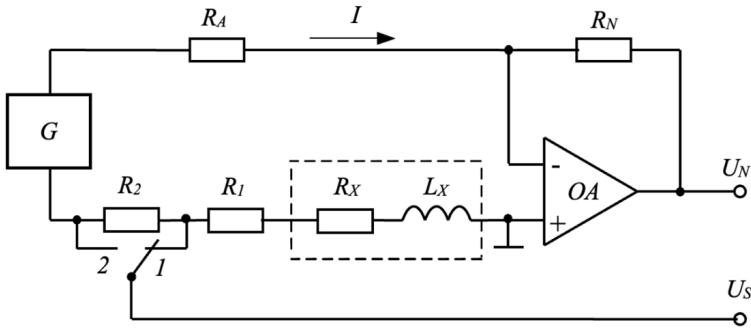
Figure 1. *Diagram of the measuring circuit for invariant conversion of inductor parameters into a phase signal*

The output voltages relative to the common wire potential are determined by the expressions $\dot{U}_{S1} = \dot{I}(R_1 + R_X + j\omega L_X)$, $\dot{U}_{S2} = \dot{I}(R_1 + R_2 + R_X + j\omega L_X)$, $\dot{U}_N = \dot{I}R_N$, therefore; in positions 1 and 2 of the switch, the following relations are valid:

$$tg\varphi_1 = \frac{\omega L_X}{R_X + R_1}, \quad tg\varphi_2 = \frac{\omega L_X}{R_X + R_1 + R_2}, \quad (1)$$

where we get:

$$L_X = \frac{R_2}{\omega\left(ctg\varphi_2 - ctg\varphi_1\right)}, \tag{2}$$

$$R_X = \frac{R_2 ctg\varphi_1 - R_1\left(ctg\varphi_2 - ctg\varphi_1\right)}{ctg\varphi_2 - ctg\varphi_1}, \tag{3}$$

$$Q = \frac{\omega L_X}{R_X} = \frac{R_2}{R_2 ctg\varphi_1 - R_1\left(ctg\varphi_2 - ctg\varphi_1\right)}. \tag{4}$$

Does not appear in (2) R_X, and in (3) - L_X, that is, separate measurement of PI parameters is provided. Only the angle needs to be measured φ in two switch positions. The measurement results do not depend on R_N, A L_X also does not depend on R_1. Generator voltages, OA zero offsets, their drift and input currents do not affect the measurement accuracy, since, unlike currents and voltages of the IC, the angle φ does not depend on them.

In the developed voltage meter $\dot{U}_S$ and $\dot{U}_N$ are supplied to the analog inputs of a programmable microcontroller (PM) (PIC32MX695F512H microcircuit), which contains two input comparators with input switching devices (one of them is used to switch a resistor R_2). With these comparators, the angle $\varphi = \psi_{U_S} - \psi_{U_N}$ converted to time interval τ. Time intervals τ And $T = 1/f$ measured by the discrete counting method by filling them with pulses of reference frequency $f_0 = 80$ MHz clock generator of the MK using its integrated timer-counter. During the measurement process, the MK controls the position of the switch, measures the angle φ in its two positions (φ_1 and φ_2), calculates the parameters of the CI using the algorithms (1) – (3) recorded in its memory and displays the measurement results on a digital display.

Theoretically, depending on the values L_X and R_X, corner φ can be located at any point in the range $0^0 \leq \varphi \leq 90^0$. However, taking into account the features of tangent and cotangent functions, in order to ensure acceptable conversion sensitivity, it is advisable that the angle φ did not approach the ends of this range. In near corners $\varphi = 0^0$ and $\varphi = 90^0$ values $tg\varphi$ or $ctg\varphi$ tend to infinity, which in formulas (1) - (4) can lead to uncertainties and loss of sensitivity. From (1) it is clear that always $\varphi_1 > \varphi_2$, and the greater the difference $\Delta\varphi = \varphi_1 - \varphi_2$, the higher the conversion sensitivity as L_X, so Q.

So that the same angle scale φ corresponded as L_X, and quality factor Q, it is necessary to ensure the condition $L_{X\max}/L_{X\min} = Q_{\max}/Q_{\min}$. The following measurement ranges have been selected for development: $L_X = 10...100$ mH, $Q = 5...50$ at $f = 1000$ Hz, and the angle scale φ selected within $10^0 \leq \varphi \leq 80^0$. From these values the resistor resistances are calculated $R_1 = 98,17$ Om, $R_2 = 245,5$ Ohm. In this case, the maxi-

mum sensitivity is obtained in the middle of the scale, at the mark $\varphi = 45^0$, and equal $\Delta\varphi \approx 31,75^0$.

The metrological characteristics of the meter have been studied. For the above measurement ranges, the limits of the main relative measurement errors with a confidence probability of 0.95 do not exceed: for L_X - 0.13%; For Q - 0.85%.

Research shows that the phase method of invariant measurement of PI parameters is easy to implement in practice and can provide accuracy sufficient for practice. The ranges for measuring the inductance and active resistance of the PI can be any, and the quality factor should preferably be limited from above to the value $Q = 100$. When increasing the quality factor measurement range to the value $Q = 300$ limit of permissible basic relative measurement error at frequencies up to $f = 1000$ Hz with a confidence probability of 0.95 can be up to 3.0%.

Measuring mutual inductance using the phase method. Mutual inductance M two magnetically coupled coils with inductors L_1 and L_2 expressed through the coupling coefficient k via formula [7]

$$M = k\sqrt{L_1 L_2} \ . \tag{5}$$

Coefficient value k varies within $k = 0...1$ and depends on the proximity of the coils, their mutual orientation, and the material of their core, the shape and number of turns. Mutual inductance is also expressed through the number of turns w_1 and w_2 coils expression

$$M = w_1 w_2 / R_M, \tag{6}$$

Where R_M - magnetic resistance of a closed circuit through which the magnetic flux common to both coils passes. From expressions (5) and (6) it follows that always $M_{12} = M_{21} = M$, i.e., the mutual inductance of the two coils does not depend on which coil creates the magnetic flux.

To measure mutual inductance, you can use all methods of measuring inductance: indirect; pavement; resonant, etc. [8]. The choice of one method or another depends on the value of the measured quantity and the required accuracy. All these methods have a common drawback: they do not provide an output signal with a single informative parameter for transmission over a distance or interface with computer technology for automated processing of measurement information.

This drawback is eliminated by measuring mutual inductance using the phase method (Fig. 2a) [9, 10]. Here, coils 1 and 2 form the windings of the transformer, to the common terminal of which a reference resistor is connected R_0. The primary winding is fed with sinusoidal current I_1 generator G (directly or through a current-limiting resistor R), and the secondary winding operates in idle mode. The output signal is the phase shift angle φ between voltages u_S and u_N .
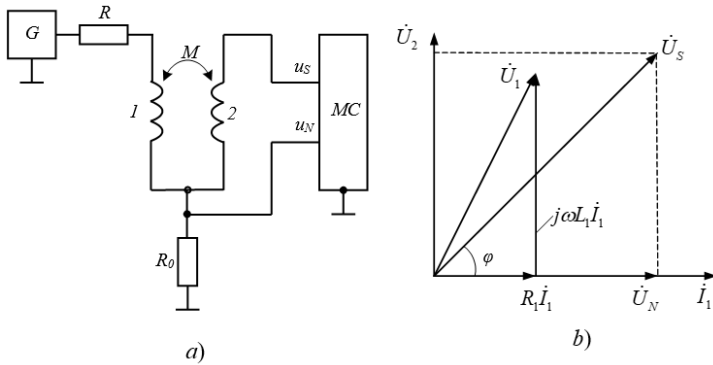
Figure 2. *Measuring mutual inductance using the phase method:*
a– diagram of the measuring circuit; b – vector diagram of current and voltage

In the vector diagram (Fig. 2b) through R_1, L_1 And U_1 the active resistance, inductance and voltage of the primary winding of the transformer are indicated, respectively, $\dot{U}_N = \dot{I}_1 R_0$, $\dot{U}_2 = \dot{E}_2 = j\omega M \dot{I}_1$, $\dot{U}_S = \dot{U}_N + \dot{U}_2$, $tg\varphi = \dfrac{U_2}{U_N} = \dfrac{\omega M I_1}{I_1 R_0} = \dfrac{\omega M}{R_0}$, hence,

$$M = \left(R_0 \cdot tg\varphi\right)/\omega. \tag{7}$$

From (7) it is clear that the measurement result does not depend on the supply current of the measuring circuit, and the angle φ is the only informative parameter. To measure angle φ digital voltage method u_S and u_N directly (or through buffers) are supplied to the analog inputs of a programmable microcontroller (PM). MC measures the angle φ and determines the value M according to formula (7). Coded angle values φ or M from the MC can be transmitted over distances or used in control systems.

Sensitivity S transformation $\varphi = f(M)$ determined from formula (7):

$$\frac{1}{S} = \frac{dM}{d\varphi} = \frac{R_0}{\omega} \cdot \frac{d(tg\varphi)}{d\varphi} = \frac{R_0}{\omega} \cdot \frac{1}{\cos^2 \varphi},$$

hence,

$$S = \left(\omega/R_0\right) \cdot \cos^2 \varphi \cdot$$

From the dependency, graph $S = f(\varphi)$ (Fig. 3) it is clear that at values $\varphi > 60^0$ the conversion sensitivity becomes less than the value $S = 0,25 \cdot S_{max}$, hence the angle scale φ it is advisable to limit from above the value $\varphi = 60^0$.
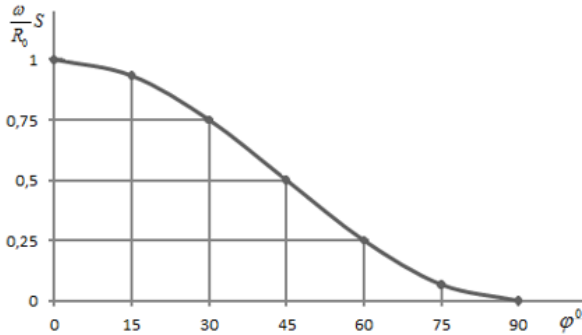
Figure 3. *Graph of the dependence of the conversion sensitivity on the phase shift angle*

If the measurement limits are set $M = 0...M_{max}$, then the value $M = M_{max}$ must match from (7) $M_{max} = R_0 \cdot tg60^0/\omega = \sqrt{3}R_0/\omega$, from where we determine the value of the resistor resistance R_0 at a known value $\omega : R_0 = \omega M_{max}/\sqrt{3}$. This means that the measurement limits can be selected using resistance R_0. For example, for the measurement limit $M = 0...0,1$ Hn, at measuring current frequency $f = 10$ kHz, it turns out $R_0 = 3,625$ k Ohm, and for $M = 0...10$ mH should be $R_0 = 362,5$ Ohm.

A methodology for metrological testing of the meter has been developed. It is shown that with a modern radio electronics element base, the phase method can provide measurement of mutual inductance with a limit of permissible basic relative measurement error with a confidence probability of 0.95 not exceeding 0,06%.

Measurement of complex magnetic resistance using the phase method. In alternating current electromagnetic devices in a magnetic core made of ferromagnetic material, electrical energy losses arise from hysteresis and eddy currents, as a result of which between the magnetizing force vector (iw) and magnetic flux vector ($\dot{\Phi}$) a phase shift angle appears, called the magnetic retardation angle [11]. The magnetic resistance of the magnetic circuit becomes a complex quantity: $Z_M = R_M + jX_M = \frac{l}{S}(\rho_R + \rho_X)$, Where l And S - length and cross-sectional area of the magnetic circuit, ρ_R And ρ_X - specific active and reactive components of the magnetic resistance of the magnetic core material. For a relatively accurate calculation of alternating current electromagnetic devices, it is necessary to have the following values: ρ_R And ρ_X, which are not given in reference books: if necessary, they are determined experimentally. A ring core is made from the magnetic material under study, onto which the magnetizing and measuring windings are evenly distributed, the magnetizing winding is connected to a sinusoidal voltage source, the no-load mode is maintained in the measuring room (usually it serves to

determine the induction in the core), the necessary electrical quantities are measured in the winding circuits, according to which, using known physical connections between electrical and magnetic quantities, calculate the required ρ_R and ρ_X.

