



# 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

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这些会议文结合了会议的材料 – 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。

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## BRICS ENERGY: APPROACHES AND SOLUTIONS TO ENERGY SHORTAGE ISSUES

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**摘要。**在全球市场条件变化以及地缘政治紧张局势加剧的背景下，改善能源安全的措施的重要性日益增加。本文分析了金砖国家燃料和能源综合体的现状，并在研究和分析其部门战略规划文件的基础上，得出了在国家能源政策框架内确保国家能源安全的方法。

**关键词：**能源安全、国家能源政策、燃料和能源平衡。

**Abstract.** *In the context of changing global market conditions, accompanied by an increase in geopolitical tensions, the importance of measures of improving energy security is increasing. In this article current state of the fuel and energy complexes of the BRICS countries is analyzed and conclusions regarding approaches to ensuring energy security at the national level within the framework of the national energy policy based on the study and analysis of their sectoral strategic planning documents are drawn.*

**Keywords:** *energy security, national energy policy, fuel and energy balance.*

### Introduction

In the context of the transformation of international economic relations and growing geopolitical tensions in world markets, accompanied by the fragmentation of the world economic space, regionalization and development of the economies of macro-regions, the relevance of the issue of ensuring energy security, which is included among the strategic goals and priority areas of activity of most states in the energy sector, is increasing. Ensuring national energy security in the current environment of world markets is possible through international cooperation of



“friendly” states and actors in the field of the fuel and energy complex (hereinafter referred to as the FEC) by encouraging mutual investments, implementing joint projects and other activities. These factors determine the growing importance of cooperation between the BRICS countries, in particular in the energy sector, in the implementation of its critical infrastructure, in its digital capabilities, and in the managed diversification of various sources of generation and distribution of calories received between potential consumers.

Building an energy policy in the field of energy security at the national level directly depends on the country’s ability to meet domestic energy needs with its own fuel and energy resources (hereinafter - FER), self-sufficiency of national fuel and energy balances (hereinafter - FEB). Depending on the presence of a surplus or deficit of the national fuel and energy reserve, the state determines the directions for ensuring and increasing energy security and national priorities in the field of fuel and energy complex. In the BRICS countries, the category of countries with a fuel surplus includes Russia, Brazil and South Africa, and India and China are countries with a fuel deficit; however, when analyzing the fuel reserves of these countries, it is necessary to take into account the specifics of their national economies, trends of accelerated development and galloping consumption.

### **Energy of Russia**

The Russian fuel and energy complex is the largest sector of the Russian economy, accounting for more than a quarter of the gross domestic product (hereinafter referred to as GDP) [1]. The country is among the world leaders in terms of fuel and energy resources and is the first economy in the world in terms of natural gas reserves and the second after the United States in terms of coal reserves [2]<sup>1</sup>. The share of the fuel and energy complex in the revenue side of the country’s federal budget at the end of 2023 is 30.3% (or 8,822.3 billion rubles, -23.86% by 2022)<sup>2</sup>, and the share of the fuel and energy complex in export earnings at the end of 2022 exceeds two thirds (about 67%, +24 percentage points compared to the level of 2021)<sup>3</sup>.

Russia, having an energy independence index of 100% [5], is a self-sufficient country in terms of primary energy consumption, fully covering the energy needs for fuel and energy resources of industry, the population and other consumers (see Diagram 1).

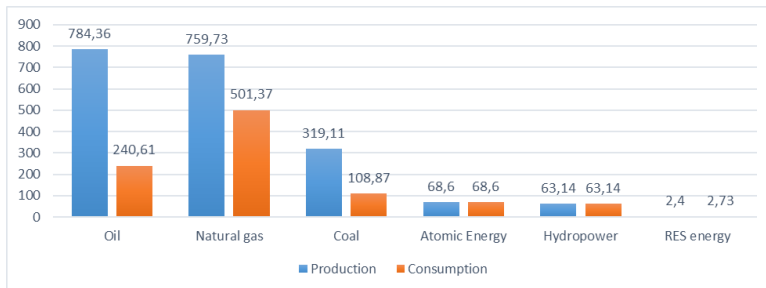
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<sup>1</sup> For reference: As of January 1, 2023, proven oil reserves in Russia amount to 80 billion barrels, natural gas - about 48 trillion m<sup>3</sup>, coal - more than 160 billion tons (at the end of 2021), which is 5.12%, 22.86% and 14.90% of the world’s oil, natural gas and coal reserves respectively.

Source: calculated by the author based on data from [2] and [7].

<sup>2</sup> According to the Russian Ministry of Finance [4].

<sup>3</sup> Calculated by the authors based on data from the International Trade Center [3].



Source: compiled by the author based on data from the Energy Institute Statistical Review of World Energy 2023 [9]

**Diagram 1.** Structure of production and consumption of primary energy in Russia by type of fuel and energy resources for 2022 (in million tons of standard fuel)

As of the beginning of 2023, primary energy production fully satisfies the energy needs of Russian consumers and exceeds primary energy consumption by 2 times with a total production of primary energy of 1997.3 million tons of equivalent fuel and its consumption of 985.3 million tons of equivalent fuel<sup>4</sup>. TSo, the need for fuel and energy resources is met by 219% (+11 p.p. compared to the 2021 level): by 326% for oil (-2 p.p.), by 152% for natural gas (+4 p.p.) and by 293% for coal (+23 p.p.)<sup>5</sup>, due to which surplus products are formed and, thus, the opportunity is created for their export. Russia’s high export potential is ensured by colossal reserves of fuel and energy resources and a relatively large gap between the production and consumption of fuel and energy resources.

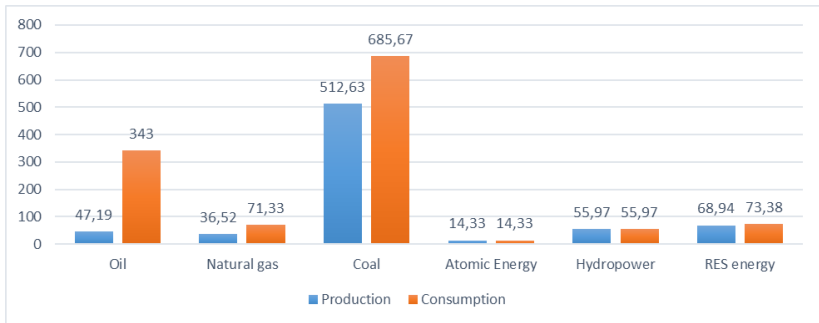
The trends described above determine the specifics of Russian energy policy. The main priorities of the national energy policy are the *effectiveness of meeting the internal needs of socio-economic development* in order to maintain self-sufficiency and independence in terms of fuel and energy supply and *increasing the role of the Russian fuel and energy complex* at the global level due to high export opportunities. To ensure the implementation of the identified priorities, Russia’s strategic planning documents provide for a number of measures, including changing the territorial structure of oil production to prevent the depletion of individual fields, increasing the efficiency of oil refining, developing and expanding LNG production, developing coal chemistry and coal processing, and developing international business in the field of nuclear energy .

<sup>4</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

<sup>5</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

### Energy of India

India, the first country in the world in terms of population<sup>6</sup> and the third largest economy in the world by GDP<sup>7</sup>, faces the problem of energy poverty. India is characterized by a low degree of development of energy infrastructure with an outdated existing infrastructure, which undermines access to energy mainly in rural areas, as well as a low level of availability of cleaner and more efficient fuels, low energy efficiency, and high exposure to external shocks, including including price fluctuations and geopolitical shocks, as a consequence of the inability to meet the energy needs of domestic consumers through domestic production of fuel and energy resources and energy production by other means (see Diagram 2). India's Energy Security Index is 65.7%<sup>8</sup>.



Источник: составлено автором на основе данных Energy Institute Statistical Review of World Energy 2023 [9]

**Diagram 2.** Production and consumption of primary energy in India by fuel and energy resources for 2022 (in million tons of standard fuel)

As of 2022, India's energy needs cannot be fully met with its own resources. Thus, fuel and energy resources produced in the country provide 54.2% of energy needs (+2.8 percentage points compared to 2021): 74.8% of coal needs (+5.5 percentage points), 51.2% natural gas demand (+5.2 p.p.) and only 13.8% of crude oil demand (-1.6 p.p.)<sup>9</sup>, which necessitates the import of fuel and energy resources. The main importers of energy goods are Iraq (the country accounts for 13.9% of India's total energy imports), Saudi Arabia (13.6%), Russia (12.3%), UAE (10.2%), USA (7.5%), Australia (5.8%) and Qatar (5.3%)<sup>10</sup>. Middle Eastern countries are the largest suppliers of fuel and energy resources to India, accounting

<sup>6</sup> According to World Population Review [16].

<sup>7</sup> According to the International Monetary Fund [15].

<sup>8</sup> According to independent research company Enerdata [5].

<sup>9</sup> Calculated by the author based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

<sup>10</sup> Calculated by the authors based on data from the International Trade Center [3].

for a total of 51%<sup>11</sup> in India's total imports of fuel and energy resources, which causes a high degree of dependence of the country on the region.

Building an effective overseas energy strategy, recognized in India's national strategy documents, is key to meeting domestic energy demand amid growing import dependence. The policy being pursued should ensure not only a guaranteed supply of fuel and energy resources, but also provide access to foreign technologies, expand land-based energy supplies, and expand India's participation in foreign energy organizations and their projects. In accordance with the National Energy Policy, in order to improve the reliability of national energy supply, it is necessary to ensure a diversified and guaranteed supply of oil and natural gas through the implementation of projects in Central and East Asia. The most promising direction of this policy is multilateral cooperation with ASEAN countries.

India's interaction with ASEAN countries is carried out in accordance with the Framework Agreement for Comprehensive Economic Cooperation between India and ASEAN, within the framework of which a number of agreements have been concluded on trade facilitation, investment promotion and other aspects. India's participation in ASEAN regional agreements ensures the synergistic development of the economies of countries in general and, in particular, their fuel and energy complex, and also provides India with profits from participation in projects and organizations of the ASEAN fuel and energy complex. India's regional partnership is key to effectively meeting the energy needs of domestic consumers, ensuring energy supply during periods of active power shortages and enhancing energy security.

### **Energy of China**

China is the world's largest economy by GDP<sup>12</sup>, largest energy consumer<sup>13</sup> with a share of global primary energy consumption of 26.4%<sup>14</sup>, and the largest electricity producer with a 29.9% share of global electricity production<sup>15</sup> – ranks first in coal energy consumption (China's coal energy consumption share of global consumption is 54.8%), hydropower (30.1%), solar (32.3%) and wind (36.2%) energy, second in consumption of oil for energy purposes (14.8%) and nuclear energy (15.6%), and third in consumption of natural gas for energy purposes (9.5%)<sup>16</sup>. China is also the largest importer of fuel and energy resources, with a 12.3% share

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<sup>11</sup> Calculated by the authors based on data from the International Trade Center [3].

<sup>12</sup> According to the International Monetary Fund [15].

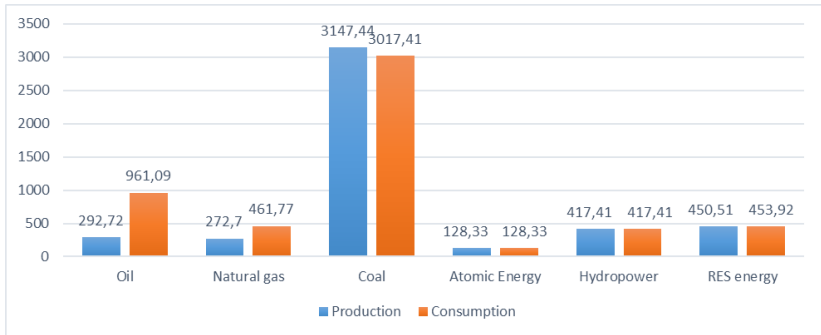
<sup>13</sup> According to the Energy Institute Statistical Review of World Energy 2023 [9].

<sup>14</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

<sup>15</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

<sup>16</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

of global fuel and energy imports<sup>17</sup>, which is due to the incomplete supply of domestic energy demand by domestic production of fuel and energy resources (see Diagram 3). China’s energy independence rate is 82.7%<sup>18</sup>.



Source: compiled by the author based on data from the Energy Institute Statistical Review of World Energy 2023 [9]

**Diagram 3.** Production and consumption of primary energy in China by fuel and energy resources for 2022 (in million tons of standard fuel)

As of 2022, fuel and energy resources produced in the country provide 83.6% of energy needs (+7.6 percentage points compared to 2021): 104.3% of coal needs (+9 percentage points), 59.1 % of natural gas demand (+4.1 p.p.) and 30.5% of crude oil demand (+2.3 p.p.)<sup>19</sup>, which creates the need to import natural gas and oil. Key exporters of energy goods to China are Russia (accounting for 15.9% of China’s total energy imports), Saudi Arabia (12.3%), UAE (7.4%) and Iraq (7.4%)<sup>20</sup>. Since China is the largest energy resource importing economy and a driver of global energy demand growth, ensuring stability and security of energy supplies is one of the key goals of China’s energy policy.

Dependence on imported fuel and energy resources makes China’s economy more vulnerable to external shocks associated with price fluctuations in global energy markets and disruption to global supply chains caused by geopolitical tensions and other factors. Ensuring the country’s economic security and reliable supply of domestic consumers with fuel and energy resources should be based on building safe and more reliable resource supply chains, as well as their diversification. However, the prospects for this direction are very limited.