In [12], a phase method was used, in which the necessary for separate determination ρ_R and ρ_X the parameters of the measuring circuit are converted into phase shift angles between two sinusoidal voltages. As an experimental sample, we used a ring core with dimensions of 40/50-20 mm, wound with a tape 0.05 mm thick from grade 79NM permalloy, with the number of winding turns $w_1 = 390$, $w_2 = 106$. Induction B in the magnetic circuit was changed in the range $B = 0,1...0,3$ Tl, measurement results are presented in the table; they can be used in the design of electromagnetic devices using magnetic cores made of 79NM permalloy. The developed research methodology is also applicable to the high induction region and to any ferromagnetic material.

Table

Values of the components of the complex magnetic resistance of a ring magnetic core wound with a 0.05 mm thick tape made of grade 79NM permalloy

B, T	0.1	0.125	0.15	0.175	0.2	0.225	0.25	0.275	0.3
ρ_R, m/Gn	22.5	20.1	19.2	18.5	18.8	19.3	20.0	21.8	23.8
ρ_X, m/Gn	14.95	14.2	13.1	12.3	11.6	11.9	12.2	10.7	10.5

Conclusions. The presented studies show that the phase method of invariant measurement of complex resistance components of any type makes it possible to simplify the measuring system, automate the measurement process and process the measurement results.

References

1. Martyashin A.I., Kulikovsky K.L., Kuroyedov S.K., Orlova L.V. Fundamentals of invariant transformation of parameters of electrical circuits. - M.: Energoatomizdat, 1990. - 216 p.

2. Kravtsov A.V. Metrology and electrical measurements. - M.: Kolos, 2007. - 216 p.

3. Melentyev V.S., Kostenko E.V., Mironov D.A. Approximation methods for separately determining the parameters of two-element, two-pole electrical circuits // Polzunovskiy vestnik. - 2011. - No. 3/1. – P. 47-50.

4. Mamikonyan B.M. Measuring the parameters of passive electrical two-terminal circuits using the phase method // NPUA Bulletin, series "Electrical engineering, energy". - 2017. - No. 1. – pp. 67-76.

5. Mamikonyan B.M., Mamikonyan H.B. Invariant transformation of electrical parameters of passive two-element two-terminal networks // Bulletin of NPUA: Electrical engineering, energy. – 2020. - No. 2. – P. 91-100.

6. Mamikonyan B.M.,Kazaryan S.A.Measuring circuits for invariant conversion of inductor parameters into a phase signal // Current problems of science and technology: Proceedings of the 1st International Scientific and Technical Conference (Sarapul, May 20-22, 2021). – Izhevsk: Publishing house UIR IzhSTU named after M.T. Kalashnikov, 2021. – 875 p. – pp. 372-376.

7. Demirchyan K.S., Neiman L.R., Korovkin N.V., Chechurin V.L. Theoretical foundations of electrical engineering: Textbook for universities. Volume 1. - St. Petersburg: Peter, 2003. - 463 p.

8. Mamikonyan B.M., Egoryan A.A., Kazaryan S.A. Methods and means of measuring mutual inductance // Bulletin of NPUA: Electrical engineering, energy. – 2023. - No. 1. – P. 9-37.

9. Mamikonyan B.M., Melikyan T.A. Measuring the mutual inductance of coils using the phase method // Izv. NAS of Armenia and NPUA. Ser. TN. - 2019, No. 4. - P. 491-502.

10. Mamikonyan B.M., Kazaryan S.A. Measurement of the components of the complex resistance of mutual induction // Scientific instrument making. – 2023. - No. 3. – P. 60-73.

11. Demirchyan K.S., Neiman L.R., Korovkin N.V., Chechurin V.L. Theoretical foundations of electrical engineering. Volume 2. - St. Petersburg: Peter, 2003. - 576 p.

12. Mamikonyan B.M. Measurement of components of complex magnetic resistance of ferromagnetic materials using the phase method // Bulletin of NPUA: Electrical engineering, energy. – 2021. - No. 2. – P. 74-84.

多间隔自适应采样装置
DEVICE FOR ADAPTIVE SAMPLING WITH MULTIPLE INTERVALS

Ishemguzhin Alexander Izmaylovich
Candidate of Technical Sciences, Associate Professor

Monov Ivan Evgenyevich
Senior lecturer

Tregubova Adelina Aleksandrovna
Master's student

Zaripov Boris Arturovich
Master's student
Ufa State Petroleum Technical University (USPTU)

注解。 在数字控制和监测系统中，来自连接到控制对象的传感器的信号经过时间离散化，并将基本控制算法的执行委托给计算机。 模数转换器用于将数据转换为数字形式。

从连续函数到离散函数的转变可以通过在离散时刻对连续函数进行采样来完成，这些采样彼此间隔相等的时间间隔。 然而，这种方法并不是最理想的。 在这种情况下，除了必要的样本之外，还会采集冗余的、不必要的样本。

不需要冗余样本来恢复连续功能。 它们的存在对于信息传输来说是不希望的，因为通信信道被占用的时间较长，需要具有更高带宽的信道。 当存储冗余样本时，所需的存储器大小增加，访问记录数据的时间增加。 将冗余信息输入计算机会影响数据处理的速度。

最佳离散化可以被认为是在最少数量的样本下以期望的精度提供连续函数的恢复的离散化。 这种离散化称为自适应，它是不均匀的。 在非均匀离散化中，样本之间的间隔会发生变化，以适应消息特征的变化。

自适应离散化方法的特点是算法、采样和恢复设备更复杂，但可以显着减少冗余样本的数量。

本文讨论了多时间间隔自适应采样器件的设计原理，这些器件最适合大信息流和多通道控制系统。

关键词： 离散化、自适应离散化、采样间隔、多重间隔、离散值、发生器、精密整流器、采样存储装置、比较器、模数转换器、数模转换器。

Annotation. *In digital control and monitoring systems, signals from sensors connected to control objects are subjected to time discretization, and the execution*

of basic control algorithms is entrusted to computers. Analog-to-digital converters are used to convert data into digital form.

Transition from a continuous function to a discrete function can be accomplished by taking samples of a continuous function at discrete moments of time, separated from each other by equal time intervals. However, this approach is suboptimal. In this case, in addition to the necessary samples, redundant, unnecessary samples are taken.

Redundant samples are not needed to restore a continuous function. Their presence is undesirable for information transmission, as the communication channel is occupied for a longer time, channels with higher bandwidth are required. When storing redundant samples, the required memory size increases, the time of access to the recorded data increases. Input of redundant information into the computer affects the speed of data processing.

The optimal discretization can be considered as a discretization that provides recovery of a continuous function with the desired accuracy at a minimum number of samples. Such discretization is called adaptive, it will be non-uniform. In non-uniform discretization, the interval between samples is varied to account for changes in the characteristics of the message.

Methods of adaptive discretization are characterized by more complex algorithms, sampling and recovery devices, but allow to significantly reduce the number of redundant samples.

The paper discusses the principles of device design for adaptive sampling with multiple time intervals, These devices are best suited for large information flows and multichannel control systems.

Keywords: Discretization, adaptive discretization, sampling interval, multiple interval, discrete value, generator, precision rectifier, sampling-storage device, comparator, analog-to-digital converter, digital-to-analog converter.

Introduction

In automatic control systems discretization of analog signals is used in converters of measuring information in feedback circuits with control objects [1].

In control systems the discretization of analog signals is used in digital converters of analog signals of threshold devices, as well as in converters of analog information into digital form with recording on a carrier for further processing with the help of computer technology [1].

1. Structural scheme

The structural diagram of the adaptive discretizer is shown in Figure 1. The input analog signal Vin is fed to the input amplifier (repeater). The output signal of the repeater is fed to the difference amplifier and to the sampling-storage device.
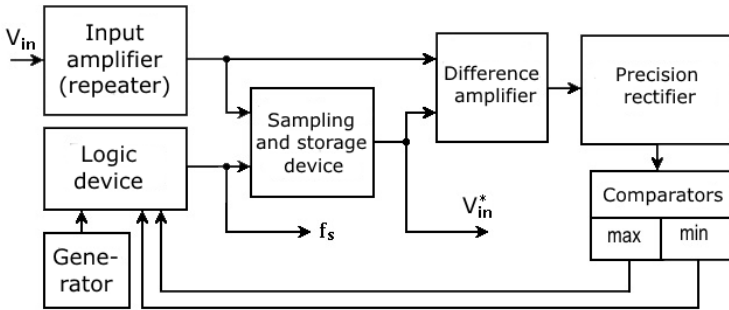
Figure 1. *Structural diagram of the adaptive sampling device*

The output of the sampling-storage device is connected to the second input of the difference amplifier. At the output of which is formed bipolar signal of the sampling error of the analog signal. This signal is converted by a precision rectifier into a unipolar signal, the amplitude of which corresponds to the sampling error. The signal of the precision rectifier is fed to the comparator block.

The left comparator is set to the maximum sampling error, the right one - to the minimum error. The outputs of the comparators are connected to a logic device. The output of the stable frequency generator is also connected to it.

When the sampling error increases (when the signal at the output of the precision rectifier increases), the signal at the output of the left comparator becomes equal to logical one. This leads to an increase in the sampling frequency and, consequently, to a decrease in the sampler error.

When the discretizer error decreases below the set limit, the signal at the output of the right comparator becomes equal to logical one, which leads to a decrease in the sampling frequency and, consequently, to stabilization of the discretizer error at the set lower level.

2. Functional diagram of the discretizer

The scheme is presented in Figure 2. It is performed in the EWB simulator, and it is possible to observe the operation of the adaptive discretizer and oscillograms at different points of the functional circuit. For this purpose: oscilloscope, function generator, analog-to-digital converter ADC and digital-to-analog converter DAC are additionally introduced into the circuit. Functional generator simulates the input analog signal, its output is connected to the input repeater (impedance converter), made on the amplifier A1. The output of the repeater is connected to the non-inverting input of the difference amplifier A3 (point 1 of the circuit) and to the input of the sampling-storage device (key S, capacitor C1, repeater on amplifier A2).
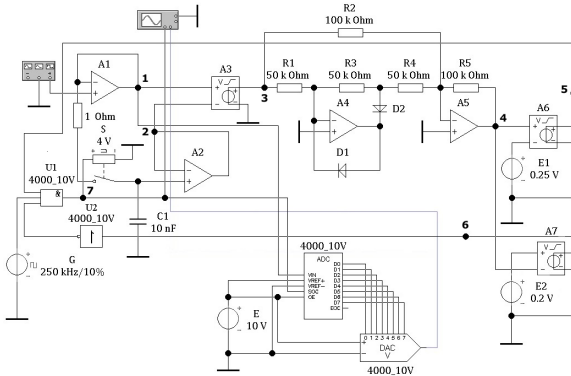
Figure 2. *Functional diagram of adaptive sampling device with multiple intervals*

The sampling-storage device [2] under control of the generator G and logic device on elements U1, U2 performs sampling of the input analog signal. The output of the sampling-storage device (point 2 of the scheme) is connected to the second input of the difference amplifier A3. At the output of A3 (point 3 of the circuit) the sampling error signal is formed. Oscillograms of voltages in the corresponding points are shown in Figure 3 and Figure 4.

The error signal is fed to the rectifier made on operational amplifiers A4, A5, diodes D1, D2 and resistors R1,..., R5. The rectifier is assembled according to the standard scheme [2]. The rectifier output (point 4 of the circuit) is connected to comparators A6, A7. Comparators A6 and A7 work in counter-phase. When the output of A6 (point 5 of the circuit) is logic one, the output of A7 (point 6 of the circuit) is logic zero, and the output of U2 is logic one.
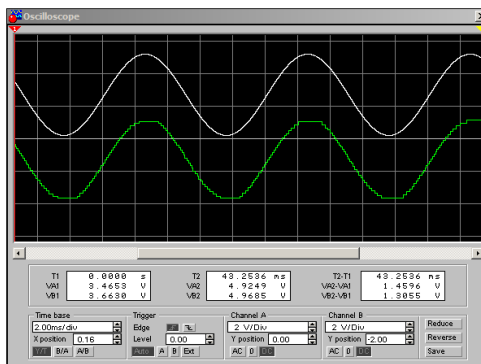
Figure 3. *Oscillograms of voltages at points 1 and 2 of the circuit*
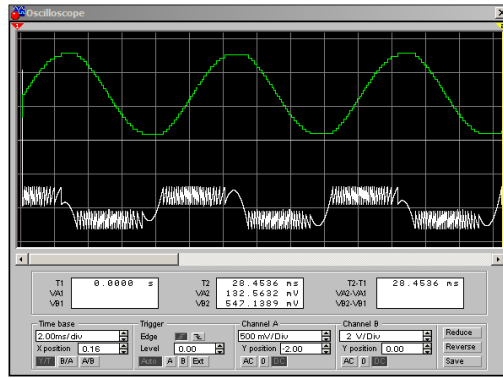
Figure 4. Oscillograms of voltages at points 2 and 3 of the circuit

As a result, the number of pulses coming from the output of element U1 (point 7 of the circuit) to the sampling-storage device increases, which is equivalent to reducing the sampling interval and reducing the sampler error. When the output of A6 is logic zero, the output of A7 is logic one, and the output of U2 is logic zero. As a result, the number of pulses arriving at the sampling-storage device decreases, which is equivalent to increasing the sampling interval and stabilizing the sampler error at a lower level.

Thus, the sampler works as a relay tracking system that stabilizes the sampling error within a given interval. A distinctive feature of such systems is their high performance. Figures 5 and 6 show oscillograms of voltages at points 2 and 7 of the circuit for different input analog signals. The upper oscillogram in Figure 5 and Figure 6 is the output of the sampling-storage device.

The upper oscillogram in Figure 5 and Figure 6 is the output of the sampling-storage device. The lower oscillogram is the sampling pulses. As can be seen from the oscillograms, the greater the first derivative of the analog signal, the higher the frequency of sampling pulses. And the reaction of the discretizer to the change of the input signal steepness is practically instantaneous. The upper and lower levels of sampling error on the functional diagram are set by sources E1 and E2. The analog-to-digital converter (ADC) [2], [3] receives discrete pulses of variable frequency and the input signal to be converted.
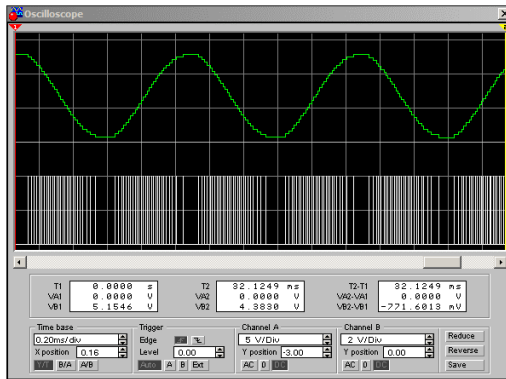
Figure 5. *Oscillograms of voltages at points 2 and 7 of the circuit for «sine»*
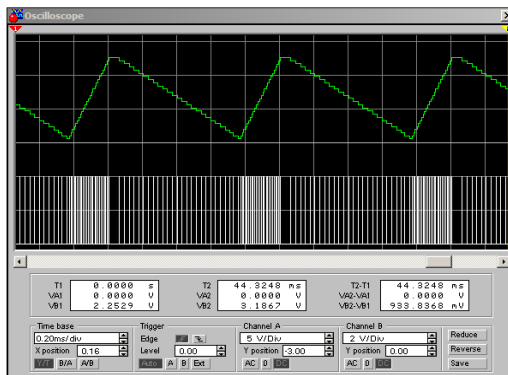
Figure 6. *Oscillograms of voltages at points 2 and 7 of the circuit for «triangle»*

The digital signal codes at the output of the analog-to-digital converter are arranged along the time axis at intervals that are multiples of the period of pulses produced by the generator G, which corresponds to the selected adaptive sampling algorithm.

The digital-to-analog converter (DAC) [2], [3] connected to the ADC outputs reconstructs the analog signal and thus shows the correct operation of the adaptive sampler. Figure 7 and Figure 8 shows the input analog signal and the signal after ADC and DAC conversion (point 8 of the schematic) for 100 Hz and 1 kHz.
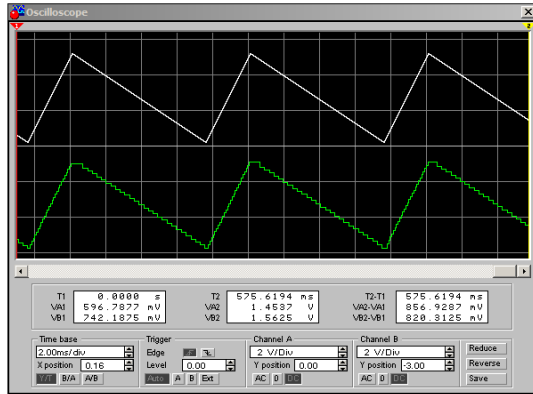
Figure 7. Oscillograms of voltages at points 1 and 8 of the circuit (f=100 Hz, fs=250 kHz)
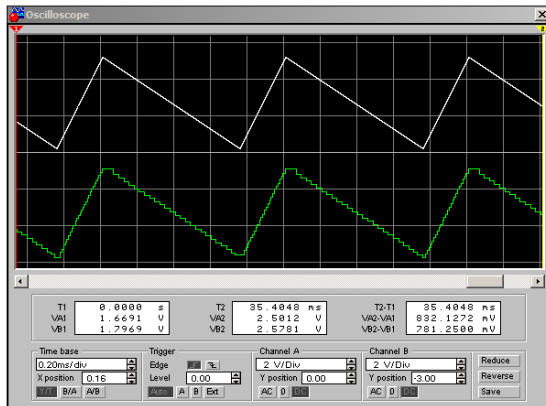
Figure 8. Oscillograms of voltages at points 1 and 8 of the circuit (f=1 kHz, fs=250 kHz)

3. Schematic realization

The circuit construction of the discretizer is one of the simplest for such devices. Devices containing elements A1, A3,...,A5 can be realized on operational amplifiers. The sampling-storage devices (A2, C1, key S) are available in integral version [2]. Comparators A6, A7, oscillator G are also available in integral version. As for the analog-to-digital converter (ADC) and digital-to-analog converter (DAC), these devices serve to illustrate the operation of the sampler. The same applies to the function generator and oscilloscope, which are included in the circuit in Figure 2.

4. Sampling interval

The minimum sampling interval $\varDelta t$ is set by the generator G. The value of $\varDelta t$ depends on the allowable maximum error on the sampling interval [4], [5].

Suppose $\varDelta x_m$ is the maximum modulo value of the sampling error on the observation interval T. Let us approximate the continuous function by a straight line between adjacent discrete values of one interval, Then we obtain that the sampling interval and the error $\varDelta x_m$ are related by the relation:

$$\varDelta x_m = tan(\alpha) \cdot \varDelta t,$$

where $tan(\alpha)$ is the tangent of the angle of slope of the straight line to the time axis.

Thus, the minimum sampling interval should be equal to:

$$\varDelta t_{min} = \varDelta x_m / tan(\alpha)_{max}.$$

At the same time, the maximum frequency for which the generator G is designed should be equal to

$$f_{sm} = tan(\alpha)_{max} / \varDelta x_m.$$

The maximum tangent of the angle of slope of the straight line to the time axis $tan(\alpha)_{max}$ can be estimated by a priori knowledge of the characteristics of the analog signal and by modeling on the function diagram in Figure 2.

5. Conclusions

1. The device of adaptive sampling of analog signals with multiple intervals will allow to convert analog signals into discrete signals in a large range of frequencies. The sampling frequency during the operation of the device is a multiple of the frequency of the reference oscillator, which facilitates synchronization of the discretizer with other devices of the digital control system.

2. The model of the discretizer in the electronic simulator is obtained. The model allows to trace the operation of the discretizer, to obtain experimentally the minimum necessary sampling interval, as well as to adjust the parameters of the discretizer for its further implementation.

3. The technical implementation of the discretizer is quite simple. It consists of widely used integrated circuits analog and pulse. In this case, the oscillator of the circuit is unregulated, it operates at a constant frequency. The multiple change of frequency is achieved through the use of a simple logic device.

List of used sources

1. *Baranov L. A. Level quantization and time discretization in digital control systems. - Moscow: Energoatomizdat, 1990. - 304 p.*

2. *Titze U., Schenk K. Semiconductor Circuit Engineering. 12th ed. Vol. II: Per. with German. - MOSCOW: DMK Press, 2007. - 942 p.*

3. Kuznetsov B.F. Electronic industrial devices. Textbook. Publisher: Angarsk State Technical Academy, 2010. - 151 p.

4. Legaev, V. P. Transformation of measurement signals : textbook / V. P. Legaev. - Vladimir: Vladimir State University Publishing House, 2019. - 151 p.

5. Digital signal processing / Yu.N. Matveev, K.K. Simonchik, A.Y. Tropchenko, M.V. Khitrov. - SPb: SPbNIU ITMO, 2013. - 166 p.

阿钦斯克远程供电系统无功横向容性补偿移动设备对电磁兼容影响的研究
INVESTIGATION OF THE INFLUENCE OF MOBILE DEVICES OF TRANSVERSE CAPACITIVE COMPENSATION OF REACTIVE POWER ON ELECTROMAGNETIC COMPATIBILITY IN THE ACHINSK DISTANCE POWER SUPPLY SYSTEM

Rubtsov Kirill Dmitrievich
Student
Krasnoyarsk Institute of Railway Transport - branch of
the Irkutsk State University of Transport,
Krasnoyarsk, Russia

Zhuiko Leonid Ivanovich
Candidate of Technical Sciences, Associate Professor
Krasnoyarsk Institute of Railway Transport - branch of the Irkutsk State
University of Transport,
Krasnoyarsk, Russia

抽象的。 本文研究了Achinsk供电距离系统中横向容性无功补偿移动设备对电磁兼容性的影响。 为此，文章作者考虑了阿钦斯克供电距离的现有供电系统，研究了现有的补偿装置及其在阿钦斯克供电距离使用时对电磁环境的影响。 作为这项工作的结果，本文的作者提出了补偿装置的最佳参数和运行模式，以确保阿钦斯克距离供电系统的电磁兼容性和电能质量。
文章作者相信本文将对无功补偿装置的开发和实施有所帮助。
关键词：无功功率、电磁兼容、补偿、供电距离、电压、牵引供电系统。

Abstract. This article conducts a study of the influence of mobile devices for transverse capacitive reactive power compensation on electromagnetic compatibility in the Achinsk power supply distance system. For this purpose, the authors of the article consider the existing power supply system at the Achinsk power supply distance, examine existing compensation devices and their impact on the electromagnetic environment when used at the Achinsk power supply distance. As a result of the work, the authors of the article presented the optimal parameters and operating modes of compensation devices that ensure electromagnetic compatibility and the quality of electrical energy in the power supply system of the Achinsk distance.

The authors of the article believe that this article will be useful in the development and implementation of reactive power compensation devices.

Keywords: *reactive power, electromagnetic compatibility, compensation, power supply distance, voltage, traction power supply systems.*

JSC Russian Railways pays special attention to the problem of electromagnetic compatibility (EMC), since this problem is an important aspect in power supply systems (PSS). Electromagnetic compatibility determines the quality of electricity and the reliability of electrical equipment. Therefore, in conditions of increasing load on the power supply system (PSS) and the use of modern devices, the problem of electromagnetic compatibility (EMC) is increasingly relevant [1,2].

One of the ways to improve electromagnetic compatibility (EMC) is to use mobile (mobile) transverse capacitive reactive power compensation devices. These devices help compensate for reactive power, which in turn leads to a reduction in electrical energy (EE) losses, improvement in the quality of electrical energy (EE) and helps reduce the impact on the electromagnetic environment (EME) [3,4,5].

To study the influence of mobile (mobile) devices for transverse capacitive compensation of reactive power on electromagnetic compatibility in the power supply system of the Achinsk distance, we will take a specific section of the Achinsk-I - Chernorechenskaya railway.

In this section, a two-way parallel power supply circuit for the contact network (CN) is used. This section includes one intersubstation zone (ISZ) between two traction substations (TS) TP Achinsk-I and TP Chernorechenskaya, on which a sectioning post (SP) Tarutino and a parallel connection point (PCS) Salyrka are installed. Figure 1 shows the track profile of the railway section under study.
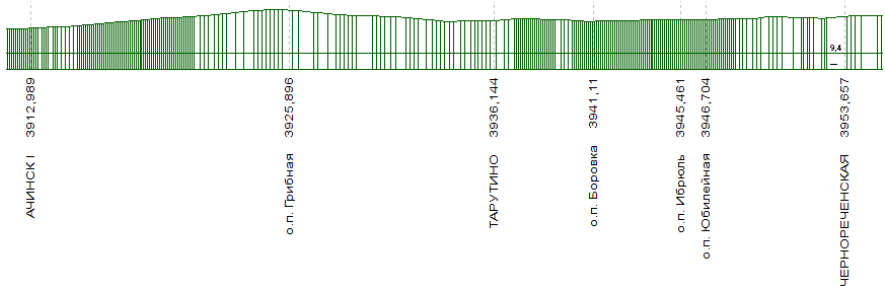
Figure 1. *Track profile of the Achinsk-I – Chernorechenskaya railway section*

According to Figure 1, we see that on the Achinsk-I - Chernorechenskaya section of the Achinsk power supply distance (EC-2) there is a long rise on the

Achinsk-I - Tarutino section. This section is one of the most difficult along the entire Achinsk distance for heavy freight trains.