Ensuring the reliability of fuel and energy supplies is achieved by expanding the energy supply potential through domestic capacities, promoting the reform of

<sup>17</sup> Calculated by the authors based on the International Trade Center [3].

<sup>18</sup> According to independent research company Enerdata [5].

<sup>19</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

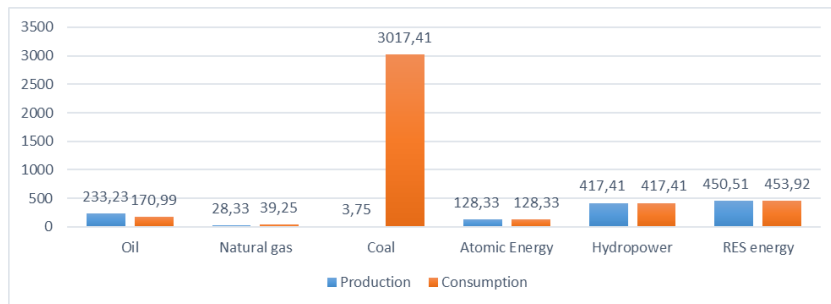
<sup>20</sup> Calculated by the authors based on data from the International Trade Center [3].

the existing energy system, increasing low-carbon generation, as well as the formation of distributed energy in remote areas of central and western China. Solving these problems involves increasing generating capacity based on renewable energy sources (hereinafter referred to as RES), primarily solar and wind, developing geothermal energy, conducting R&D in the field of exploration and production of hydrocarbons from deep-sea and deep-lying deposits and unconventional hydrocarbons to reduce dependence on imports FER, as well as the construction of nuclear power plants off the east coast and a complex of hydroelectric power plants in the southeast of the country to supply energy to large cities.

In general, the Chinese national energy policy is characterized by the high importance of alternative energy as a way to create a diversified and self-sufficient fuel and energy resource in order to ensure independence from external sources of fuel and energy supplies and achieve climate and environmental goals. It is these trends of convergence of existing energy infrastructure and advanced technologies that solve issues of civilized development and coordinate competition within China between suppliers and high-tech aimed at the digital effects of obtaining and distributing calories in various ways, including renewable energy sources themselves.

### Energy in Brazil

Brazil, the seventh economy in the world, the first economy in Latin America in terms of GDP<sup>21</sup>, has a highly environmentally friendly fuel and energy complex with a high share of hydro and renewable energy generation. Domestic energy needs are predominantly met with its own resources (see Diagram 4). Brazil's energy independence rate is 100%<sup>22</sup>.



Source: compiled by the author based on data from the Energy Institute Statistical Review of World Energy 2023 [9]

**Diagram 4.** Production and consumption of primary energy in Brazil by fuel and energy resources for 2022 (in million tons of standard fuel)

<sup>21</sup> According to the International Monetary Fund [15].

<sup>22</sup> According to independent research company Enerdata [5].

As of 2022, fuel and energy resources produced in the country cover 115.2% of the need for fuel and energy resources (+6.2 p.p. compared to the level of 2021): 18.6% of the need for coal (+1.7 p.p.) .72.2% of natural gas demand (+11.9 p.p.) and 136.4% of crude oil demand (-1.1 p.p.)<sup>23</sup>. In general, energy needs are met in full - the missing volumes of demand for fuel and energy resources are met through large-scale hydro and renewable energy generation, Brazil's fuel and energy resources are self-sufficient, and non-energy needs for coal and natural gas are met through their imports.

Since Brazil's fuel and energy sector is characterized by a high degree of diversification and a low degree of dependence on external supplies of fuel and energy resources, the main direction of the national energy policy is to ensure wide access to electricity for domestic consumers. In order to ensure the implementation of this direction, a number of measures are being carried out, mainly in the field of alternative energy, including the expansion of biofuel consumption (biomethanol, etc.), the development of nuclear energy, and an increase in the share of renewable energy sources relative to hydropower. Brazil skillfully manipulates market shocks in the energy services market, attracting national and global TNCs to the development and modernization of its critical energy infrastructure, actively using the experience and technologies of the East and West, allowing the gradual integration of its high-tech industries, including oil - and gas processing to single closed cycles of long-term export supplies, most of which are diversified into the BRICS countries or states sympathizing with it. And the decision that the former President of the country and the head of the largest national oil company Petrobras, Dilma Van Rousseff, was confirmed at the 15th BRICS summit in Johannesburg as the president of the New BRICS Development Bank (appointed to this position on March 24, 2023) speaks of the basic the involvement of Brazilian energy lobbyists in the creation and development of new global distribution networks of the BRICS countries, as the main vector of the emerging ideology for the development of this integration association.

### **Energy South Africa**

South Africa, Africa's third largest economy by GDP<sup>24</sup>, seventh largest coal producer in the world<sup>25</sup>, has a fuel and fuel surplus (see Diagram 5). South Africa's energy independence rate is 100%<sup>26</sup>.

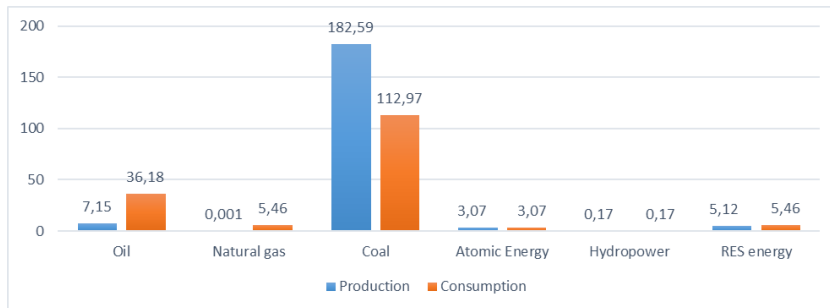
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<sup>23</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].

<sup>24</sup> According to the International Monetary Fund [15].

<sup>25</sup> According to Energy Institute Statistical Review of World Energy 2023 [9].

<sup>26</sup> According to independent research company Enerdata [5].



Source: compiled by the author based on data from the Energy Institute Statistical Review of World Energy 2023 [9] and independent research company Enerdata [5]

**Diagram 5.** Production and consumption of primary energy in South Africa by fuel and energy resources for 2022 (in million tons of standard fuel)

As of 2022, fuel and energy resources produced in the country provide 122.7% of all energy needs (+3 p.p. to the 2021 level) and 161.6% of coal needs (+6.6 p.p.)<sup>27</sup>. Demands for oil and natural gas are met primarily by imported resources, since the level of their production within the country is extremely low. In general, South Africa’s energy balance is self-sufficient, and the lack of other fuel and energy resources for electricity production is compensated by coal.

The dominant position of coal in the fuel and energy balance of South Africa shapes the country’s energy policy and necessitates the need to diversify energy sources in order to ensure guaranteed energy supply and minimize environmental risks. The main direction of the policy is to reduce the share of coal in electricity production, develop the national renewable energy market, study the feasibility of implementation and develop the production of “green” hydrogen. In parallel, after the re-election of the President of South Africa, Cyril Ramaphosa, the goals of the BRICS “evergreen continent” in terms of energy and mining will be increasingly diversified and involved in the struggle for the “French heritage”, mainly for access to uranium mines and polymetallic ores, as well as diverge in the priorities of the globalized chains being formed in the BRICS and in the new fragmentation of value-added energy products from enriched mineralogical and metal concentrates to the receipt of ready-made fuel rods and renewable energy solutions, according to the capabilities of NBICS technologies of Industry 4.0., as well as the growing political influence and coverage. The scientific and technological progress of all countries in the region emerging from the colonial dependence of the empires of the Old World with their traditional reliance on Anglo-Saxon support, as a brake

<sup>27</sup> Calculated by the authors based on data from the Energy Institute Statistical Review of World Energy 2023 [9].



on the development of all BRICS efforts in the field of alternative energy and in creating a polycentric and multipolar world of new and equal opportunities outside the framework of neo-colonial models and hegemony.

Conclusions on the energy problems of the BRICS and ways to overcome the deficit in China and India, existing energy imbalances can be the lobbying orientation of a step-by-step policy of controlling the market for oil and gas production and consumption within the BRICS countries, which already includes 4 leading producing countries (Russia, UAE, Saudi Arabia and Iran) and the countries of the “global South”, ready to build their BRICS energy system of production and consumption on a transparent and long-term basis in the form of transparently formed prices. This will be an effective and expedient response to other states that are still trying, as before, to exert monopoly or cartel influence on the level of world prices and on the daily production of a whole bunch of different grades and grades of oil and gas, as is customary today in OPEC and other monopoly and regional organizations varying degrees of dependence on the political situation and the will of the “collective West”, which do not allow anyone to build an orderly system of balanced and reasonable consumption, devoid of peaks of deficit and/or surplus volumes in the receipt and distribution of hydrocarbon resources in the event of geopolitical shocks or total chaos of the single energy market, hiding behind the “invisible hand of the market” of Adam Smith, not ready to truly consider the obvious optimum of the “carbon footprint” and the symbiosis of gradually introduced renewable energy sources and “hydrogen energy” solutions for a truly working “green agenda” for the benefit of all humanity.

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创意经济是中国文化创意产业的实现领域  
**CREATIVE ECONOMY AS A SPHERE OF REALIZATION OF  
CHINA'S CULTURAL AND CREATIVE INDUSTRIES**

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摘要。当今的创意产业对社会各个领域都有着重大影响，吸引了创新思想和人才。中国的文化创意产业已成为国家经济转型的重要工具。它们有助于从“中国制造”向“中国创造”的转变，展示了中国创造者思想的独创性和新颖性。可以说，今天的中国不是一个拥有廉价劳动力和廉价建筑租金的全球工厂，而是一个拥有强大文化创意产业的国家，能够创造自己的产业。

关键词：创意产业、文化产业、中国经济。

**Abstract.** *The creative industries today have a significant impact on various spheres of society, attracting innovative ideas and talented personnel. China's cultural and creative industries have become an important tool for transforming the country's economy. They contribute to the transition from "Made in China" to "Created in China", demonstrating the originality and novelty of the ideas of Chinese creators. It can be argued that today, the PRC is not a global factory with cheap labor and cheap buildings for rent, the PRC today is a country with strong cultural and creative industries capable of creating their own.*

**Keywords:** *creative industries, cultural industries, China's economy.*

In the modern world, which has endless variety of ways to demonstrate and broadcast not only the personal creative abilities of an individual, but also the cultural heritage of an entire country, the emergence of such an economic sector as the creative industries was a natural phenomenon. The main advantage of this area is the symbiosis of an inexhaustible source of creative resources, i.e. ideas, creative potential and intelligence, and permanently developing technologies, which makes the creative economy attractive from the point of view of investment and development at the national level. It is also worth noting that creative industries in

many ways contribute to the actualization of cultural and spiritual values, develop the creative abilities of the population, thus having a positive impact on the quality of life of people and sustainable development of society, create jobs and diversify non-resource exports.

It is worth paying attention to terminology when considering China's creative industries from an economic perspective. The cultural specificity of each country necessitates adjustments to the theoretical design and applied understanding of creative industries. Consequently, there is no universal definition of this concept today. An important point is also its lexical meaning: when considering Chinese creative industries, it is worth paying close attention to the translation options and their meaning hidden in the difference between "creative" and "cultural", because to miss the first or second components in the concept of "文化创意产业" is to miss its holistic essence. Although many countries identify the concepts of "cultural industries" and "creative industries", in the initial stage of their development in China, only the former was used. In March 2001, the 4th Session of the 9th National People's Congress adopted the "Basic Provisions of the Tenth Five-Year Plan for Economic and Social Development", which approved the proposals on cultural industries and cultural policies created at the 5th Plenum of the 15th CPC Central Committee: "Improving the Cultural Industries Policy, Intensifying Construction and Strengthening Management over Cultural Markets, Stimulating the Development of Cultural Industries" ("完善文化产业政策, 加强文化市场建设和管理, 推动有关文化产业发展") [1]. Since 2005, CPC official documents have used the phrase "cultural and creative industries" — "this seemingly indiscriminate use and confusion of terminology is typical not only of China, but also of Asian national contexts in general" [2, p. 190]. The term combines two levels of understanding. Cultural industries are designed to expose China's ancient traditional culture to the world as a treasure trove of the riches of centuries of history, a storehouse of ideas that make Europeans marvel, and an endless source of knowledge accumulated by such eminent figures as Confucius, Lao Tzu, and Sun Tzu. Cultural industries are an instrument of soft power (中国文化软实力) directed outward under state patronage. These include, above all, Confucius Institutes opened around the world, the One Belt, One Road Initiative, foreign media outreach, diplomacy, and "establishing cultural bases and clusters abroad" [2, p. 191]. It is also worth noting that cultural industries are also oriented inward as part of the concept of "dual circulation" (双循环), which is aimed at shifting the main driver of China's sustainable growth from global integration to greater reliance on the domestic market [3, p. 242]. Another important tenet of the "double circulation" is the development of cultural industries as a factor in the country's economic growth, because culture is the fourth certainty in the concept of "Four Confidences" (四个自信) first voiced in 2016 at the 95th anniversary of the CPC:

“It is necessary to adhere to the confidence of the path of socialism with Chinese characteristics, confidence in its theory, confidence in its system, confidence in its culture” (<...> 就要坚持中国特色社会主义道路自信、理论自信、制度自信、文化自信) [4]. Thus, the term “cultural industries” has obvious ideological aggrandizement and political overtones and is mainly used by conservative figures. Comparing it with its English “equivalent” “Cultural industries” also reveals differences in the sets of connotations: the 产业 of “文化产业” contains both 产权 and 事业, i.e. a property right and a public institution, which already introduces a different meaning than first embedded in cultural industries [5, p. 560].