Figure 2 shows a diagram of the analyzed section Achinsk-I - Chernorechenskaya.

At the moment in time, reactive power compensation devices (CD) are not used on the railway section under study. This complicates the passage of freight trains of increased weight. Therefore, in this area it is planned to install an adjustable device for transverse reactive power compensation through the installation of a static reactive power generator (SRPG).

It is also possible to install an unregulated compensating device (ACD) with a power of 9.3 MVAr and an adjustable compensating device (ACD) with a power of 11.6 MVAr.

Table 1 shows the data on the available daily capacity when passing heavy trains for the odd and even directions of the design section Achinsk-I - Chernorechenskaya. For this purpose, the throughput capacity is calculated in the "COR-TES" software package.
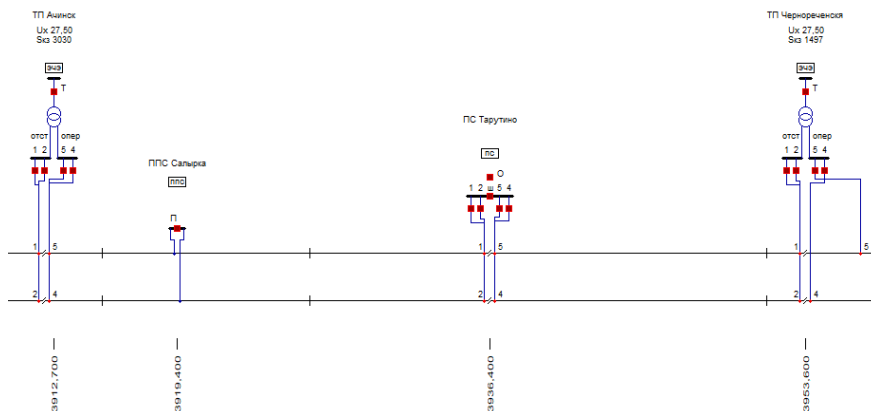
Figure 2. *Scheme of the Achinsk-I - Chernorechenskaya section*

Table 1.

Available daily capacity when passing heavy trains for the odd and even directions of the calculated section Achinsk-I - Chernorechenskaya

ISZ	Pnt	Voltage	Heating of CN wires	Final
1	2	3	4	5
Before amplification	60/56	74/69	159/150	60/56
UCD 9.3 MVAr	68/64	87/82	159/150	68/64
RCD 11.6 MVAr	70/66	87/82	159/150	70/66

2 tr-rs	106/100	106/100	159/150	106/100
UCD 9.3 MVAr + 2 transformers	120/112	106/100	159/150	106/100
RCD 11.6 MVAr + 2 transformers	120/112	120/112	159/150	120/112

Having analyzed Table 1, we can conclude that, according to the calculation results, the available daily capacity of freight trains before the strengthening was 60 pairs of trains per day in the odd direction and 56 pairs of trains in the even direction.

For further research, it is necessary to determine the effect of mobile transverse capacitive reactive power compensation devices on electromagnetic compatibility. For this purpose, data was collected on the parameters of the power supply system, including voltage, current, power. Measurements were taken before installing transverse capacitive reactive power compensation devices (Table 2).

Table 2.

Active and reactive power consumption, reactive power factor at TS Achinsk-I, Chernorechenskaya and ISZ

Amplification method	Traction substation	Power consumption		tgφ	cosφ	kпер	Tempera-ture, °C	
		Active, kWh	Reactive, kWh				wind-ings	oils
1	2	3	4	5	6	7	8	9
Original circuit	Achinsk-I	219 296	263 164	1,20	0,64	1,20	121	96
	Chernorech-enskaya	275 603	366 141	1,33	0,60	1,62	137	106
	ISZ	494 899	800 593	1,62	0,53	–	–	–

Since reactive power compensation installations are not used in this area, it is necessary to carry out modeling in the "CORTES" software package. The simulation results are presented in Table 3.

According to the data given in Table 2 and the modeling results (Table 3), we can conclude that the use of transverse reactive power compensation devices is effective, since the percentage of total compensated reactive energy for the installation of UCD is 21%, and for UCD 26%, which in turn turn, has a beneficial effect on the power factor. Also, when using CD, a more favorable operating mode of transformers is achieved by reducing the overload factor, the temperature of the transformer windings and transformer oil, which increases its service life.

Table 3.
Simulation results

Amplification method	Traction sub-station	Power consumption		tgφ	cosφ	kпер	Temperature, °C	
		Active, kWh	Reactive, kWh				windings	oils
1	2	3	4	5	6	7	8	9
UCD 9.3 MVAr	Achinsk-I	229 811	189 859	0,83	0,77	1,09	100	82
	Chernorechen-skaya	281 364	260 725	0,93	0,73	1,50	114	91
	ISZ	511 175	681 414	1,33	0,60	–	–	–
RCD 11.6 MVAr	Achinsk-I	232 765	169 959	0,73	0,81	1,06	98	80
	Chernorechen-skaya	283 085	232 321	0,82	0,77	1,46	110	87
	ISZ	515 850	654 164	1,27	0,62	–	–	–
Two transform-ers	Achinsk-I	225 419	270 013	1,20	0,64	0,59	71	65
	Chernorechen-skaya	294 814	390 940	1,33	0,60	0,92	85	74
	ISZ	520 233	841 131	1,62	0,53	–	–	–
UCD9.3 MVAr+ Two transform-ers	Achinsk-I	235 660	195 408	0,83	0,77	0,53	69	65
	Chernorechen-skaya	293 527	270 704	0,92	0,74	0,83	77	69
	ISZ	529 187	705 194	1,33	0,60	–	–	–
RCD11.6 MVAr + Two trans-formers	Achinsk-I	238 618	175 685	0,74	0,81	0,52	69	65
	Chernorechen-skaya	293 532	239 347	0,82	0,78	0,81	76	67
	ISZ	532 150	674 859	1,27	0,62	–	–	–

Calculation of electromagnetic compatibility indicators

For further assessment, it is necessary to calculate electromagnetic compatibility indicators. Since reactive power compensation devices are not currently used on the section of the Achinsk-I - Chernorechenskaya railway, it is necessary to calculate the electromagnetic compatibility indicators on the section Achinsk-I - Chernorechenskaya.

For the calculation, I chose the "EMC Planner" program, which is designed for calculating electromagnetic compatibility. The program allows you to perform electromagnetic compatibility assessments operating in the range 27 – MHz – 40 GHz in accordance with GOST R 55 898-2013 "Technical means of radio communications". This program is suitable for specialists involved in the design and commissioning and ensuring electromagnetic compatibility of objects.

Electromagnetic compatibility research will be carried out according to the following parameters:
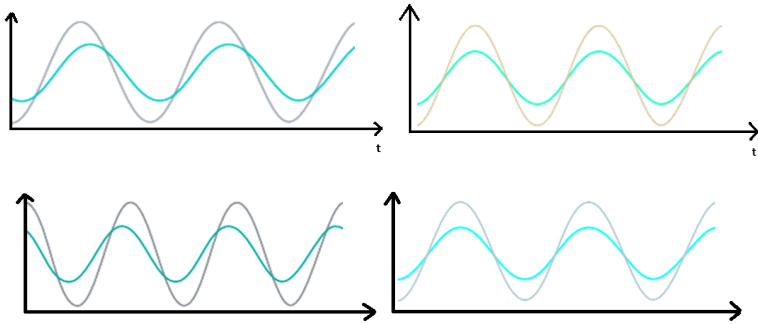
1. Real-time control of reactive power flow between source and consumer;

2. Active filtering of higher harmonics and subharmonics of current;

3. Phase-by-phase voltage balancing due to compensation of negative and zero sequence current;

4. Regulation, maintaining the supply voltage at the required level.

To study the electromagnetic compatibility of the Achinsk-I - Chernorechen-skaya section, we create the necessary model in the «EMC Planner» program and study it according to the parameters specified above.

1. Real-time control of reactive power flow between source and consumer

A) Modeling before strengthening the traction power supply system (SPS), initial diagram (Figure 3a, Figure 3c);

B) Modeling after strengthening the traction power supply system (TPS), due to the installation of a mobile device for transverse capacitive compensation of reactive power (Figure 3b, Figure 3d).

Figure 3. *Real-time control of reactive power flow between source and consumer*

According to the modeling presented in Figure 3, we can conclude that without the use of mobile devices for transverse capacitive compensation of reactive power on the Achinsk-I - Chernorechenskaya section, electrical installations with direct energy flow will be consumers of reactive power of an inductive nature (inductive current), which in turn characterized by a lag between the current and the voltage (Figure 3a).

Also, in the reverse energy flow mode, reactive power sources will have a capacitive nature. Therefore, in this mode, the current will lead the voltage (Figure 3c).

From Figure 3b, we can conclude that when using mobile devices for transverse capacitive reactive power compensation, the installation generates a capacitive current (the current phase advances the voltage phase), compensating for the inductive component of the load current. The result will be: the current and voltage in the network are in phase.

If, when using mobile devices for transverse capacitive reactive power compensation, the installation generates an inductive current (the current phase lags behind the voltage phase), compensating for the capacitive component of the load current. Result: the current and voltage in the network are in phase.

2. Active filtering of higher harmonics and subharmonics of current

Active filtering of higher harmonics and subharmonics of current in the Achinsk-I – Chernorechenskaya section makes it possible to improve the quality of electricity, reduce losses of electrical energy and increase the efficiency of the system. In turn, active filtering of higher harmonics and subharmonics of the current helps to improve electromagnetic compatibility in the power supply system of the Achinsk distance.
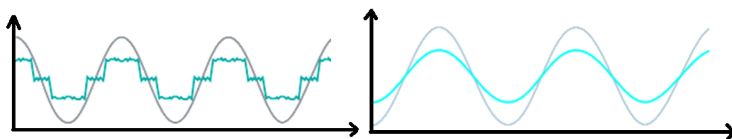
Figure 5. *Active harmonic filtering before and after amplification*

From Figure 5 we can conclude that before strengthening the Achinsk-I – Chernorechenskaya section, the current consumed by the nonlinear load contains higher-order harmonics (Figure 5a). When using mobile devices for transverse capacitive compensation of reactive power, the installation generates a total current containing higher harmonics, which have the opposite phase to the higher harmonics in the network (Figure 5b).

3. Phase-by-phase voltage balancing due to compensation of negative and zero sequence current

Phase balancing allows you to eliminate asymmetry caused by load imbalance in phases. This leads to equalization of voltages in the phases, improving the quality of electrical energy.
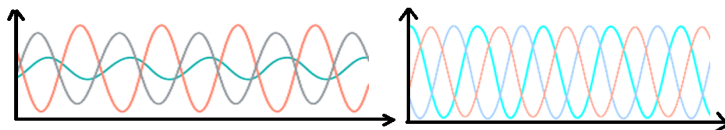
Figure 6. *Phase-by-phase voltage balancing of the design section*

Without the use of mobile devices for transverse capacitive compensation of reactive power, the operation of the power supply system is carried out in an asymmetrical mode (Figure 6a). When using mobile transverse capacitive compensation devices, current symmetry is ensured by compensating negative sequence currents.

4. Regulation, maintaining the supply voltage at the required level

This aspect is important in ensuring reliable operation of electrical equipment and systems at the Achinsk power supply distance (in particular, in the study area).
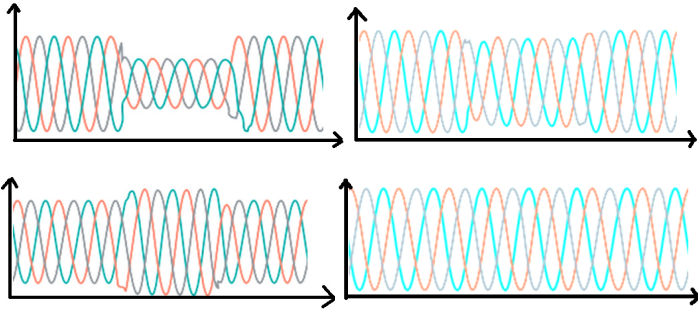
Figure 7. *Regulation and maintenance of supply voltage at the required level for the Achinsk-I – Chernorechenskaya section*

Thus, if there is a sag in the network voltage (Figure 7a), then the mobile installation will maintain the voltage by generating a capacitive current. If, on the contrary, the voltage is exceeded, the mobile installation will generate an inductive current to maintain the voltage level.