In contrast, the essence of creative industries is devoid of political connotation and is aligned with the essence of European and American creative industries, which is focused on investment, innovation and total commercialization. The concept was initially developed at the level of conceptual new ideas, including the creative economy, which is often used as a synonym for “creative industries,” creative cities, clusters, and the creative class. These ideas were subsequently adopted by entrepreneurs, academic economists, and other experts in the field of existing cultural industries. As a major developing country, the PRC continues to pay great attention to cultural and creative industries, which have now become an important component of the national creative economy. According to the research on the terminology and the different meanings that envelope cultural and creative industries separately, it can be concluded that China applies both the policy of cultural exclusion to the former and the neoliberal model to the latter, which makes it possible to create one powerful industry that is the foundation of the creative economy, which contains the intertwining of classical Chinese culture, designed solely in the interests of the state, and creativity, which brings in the neoliberal spirit, formerly presented as a “Trojan horse” but is now a phoenix [6]. In future work we will use a variant that combines two complementary concepts - cultural and creative industries.

To consider the potential of China’s cultural and creative industries from an economic perspective, it is worth noting that their main indicators are categorized into three. These are cultural production, the wholesale and retail industry, and the cultural service industry. The first indicator for 2020 was 381 million yuan, the second was 164 million yuan, and the third was 488 million yuan [7]; in 2021, we can observe growth in all parameters, but the cultural services industry showed the highest growth of 582 million yuan [8]. Based on the data we can conclude that today cultural and creative industries make a significant contribution to the country’s economy, and their annual growth only strengthens the opinion about the need for their further development and government support. In addition, the PRC cultural and creative industries, occupying an important place in the economic sphere, accelerate the transformation of the economic model through the

transformation of intangible resources, value-added, structural optimization, market diversification, etc. These activities are carried out as follows:

The transformation of intangible resources comes to the fore “in conditions when the achievement of competitive advantages shifts to the intangible sphere” [9, p. 14]. The expansion of the definition of the creative industries’ “resource” is a key factor in the realization of these industries. This expansion encompasses a growing number of components, including artifacts of history, folklore, cultural elements, ideas of individuals, and creative teams. China is currently utilising intangible resources to not only generate new products within the creative and creative industries, but also to reconstruct existing ones. One example of this is the transformation of old, abandoned buildings into creative spaces. The increase in added value through the creation of national brands, in-house design in various fields, R&D, increased technological sophistication of production, etc. contributes to the transition to the concept of “Created in China”, as the products and services of cultural and creative industries – have ideological and semantic content, originality and often novelty, allowing to present to the world exactly “created” goods, and not “made” by ready-made samples or requests. Often the notion of creativity woven into the idea of “Created in China” also overlaps with innovation: some studies say that creativity is the first step to innovative development, and some studies share these concepts [10]. “创新” is often used for “innovation”, i.e. “to bring new things”, “to come up with new ideas”; “创意” is often used for “creativity”, i.e. “originality” and “creating new ideas”. However, despite the advantage of a new concept built on the inspiring idea of being innovators, the “Made in China” phase was an important one for the country economically: in 2008, China’s GDP was the third largest in the world. This was not an indicator of happiness, wealth or sustainability — the economic growth of the time depended on investment and exports, which led to the depletion of natural resources, pollution and lack of national innovation and technology, but there were also positive aspects: affordable low prices of goods contributed to the improvement of living standards, cheap labor multiplied the global competitiveness of the country, which allowed Chinese goods to take a strong position on the world stage.

Structural optimization takes place by recreating and modernizing traditional cultural industries and giving them a more attractive and modern image. This also applies to territorial areas. A prime example is the founding of a technology and science center, Zhongguancun (“中关村”), which has become a natural point of attraction for more than 200 creative companies, generating an annual profit of 5 billion yuan. This creative zone is valued at 2.63 billion yuan, at about 67,000 yuan per square meter. Integration is taking place even in urban agriculture: new opportunities (sightseeing, ecotourism, etc.) are generating profits. Zhang Yongwei, vice-president of the Development Research Center’s research institute, notes

that through structural optimization and the growth of the technology sector within the creative industries, the decline of traditional industries will be offset [11].

The special features of cultural and creative industries products contribute to the expansion of the consumer market. As of 2020, China is the largest exporter of creative industries products, occupying 32.3% of global exports, and one of the largest exporters of creative services (59 billion dollars), second only to Germany (75 billion dollars) [12, p. 38]. Attracting new audiences and diversifying the market is carried out through several ways. The first is the rethinking of the national classics, its “rejuvenation”. The case of the Forbidden City of Beijing (the “Gugong Case”) is an example: the integration of cultural and creative products of the museum complex with the digital economy, increasing the efficiency of promotion channels, has attracted great attention of tourists. The modernization process touched the user service chain from buying a ticket to visiting the museum itself, and the range of cultural and creative products (multimedia applications, games, printed publications, etc.) exceeded 10 thousand items. Thus, today, “the Gugong Museum Complex receives good economic benefits through the construction of a complete value-added chain” [13, p. 764] and also contributes to the expansion of the consumer market with its new “digital”, “virtual” form. It is also worth noting the role of advertising, which creates an image of the product and promotes it.

In the creative economy, the digital (virtual) sector plays a significant role, blurring the boundaries between the consumer and the content producer. This is due to the fact that the former can easily become the creator. The structure of this area has the following content: consumers of products and services (about 617 million PRC residents in 2020 watched videos and live broadcasts on various platforms, by mid-2021 this number increased to 880 million people) [14, p. 98]; advertisers and companies outside the virtual sector, taking advantage of the creative economy as a relevant channel for advertising and sales of goods; platforms that act as a link between content creators and their consumers (social networks (“微博”), e-commerce platforms («淘宝»), mobile apps with short videos (“抖音”), mobile apps for storing and showing videos (“Bilibili”), a platform combining social network and online shopping (“小红书”) and others); digital content creators and their agencies using MCN (multi-channel network). MCN are “vertically integrated associations, whose specialists search for and attract new authors and manage the creation of content with the use of modern technologies, marketing, e-commerce” [14, p. 98]. Today, China’s multichannel networks have evolved into multiplatform networks that manage several accounts of content creators and cooperate with other platforms based on audience preferences. Their number has grown significantly over the past couple of years: as of 2021, there are over 34 thousand multichannel networks, with a market size of \$6 billion, and moreover, the percentage of content created by MCN is as much as 60% of all content posted on a variety of platforms [15]. MCN is classified into two categories:

1. MCN whose focus of work is fixed mainly on e-commerce: their main activity is to find talented creators whose ideas they turn into branded goods and realize on the consumer market. Often companies of this type of MCN are called “incubators of bloggers” [16], as they help to put together an interesting public image, provide professional equipment for filming and photo shoots, take over content placement and control over account development. Examples in China include: “Ruhnn” (“如涵”), a company formerly selling clothes under the name “LiBeilin” (“莉贝琳”), is now the most successful company in the MCN with the principle of “quality over quantity”. For example, “Ruhnn” cooperates with a limited number of people, but its industries are diverse: cosmetics, fitness, health, etc. Another quite famous company is Weinian (“微念”), one of whose representatives is the popular blogger Li Ziqi (李子柒): her Youtube channel has 18.7 million subscribers. It is worth noting that such MCN often become attractive for investment by holding internet companies: one such company, ByteDance, has invested in 28 companies that have begun to gain popularity among young people. “MountainTop” a well-known Chinese agency, 9% owned by ByteDance, works with celebrities. This focus multiplies the attractiveness of ByteDance’s investments, as the company’s products are also promoted through cooperation [17]. This type includes e-commerce platforms (for example, the platform “MeiOne” (“美one”), whose representatives say that today live broadcasts are becoming a kind of “bridges” between brands and consumers).

2. MCN that focus on the production of high-quality products and cooperation with content creators in a variety of areas based on the creation of advertising. Due to this policy, the second type of MCN “help to achieve high sales volumes in exchange for a share of the company’s income from them and payment for the number of views of product advertisements [15, p. 99]. As an example, we can mention Dayu Media (“大禹”), which is one of the important partners of Weibo in the field of quality video production; Ergeng (“二更”), which is also engaged in the creation of videos about travel, culture and food on various platforms (“WeChat”, “Weibo”). It is worth noting that the services of multichannel network companies do not require permanent cooperation; any digital content creator can contact the service center to receive the following assistance: managing accounts registered on various platforms, supporting content creation, finding reliable suppliers, providing supply chain management, as well as assistance in finding marketing services (advertising), converting the content creator’s personal knowledge and experience into courses or master classes. In addition to multichannel networks, an important role in the digital sector of the creative economy is played by creators of software and other supporting components needed to organize online commerce, websites, etc. For example, in China, there is a company called Xiaoe-Tech (“小鹅通”) that specializes in providing SaaS services (software as a service), which



include monetizing content, providing tools for live streaming, helping to manage private domain communities, etc. The listed participants of the digital sector of the creative economy are attractive investment targets: most often MCN are mostly controlled by such large-scale and technological companies as Alibaba - they are their main investors. Venture capital companies are also invested, i.e. those companies that are oriented “to work with innovative enterprises and start-ups” [18].

Consequently, the creative economy of the People’s Republic of China represents an optimal environment for the implementation of creative industries. The symbiotic relationship between the economy and creativity gives rise to a plethora of new and innovative objects that act as “instruments of post-industrial transformation of the Chinese economy” [19]. These objects ensure the advanced development of the People’s Republic of China in the context of the existing world system challenges, contribute to the modernization of production processes and act as a means of harmonizing various spheres of life in Chinese society. This is a key feature of cultural and creative industries in China.

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夫妻财产关系法律调整的若干问题  
**SOME ASPECTS OF LEGAL REGULATION OF PROPERTY  
RELATIONS OF SPOUSES**

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摘要。本文探讨了俄罗斯联邦关于配偶间财产关系的法律法规。作者概述了这些财产关系的特点，探讨了俄罗斯联邦家庭法典框架内法律规范的各个方面，考虑到科学家的观点，并得出了改进立法的适当结论。

配偶间财产关系的法律规范很复杂，但在执法实践中，财产的分割相当困难，因为每个配偶都试图保留大部分财产。

关键词：配偶、财产法律制度、协议、补偿、财产价值、婚姻、配偶间纠纷、离婚、法院。

**Abstract.** *The article examines the legal acts regulating property relations between spouses in the Russian Federation. The authors outline the features of these property relations, explore various aspects of legal regulation within the framework of the Family Code of the Russian Federation, taking into account the points of view of scientists, and draw appropriate conclusions on improving legislation.*

*The legal regulation of property relations between spouses is complex, but the division of property is quite difficult in law enforcement practice, since each spouse tries to keep most of the property.*

**Keywords:** *spouses, legal regime of property, agreement, compensation, value of property, marriage, disputes between spouses, divorce, court.*

Property relations between spouses are a truly important institution of family law, covering a wide range of issues: from the definition of jointly acquired property to the procedure for its division upon divorce, which determined the relevance of the research topic.

It should be noted that upon termination of family and marital relations in court, property can be divided by concluding an agreement, which is submitted to the court, and if there are common minor children, the court takes into account their interests and accepts this agreement, or the agreement is declared invalid and divides the common joint property according to rules of Art. 38 of the Family Code of the Russian Federation (hereinafter referred to as the FC RF) [1].

It seems that almost all spouses upon divorce are in a long, protracted conflict and therefore are not ready to agree with each other on the division of common joint property.

The court may recognize the property of each of the spouses as their joint property if it is established that during the marriage, contributions from the common property of the spouses, or from one of them, or thanks to their efforts, significantly increased the value of the property, which indicates a transformation of the property (Article 37 of the Family Code RF).

However, if the spouses invested significant funds or labor into improving or modernizing property during the marriage, the court may determine this property as jointly acquired property.

Thus, in the event of divorce and property disputes, the court considers not only the formal ownership of property, but also the actual circumstances that could affect the increase in its value. This approach, in our opinion, ensures a more equitable distribution of property between spouses, taking into account the contribution of each of them to increasing its value.

At the same time, the court seeks to take into account the interests of spouses, as well as children, in order to make a decision that is consistent with the principles of legality, fairness and equality. Court decisions are based on a detailed analysis of all the factual circumstances of the case, including financial investments, labor costs and other efforts made by each spouse to increase the value of the property.

Therefore, in our opinion, in the process of divorce and resolution of disputes about the division of common joint property, the court takes into account the evidence presented by spouses or third parties who make independent claims and claim part of the property belonging to the spouses.

Property relations of spouses are regulated not only by the Family Code, but also by the Civil Code of the Russian Federation [2], as well as by decisions of the Plenum of the Supreme Court of the Russian Federation.

Art. 33 of the Family Code of the Russian Federation states that “the legal regime of the property of the spouses is the regime of their joint ownership in the event that the marriage contract does not provide otherwise. Property acquired by spouses during marriage is their joint property.”

Each spouse has equal rights to this property, regardless of whose name it is registered in or who contributed more to its acquisition. The only exception is the

presence of a marriage contract, which may stipulate other conditions for the distribution of property in the event of divorce of the spouses. In the absence of such an agreement, the standard regime is recognized as common joint property, which implies equal ownership, use and disposal of property by spouses.

Community property includes everything acquired through joint income: from cars and real estate to shares and deposits in financial institutions, even if they are in the name of one of the spouses.

It should be noted that this list is not exhaustive in the law and gives rise to discrepancies, as well as lengthy disputes between spouses during divorce and division of property. For example, it is not common joint property that was acquired during the marriage, but the money of the spouse that belonged to him before the state registration of the marriage and there is appropriate evidence for this (clauses 15, 17 of the Resolution of the Plenum of the Armed Forces of the Russian Federation of November 5, 1998 No. 15 “On the application of legislation by courts when considering divorce cases”) [3].

Jointly acquired property between spouses is divided in equal shares, unless otherwise established in the marriage contract. In this regard, each spouse has not only property rights, but also responsibilities.

As noted earlier, in Russia currently the legal property regime for spouses is community of property. In Russian law, the property community of spouses is realized through the concept of common joint property.

In our opinion, we should agree with A.N. Levushkin, who identified the following features inherent in the common joint property of spouses: personal legal connection between the subjects; community of property between spouses is a legal consequence of marriage; shareless nature of ownership [4, p. 9].

Property rights include: real; obligatory; exceptional.

Considering the point of view of E.S. Medvedeva about the property rights of spouses, we see that they are divided into three basic categories, each of which covers its own characteristics of the use and ownership of property within the framework of family and marital relations. For example, the first category includes real rights relating to physical objects that spouses can jointly own, use and dispose of [5, p. 263].

For example, a car purchased during marriage by spouses clearly illustrates how such items become jointly owned and available for use by both partners, emphasizing the idea of shared ownership and control of resources in the marital relationship.

Rights of obligation go beyond mere ownership of physical objects, and they mainly relate to the responsibilities that spouses bear for obligations incurred during married life. For example, spouses received loan funds to purchase a car and in case of late payment, the credit institution makes claims to collect the amount of debt against both spouses.

According to the current legislation of the Russian Federation, “the penalty is applied to the common property of the spouses for obligations that arose in family and marital relations (Article 69 of the Federal Law “On Enforcement Proceedings” [6]).

All this indicates that in a marriage, individual financial obligations can become joint if they are aimed at meeting family needs, and both spouses can bear mutual responsibility, including, if the common property is not enough, then foreclosure is applied to the property belonging to each of them. spouses (pre-marital property), to pay off accumulated debts.

In addition, spouses may own exclusive rights, including intellectual property. During a divorce, the court pays special attention to the rights to the results of intellectual activity. It should be noted that the exclusive right to the result of intellectual activity created by one of the spouses belongs to the author of such result (Clause 3 of Article 36 of the FC RF). Therefore, the court needs to determine who created the result of intellectual activity, which does not participate in the division of common joint property.

As a rule, intellectual property inherited by one of the spouses is not subject to division.

Spouses may own securities, shares in the authorized capital, digital financial assets by right of common joint ownership, and the resulting profit is divided in half.

Article 34 of the FC RF contains a list of objects of joint property of spouses and the main sources of its origin: income of spouses from labor activity, entrepreneurial activity and results of intellectual activity; pensions, benefits and other monetary payments received by them that do not have a special purpose; securities, shares, deposits, shares in capital acquired at the expense of the common income of the spouses, contributed to credit institutions and other commercial organizations; any other property acquired by the spouses during the marriage.

In addition, in accordance with the Civil Code of the Russian Federation, the joint property of spouses is any movable and immovable property acquired by them during marriage, not withdrawn from civil circulation, the quantity and value of which are not limited, with certain exceptions provided by law (Articles 128, 129, p. 1, 2 Art. 213 of the Civil Code of the Russian Federation). Thus, the above list of the common property of the spouses shows that it is non-exhaustive, if we take into account the sources of the emergence of common joint property reflected in Art. 34 FC RF.

To summarize what has been said, it should be noted that in domestic legal science and practice the presumption of the validity of the legal regime is used in the absence of a marriage contract (Clause 1 of Article 33 of the FC RF). The application of this presumption is characterized by the fact that: any property ac-

quired during marriage, with the exception of personal property specified by law, is considered joint; list of joint property specified in paragraph 1 of Art. 34 of the FC RF is open, it must be applied taking into account the norms of civil legislation and judicial practice (for example, digital rights acquired by one of the spouses during marriage should also be considered common); when classifying specific property as common, one should use criteria such as: the fact of acquisition of property during marriage, acquisition of property at the expense of common funds, the basis for the acquisition of property; the other spouse has the right to present evidence that the property acquired during marriage in his name is personal, since it does not meet one or more criteria for classifying property as common (in particular, it was acquired by him in a compensated transaction, although during the marriage, but at the expense of his personal funds).

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关于英国不动产物权类型的问题：比较法律视角  
**ON THE ISSUE OF THE TYPOLOGY OF REAL ESTATE OBJECTS  
IN THE UK: A COMPARATIVE LEGAL ASPECT**

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**摘要。**作者探讨了英国不动产物权类型学问题，并从比较法的角度进行研究，这不仅大大扩展和深化了研究的理论和法律部分，而且也扩展和深化了实际的民事部分。作者确定了物权的主要类型，对其进行了分类，并得出结论，主要差异在于历史和法律根源，即罗马私法被各国法律体系所接受。

**关键词：**不动产、不动产所有权、不动产权利登记、物权类型学。

**Abstract.** *The author explores the problem of the typology of real estate objects in the United Kingdom, and the research is conducted in a comparative legal aspect, which significantly expands and deepens not only the theoretical and legal part of the study, but also the actual civil component. The author identifies the main types of objects, classifies them and concludes that the main differences lie in the historical and legal roots, namely in the reception of Roman private law into the legal systems of various states.*

**Keywords:** *real estate, title to real estate, registration of rights to real estate, typology of objects.*

The fundamental difference in the comparative analysis of typologies of property in the Russian Federation and in the UK is the lack of a clear division of objects into movable and immovable. What in modern English law is closest to our existing concept of "real estate" is called real property<sup>1</sup>.

In accordance with modern English law, only land located in a freehold estate is recognized as real estate, which includes everything located on, under and above it, including minerals, minerals, buildings, parts thereof, trees, income received, etc. or otherwise derived profit, as well as everything attached to it artificially or naturally<sup>2</sup>.

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<sup>1</sup> Blackstone, Sir William. Commentaries on the Laws of England in Four Books, (Philadelphia: J. B. Lippincott Co., 1893). Vol. 1 - Books I & II, 29 pp.

<sup>2</sup> Roberts, Chris. Heavy Words Lightly Thrown: The Reason Behind Rhyme. Waterville, Me.: Thorndike Press, 2006.



Initially, it was believed that an object was not attached to the ground (fixture) if it rested on the surface only due to its own weight. However, subsequently the purpose of attaching an object to the land became more significant, and the decisive question was: whether the object was attached for a more convenient (better) use of the land plot or building or to obtain benefits from the use of the object itself.<sup>3</sup>

Thus, the same item under different circumstances can act as both separate movable property and part of a land plot.

This division is important from the point of view of real estate transactions: the seller can retain the right to part of the land plot only if this is specifically agreed upon in the purchase and sale agreement; in other cases, the rights to attach real estate, as well as the rights to a land plot, are transferred to the acquirer. The seller always retains rights to improvements, and transactions with them are carried out separately from the main real estate transaction, in accordance with the rules of contract law.

Based on this provision, in each specific case it is important to establish whether this or that object is part of the earth (fixture<sup>4</sup>) or independent movable property, improvements (fittings<sup>5</sup>) land plot, while the lawyer must identify

- 1) the degree of connection of the object with the earth;
- 2) the purpose of connecting an object to the ground.

Under English law, premises are not considered real estate. Residential tenants are given special protection, with the aim of making housing more affordable for the poor. Records of residential premises are maintained by municipalities, but not for legal purposes, but for managing the social sphere. It should be noted that with the adoption of the Real Estate Registration Law, the system of registered land rights has become more defined.

Currently, when registering rights to real estate of private individuals, the following types of rights are distinguished:

- property (freehold);
- rent for a period of more than 7 years (leasehold);
- collateral (mortgage);
- easement;
- usufruct (profits);
- duties (charges).

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<sup>3</sup> Kramkova T.V., Pavlov P.N. Real estate rights and their registration in the UK // Law and investments No. 1-2 (49) June 2012 (Electronic resource) 105c-Access [http://dpr.ru/journal/journal\\_47\\_23.pdf](http://dpr.ru/journal/journal_47_23.pdf)

<sup>4</sup> Ziff, Bruce. Principles of Property Law (4th ed.). Toronto: Thomson Carswell, 2006, 102 pp.

<sup>5</sup> Oxford Dictionary (Electronic resource). Access - <http://www.oxforddictionaries.com/definition/english/fitting>

Depending on the time of registration, the presence of defects in the submitted documents and possible rights of third parties, etc. registered rights are divided into unconditional, recognized and proprietary.

In practice, there are four main classes (titles) of real estate rights:

- 1st class - guaranteed ownership of real estate (highest class of protection). Registration of this right cancels all unregistered rights that contradict it;
- 2nd class - qualified property rights (registered if there is no certificate that the property has belonged to the subject for 15 years);
- 3rd class - ownership (registered on the basis of the fact of ownership and declaration; in the absence of documents, it is necessary to prove that the subject has owned the real estate for 14 years);
- 4th class - guaranteed rental right (registered if the owner of the property has a certificate of guaranteed ownership of the property). The class of real estate rights may be changed (increased) if additional evidence and documents are presented. For example, in order to upgrade from freehold to secure title, a person must have owned the property for 12 years from registration (the UK statute of limitations).

Due to established practice, in the UK there is no separate real estate accounting system (real estate cadastre); it is combined with the Land Registry, in which rights to real estate are registered. It was originally believed that an object was not attached to the ground if it rested on the surface only due to its own weight. However, later the purpose of attaching an object to the earth became more significant. Under English law, premises are not considered real estate.

Historically, the description of land in the UK was carried out in the form of a general description of boundaries (verbal description through terrain features and (or) a diagram). Since 1925, with the adoption of the Real Estate Law, the requirements for the accuracy of boundaries have become stricter, and great importance has been attached to the geodetic description of the object. At the same time, widespread surveying and geodetic surveys of land plots were not carried out after the entry into force of this Law. The state allowed the possibility of registering a right both on the basis of a general description of an object (without guarantees of the accuracy of the boundaries of the object for which the right was registered) and on the basis of an accurate geodetic description (with a guarantee). At the same time, it was necessary to coordinate the boundaries of the land plot with the boundaries of adjacent land plots.

According to the Real Estate Registration Act 2002, an accurate geodetic description of land is required only in the following cases:

- registration of rights based on a court decision that resolved a land dispute;
- registration of rights to land plots formed from a land plot that had an accurate geodetic description;
- transfer (sale) of part of the estate, i.e. due to the need to form a new property;

• if the requirement for an accurate geodetic description is a condition of the contract for the transfer of real estate. Currently, if a land plot is transferred in its entirety under a transaction, the state recognizes the existing boundaries of the land plot, i.e. clarification of boundaries in accordance with current requirements is desirable, but not necessary, even if such boundaries were established 100 years ago or more.

If during registration there are doubts about the correctness of the boundaries, specialists from the relevant office of the Real Estate Register can independently make the necessary measurements on the ground or invite surveyors from the Cartographic Department. It should be noted that disputes over the boundaries of land plots still exist, but there are not many of them. In cases where there is a change in boundaries (for example, if a plot is divided into several plots), the boundaries of land plots are established in accordance with modern requirements. The exact boundaries of real estate are determined by the Ordnance Survey using satellite technology (even for unregistered properties, based on their actual condition). There is a formalized list of real estate objects (units) prepared by the Post Office (by address). The exact boundaries of real estate are determined by the Ordnance Survey using satellite technology.

Since 2002, mandatory registration of leases for a period of more than 7 years has been introduced, all registration is carried out electronically. The maps contained in the Real Estate Register are in vector form. They show which land plots are registered and which are not. The process of transferring rights to real estate includes the following stages:

1. Search for the necessary real estate (as a rule, this is carried out by lawyers specializing in this).
2. Application of interested parties to the Real Estate Register for information about real estate, rights to it, encumbrances, etc.
3. Preparation of a purchase and sale agreement. Payment of deposit. Transfer of rights to real estate.
4. Taking actual ownership of real estate.
5. Transfer of documents for registration of rights to the Real Estate Register.

A registration entry is made in the Real Estate Register, which may consist of three parts:

- part “A” contains a description of the property, rights to it, initial encumbrances;
- Part “B” records data about the owner of the property and the sale price of the property. In addition, it contains information about restrictions related to credit and collateral;
- Part “C” includes encumbrances and other data on real estate.

Mandatory initial registration of real estate was introduced in 1925, from the moment the Real Estate Law came into force. At the same time, the requirements

for the accuracy of geodetic measurements of real estate boundaries have also become more stringent. There is still quite a lot of unregistered real estate in England and Scotland (state-owned land, parks, forests, schools, farms, etc.).