Thus, mobile devices for transverse capacitive compensation of reactive power are an effective way to improve electromagnetic compatibility in power supply systems of the Achinsk distance. The introduction of these devices at the Achinsk power supply distance will reduce the cost of electrical energy and increase the reliability of electrical equipment. Also, the use of mobile devices for transverse capacitive reactive power compensation is one of the effective ways to improve electromagnetic compatibility (EMC) in power supply systems.

References

1. Rubtsov, K. D. Application of longitudinal and transverse compensation at the Minino station / K. D. Rubtsov, P. O. Chinkov // Youth science: proceedings of the XXVI All-Russian student scientific and practical conference KrIRT ISTU, Krasnoyarsk, April 22, 2022 . Volume 1. – Krasnoyarsk: Krasnoyarsk Institute of Railway Transport - branch of the Irkutsk State Transport University, 2022. – P. 138-141. – EDN FFZQBR.

2. Valyanov, D. P. Increasing capacity on the Kemchug - Kacha section due to the installation of transverse capacitive compensation of reactive power / D. P. Valyanov, A. A. Naumenko, K. D. Rubtsov // Youth science: Proceedings of

the XXVII All-Russian student scientific and practical conference KrIRT ISTU, Krasnoyarsk, April 20, 2023 / Editorial Board: V.A. Pomortsev (responsible editor) [and others]. Volume 1. – Krasnoyarsk: Krasnoyarsk Institute of Railway Transport - branch of the federal state budgetary educational institution of higher education «Irkutsk State Transport University», 2023. – P. 39-44. – EDN NKTEXJ.

3. Cheremisin, V. T. Comparison of energy indicators of adjustable devices for transverse compensation of reactive power under operating conditions at sectioning posts / V. T. Cheremisin, A. V. Nikonov // Transport of the Urals. – 2018. – No. 1(56). – P. 30-34. – DOI 10.20291/1815-9400-2018-1-30-34. – EDN XNZIAX.

4. Adjustable installation of transverse capacitive compensation in an alternating current traction network / L. A. German, A. A. Karabanov, V. P. Goncharenko, A. S. Serebryakov // Electronics and electrical equipment of transport. – 2022. – No. 1. – P. 10-17. – EDN QWYVYV.

5. German, L. A. Increasing the railway capacity with the installation of reactive power compensation / L. A. German // Bulletin of the Scientific Research Institute of Railway Transport. – 2021. – V. 80, No. 1. – P. 35-44. – DOI 10.21780/2223-9731-2021-80-1-35-44. – EDN IPKANR.

阈值数据分离方法比较
COMPARISON OF THRESHOLD DATA SEPARATION METHODS

Mikhailishin Andrei Sergeevich
Student
Institute of Mechanics, Mathematics and Computer Sciences named
after Vorovich Southern Federal University,
Rostov-on-Don, Russia

Mogilevskaya Nadezhda Sergeevna
Candidate of Technical Sciences, Associate Professor
Institute of Mechanics, Mathematics and Computer Sciences named
after Vorovich Southern Federal University,
Rostov-on-Don, Russia

注解。 使用阈值数据分离方法可以组织容错的分布式数据存储。 本文讨论了两种这样的方法。 根据研究和分析的结果，指出了它们的优点和缺点。 这些方法是在软件中实现的。 进行实验来评估方法的冗余性。

关键词：阈值数据分离方法、分布式存储系统、冗余残差类系统、容错数据存储、伽罗瓦域。

Annotation. *Threshold data separation methods can be used to organize fault-tolerant distributed data storage. This paper discusses two such methods. Based on the results of their study and analysis, their advantages and disadvantages are indicated. The methods are implemented in software. Experiments were conducted to assess the redundancy of methods.*

Keywords: *threshold data separation method, distributed storage system, redundant residual class system, fault-tolerant data storage, Galois fields.*

Introduction.

One of the ways to ensure reliability, fault tolerance and availability of stored or transmitted data is to use threshold data separation methods [1, 2, 3]. The basic idea behind such methods is that the source data is divided into several parts in a special way. These parts can then be stored or transferred separately. The assembly of the source data is possible even if some of the parts are lost or damaged.

This work discusses a data separation method based on a redundant system of residual classes (the RSRC method) [1] and a method based on working with matrices of the Vandermonde matrix type and Galois fields of prime cardinality [3]. Further, for convenience, we will call this method by the first letters of the names of its authors (A. G. Tormasov, M. A. Khasin, Y. I. Pakhomov), namely the TKP method.

The purpose of the work is a comparative analysis of these methods. To achieve the goal, the methods were implemented in software, then, using the software implementation, experiments were carried out to evaluate their properties and develop recommendations for their use.

Section 1 of the work based on materials from [1] describes the method for separating IRS data; in Section 2 based on materials from [3, 4] the method of TKP threshold data separation is described. Section 3 is devoted to highlighting the advantages and disadvantages of the methods and comparing them.

1. RSRC method.

Let us consider the method of dividing the RSRC data. Any data in bit form can be represented as a number A. In the RSRC method, modulo division is used for encoding, that is, the number A is represented as the following sequence of remainders:

$$A = (a_1, a_2, \ldots, a_n), \text{ Where } a_i = A \bmod p_i i = 1, \ldots, n \tag{1}$$

where $\{p_1, p_2, \ldots, p_n\}$ is a set of relatively prime numbers or bases, of which the first k bases $\{p_1, p_2, \ldots, p_k\}$ are called working bases, and the subsequent bases $\{p_{k+1}, p_{k+2}, \ldots, p_n\}$ are called redundant. Product of working bases

$$P_k = \prod_{i=1}^{k} p_i \tag{2}$$

is called the working range of number representation, and the product of all bases

$$P_n = \prod_{i=1}^{n} p_i \tag{3}$$

called full range. According to the Chinese remainder theorem [1], the representation of a number in the sequence (1) is unique when $A \in [0, P_k)$, the RSRC method uses this principle by adding additional coprime remainders. The representation of the number A remains unique, but now it becomes possible to reconstruct the number A from any set of numbers k in the sequence (1).

To restore a number from a certain set of remainders from (1) A we will need to calculate a set of orthogonal bases for them $\mathbf{B}$ [1], the bases depend only on the base system and do not depend on the number A, therefore they can be calculated in advance. Restoring the number will look like this:

$$A = \left| \sum_{i=1}^{n} a_i \cdot B_i^{(k)} \right|_{P_k}, \text{ Where } B_i^{(k)} = \frac{P_i}{P_k} \left(\frac{P_i}{P_k} \bmod p_i \right) \tag{4}$$

If set (1) was damaged during its storage and transmission over communication lines, i.e. set received

$$A' = (a'_1, a'_2, \ldots, a'_n), \tag{5}$$

then you can try to reconstruct the number using the maximum likelihood projection method [1]. The maximum number of errors for which correct recovery is possible does not exceed half the number of control values [1]

$$q = \left\lfloor \frac{n-k}{2} \right\rfloor. \tag{6}$$

To restore A, it is enough to use arbitrary residues from the available n residues of decomposition (5). In what follows, sets of k remainders will be called projections. Note that an arbitrary a_i remainder can be included in several projections. If distorted residuals are used in the projection used for A reconstruction, then the result of applying formula (4) to the projection will lie outside the range and must lie in the range $[0, P_k)$, otherwise, if all of the k residuals used are undistorted, then the result of calculation (4) will lie in the range $[0, P_k)$.

To restore A, perform the following steps for each projection. Using the projection $a_{g(1)}, a_{g(2)}, \ldots, a_{g(k)}$ obtained from the bases $P_{g(1)}, P_{g(2)}, \ldots, P_{g(k)}$, we calculate

$$A^\Delta = \left| \sum_{i=1}^{k} a'_{g(i)} \cdot B_i^\Delta \right|_{P_\Delta} \tag{7}$$

Where

$$B^\Delta = \{B_1^\Delta, \ldots, B_k^\Delta\}, \ B_i^\Delta = \frac{P_i}{P_\Delta}\left(\frac{P_i}{P_\Delta} \bmod p_i\right), \ P_\Delta = \prod_{i=1}^{k} P_{g(i)} \tag{8}$$

If $A^\Delta \notin [0, P_k)$, then the current projection is discarded. If $A^\Delta \notin [0, P_k)$, then we assume that the A sought value coincides with the found value A^Δ. Next, you need to convert A^Δ to a set of residues $(a_1^\Delta, a_2^\Delta, \ldots, a_n^\Delta)$ and calculate the Hamming d distance between the vectors $(a_1^\Delta, a_2^\Delta, \ldots, a_n^\Delta)$ and $(a'_1, a'_2, \ldots, a'_n)$. If $d \leq q$ then A^Δ declared as a corrected number, otherwise the current projection is discarded.

Further, if we need to restore the distorted residues in the vector $(a'_1, a'_2, \ldots, a'_n)$, then we can simply replace those that differ from the restored vector $(a_1^\Delta, a_2^\Delta, \ldots, a_n^\Delta)$

2. TKP method

Let us consider the method of TKP (n, k)-threshold data separation [4]. The matrix plays an important role in the method

$$V = \begin{pmatrix} 1 & x_1 & \cdots & x_1^{k-1} \\ 1 & x_2 & \cdots & x_2^{k-1} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_n & \cdots & x_n^{k-1} \end{pmatrix}, \tag{9}$$

where x_i is the generating element of the Galois field F_p, $p > 2$, n and k are the parameters of the TKP method, and $k < n$. It is easy to see that the rows of the matrix V are linearly independent, since it is structurally similar to the Vandermonde matrix.

Let us consider algorithms for data separation and recovery. The division algorithm receives as input the method parameters p, n and k, as well as the original number A. We break A the Galois field F_p into elements and write them down line

by line in the form of a matrix M of rows k and n columns. Calculating the product of matrices

$$VM = R = \begin{pmatrix} R_1 \\ \vdots \\ R_n \end{pmatrix}. \tag{10}$$

The rows R_i, $i = 1..n$ of the resulting matrix contain the final shares (parts), from which it will be possible to restore the original A one in the future.

The data recovery algorithm receives the input k of various shares R_i and the method parameters p, n and k. We form a matrix from the available shares k

$$R' = \begin{pmatrix} R_{i_1} \\ \vdots \\ R_{i_k} \end{pmatrix}. \tag{11}$$

Then we build a matrix V (see (2.1)) and from its rows, we form a new matrix

$$V' = \begin{pmatrix} V_{i_1} \\ \vdots \\ V_{i_k} \end{pmatrix} = \begin{pmatrix} 1 & x_{i_1} & \cdots & x_{i_1}^{k-1} \\ 1 & x_{i_2} & \cdots & x_{i_2}^{k-1} \\ \vdots & \vdots & \ddots & \vdots \\ 1 & x_{i_k} & \cdots & x_{i_k}^{k-1} \end{pmatrix}. \tag{12}$$

We calculate

$$M' = (V')^{-1} R'. \tag{13}$$

By reading the matrix M' elements line by line, we get the original number A.

3. Comparison of methods.

An analysis of the data separation methods studied showed that the TKP method works on Galois fields of any power above 2; including over the fields of characteristic 2, which makes it possible to use fast computational algorithms in the method. The method uses a computationally intensive matrix inversion operation (see (13)), but there is a finite set of possible V' matrices; therefore, these matrices can be calculated in advance. In [4] it is shown that the redundancy of the TKP method in the case of working with Galois fields of simple power is higher than in the case of working with fields of characteristic 2.

The RSRC method works with data defined over Galois fields of simple cardinality, which implies non-optimal storage of projections a_i. Compared to the TKP method, it has the advantage of being able to identify errors when restoring a number, and therefore have the ability to correct errors that occur during storage, transmission or encoding of information. A computationally difficult task in the RSRC method is the calculation of orthogonal bases B^Δ (8), but there is a finite number of such possible bases, so they can be calculated in advance. Note that for RSRC, storing all bases will take less memory than storing all inverse matrices for TKP.

Experiments were conducted in the MAPLE environment to evaluate the redundancy of the methods. For the experiments, two files with sizes of 95232 bits and 952320 bits were used. Method parameters: $n = 17$, $k = 8$. For the TKP method the most optimal Galois fields in terms of redundancy were used - binary ones. A

comparative analysis showed a gain in redundancy for the RSRC method. The results are shown in Table 1.

Comparison of redundancy for TKP and RSRC methods

Input data size, bits	Encoding method	TKP parameters, Galois field	Total volume of all shares, bits	Redundancy (Total shares/size of original data)
95 232	RSRC	—	202 385	~2.125
95 232	TKP	F_{256}	203 456	~2.136
952 320	RSRC	—	2,023,697	~2.125
952 320	TKP	F_{1024}	2,312,000	~2.428

Such a gain in redundancy for the RSRC method can be explained by the fact that for these method individual keys can be generated for each object, and for the TKP method, a matrix of a certain dimension is used - such that a binary Galois field is used. If you use other fields, the redundancy may decrease, but this will dramatically affect performance.

Conclusion. This paper studies the properties of two methods of threshold data separation, namely, the RSRC and TKP methods. The methods are implemented in software. Experiments have shown that the redundancy of the RSRC method is less than the redundancy of the TKP method. It should also be noted that there is a dependence of redundancy on the choice of parameters for encoding.

References

1. Nazarov, A. S. Development of methods and algorithms for constructing fault-tolerant distributed data storage systems based on modular arithmetic:dis. ...cand. tech. Sciences: 05.13.18. –North Caucasus Federal University, Stavropol, 2019 - 272 p.

2. Mogilevskaya NS Data Sharing Method with Error Protection of Shares. 2023 IEEE 17th International Conference on Application of Information and Communication Technologies (AICT), Baku, Azerbaijan, 2023, pp. 1-6, doi: 10.1109/AICT59525.2023.10313186.

3. Tormasov, A. G. Model of distributed data storage with adjustable redundancy / A. G. Tormasov, M. A. Khasin, Yu. I. Pakhomov // Researched in Russia: [site]. — 2001 — No. 1–4 — P. 355–364. — URL: http://zhurnal.ape. relarn.ru/articles/2001/035.pdf (access date: 11/11/2022).

4. Gurova S.E., Mogilevskaya N.S. INCREASING THE EFFICIENCY OF ONE METHOD OF THRESHOLD DATA SEPARATION // Young Don Researcher. 2023. No. 2 (41). URL: https://cyberleninka.ru/article/n/povyshenie-effektivnosti-odnogo-metoda-porogovogo-razdeleniya-dannyh (date of access: 04/06/2024).

世界展览的建筑：关于寻找国家认同的问题
ARCHITECTURE OF WORLD EXHIBITIONS: ON THE ISSUE OF THE SEARCH FOR NATIONAL IDENTITY

Konovalova Nina Anatolievna
Ph.D. in History of Arts, Deputy Director for Science
Scientific Research Institute of the Theory and History of Architecture
and Urban Planning - branch of the Central Scientific-Research and
Project Institute of the Construction Ministry of Russia

注解。 自从世界博览会（1851年）等国际节日出现以来，其准备工作无一例外地包括创建"新建筑"。 寻找建筑的"新"是世界展览组织最初的主要想法。 在主要展览设施、国家馆的建设过程中，始终试图实现其主要目标，即创建实验性建筑结构或展示创新的建筑技术（即展望未来的建筑）。 同时，有必要展示民族建筑的传统（即实现昨天的一天）。 由此，世博会创造了一种独特的现代建筑，它将某个国家的过去和未来连接成一个"语义结"。 组合旨在强调特定国家历史、文化和传统的独特性/在打造世博会国家馆的建筑和艺术形象时，每个国家都面临着在现代建筑中寻找和识别国家认同的挑战 。 文章在寻找建筑民族认同的基础上，分析了不同国家在世界展览建筑中塑造自己形象的策略。
关键词：现代建筑、民族认同的探索、世界展览。

Annotation. Since the advent of such international festivals as the World Exhibitions or Expo (1851), preparations for them have invariably included the creation of a "new architecture". The search for the "new" in architecture was the main initial idea of World Exhibitions organization. The process of construction of the main exhibition facilities, national pavilions always tries to attain its main goal which is to create experimental building structures or to present innovative construction technologies (i.e., to look into the architecture of tomorrow). At the same time, it is necessary to show the traditions of national architecture (i.e. to actualize yesterday's day). Thus, a unique kind of modern architecture is created at World Exhibitions, which should link the past and future of a particular country into a "semantic knot". The combination aims to emphasize the uniqueness of the history, culture and traditions of a particular country/ When creating an architectural and artistic image of the national pavilion for the World Exhibition, each country faces the challenge of search and identification of national identity in modern architecture. The article analyzes the strategies of different countries

to create their own image in the architecture of World Exhibitions based on the search for national identity in architecture.

Keywords: *modern architecture, the search for national identity, World exhibitions.*

The history of World Exhibitions (or Expo) started in 1851 and continues until modern days. Expo has become the largest international event aimed at demonstrating achievements in science, technology, industry and art. It is no coincidence that the largest World exhibitions are evaluated by contemporaries as "the concentration of the most important interests of mankind", "the ideology of the epoch", "the results of the century"[1,2]. But the main point of exhibitions of this kind and level is that they are not a parade of merchandize, but a parade of states. Exhibitions of this status are designed to highlight the economic, socio-cultural, and political situation of the countries participating in them and to show the successes of a particular country in science, technology, and art. All this is demonstrated, first of all, by means of architecture.

Architecture has been the main symbol of World Exhibitions since 1867. In the span of the Paris Expo the expositions of the participating countries began to be placed in temporary buildings specially built by them - national pavilions. At the exhibition areas of Expo 1867, visitors could see a Russian hut, an oriental minaret, Turkish baths, a Chinese theater, an American ranch, a Dutch farm, and even the "restored" catacombs of Rome. This is how national pavilions became the central exhibit discussed at the Expo. This led to development of the concept of national pavilions, that embody the values of different cultures, nourished by each country trying to demonstrate its own version of combining the traditions of its own culture with the latest technologies and modern worldview. Intercultural differences in values, signs and symbols are revealed primarily in the exhibition halls, giving them that national identity that makes them recognizable. At the same time, each participating country should refract its cultural traditions in the light of the ideas that set the theme of the exhibition when designing the national pavilion.

The history of World Exhibitions shows that the temporary sites created at them serve as experiment fields, where countries can realize their wildest ideas and test new technologies. This attracts interest of specialists in various fields of knowledge and makes them focus their attention at the World Exhibitions. And due to the fact that recently World Exhibitions have become a vivid show combining architectural, scientific and technological progress, millions of people are eager to see the experiments prepared for them by different nations. The history of modern architecture also constantly refers to exhibitions and innovations introduced there, that revealed new possibilities for the artistic language of architecture and innovative approaches to construction techniques implementation.

Most of the projects are selected by the participating countries to represent them at the Expo due to their excellency in engineering, technical, but it is equally significant to verify if they have reached a certain level in architectural and artistic terms or are highly appreciated as an impetus for the future development of architecture. We cannot attribute responsibility for the development of historical ideas about "modern architecture" only to the pavilions of World Exhibitions, but it is also impossible to ignore their significant influence on this process. For more than a century and a half of the history of the Expo, both the general approaches and concepts of the architecture of exhibition facilities have changed, as well as the logic of presenting each country with the peculiarities of its culture. There are countries that create the image of their pavilion obeying their own internal logic and developing a long-chosen line of ideas and symbols during participation in the last World Exhibitions of the third millennium.

At each World Exhibition, even in the modern age, you can find a number of countries that strive to reproduce a fragment of an outstanding architectural masterpieces from their own history or decorate their exhibition pavilion national ornaments of a large scale. All this aims to convey an unambiguous reading of the nationality of the exhibition building to all visitors. Nevertheless, this path is considered to be the easiest in terms of national identity representation. Some countries choose a more complicated approach, which is based on a creative understanding of the traditions of their own culture, their refraction in the light of the search for the architecture of the future.

Poland, for example, at World Exhibitions constantly uses an ornament, but does not do it "head-on", but very subtly and creatively. The facade of the Polish pavilion at Expo 2010 (Fig.1) was perforated with a traditional Polish pattern. During the day, the sun's rays penetrated through it, in the evening this intricate ligature shone from the inside, turning the building into a patterned openwork. At Expo 2015, a similar effect was achieved by using apple crates, from which the Polish pavilion was assembled (Fig. 2). The arrangement of wooden boxes with the formation of voids on the facades could also be "read" as an openwork ornament. During the pavilion construction, several levels of perception were calculated, depending on the scale. The image of the building changed depending on the visible number of details. From a distance, the structure looked like a packaging container for transporting vegetables or fruits, from a closer distance one could see the openwork walls, which are a fragile barrier and let sunlight and wind into the interior. And only the visitors of the pavilion, who had access to a micro-scale, could get an accurate idea of the modularity of the design and the purpose of each of the links. The facade of the wooden pavilion, which Poland presented at Expo 2020 (Fig.3), was decorated with a kinetic sculpture depicting flying birds. This lightweight permeable sculptural composition was extremely dynamic. Every

breath of wind set them in motion, which changed the overall pattern of the facade and allowed one to hear the rustle of "bird wings".

Figure 1. Polish pavilion at Expo-2010

Figure 2. Polish pavilion at Expo-2015

Figure 3. Polish pavilion at Expo-2020

Having become the host of the 2015 World Expo, Italy erected a large–scale structure, calling it the "Palace of Italy" (Fig.4). The pavilion created the image of a genuine palace - the building had classic proportions and a special geometry that included historical architecture. However, Italy had used this strategy of presenting its culture before. The Italian Pavilion at Expo 2010 (fig.5) also embodied the image of a palazzo. The created exhibition space served the purpose of, on the one hand, to show the preserved cultural heritage of Ancient Rome, and on the other hand, to present a dynamically developing country. The exterior of the building was a movable mosaic, the parts of which assembled into a variety of patterns. The facade of the pavilion consisted of 20 modules, each of them symbolizing a region in Italy.

Russia also repeatedly selected the path of national ornament installation in order to achieve fast and easy recognition of the architecture. For example, Russian pavilion at Expo-2010 was surrounded by twelve white and golden towers. The

perforation of the upper parts of these towers was created on the basis of ethnic ornaments of the peoples inhabiting Russia.

Figure 4. *Italian pavilion at Expo-2015* **Figure 5.** *Italian pavilion at Expo-2010*

The most vivid example expressing the presented trend was the pavilion of Russia at Expo 2015 (Fig.6, architect S. Choban). The shape of the Russian pavilion, according to its architect, should have achieved a certain identity and continuity in relation to those structures that were represented by Russia at previous World Exhibitions. The concept of the national construction during the Expo-2015 paid tribute to the Soviet pavilions that glorified Russia during previous exhibitions. Many of the Russian pavilions at one time became landmarks for the development of architecture. Concerning the post–war period, the architecture of the Russian national pavilions presented at World Exhibitions presupposed the commonality of featuring characteristic of each building - dignity, simplicity and clarity of silhouette.

The peculiarity of the exhibition architecture is, first of all, the need to create trajectories of human movement in space. Not only the comfort and safety of visitors to the pavilion, but also the full-fledged perception of architecture depends on how well the route will be developed. The creators of the Russian pavilion at Expo 2015 paid a lot of attention to this problem. As a result, the large and complexly organized exhibition space of the Russian Pavilion was very comfortable for the movement of a large number of visitors due to the thoughtful management of human flows.

The USSR pavilion at the Expo 67 in Montreal (Fig.7), which was a resounding success, was taken as a prototype of the architectural structure for the one exposed at the Expo 2015. The success was possibly achieved because of its main and recognizable detail – the soaring roof. The console can be called one of the most important elements of the Russian national tradition. Architect Sergey Choban believes that "Russian architecture is the architecture of consoles." In connection with this belief, the author focuses on this architectural detail of the pavilion.

The pavilion, presented by Russia at the 2015 World Exhibition, personified lightning-fast movement, striving upward. The building in the form of an elongated parallelepiped, with an area of 3,200 square meters, was made of glass and wood. A 30-meter canopy rose above the entrance like a huge wave. The huge elongated visor of the Russian pavilion at Expo 2015 was made mirrored, reflecting everything that is happening around, as well as all visitors who fall into the field of its attraction. A recreation area decorated with greenery was arranged on the huge roof of the pavilion, in addition, the roof became a wonderful observation deck.

Figure 6. Russian pavilion at Expo-2015

Figure 7. USSR pavilion at Expo-67

Japan, during the last several World Expositions (Fig.8-10), has also developed its own logic of presenting the main values of culture and national architectural traditions, which can be traced in the shaping of its exhibition facilities, the organization of internal space, etc. [3].