The state cannot force owners to register their property, but it seeks to encourage them to do so through discounts on registration, advertising, outreach, etc. A prerequisite for the initial registration of real estate is proof of ownership for 15 years. During the initial registration, issues related to the permitted use of real estate are also recorded (for example, the use of land only for a garden, a ban on placing a restaurant, etc.).

State administration and regulation in the field of registration of rights to real estate in the UK (with the exception of Scotland) is carried out by the Companies House - the body maintaining the Real Estate Register, the activities of which are coordinated by the Ministry of Enterprise and Innovation (formerly the Ministry of Justice). The Real Estate Register in Great Britain was founded in 1862, since 1990 it received the status of an executive body (Agency), and since 1993 - the status of a commercial fund (provides the opportunity to engage in entrepreneurial activities). In accordance with the Law on Real Estate Registration, the Real Estate Register is the responsibility of the Chief Registrar of Real Estate, who is appointed by the Minister of Enterprise and Innovation (formerly the Minister of Justice) and reports to Parliament (prepares an annual plan-report on the work done and results). The activities of the Real Estate Register staff are regulated by laws, as well as more than 60 instructions and regulations. The main purpose of creating the Real Estate Register is to maintain a register of ownership and rental rights of real estate in England and Wales (in Scotland and Northern Ireland there is a special, slightly different procedure for registering real estate).

Objectives of the Real Estate Register:

- ensuring sustainable and effective registration of rights to real estate;
- guarantees of ownership of real estate;
- providing convenient access to up-to-date and reliable information about real estate.

The Property Register system consists of a head office in Croydon, one branch office, 14 regional offices and a data warehouse in Plymouth (total staff of approximately 5,000 people). The real estate register is self-financing.

The main income comes from fees for the provision of services, which can be divided into two parts:

- preparatory services (providing a copy of the map, official extracts from the Register, searching and providing information about real estate);
- post-sale services (initial registration of real estate, registration of the sale of the entire property, registration of the transfer of rights to an apartment or other part of the property (allotment), registration of lease).

Clients of the Real Estate Register are landowners, banks, construction organizations, real estate agents, law firms, government agencies, etc. Both registration and provision of data from the Real Estate Register are subject to a fee (minimum cost of registration - 50 pounds, minimum cost of information provided - 8 pounds). Free actions are carried out only in certain cases (for example, when changing persons, removing encumbrances, etc.).

In turn, the Real Estate Register purchases the cartographic basis for its purposes from the Cartographic Department, which is also an executive body that provides relevant services for a fee. Since 1993, the Real Estate Register has been converted into electronic form, but paper documents are still stored in a special storage facility. In addition, the entire history of requests for each property is stored in an electronic database. In case of an error, the losses incurred are compensated by the relevant territorial office of the Real Estate Register from the funds of a special compensation fund, and in full. Sometimes such compensation reaches significant amounts, but this does not happen very often (the probability of errors is about 1.5%).

The structure of land management in the United Kingdom is such that diverse information about it is held by various departments and organizations dealing with environmental protection, agriculture, land valuation, mapping, etc.

For the purpose of obtaining comprehensive and complete information about real estate, a special real estate information system was created - the National Real Estate Information Service, which receives data on real estate from various departments and organizations.

The National Real Estate Clearinghouse is also self-funded and provides real estate information and searches for a fee. This information is publicly available: any person, for a fee, can obtain information about the object, owner, rights to it and the cost of the previous sale.<sup>6</sup>

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俄罗斯与中国社会基础设施建设项目中公民社会参与实践的比较分析  
**COMPARATIVE ANALYSIS OF ENGAGEMENT PRACTICES  
CIVIL SOCIETY IN SOCIAL INFRASTRUCTURE DEVELOPMENT  
PROJECTS IN RUSSIA AND CHINA**

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摘要。本文由理论部分组成，重点介绍了中国和俄罗斯的居住区组织和类型、中国和俄罗斯联邦城市发展的特点、中国和俄罗斯联邦城市基础设施的现状；分析部分，介绍了中国和俄罗斯联邦的城市化模式、中国和俄罗斯联邦在行政和社会改革领域的问题，以及“2014-2020年新型城镇化国家规划”的出台作用、人力资本强化在城市管理领域的作用；项目部分，阐述了提高社会基础设施现代化程度和改善城市环境的设计发展；引言和参考文献列表。

关键词：俄罗斯、中国、公民社会、社会基础设施发展。

**Abstract.** *This article consists of a theoretical section that highlights the organization and typology of settlements in China and Russia, the characteristic features of the development of cities in China and the Russian Federation, the state of urban infrastructure in China and the Russian Federation; an analytical section that provides a description of the urbanization models of China and the Russian Federation, the problems of China and the Russian Federation in the field of administrative and social reform, as well as the role of the introduction of the “National Program of a new type of Urbanisation for 2014-2020”, the role of the intensification of human capital in the field of urban administration; a project section explaining design developments to increase the degree of modernization of social infrastructure and improve the urban environment; an introduction and a list of references.*

**Keywords:** *Russia, China, civil society, social infrastructure development.*

**Introduction** This work is devoted to research in the field of political sociology and concerns the study of programs aimed at the direct creation, modernization, equipping of social facilities of interest to citizens in the PRC and the Russian Federation, as well as criteria for increasing the effectiveness of the process of social modernization and at the same time the level of satisfaction of citizens.

The object of the study is the social reform of the state. The subject of the study is tools for involving citizens in monitoring, creating and modernizing social facilities. The object and subject of the study are taken for the period from the 2000s to the 2020s. This article can be considered relevant and socially significant because all the research carried out is of a practical and normative nature, and therefore can be used in the field of social, urban and administrative reform. Borrowing foreign experience, which means preparation and negotiation, retraining of personnel leads to an international exchange of knowledge and experience between countries, which, in turn, can contribute to the development of cooperation and improvement of practices in the field of social infrastructure.

**Problem Statement** The author of the article identified a number of key problems in the field of administrative and social reform and their correlation with the level of modernization of urban infrastructure in small and medium-sized cities. In the People's Republic of China: the lack of an effective urban order; a blurred division of competencies, responsibilities and powers of local governments; a system of unity of command that limits the improvement of local government and accountability; problems with corruption at various levels of government, which complicates the effective functioning of State bodies and creates obstacles to reform. In general, the lack of a comprehensive urbanization policy in the PRC increases the likelihood of the danger of so-called "false urbanization". In the Russian Federation, there are various problems in the field of administrative and social reform. Some of the main problems include the following: centralization of power, corruption and inefficiency in the administrative system, lack of social support and protection, low standard of living in a number of regions, demographic challenges.

**Research Questions** The hypothesis can be described as follows: the initiative to modernize social infrastructure and improve the urban environment should come from citizens.

**Purpose of the Study** At the beginning of the study of the problem of modernization of social infrastructure and improvement of the urban environment, the author of the article set the following goals: to assess the degree of interest of citizens in participating in monitoring, to identify the most popular and interesting formats of interaction for citizens, as well as to develop recommendations for the development of software and methods of interaction with citizens.

**Research Methods** The following methods became the methodological basis for the research: event analysis, comparative studies, expert interviews, content analysis of archival documents, statistical analysis. A number of non-classical approaches can be identified as the theoretical basis of the study: postmodern studies, communicativism, as well as conglomerate interpretations of the modern world. In addition, the author of this article referred in his research to the theory of political social networks, scientific works of well-known domestic and foreign political scientists and historians

in the field of the state of the social security system in modern China, as well as to the experience of China's public policy on urban modernization.

**Findings** Firstly, the author of the study characterized the structure and classification of cities in the People's Republic of China, as well as the characteristic features of their development, namely, he emphasized that at the present stage there are six hundred and eighty-seven cities in China, one hundred and six of them are million-plus cities. The maximum number of citizens lives in Shanghai. This is followed by Beijing, Chengdu, Wuhan, Tianjin, and Shenyang. There are about 1,119 cities in the Russian Federation, 16 of them with a population of over a million people. Despite, at first glance, the many differences between states, the researcher identified a number of similarities related to urban development. First of all, it is the rapid and intensive development of infrastructure, the construction of high-rise buildings, an increase in the number of residents and the development of the economy. In addition, it is important to note the fact of the numerical superiority of small towns (with a population of up to 1 million people). At the moment, these are 581 out of 687 cities, while only 33.7% of the country's urban population (475 million people) in China and 1103 out of 1119 small towns in the Russian Federation are permanently located in them.

Secondly, the models of urbanization characteristic of the People's Republic of China were identified: the "city-village" model (the "city-city" model (the "city-city"). Both models of urbanization are widely used in different regions of China, depending on specific conditions and development objectives. Urbanization in the Russian Federation is carried out in accordance with various models and approaches that take into account the specifics of the country, namely the Centrifugal model of urbanization, the Model of Sustainable Urban Development, the Model of a compact city, the Model of an innovative city. These models of urbanisation in Russia help to orient urban development towards solving urgent problems such as environmental sustainability, improving the quality of life of citizens, stimulating economic growth and developing innovations. Combining different approaches and principles makes it possible to create unique urban spaces that meet modern challenges and tasks.

Thirdly, the degree of influence of the Growth Poles of the People's Republic of China was determined.

Fourthly, the author of the study revealed the fact that the role of human capital in the field of urban economy is increasing every year. For this reason, it is proposed to coordinate the actions of national governments and international donor organizations to optimize urban governance in China. Such initiatives may include: the development of a stable information exchange system between States both within a certain region and beyond. It could consist of experts, donor organizations and international organizations, civil servants, scientists, business



representatives, specialists and NGOs; creation of a comprehensive demographic, migration, economic database on various factors affecting urban modernization; provision of advanced training courses and educational programs for employees on issues organization of local self-government, management of the urban infrastructure of municipal financing and inter-budgetary relations. These strategies would allow us to bring the exchange of experience and opinions to a new level, as well as improve inter-city cooperation.

**Conclusion** The author of the article has developed a strategy aimed at the direct creation, modernization, and equipping of social facilities of interest to citizens, as well as recommendations for the creation of social reform measures in Russia based on empirical research. As such measures, it is proposed to permanently increase the level of informatization of rural schools (to do this, improve the basic infrastructure for the implementation of informatization processes), pay more attention to the development of preschool education (since an increase in the level of rural education affects the overall improvement in the quality of life of the entire nation), reduce the number of socially vulnerable rural students thus realizing true equality in education, to offer privileges to those specialists in the capital who will be ready to move to the place of the problem and solve it in a limited time. In addition, recommendations were given on which applications can help the Government of the state in the field of administrative and social reform. Russian government could use Baidu Maps (百度地图), Dianping (大众点评), Koubei, Sina Weibo, Tianya Club и WeChat (微信) and other applications aimed at gathering public sentiment.

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DVGAFK 本科生一年级与二年级姿势稳定性比较  
**COMPARISON OF POSTURAL STABILITY OF  
UNDERGRADUATES FROM THE PEOPLE'S REPUBLIC  
OF CHINA IN THE FIRST AND SECOND YEARS OF STUDY  
STUDYING AT DVGAFK**

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**摘要。**本研究的目的是比较DVGAFK大学一年级和二年级中国本科生在2023年上半年的训练和比赛负荷期间的姿势稳定性指标。在研究过程中，与2年的本科生相比，1年的本科生根据Romberg测试的姿势稳定性指标闭眼时比睁眼时下降最少，这表明在没有视觉控制的情况下前庭稳定性更好，并且在视觉感官系统主动可视化的条件下，2年的本科生睁眼时的姿势稳定性指标比1年的本科生更好，这在游戏运动中非常重要。

**关键词：**大学生，中华人民共和国，姿势稳定性，硬件和软件综合体“Stabilan 01-2”，Romberg 测试，静态运动图支持面积，平衡功能质量，压力中心运动平均速度，沿额状面的扩散，沿矢状面的扩散，平均扩散。

**Abstract.** *The purpose of this study was to compare the indicators of postural stability of undergraduates from the People's Republic of China in the first and second years of study at DVGAFK during training sessions and competitive loads for the first half of the 2023 year of study at the University. In the course of the study, the indicators of postural stability according to the Romberg test for undergraduates of 1 year of study, compared with undergraduates of 2 years of study, deteriorated least with closed eyes compared to open eyes, which indicates better vestibular stability in the absence of visual control, and indicators of postural stability of undergraduates of 2 years of study with open eyes are more preferable compared with undergraduates of 1 year of study in the conditions of*

*active visualization of the visual sensory system, which is very important in game sports.*

**Keywords:** *undergraduates, People's Republic of China, postural stability, hardware and software complex "Stabilan 01-2", Romberg test, the area of the statokineogram support, the quality of the equilibrium function, the average velocity of the pressure center movement, the spread along the frontal plane, the spread along the sagittal plane, the average spread.*

## **Introduction**

Currently, undergraduates from the People's Republic of China are studying at the Far Eastern State Academy of Physical Culture within the framework of international cooperation between DVGAFK and Harbin Sports University (PRC) [2].

For undergraduates of the first and second years of study who are studying at the University, a large proportion of practical classes were game sports [4]. After participating in a number of competitions held at the DVGAFK from October to December 2022 [4], tournaments in April-May 2023 [6], postural stability was studied among undergraduates of the first and second years of study in addition to studying psychomotor indicators.