Figure 8. Japanese pavilion at Expo-2000

Figure 9. Japanese pavilion at Expo-2005

Figure 10. Japanese pavilion at Expo-2010

Each Japanese pavilion without exception (throughout the history of World Exhibitions) necessarily had a natural element, a traditional Japanese garden – a symbol of culture. A large spreading pine tree grew in the central open courtyard of the Japanese pavilion at Expo 2015. Such a tree, with a crooked trunk, as if bent by the wind, is considered one of the symbols of Japan. It is not only a symbol of longevity, permanence and eternity, revered in the country, but also one of the

most striking signs in artistic culture. For example, a spreading pine tree is the main element of the ancient Japanese theater No, it invariably decorated the back-drop of the stage, regardless of the play being performed.

At Expo 2015, Japan decided to move away from the general established patterns, which, however, did not lead to less accurate methods of transmitting the traditions of this culture. The Pavilion of Japan at Expo 2015 (fig.11) was built in wood. The appearance of the horizontally oriented building certainly conveys the appearance of ancient Japanese temples. According to the creators, Japan should present the fusion between tradition and modernity in the architecture of the pavilion, thereby presenting the philosophy of modern architecture of the country.

Figure 11. Japanese pavilion at Expo-2015

During the construction of the building, identical wooden bars were used, from which a three-dimensional hexagonal pattern was laid out. Triple walls with such hexagonal weaving formed the structural basis of the pavilion, reminding, in addition, of the importance of quickly replacing dilapidated or destroyed parts of the building. This principle, which has been used in Japanese architecture since ancient times, has not lost its relevance today. The appearance of the exhibition pavilion, striving for ecological and aesthetic perfection, showed the way to harmony, which, according to architects, architecture of the third millennium needs to find. The interior was dominated by an empty space delimited by thin bamboo walls. The exhibition halls, mostly shaded, were supposed to give visitors an idea of the aesthetic canons that have existed in Japan since ancient times and remain relevant to the present.

The UAE took part in World Exhibitions for the first time in 1970. At that time, the Abu Dhabi Pavilion (fig.12) was built at Expo-70 in Osaka, it resembled the Al Ain Fort. Even though visitors could not always accurately identify the prototype of the pavilion, its jagged parapets and tall cylindrical towers were clearly associ-

ated with the old forms of the Persian Gulf. At Expo 92 in Seville, the UAE pavilion was again a fort, this time Fort Al Jahili was chosen as the prototype of the pavilion. At Expo 2000 in Hanover, the UAE again decided to create its national pavilion (Fig.13) in the form of Fort Al Jahili. To create a reliable atmosphere of desert architecture, a significant amount of sand and palm trees were brought to the exhibition.

Only in 2010 UAE shifted away from the fort structure and established the theme of sand dunes that was consistently developed in the architecture of the national pavilions throughout several exhibitions. At the Expo 2010 in Shanghai, the UAE presented a pavilion that conveys the image of the sand dunes of the Arabian desert (Fig.14). Its author, architect Sir Norman Foster, based the idea of the project on an imitation of the smooth shapes of desert dunes, that most vividly reflect regional identity in architecture. Moreover, the architect did not stop at demonstrating visual identity, he achieved a color similarity with the emirate desert, which has a pronounced orange hue, covering all the surfaces of the pavilion with a golden-colored "skin" made of stainless steel.

Figure 12. UAE pavilion at Expo-70

Figure 13. UAE pavilion at Expo-2000
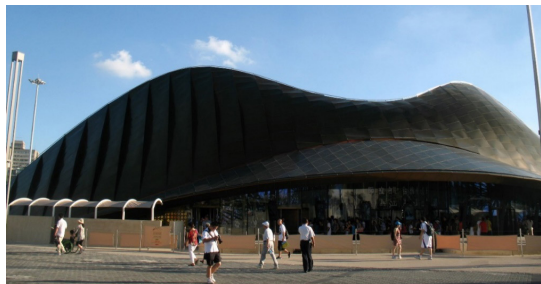
Figure 14. UAE pavilion at Expo-2010

Expo 2020 in Dubai was the first World Exhibition ever held in the Middle East, it amazed with its scale and the number of participating countries. The pa-

vilion of the host country at the World Expo is always in the spotlight, so the host country strives to create a memorable image of its main building. The UAE invited Sir Norman Foster to design its pavilions for Expo 2010 (Shanghai, China) and Expo 2015 (Milan, Italy), thus it is not surprising that a world-renowned architect, Santiago Calatrava, was invited this time to create the UAE pavilion at Expo 2020.

The architectural and artistic image of the UAE pavilion at Expo 2020 was inspired by the shape of the wing of a flying falcon (Fig.15). The motif of the bird and flight is one of the key ones in Calatrava's works. The building looks light and dynamic, but most importantly, it is indeed ready to move: the "feather" panels are able to rotate, changing the image of the building and, if necessary, closing the solar panels on the roof. The "falcon" theme was also chosen for a reason — the noble bird is the personification of strength and courage, being considered a symbol of the UAE. In this case, it should be emphasized once again that for all the vibrancy of the architectural and artistic image of the pavilion of the host country at Expo 2020, a well-recognized, even outside the Arab culture, symbol, which would definitely be perceived as key to the culture of this country, was taken as the basis.

Figure 15. UAE pavilion at Expo-2020

The country making the decision to participate in the World Exhibition always faces a challenging task. The nation must present an architectural structure that fully reflects its cultural heritage. In addition, the architecture of the national pavilion should have a vivid and memorable artistic image that visitors can easily connect with the cultural traditions of a particular country. Many interesting architectural and design discoveries appear at the Expo every time. But apart from them, each country at the World Exhibition shows its model of self-expression in the international arena, proving its integrity and representativeness.

References

1. Shpakov V.N. The history of world exhibitions (Istoriya vsemirnyh vystavok). Moscow: AST: Zebra E, 2008 [in Russian].

2. Jackson A. EXPO International Expositions 1851–2010. Haziran, 2008.

3. Konovalova N. A. The integrity of Japanese culture and its embodiment in the architecture of Expo-200 and Expo-2005 (Tselostnost' iaponskoi kul'tury I ee voploshchenie v arkhitekture Expo-200 i Expo-2005). In: Questions of architecture theory. Architecture and culture of Russia in the 21st century (Voprosy teorii architektury: Architektura i kul'tura Rossii v XXI Veke). Moscow, 2009, pp.280-285 [in Russian].

寻找21世纪城市的本土特色：亚洲国家的建筑经验
THE SEARCH FOR A LOCAL IDENTITY OF CITIES IN THE 21ST CENTURY: THE ARCHITECTURAL EXPERIENCE OF ASIAN COUNTRIES

Maevskaya Marianna Evgenievna
Leading Researcher
Research Institute on the Theory and History of Architecture and Urban Planning — branch of the Central Research and Planning Institute of the Ministry of Construction of the Russian Federation;
Professor
International Academy of Architecture, Moscow, Russia;
Head of Department
Social Sciences Institute of RANEPA (The Russian Presidential Academy of National Economy and Public Administration)

注解。　二十年来，中国、印度、韩国、印度尼西亚等亚洲地区国家以及中东地区的城市发展集约化程度实现了质的飞跃。 这一过程既影响了具有深厚历史根源的现有城市，也影响了全新的城市形态。 众多新城市的规划和建设、空间的重新布局以及历史聚落遗址的集约开发已经制定了一系列具有明显区域特色的战略。本文致力于识别和分析现代世界城市发展区域战略的工具。
寻找亚洲和中东城市的本地特色和新形象的最有效策略之一是创建具有令人难忘的轮廓或完成度的高层建筑； 创建具有全市和全国意义的公共空间和文化机构； 全天候使用灯光设计、媒体立面和视频投影； 推广生态建筑。
关键词：发展战略、地方认同、城市天际线、建筑主导、国家认同、建筑意象、媒体技术、视频映射、生态建筑。

Annotation. Over the past two decades, there has been a qualitative leap in the intensification of urban development in China, India, South Korea, Indonesia and other countries of the Asian region, as well as in the Middle East. This process has affected both existing cities with deep historical roots and completely new urban formations. Numerous planning and construction of new cities, reformatting of space and intensive development of historical settlement sites have developed a certain series of strategies that have received their pronounced regional specificity. This article is devoted to the identification and analysis of the tools of these regional strategies of urban development in the modern world.

Among the most effective strategies for searching for local identity and new imagery of cities in Asia and the Middle East are the creation of high–rise dominants with a memorable silhouette or completion; the creation of public spaces and cultural institutions of citywide and national significance; the round-the-clock use of lighting design, media facades and video projections; the promotion of eco-oriented architecture.

Keywords: *development strategy, local identity, skyline of cities, architectural dominants, national identity, imagery of architecture, media technologies, video mapping, ecological architecture.*

1. Introduction.

The modification of urban space, which occurs with different intensity in different periods, requires a clear analysis with obvious time boundaries. And in the case of analyzing the space of Asian cities at the present stage of development, an analysis of many objects is required in combination with an analysis of transformations of the figurative and artistic component of the latest architecture.

As the main strategies in creating architectural and artistic characteristics of modern Asian cities, forming their leading visual parameters, it is proposed to identify the following:

- creation of iconic structures that have changed the overall skyline of Asian cities and have a "wow effect". In the late 1990s and in the 2000s, individual iconic buildings with outstanding technical parameters (towers, skyscrapers with an unusual silhouette, completion, unique facade coating, etc.) played a special role.;

- widespread use of media technologies (hinged facade and freestanding LED screens, solid media facades, video mapping elements), their active inclusion in the overall appearance of the existing development. Moreover, it is in Asian countries that the use of various forms of video projections and lighting design elements has spread widely (especially in the 2010s) not only to iconic architectural structures themselves, but has become part of mass landscaping with a natural component of the urban environment. (Landscape parks with lighting and design solutions, complex multi-level urban public spaces with a diverse system of lighting design have appeared in various ways integrated into the urban fabric);

- the construction of symbol buildings that create recognizable images of specific places and become markers of national identity.

The highlighted strategies significantly influenced the general character of the imagery of Asian cities in the new century, changing the usual visual accents both in the structure of the already established quarters of many cities in the region and in the areas of new development in recent years.

2. Significant iconic structures

Architectural strategies for the development of Asian cities at the turn of the millennium were largely focused on the creation of new high-rise dominants and acutely individual, programmatically different objects from their surroundings. New opportunities in the design and construction industries, which have developed due to the widespread introduction of digital technologies into this sphere of life, have contributed to the growth of public demand for the creation of particularly memorable and previously unseen buildings around the world. This trend was most clearly reflected in the so-called "high-altitude race" of the turn of the 1990s-2000s. The approval and implementation of projects of super-tall (over 300m) towers with a memorable finish and silhouette led to a noticeable change in the skyline of cities. Many Asian cities were in fierce competition with each other for the right to hold various titles in the field of high-rise construction. The skyscrapers of Singapore, Shanghai, Tokyo and Seoul were consistently considered the tallest in Asia. However, in the following decade, leadership in this area has already been completely transferred to the PRC, where by 2017 there were already more high-rise towers in the category above 150m than in the USA, Japan, South Korea and other Asian countries combined.

As part of the postmodern approach to the possible inclusion of vernacular and compilations of various architectural styles of the past in one building, the new high-rise dominants were proclaimed to reflect important local traditions. [1]. For example, the completion forms of the famous twin towers in Kuala Lumpur were covered in the press as a new reading of the traditional Muslim completion of arched vaults. In addition to the search for national and religious identity, important ideological contradictions were also manifested within the framework of high-altitude rivalry. In particular, the epic of the construction of Taiwan's main skyscraper "Taipei 101" (509.2 m with a spire) was closely watched in China, where only in 1998 the Shanghai Jin Mao tower (421m) was built with an unusually expressive appearance for a skyscraper of similar height and a tiered silhouette with trapezoidal segments (associatively reminiscent of the multi-tiered Chinese pagodas "bao- that"), which was the subject of undoubted national pride and a visible confirmation of the superiority of the country's own ideological model of development as a whole. Gradually (by the mid-2000s), the images of skyscrapers of unexpected shapes, with unique facade shells and memorable completions became the most noticeable trend in the architectural strategy of Asian cities.

3. Changing the skyline of the city due to new unique high-rise dominants.

Already in the noughties and 2010s, the idea of high-rise dominance at the level of the entire skyline and the general imagery of the city due to the abundance and diversity of high-rise objects was reflected in the gradual increase in the level of significance and recognition of the image of Shenzhen compared to the former

British Hong Kong, which was of particular ideological importance for the development of the PRC. And Shanghai consolidated its unspoken title as the capital of Chinese skyscrapers with the completion of the 632-meter Shanghai Tower in Pudong District in 2015. Together with the towers of the Shanghai World Financial Center built nearby (completed in the form of a "bottle opener") and the already mentioned Jin Mao tiered tower, Shanghai received a new expressive skyline with memorable high-rise accents of the general panorama of the city.