Since the specifics of game sports, in particular hockey, affect the manifestation of the athlete's coordination abilities, which are based on the coordination of the activities of various muscle groups, during the implementation of a motor act and the proportionality of movements, which is characterized by the accuracy of reproduction and differentiation of various movement parameters, programming the speed and trajectory of the athlete [3]. For athletes of game sports, the assessment of coordination abilities, as well as the diagnosis of psychomotor abilities, occupies a leading place, but currently there is little work on assessing postural stability in athletes engaged in game sports using hardware and software complexes.

Therefore, the purpose of our study was to study and compare the features of postural stability of undergraduates from the People's Republic of China in the first and second years of study at DVGAFK during training sessions and competitive loads for the first half of the 2023 year of study at the University.

### **1. The experimental part**

In accordance with the stated purpose of this study, on May 31, 2023, in the morning hours in the laboratory of "Monitoring of physical Condition" of the Far Eastern State Academy of Physical Culture, an assessment of the postural stability of undergraduates of the first and second years of study was carried out using the hardware and software complex stabilometric platform "Stabilan 01-2".

The number of undergraduates surveyed in both groups was 4 each. The stabilometric platform "Stabilan 01-2" was used to assess the functional state of sys-

tems for maintaining vertical posture at rest (a static component of the statokinetic function) [5 ].

The subjects performed the Rombergam stabilographic test (a test with open and closed eyes) on a stabilographic platform, which allows them to assess the state of vertical posture support systems in various variants of the functioning of sensory systems [5 ].

To analyze postural stability, in addition to the selected most informative stabilographic indicators of pressure center fluctuations: Ells, mm<sup>2</sup> – the area of the confidence ellipse; VSR, mm/sec – the average velocity of movement of the pressure center; CFR, % – the quality of the equilibrium function [1], Q<sub>x</sub>, mm – the spread along the frontal plane; Q<sub>y</sub>, mm – the spread along the sagittal plane and R, mm is the average spread.

The spread along the frontal plane (Q<sub>x</sub>, mm) is the average spread of fluctuations in the center of pressure of the central nervous system in one frontal plane (left-right). An increase in its value indicates a decrease in the patient’s stability in this plane.

Sagittal plane spread (Q<sub>y</sub>, mm) is the average spread of fluctuations in the center of pressure of the central nervous system in one sagittal plane (forward-backward). An increase in its value indicates a decrease in the patient’s stability in this plane [5].

The average spread (R, mm) is the average radius of deviation of the center of pressure (CD). The indicator determines the average total variation of the fluctuations of the central nervous system, an increase in its values indicates a decrease in the patient’s stability in both planes[1].

**2. Results**

As a result of the study, comparing the indicators of undergraduates of 1 year of study with those of undergraduates of 2 years of study according to the Romberg test (open eyes test), we found that a significant difference is observed in such indicators as the spread along the frontal plane (Q<sub>x</sub>, mm), the average velocity of the center of pressure (VSR, mm/sec) and the area of the confidence ellipse (Ells, mm<sup>2</sup>) (Table 1).

**Table 1**  
*Indicators of postural stability of undergraduates from the People’s Republic of China in the first and second years of study*

Indicators The Romberg test	May 2023			
	Undergraduates of 1 year of study		Undergraduates of 2 year of study	
	Open eyes	Closed eyes	Open eyes	Closed eyes
Q <sub>x</sub> (mm)	2±0,4	1,71±0,4	1,46±0,3	2±0,4

Oy (mm)	3,57±0,9	4,33±0,7	3,80±0,9	4,44±0,5
R (mm)	3,3±0,65	3,83±0,6	3,45±0,6	4,21±0,5
V cp (mm/sec)	6,0±1,2	9,34±1,1	7,09±0,6	9,89±1,75
S <sub>EllE</sub> (mm <sup>2</sup> )	95,3±33,5	100,3±30,0	78,4±23,0	119,5±29,1
CFR (%)	112,5±9,0		113,5±7,0	

Thus, for undergraduates of 2 years of study, the average spread along the frontal plane (1,46mm) was 27% significantly better than for undergraduates of 1 year of study (2mm) ( $p<0,05$ ), and one of the undergraduates of 2 years of study recorded the best indicator-0,93 mm. In all subjects, this indicator was within the normal range.

When comparing the average spread over the sagittal plane for undergraduates of 1 year of study (3,57mm) and undergraduates of 2 years of study (3,80mm), no significant differences were found ( $p>0,05$ ), but the smallest spread of fluctuations in the center of pressure in the forward-backward plane was for the undergraduate of 2 years of study-1,93mm and the smallest A large spread in this plane is also for a 2-year undergraduate student -5,83 mm, while out of 4 undergraduates, both 1 and 2 years of study, two undergraduates had indicators that were not normal and conditionally normal.

Such an indicator as the average spread (R, mm) also had no significant differences between undergraduates of 1 year of study (3,3mm) and undergraduates of 2 years of study (3,45) ( $p>0,05$ ), but the smallest average total spread of fluctuations in the central nervous system was recorded for a 2-year undergraduate- 2,2mm, and the largest the spread of this indicator for a 1-year undergraduate is 4,96 mm.

The average velocity of movement of the pressure center (VSR, mm/sec) was significantly better by 18,1% for undergraduates of the 1st year of study (6,0mm/sec) compared with the indicator of undergraduates of 2 years of study (7,09 mm/sec) ( $p<0,05$ ), while the worst indicator was recorded for a master's student of 1 year of study-9,12 mm/sec and the best also for a master's student of 1 year of study – 4,33 mm/sec.

And finally, the index of the area of the confidence ellipse (EllS, mm<sup>2</sup>) was 17,7% significantly better for undergraduates of 2 years of study (78,4 mm<sup>2</sup>) compared with the index of undergraduates of 1 year of study (95,3 mm<sup>2</sup>) ( $p<0,05$ ). The best indicator of the area of the confidence ellipse was found in a 2-year undergraduate student – 33,5 mm<sup>2</sup>, and the worst indicator in a 1-year undergraduate student – 174,1 mm<sup>2</sup>.

When comparing the indicators of undergraduates of 1 year of study with those of undergraduates of 2 years of study according to the Romberg test (closed eyes test), it was found that a significant difference was observed in such indicators as the spread along the frontal plane ( $Q_x$ , mm), the average spread (R, mm) and the area of the confidence ellipse (EllS, mm<sup>2</sup>) ( $p<0,05$ ).

Thus, for undergraduates of 1 year of study, the average spread along the frontal plane (1,71mm) was 16,9% significantly better than for undergraduates of 2 years of study (2mm) ( $p < 0,05$ ). The worst given indicator (2,77mm) was recorded for a 2-year undergraduate student, and the best (0,97mm) for a 2-year undergraduate student. In all subjects, this indicator was within the normal range.

The average spread over the sagittal plane for undergraduates of 1 year of study (4,33mm) had no significant differences with the indicator of undergraduates of 2 years of study (4,44mm) ( $p > 0,05$ ), while the smallest spread of fluctuations in the center of pressure in the forward-backward plane was for a graduate student of 1 year of study -2,64 mm, and the largest the spread of this indicator for a 2-year undergraduate student is 5,41 mm. In all subjects, this indicator was within the normal range.

The average spread (R,mm) was 9,9% significantly better for undergraduates of 1 year of study (3,83 mm) compared with the indicator of undergraduates of 2 years of study (4,21 mm) ( $p < 0,05$ ). The smallest average total variation of CD fluctuations was recorded in a 1-year undergraduate student - 2,27mm, and the largest variation of this indicator in a 2-year undergraduate student - 5,01mm.

The indicator of the average velocity of movement of the pressure center (VSR, mm/sec) had no significant differences between undergraduates of 1 year of study (9,34 mm/sec) and undergraduates of 2 years of study (9,89 mm/sec) ( $p > 0,05$ ), while the worst indicator was recorded for a 2-year undergraduate student -13,55 mm/sec and the best is also for a 2-year undergraduate student - 6,34 mm/sec.

And finally, the index of the area of the confidence ellipse (EILS, mm<sup>2</sup>) was 19,1% significantly better for undergraduates of 1 year of study (100,3 mm<sup>2</sup>) compared with the indicator of undergraduates of 2 years of study (119,5 mm<sup>2</sup>) ( $p < 0,05$ ). The best indicator of the area of the confidence ellipse was found in a 2-year undergraduate student - 33,5 mm<sup>2</sup>, and the worst indicator in a 1-year undergraduate student - 174,1 mm<sup>2</sup>. The best indicator of the area of the confidence ellipse was found in a 1-year undergraduate student - 36,5 mm<sup>2</sup>, and the worst indicator in a 2-year undergraduate student - 166 mm<sup>2</sup>.

When comparing the indicators of the Romberg test (open/closed eyes), undergraduates of the 1st year of study showed a significant deterioration in the indicators of the Romberg test with open eyes compared with those with closed eyes, according to indicators such as the sagittal plane spread ( $Q_y$ , mm) by 21,2%, the average spread (R, mm) by 16% and the average velocity of movement of the pressure center (VSR, mm/sec) by 55,6% ( $p < 0,05$ ). The spread index along the frontal plane with closed eyes (1,71mm) significantly improved by 14,5% compared to the indicator with open eyes (2mm), and the average area of the confidence ellipse (EILS, mm<sup>2</sup>) with closed eyes (100,3 mm<sup>2</sup>) slightly worsened during the study, but had no significant decrease compared to with an average with open eyes (95,3 mm<sup>2</sup>) ( $p > 0,05$ ).



When comparing the indicators of the Romberg test (open/closed eyes), undergraduates of 2 years of study had a significant deterioration in the indicators of the Romberg test with open eyes compared with those with closed eyes, according to indicators such as the spread along the frontal plane ( $Q_x$ , mm) by 37%, the spread along the sagittal plane ( $Q_y$ , mm) by 16,8%, the average spread ( $R$ , mm) by 22%, the average velocity of the center of pressure (VSR, mm/sec) by 39,5% and the area of the confidence ellipse (EIS,  $\text{mm}^2$ ) by 52,4% ( $p < 0,05$ ).

The indicator of the quality of the equilibrium function (CFR, %) according to the Romberg test (open/closed eyes) for undergraduates of 1 year of study (112,5%) had no significant differences with the same indicator for undergraduates of 2 years of study (113,5%), but the highest indicator was recorded for undergraduates of 1 year of study -136%, so as well as the lowest rate for a 1-year undergraduate student -99%.

## 2. Conclusions

As a result of the study, a comparative analysis of the postural stability of undergraduates from the People's Republic of China for 1 and 2 years of study according to the indicators of the Romberg test (open eyes) showed that undergraduates for 2 years of study compared with undergraduates for 1 year of study had significantly better results in such indicators as the spread along the frontal plane, the area of the confidence ellipse and only in terms of the average speed of movement of the pressure center is significantly better on average for undergraduates of 1 year of study. Although no reliability was revealed for indicators such as the sagittal plane spread and the average spread, individual undergraduates of 2 years of study had better results compared to undergraduates of 1 year of study. At the same time, two undergraduates of 1 and 2 years of study were found to be abnormal and conditionally normal in the indicator of the sagittal plane spread, but to a lesser extent deviations from the norm for undergraduates of 2 years of study.

A comparison of the postural stability of undergraduates from the People's Republic of China for 1 and 2 years of study according to the indicators of the Romberg test (closed eyes) revealed that undergraduates of 1 year of study compared with undergraduates of 2 years of study had significantly better results in such indicators as the spread along the frontal plane, the average spread, the area of the confidence ellipse. Although no reliability was revealed for such indicators as the spread along the sagittal plane and the average velocity of the center of pressure, individual undergraduates of the 1st year of study had better results compared to undergraduates of the 2nd year of study.

An analysis of the indicators of postural stability with open and closed eyes in undergraduates from the People's Republic of China for 1 year of study according to the indicators of the Romberg test showed that in many indicators with closed eyes compared with open eyes, there is a deterioration, most noticeable in the av-

erage speed of movement of the pressure center by 55,6%, except for the indicator of the area of the statokinesiogram, which is slightly significantly not it worsened, and the sagittal plane scatter indicator with closed eyes, on average, compared with the indicator with open eyes, even significantly improved, this indicates a lesser degree of influence of the lack of visual control on the fluctuations of the center of pressure in the forward-backward plane.

An analysis of the indicators of postural stability with open and closed eyes for undergraduates from the People's Republic of China for 2 years of study according to the Romberg test showed that for all indicators with closed eyes compared with open eyes, there is a deterioration, most noticeable in terms of the area of the statokinesiogram by 52,4%, the average speed of movement of the pressure center by 39,5% and the spread over the frontal plane by 37%.

The analysis of the quality indicator of the equilibrium function (CFR,%) according to the Romberg test (open/closed eyes) in undergraduates from the People's Republic of China for 1 year and 2 years of study, although there were no significant differences during the study, but at the same time a higher indicator was recorded in a 1-year undergraduate student -136%, as well as and the lowest rate for a 1-year undergraduate is 99%.

Thus, in general, it can be said that the indicators of postural stability according to the Romberg test for undergraduates of 1 year of study compared with undergraduates of 2 years of study deteriorated least with closed eyes compared to open eyes, which indicates better vestibular stability in the absence of visual control, and indicators of postural stability of undergraduates of 2 years open-eyed studies are more preferable compared to undergraduates of 1 year of study in conditions of active visualization of the visual sensory system, which is very important in game sports.

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教育机构中未成年人社会化的法律问题  
**ISSUES OF LEGAL SOCIALIZATION OF MINORS IN AN  
EDUCATIONAL ORGANIZATION**

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**摘要。**本文探讨法律社会化问题、法律社会化的构成要素、影响未成年人行为表现的因素、社会法律角色和社会法律能力的概念、有助于有效提供未成年人法律社会化的形式。

**关键词：**未成年人、法律社会化、法学教育、法律文化、社会和法律角色、社会和法律能力。

**Abstract.** *This article discusses the issues of legal socialization, its components, factors of influence on the behavioral manifestations of a minor, the concept of socio-legal role and socio-legal competence, forms that contribute to the effective provision of legal socialization of minors.*

**Keywords:** *minor, legal socialization, legal education, legal culture, social and legal role, social and legal competence.*

Currently, which is characterized by its dynamism and complexity of perception of ongoing processes in society and the world as a whole, there is an increase in destructive behavior, an increase in the level of aggressiveness in children and adolescents, and a general decrease in motivation to learn. This problem should be considered through a combination of external and internal factors. External factors include (macro factors) - state, institutional and social levels; (micro-factors) - organizational, procedural, interpersonal. Internal factors include problems of behavioral, personal, motivational and cognitive and other areas of students [1].

Undoubtedly, the modern world is dynamic even more than before, its stability, both economic and political, are unstable, lead to an aggravation of the situation of the population, which cannot but affect the behavior of the teenager.

The behavior of minors is dictated by age and individual characteristics: increased emotional excitability, impulsivity, imbalance of excitement and inhibition, as a result of hormonal restructuring of the body; motor and verbal activity;

suggestibility; imitation; the desire for independence, the desire for prestige in the group of affiliation, negativism, lack of life experience, a low level of self-criticism, etc., which can lead to manifestations of legal nihilism and behavioral manifestations of a destructive nature with signs of a calculated act. This may depend on situational, sociocultural and individual psychological factors.

One of the priority tasks of an educational organization is the legal socialization of a minor.

Legal socialization is considered as the formation and development of the legal consciousness of adolescents, and is presented not in the form of specially created, special educational systems, but in systemic purposeful activities leading to conscious changes; organization and content of legal and social practice; that is, it acts as a mechanism for the formation of a student's legal awareness, i.e. his conscious choice.

The legal consciousness of minors reflects the values inherent in the public legal consciousness: illegal practices and rejection of the law are widespread in society, are enshrined in the behavior of minors [2].

The main stages of legal socialization of young people, according to O.E. Tomazova, are [3]:

**Table 1**  
*Stages of legal socialization*

<b>socialization stage</b>	<b>characteristic</b>	<b>period of life</b>
primary legal socialization stage	assimilation of the foundations of legal culture and legal values that form the legal consciousness	10 to 13 years
transitional socialization stage	tendency to acute perception of negative aspects of social life, instability of socio-legal and psychological attitudes	14-16 years
stable socialization stage	formation of stable legal of a young person, influencing his social and legal activity and an informed choice of legal behavior, a high level of legal awareness and legal culture	17-18 to 25-30 years

A.M. Stolyarenko defines the result of legal socialization as the legal formation of a person, acting in its highest manifestation in the form of a legal culture of a person with four components: legal education (legal knowledge, views, beliefs); legal education (respect for the law); legal training (experience of lawful conduct); legal development (assessments, selection guidelines) [4].

Z.N. Kalandarishvili singled out the following methods of legal education: information method (transfer of legal knowledge); orientation and activity method (legal activity); development of evaluation activities (critical thinking) [5].

All this must be taken into account when designing activities for the legal education of minors in an educational organization, and correlate with the individual characteristics of students.

The definition of age standards for the legal socialization of minors will make it possible to outline the range of tasks, the solution of which will contribute to raising the level of legal culture and the formation of legal awareness of students.

Legal education, in essence, is collective education and since subjects in educational organizations operate in a collective environment and use collective norms, collective education is inevitable. The way of an educational organization is of great importance, it forms an environment that undoubtedly affects the student and forms models of his behavior, including the legal one.

The greatest difficulties in the field of legal education and legal protection of children arise in cases of delayed mental development in students, etc. By the legally defined period of their full legal capacity, as a rule, they are not ready for independent life due to the peculiarities of development, and their further being under the care of adults becomes impossible.

Cases of offenses that have not been suppressed and have not entailed appropriate penalties and consequences can have a significant negative impact on the legal consciousness of minors.

The practical orientation of legal education, the formation of legal behavior of a minor suggests that it is not enough to have legal information, it is important to be able to use it competently. But literacy alone is not enough, legal knowledge must pass into skills, i.e. into competence.

Socio-legal competence is a personal characteristic, including a respectful attitude to laws, an awareness of the need to comply with them, formed attitudes towards social interaction, the adoption of moral norms of society (value-motivational criterion); high level of socio-legal knowledge, the desire for their continuous improvement (cognitive criterion); social and legal experience, the ability to consciously choose and make decisions, willingness to take responsibility, participation in the public life of an educational organization, constructive communication (activity criterion), a set of interconnected knowledge, skills and abilities, organization of effective social interaction in accordance with strategies and tactics of legal behavior, personal and volitional attitudes that determine the possibility and desire to commensurate their social behavior with the law and other norms in force in society [6].

- Increasing the legal literacy of minors is carried out on the basis of the requirements of the GEF, which determines the amount of knowledge. All this knowledge and skills are necessary for the effective solution of everyday life situations. Legal literacy is necessary even at the everyday level.

- The results of the study showed that 55% of the surveyed minors who committed offenses found it difficult to explain the circumstances of the crime (offense), although 90% noted the presence of some theoretical knowledge about the laws, but do not correlate them with their actions. Adolescents believe that it allows to eliminate (prevent) offenses (crimes) the following aspects:
  - legal knowledge of the consequences of committing a crime (offense) - 62%
  - opportunity to earn money for children and adolescents after school hours 51%
  - expansion of measures and forms of prevention - 47%.

Parents (70%), school (60%), media (50%), and a juvenile inspector (20%) are priority ways to obtain information about laws, norms and rules of conduct.

The participation of the juvenile inspector is urgently needed in preventive activities and legal education of students. Experience shows that where the interaction of an educational organization and an inspector for juvenile affairs is established, the indicators of those registered in the Juvenile Affairs Department are minimal or absent.

Analysis of the process of preventing destructive behavior of adolescents requires taking into account both positive and negative factors that affect the personality. The main task in this case is to neutralize negative aspects in order to ensure favorable conditions for their socialization.

An important milestone in the legal socialization of minors is the assimilation of socio-legal roles.

Socio-legal roles are a set of requirements imposed on an individual by society in accordance with socio-legal norms, as well as actions performed by a person that comply with the norms of law. Man is the bearer of many different roles that are regulated by socio-legal norms, and perform very important functions in society: regulating the general course of socialization, integrating individuals into society; control of deviating behavior; serve as patterns of behavior.

The following socio-legal roles can be distinguished: employee/student; owner; consumer; citizen, family member. Socio-legal roles undoubtedly influence personality development. Mastering a new role can make a huge difference in changing a person and their further achievements. Social and legal roles are performed in accordance with the generally accepted social standard and provided with a regulatory framework. Each role has its own functions, rights and responsibilities:

- the role of a citizen is the executor of laws, defender of the Fatherland, taxpayer, voter, public figure, etc.
- the role of the employee/student - the performer of labor duties (employer, employee, student, mentor, trade union member, etc.).

- consumer role - buyer and user of goods/services, etc.
- the role of a family member - the executor of marital, parental and other duties (marital relations (husband, wife); child-parent relations (father, mother, son, daughter); - family and family (brother, aunt, nephew, grandfather, great-grandmother, etc.), etc.
- the role of the owner - the executor of the duties of the owner of something (dwelling, vehicle, etc.).
- the role of the consumer - the performer of the behavioral practices of the buyer/consumer of services (financial, medical, household, etc.).

Each socio-legal role is endowed with rights and obligations.

Insufficient legal literacy can lead to non-fulfillment (neglect) of socio-legal roles, which will inevitably entail a change (downgrade, loss of previous) status, asocial behavior.

The inability to fulfill one of the socio-legal roles can be reflected in other roles and in socialization in general

For the purpose of legal education of minors, it is necessary to conduct classes for each block corresponding to socio-legal roles. As practice shows, knowledge of articles of codes/laws does not prevent minors from committing offenses. Assimilation of social and legal roles by students gives a greater result in the prevention of offenses by minors and their legal socialization, which leads to a reduction in the number of registered persons in the Juvenile Affairs Department.

Mastering socio-legal roles can change the behavior and worldview of a minor, his value attitudes and social position, which leads to legal socialization and enables adolescents to manifest their active civic position in a socially approved direction and gain social experience necessary for self-realization and increase self-esteem significant for a minor, especially in adolescence.

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开展志愿活动，培养学龄前儿童沟通文化的机会

**OPPORTUNITIES FOR VOLUNTEER ACTIVITIES IN  
DEVELOPING A CULTURE OF COMMUNICATION AMONG  
PRESCHOOLERS**

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注释。本文分析了志愿活动在学龄前儿童交流文化形成中的教学潜力。在学龄前儿童时期，儿童的交流非常频繁。现代儿童的这一过程可能会受到父母太忙、孩子在家庭中被孤立等因素的负面影响。志愿活动有助于消除这些负面因素对学龄前儿童社会化的影响，以及独立性和主动性的形成。这种影响是通过积极行动来实现的，这些行动有助于学龄前儿童交流文化的发展。

关键词：志愿服务、学龄前儿童、组织和活动、事件。

**Annotation.** *The article analyzes the pedagogical potential of volunteer activities in the formation of a culture of communication among preschool children. During the period of preschool childhood, children's communication occurs intensively. The course of this process in modern children can be negatively influenced by factors such as parents being too busy, the child being isolated in the family, etc. Volunteer activities help eliminate the influence of these negative factors on the socialization of preschoolers, as well as the formation of independence and initiative. This impact is carried out through active actions that contribute to the development of a culture of communication among preschoolers.*

**Keywords:** *volunteering, preschoolers, organization and activities, events.*

Charitable activity is understood as the voluntary activity of citizens and legal entities in the disinterested (free of charge or on preferential terms) transfer of

property, including money, to citizens or legal entities, the disinterested performance of work, the provision of services, and the provision of other support.

Currently, “volunteering” is commonplace in various areas of social life: from improving courtyards and city streets to helping animals and zoos; from caring for people with disabilities, migrants, refugees to helping drug addicts, from participating in one-time events to implementing state national programs.

Volunteer activities are aimed, first, at helping people in dire need who are unable to help themselves (old age, homelessness, disability, natural disasters, and social cataclysms). In the Russian Federation, the legal justification for the volunteer movement is enshrined in the relevant provisions of the Constitution of the Russian Federation, the Civil Code of the Russian Federation, other federal laws and laws of the constituent entities of the Russian Federation.

Volunteering plays a critical role in child and adolescent social care settings as they provide much-needed support and resources to these vulnerable populations. However, the organization and management of voluntary activities in these institutions has its own characteristics and requires a high degree of organization of humanitarian programs and projects aimed at supporting youth in difficult life situations. Theoretical approaches to organizing volunteerism offer valuable insights and strategies that can improve the effectiveness and impact of these initiatives [3].

The effectiveness of voluntary activities can be assessed through various methods, such as assessing the complexity, effectiveness and quality of their work, as well as their personal qualities and contribution to the organization. In general, volunteer activities and their evaluation make a significant contribution to the success and development of social assistance institutions for children and adolescents [2].

This form of assistance is a key tool for organizing humanitarian programs and projects aimed at supporting young people in difficult life situations.

The organization of volunteer activities in social assistance institutions for children and adolescents is based on various theoretical approaches that help to effectively structure and manage this process. Here are a few examples.

1. Social Capital Theory: This theory suggests that volunteering helps develop social connections and build social trust. Volunteers can become part of a support network for children and adolescents and help them establish social contacts.
2. Motivation theory: each volunteer has different motives for which they decide to devote their time to children and adolescents in social assistance institutions. Studying the motivations of volunteers will help activity organizers to effectively attract and retain volunteers.
3. Role theory: Each volunteer performs certain roles in the organization. For example, someone can work with children, someone can organize

events, and someone can keep financial records. Role theory helps organizers define the required roles and divide tasks among volunteers.

4. Learning Theory: The organization of volunteer activities is based on the principles of learning, which allows volunteers to gain the necessary skills and knowledge to work with children and adolescents. Approaches such as active learning allow volunteers to actively participate in the learning process and apply what they learn in practice.
5. Management theory: organizing volunteer activities requires a management approach, since it is necessary to effectively coordinate the activities of volunteers and ensure certain quality standards. Management theory helps to structure processes, develop reporting systems and evaluate the performance of volunteers.

These theoretical approaches influence the organization of volunteer activities in social assistance institutions for children and adolescents. They help to structure and guide the process to achieve maximum benefit for children and young people and to meet the needs of volunteers to get involved in the community and help others.