The Shanghai Tower has become the owner of the highest observation deck (located on the 121st floor) in the country, and the building with the fastest elevators, and also the most-the most skyscraper with a whole set of engineering and technical innovations reflecting the capabilities of the advanced architectural and construction industry of the People's Republic of China. The designers of the Gensler company, together with the Chinese architect Jun Xia, did not ignore the environmental issues of the new skyscraper. They designed a special spiral chute that runs along the entire height of the building and serves to collect rainwater, then used in heating and air conditioning systems. An additional 10% of the building's energy is generated by wind turbines on the facade of a "twisted" (at the end – by 120 degrees) building of nine structural cylindrical sections. Transparent facade cladding allows you to optimize the lighting system, and the voids between the inner and outer shells of the skyscraper help maintain optimal temperature all year round. Additional proximity to nature inside the building is created by 24 "heavenly gardens" with living greenery, also located between the outer and inner facade shells. [2].

More than a hundred high-rise structures are put into operation in China every year, and the total number of skyscrapers and super-skyscrapers (above 300m) at the end of 2021 was almost two thousand, which significantly exceeds similar figures in the United States, Japan, South Korea and even in countries in the Middle East. Obviously, it was in China that the principles of working with new high-rise dominants on a citywide scale should have been formed in the first place. And the proposed urban transformation strategies in the format of creating a new imaginative identity through high-rise accents have already begun to be applied and refined in neighboring countries. The practice of inviting star architects and reputable international design bureaus has continued to be relevant since the mid-1990s to the present day, especially in South Korea and China. The recent project of the North Xingge Jinze skyscraper-arch (rectangular with a sloping top) for the Zhuhai business district from Aedas company illustrates this strategy well - inviting eminent architects and star bureaus for the development of Chinese cities. With their help, it was supposed to find new iconic images of structures in order to get out of the shadow of Macau, Zhuhai's famous neighbor. Perhaps it will work out, just as Shenzhen has managed to surpass Hong Kong in 20 years.

After two decades of intensive high-rise construction in various cities of the People's Republic of China, strict principles of hierarchical relationships between the number of population, acceptable architectural techniques and high-rise parameters of new urban dominants have been formulated in the country. [3] Today, the three tallest buildings in China are located in different cities – Shanghai, Shenzhen and Tianjin.

It is important to note that the availability of a unique panoramic view of the city in the new century has become a significant parameter in indicating the overall attractiveness and significance of the new building. Most of the new iconic skyscrapers offered such a spectacular component in the list of their undoubted advantages, which can be considered an architectural reflection of the public demand to increase the overall visual attractiveness and entertainment of urban space in the new century [4].

The construction of the new capital of Indonesia entailed the need to create new expressive architectural symbols that determine the recognition of the image of the new capital of the country. In the 1990s and 2000s, the world has already witnessed the titanic efforts of Kazakhstan in moving the capital from Almaty to Astana, where the world's best construction companies and star architects were attracted to formulate and implement the modern image of the new administrative and state center of the country. In Kazakhstan, it was necessary to fill the city with bright and memorable structures, but the practice of erecting high-rise towers gave way to the strategy of creating socio-cultural structures with a unique character and appearance. Such a strategy has been taken as a basic model for design and development in many fast-growing cities in China, South Korea, new cities in India and the Middle East.

In the Indonesian concept of development, the construction of a high-rise symbol of the new capital has taken a very significant place. The ambitious tower should surpass all existing high-rise towers in the region, including the Shanghai Tower and the Pinan International Financial Center Building (599m, KPF Bureau) in Shenzhen. Ultra-high skyscraper projects and entire cities of skyscrapers were planned in the 2000s and 2010s in China, India, the UAE, and Saudi Arabia, but the economic crisis of 2007-2009 suspended or completely canceled most of these high-rise projects. But the Indonesian high-rise was more fortunate than other similar projects.

Today, the 700 m high BUM Tower for the city of Nusantara in Indonesia is being intensively built. The tower was designed by the local studio Alien DC in partnership with the British bureau Atkins. As an initial task, the architects were asked to create a new main visual dominant of the city. The architects designed a two–part complex of skyscrapers with a memorable appearance - two towers of different heights with a curved silhouette and "cut" inclined ends, united by a

curving horizontal bridge at about a third of the height of the main vertical. The area around the towers is a huge indoor complex with various public spaces, shopping malls and a transport hub. This project should become the central point of attraction of the new capital of Indonesia.

A project similar in height dimensions in neighboring Malaysia - the Merdeka 118 tower in Kuala Lumpur (678m) was completed in December 2023. The silhouette of the new high-rise accent of the city appears in the form of a thin broken faceted crystal on a triangular base. The building has the highest observation deck in the world, taking over this title from the Shanghai Tower and the equally iconic Singapore Marina Bay Sands complex (from the legendary Moshe Safdie). In all these buildings, the regional trend of "presenting" the image of the city through its special buildings, including with the possibility of a unique overview of the urban space as a whole, has been preserved for quite recent times. This approach to the perception of the image of the city is an important factor for identifying each specific place and reflects a regional strategy for working with urban space in Asian countries.

Both Indonesian and Malaysian projects also fit very well into the region's characteristic urban development strategies by creating new visual accents of the urban skyline and high-rise dominants with a memorable character and silhouette. They continue the trend that began in the late 1990s and early 2000s, already mentioned earlier. But at the end of the 2010s, the figurative, artistic and civil engineering implementation of this development strategy is already being carried out at a new technical level, which is currently available in the industry.

4. Public spaces and cultural institutions as markers of national identity

Through the appeal to traditional associative symbols reflected in the use of recognizable forms and decorative motifs in modern Chinese architecture, a local identity is being formed. The use of a cultural code in a public facility is also found in other countries of the region. For example, not only architectural but also sculptural objects can be used as a basic archetype. [5]. An example of the creation of such a structure with a "wow effect" in India is a giant skyscraper-the Statue of Unity in the Indian state of Gujarat with a height of 240 m (182m without a pedestal). The statue is placed in a natural landscape, although it is formally considered an urban landmark. Built in 2018, the statue is a high–rise metal structure, dressed in the forms of a generalized image of a male fighter for the rights and independence of India. In general, the construction of such a large-scale sculptural object is also a kind of tribute to the regional (in particular, Buddhist) tradition of erecting giant statues – 8 of the 10 tallest statues in the world are located in Asia.

5. New forms of video projections in urban space

Since a modern Asian city is most often based on a mixed and difficult-to-read spatial planning structure that combines elements of regular and open-plan plan-

ning with separate inclusions of historical neighborhoods and iconic monuments, easily allowing arbitrary combinations in architecture of all available modern technologies and stylistic trends, an abundance of advertising, it is not surprising, that such a city requires more special landmarks to facilitate navigation in space and more mobile includes in its space available tools to enhance the imagery of the existing development. In large cities of China, Japan, South Korea, Indonesia and Singapore, the practice of round-the-clock visual fullness of urban space is being worked out especially successfully. The emphasis on the momentary perception of the appearance of the structure is achieved through the use of separate hinged LED screens and full-fledged media facades, originally designed to demonstrate various visual content. The format of festivals and special art events is gaining more and more popularity in the region every year. [6]. Of course, harsh lockdowns and quarantines temporarily suspended the possibility of holding such urban events, but the mechanism of using video projections of media facades and architectural video mapping capabilities, coupled with 3D advertising in the space of Asian cities, has already taken root in the perception of citizens as a method of forming new visual dominants of the urban environment. [7].

6. Eco-towers in the construction of Asian cities. Integration of natural elements into architecture and urban space

Almost any socially significant project being built in modern China, South Korea, Japan or Singapore necessarily contains advanced energy-saving and environmentally advanced technologies. However, in the field of high-rise construction, this trend also has a noticeable figurative and artistic expression. The promotion of "green" towers, which differ significantly in appearance from the glass-metal urbanized architecture of most high-rise buildings, is a trend of Asian architecture in recent years. Skyscrapers with terraces of living greenery, landscaped atriums and public areas are increasingly being built in major cities of the region.

Projects within the framework of the concept of Arcology are also regularly manifested, when the structure fully meets the basic needs of residents, including food cultivation. In the 2010s, various "vertical farms" and eco-towers were designed for Singapore, Mumbai, and other major cities in the region by design teams from around the world. In 2022, an interesting work in this logic was presented at a competition in Hong Kong by the Russian studio Totement/Paper. Interesting author's interpretations of the theme of natural presence in modern residential complexes are consistently shown by the Chinese bureau MAD Architects, which has already built several large-scale residential eco-complexes in different Chinese cities

Conclusion.

The presented review of strategies for the formation of local identity through the creation of a new system of visual accents and images of a modern city demon-

strates the multi-vector and diverse directions of development of modern architecture. The presence of expressive high–rise dominants is a very significant factor influencing the perception of the city as a whole as a significant and special place. The formation of an expressive skyline through unique memorable buildings is an effectively applied strategy for the transformation and development of Asian cities. And the use of media facades and LED screens in urban space can be used not only to demonstrate commercials, but also to form a more eventful urban life, create new accents and high-rise dominants, as well as to add up the image of the city as a brand. The development of an ecological direction with the inclusion of elements of living greenery and natural landscapes in urban space gives the appearance of a modern Asian city a less urbanized and more harmonious appearance. And unique public buildings and cultural institutions contribute to the development of local artistic originality of specific places, regardless of the population.

Summing up, it should be noted that the formation of local identity and new visual imagery of cities in Asia and the Middle East in the 21st century occurs as a result of the implementation of comprehensive development strategies, including:
• Attracting the best architectural and design teams
• Creation of unique iconic public facilities
• The construction of high-rise dominants in accordance with the hierarchy of urban planning
• Application of the most advanced construction and media technologies
• Monitoring the relevance of the city regulatory legal framework
• Implementation of the practice of eco-oriented residential architecture

The massive spread of digital technologies and the appearance of a large number of LED screens in urban space made it possible to model the entertainment of the architectural environment of a modern city in a new way and gave a recognizable and unique character to individual Asian cities, influencing residents around the clock.

References

1. Khrenov N.A. Interaction of spectacular and visual forms in modern culture [Electronic resource] // Culture of Culture. 2014. No. 4 (4). Accessed: http://cult-cult.ru/interaction-ofentertainment-and-visual-forms-in-contemporary-culture / (Accessed: 25.05.2023) [in Russian] Khrenov N.A. Vzaimodeistviye zrelishchnykh I vizual'nykh form v sovremennoy kul'ture [Elektronnyi resurs] // Kul'tura kul'tury. 2014. № 4 (4). Rezhim dostupa: http://cult-cult.ru/interaction-ofentertainment-and-visual-forms-in-contemporary-culture / (data obrashcheniya: 25.05.2023)

2.   *Giants of the Middle Kingdom: Top 3 tallest buildings in China. https:// gge.ru/press-center/news/ispoliny-podnebesnoy-top-3-samykh-vysokikh-zdaniy-kitaya/ (Accessed: 25.05.2023) [in Russian]*

3. *Maevskaya M. New ways of shaping the image of the city in the digital age. (Novye sposoby formirovaniya obraza goroda v thifrovuyu epokhu).   // Sovremennaya arkhitektura mira. 2021. №. 2 (17). P. 199-221 [in Russian].*

4. *Ptichnikova G.A., Chernichkina O.V. Current trends in the development of media architecture// Artistic culture. 2019. No.3. pp. 342-357 [in Russian] Ptichnikova G.A., Chernichkina O.V. Aktual'nyye tendentzii razvitiya media-arkhitektury // Khudozhestbennaya kul'tura. 2019. №3. P. 342-357*

5. *Konovalova, N. A. Architecture of theaters & theatricality of architecture: modern theaters of Guangzhou (China) // Contemporary architecture of the world. – 2021. – № 1(16). – Pp. 157-171. Konovalova, N. A. Arkhitektura teatrov & teatral'nost' arkhitektury: sovremennye teatry Guangzhou (Kitay)// // Sovremennaya arkhitektura mira. 2022. №. 1 (16). P. 120--157-171 [in Russian].*

6. *Festival sveta Lyuminari v Kobe. https://funnyfest.ru/events/festival-sveta-lyuminari-v-kobe/ [in Russian].   accessed: 14.03.2023*

7. *Ptichnikova G.A., Korolyova O.V., Chetnichkina O.V. Media architecture in urban space: problems and negative practices. (Mediaarkhitektura v gorodskom prostranstve: problemy i negativnyie praktiki). // Sovremennaya arkhitektura mira. 2019. №. 2 (13). P. 120-138 [in Russian].*