Thus, the use of various theoretical approaches to the organization of volunteer activities in institutions of social assistance to children makes it possible to increase the efficiency of volunteers and provide children with the necessary support and care. The responsibility and professionalism of volunteers, supported by modern theoretical approaches, contribute to improving the quality of life of children and their integration into society.

Assisting children who, for various reasons, were left without parental care (“physical” orphans and social orphans) is the most important direction of the state’s social policy [5]. The decision to become a volunteer for orphans and children left without parental care should be made calmly and carefully. When visiting orphanages, certain rules must be followed. They will help maintain good relationships with pupils of social institutions and preserve the volunteers’ peace of mind:

1. Do not talk about parents, do not ask about family;
2. Do not call children orphans, many have parents alive, children know about this;
3. Do not make empty promises;
4. Learn to say the word “no”. Pupils know how to achieve relationships; it is difficult for them to refuse. It is important to be able to set boundaries in communication;
5. Do not treat children from the orphanage with pity. Such thoughts will certainly be embodied in actions and phrases that will hurt the students and lower their self-esteem.

Volunteers can create a living space for preschoolers to adjust their emotional-volitional qualities by following several steps:

1. **Creating a Safe and Supportive Environment:** Volunteers can create an environment where children feel safe and comfortable so that they can openly express their emotions and feelings. It is important that volunteers express attention, care and understanding to each child.
2. **Create structured programs and activities:** Volunteers can develop special programs and activities that will help children develop self-management and emotional self-regulation skills. This may include games, story-telling, or creative projects that promote emotional awareness and self-control.
3. **Conducting individual and group conversations:** Volunteers can offer regular individual and group conversations with children to discuss their emotional state, problems or concerns. This can help children develop communication and communication skills and learn to better understand and manage their emotions.
4. **Participation in trainings and seminars:** Volunteers can also take part in trainings and seminars that will help them develop skills in working with the emotional-volitional sphere in children. For example, they can learn about self-regulation training or practice relaxation and meditation techniques.

All these steps will help volunteers create a living space where children can develop skills of emotional awareness, self-regulation and strengthen their emotional-volitional sphere, which will have a beneficial effect on the development of a culture of communication.

One of the most effective forms of subjective interaction of children in a kindergarten is joint games for children, in which they act simultaneously and in the same way. The absence of objects and competition in such games, the commonality of actions and emotional experiences create a special atmosphere of unity with peers and closeness of children, which has a beneficial effect on the development of their communication and interpersonal relationships.

Throughout the entire work on creating a culture of communication among preschoolers, it is necessary to keep constantly an eye on conflicting children due to their inability to control their behavior and insufficient playing skills. They need to be more often included in socially useful activities: involved in the manufacture of play equipment and, thus, involved in the life of the children's team; offer roles that require accuracy and discipline (construction manager, store director, library manager).

In interaction with peers, children learn to act together and voluntarily control their behavior. It is important to introduce children to the rules of behavior and

teach them to use the rules as guidelines for forming children's opinions about the behavior of peers and themselves, and cultivating friendly relationships [1].

The main content of children's play is to perform certain actions with toys and reproduce the actions of people; older children – in reproducing relationships between adults; For older preschoolers, the content becomes the rules of social behavior and social relations between people [4].

Through a certain plot, content and role during the game, the moral and social feelings of preschoolers can be formed. A necessary condition for this is the modeling of relationships in which humane feelings are manifested. You can count on awakening humane feelings by programming their manifestation in the game. The rules of cultural behavior of pedagogically oriented gaming activities are introduced into role requirements as a mandatory attribute of the game.

Thus, developing a culture of communication in children through volunteering is necessary because volunteers can help children develop communication skills, adaptation in society, the ability to express themselves emotionally and empathy for other people. Children may experience inferiority, lack of self-esteem and self-confidence. Volunteering provides an opportunity to work in a team, solve problems together, develop skills in interacting with different people, and learn to accept and coordinate different points of view.

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通过“情感”激发年轻人的学习兴趣和创新能力  
STIMULATE YOUNG PEOPLE'S INTEREST IN LEARNING AND  
INNOVATION ABILITY THROUGH EMOTIONAL

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**摘要。** 随着世界人口的增加和各行业竞争的加强, 家长和社会给予年轻人的学习压力加大。许多年轻人无法正确面对自己的情绪问题, 这大大增加了年轻人患抑郁症的可能性。不正确的释放压力的方式也会导致年轻人对学习和创新能力的兴趣下降。本文科学分析了如何以正确的方式给予年轻人情感支持, 以提高他们的学习兴趣和创新能力。

**关键词:** 情感教育, 情感系统, 增加学习兴趣, 创新能力培养。

**Abstract.** *With the increase of the world's population and the strengthening of competition in various industries, the learning pressure given to young people by parents and society has increased. Many young people are unable to face their emotional problems correctly, which greatly increases the probability of depression among young people. Incorrect ways of releasing stress also lead to a decrease in young people's interest in learning and innovation ability. This article scientifically analyzes how to give emotional support to young people in the right way to improve their interest in learning and innovation ability.*

**Keywords:** *Emotional education, Emotional system, Increase interest in learning, Innovation ability training.*

The richness of emotions is an important feature that distinguishes humans from other living things, but the study of the influence of emotions on learning ability did not officially open the precedent of emotion research until the end of the 19th century, when Darwin published “Human and Animal Expressions”. At the same time, the status of emotional research in education has always been affected by the status of intelligence in education, and the attitude towards emotional research has also undergone many changes.

Intelligence tests have emerged since the 20th century, and psychologist Ash (Ash, M.) Studied the educational psychology textbooks in the United States from 1954 to 1983, and conducted a quantitative analysis. The focus of his analysis

textbook is on intelligence, memory and forgetting, and reached its peak in the 1960s and 1970s. There is very little research on emotion and personality. This research shows that the focus of educational psychology in the 20th century was on IQ rather than emotional intelligence. With the development of the concept of intelligence, everyone has increasingly recognized the view that intelligence is no single but multiple. The concept of “emotional intelligence” was proposed in 1990. At that time, “emotional intelligence” was defined as the ability to recognize the emotions of oneself and others, and use these emotions to guide one’s own thinking and help one’s own actions. Although there was a concept of emotional intelligence in the 1960s, it was not recognized and it was not recognized until the 1990s. This means that the first transformation has occurred, that is, from cognitive intelligence to emotional intelligence [1, pp. 5].

Harvard University Gorman, in 1995, he published a book called “Emotional Intelligence”, which goes beyond the definition of emotional intelligence in traditional psychology, and is no longer limited to attributing emotional intelligence to the ability to perceive, use and understand, manage emotions, and use emotions for reasoning, but mixes and absorbs other personality traits. In the book, there is a chapter dedicated to the practice of “emotional education”. In this way, emotional intelligence has entered the field of pedagogy from the field of psychology, so there is a second shift, from “intelligence” to “ability”. It is specifically reflected in the shift from intelligence testing to educational practice; from focusing on individuals to paying more and more attention to groups; from the treatment model of psychology to the prevention model and growth model of education.

From the international level, after the 21st century, social and emotional competence has generally been regarded as a priority area of policy development. For example, the United Kingdom has continued to recommend social and emotional learning projects in the Ministry of Education and Skills since 2005, and the participation rate of primary and secondary school students is as high as 80%. The United States issued a bill in 2015 to regulate emotional learning, and social and emotional competence has entered the era of global promotion. The most typical is the promotion of socio-emotional capacity projects by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the United Nations Children’s Fund in more than 170 countries. The International Organization for Economic Co-operation and Development (OECD) released an influential report “Skills to Promote Social Progress: The Power of Society and Emotion” in 2015, which clearly pointed out that social and emotional abilities are the core soft power of the 21st century, and released a report on the assessment of social and emotional abilities of adolescents to the world in 2021. Vigorously promote the assessment and practice of social and emotional abilities around the world [2, pp. 6].

The influence of emotions on adolescents cannot be ignored. For example, the national happiness score of middle school students in China in 2023 was only 7.1



points, which is a decrease of 0.4 points compared to 2018, and 17.8% of middle school students have serious psychological disorders. These psychological disorders are mainly manifested as anxiety, depression, low self-esteem, loneliness, disgust with learning, aggression, etc. In addition, in the analysis and testing of the emotional ability and mental health of the 15-year-old group and the 10-year-old group, the emotional ability of the 15-year-old group is much lower than that of the 10-year-old group, which shows that adolescents encounter serious psychological disorders in interacting with others and integrating into society. There have been some difficulties and setbacks, resulting in their emotional needs not being effectively met.

In family education, when many parents of students face their children's love problems, some parents often react too extreme, by controlling their children's freedom in all aspects 24 hours a day, to avoid their children falling in love, so that there are often news reports that many children have harmed their bodies as a result, and at the same time, the children did not improve their academic performance because of the breakup. In this regard, parents of students must recognize that emotional needs are essential for everyone, and correctly combing their children's emotions is the key to avoiding tragedies and improving their children's learning ability. Under the premise of their children's happiness, it is recommended that parents of students should carry out emotional education with the following goals [3, pp. 12].:

- Let children have a sufficient sense of security in life
- Let children learn how to express emotions rationally
- Let children learn how to get along and communicate with others
- Stimulate children's creativity and imagination

In the current school education, contemporary teachers are paying more attention to the cultivation of students' interest in learning than just their attention to students' test scores. Among them, the formation of cognitive interest is achieved through the use of interactive teaching methods, the use of game elements, and individual and collective emotional participation in student activities. The core of this is emotional support. The use of emotional support enhances students' emotional preparation to perceive new information and interact with the surrounding world. For example, when dealing with emotional support (such as riddles), teachers can use semantic-visual methods. When certain emotions are formed in students, including positive sensory and thoughtful cognitive activities, teachers can ask students questions, induce students to think more positively, and develop students' insight and intuition. Characteristics. At the same time, teachers have also received many courses on how to properly educate students' emotions. In the process, teachers are required to learn to appreciate students, cooperate with students from time to time, and respect and understand students' negative emotions.

For how to properly cultivate emotions in school education, we can summarize it as a few points [4, pp. 368].:

- Carry out pre-class activities to stimulate students' emotions of loving language and writing
- Pay attention to sensory cognition in the teaching and explanation process, and strengthen the construction of situational atmosphere
- Mining teaching materials to stimulate students' rich emotional experience
- Pay attention to equal communication with students in the process of correcting homework
- Respect students' negative emotions and be empathetic

In individual courses that use emotional support, a “fusion” of students' emotional state and their cognitive activities should be provided. The task of parents is to give their children high-quality companionship and form a good family atmosphere. Children's psychology should not be affected by quarrels between parents, and effective parent-child communication methods should be established to avoid overprotection and turning a blind eye. The task of teachers is to find a balance between maintaining the necessary level of cognitive interest in the course and ensuring the necessary level of absorption of materials, on the one hand to improve the scientific nature of their own teaching, on the other hand to improve the emotional attention of students in the teaching process. In the methodological literature, there is a method of “sensory” comparison. For example, by playing two videos of the living environment of different countries, students can use their own life experience to analyze the characteristics of people in different countries. In the process of student analysis, some questions related to teaching goals are also raised, allowing students to draw a more scientific and systematic point of view and increase the perspective of thinking about problems through their own thinking. Teachers can use this emotional support to form cognitive interest by using special “remember” gauges at the beginning and end of the scoring gauge. For teachers, it is important to remember the psychological comfort in the group and reveal the answers of children who are sure of the answers, gradually revealing their answers and supplementing them. This technology has a positive impact on students' perception of the subject, improving their communication skills in the classroom and their comfort in interacting with the environment [5, pp. 385].

In addition, with the rapid development of science and technology, the impact of artificial intelligence on adolescents cannot be ignored. Thinking about how emotional education can proceed smoothly in the era of artificial intelligence has also become the key. First of all, artificial intelligence provides more ways for education. At the same time, it also causes many adolescents to rely too much on artificial intelligence and become addicted to the world of accumulating power. Ignoring the observation of things around you causes emotional loss, and this

kind of continuous sensory stimulation such as vision and hearing can also lead to damage to physical health. It can be judged that although artificial intelligence is convenient, it has played a more negative impact on the psychological level of adolescents. Under the guidance of the three concepts of emotional transformation in youth education, the emotional education of contemporary youth urgently needs to be reconstructed in order to greatly improve the emotional skills of young people and effectively fill the shortcomings of emotional education. In this regard, we should adhere to the limited use of artificial intelligence to avoid potential risks. We can build a smart campus through artificial intelligence, such as monitoring the temperature, humidity and noise of the classroom through artificial intelligence and adjusting it to create a comfortable learning environment, which is conducive to maintaining students' emotional stability in the process of emotional education, or using artificial intelligence to automatically correct homework, etc. To reduce teachers' repetitive work, so that teachers can spend most of their time communicating emotionally with students [6, pp. 195].

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汉俄语言中“毒性”概念的语义发展演变  
**EVOLUTION OF THE SEMANTIC DEVELOPMENT OF THE  
CONCEPT OF “TOXICITY” IN CHINESE AND RUSSIAN  
LANGUAGES**

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摘要. 本文研究了汉俄语言材料中“毒性”一词及其派生词的语义发展。现代社会的发展,以及虚拟现实的出现而产生相关沟通渠道的变化导致二十世纪下半叶“毒性”一次在两种语言中都经历了概念演变并获得隐喻意义。其中,“毒性”在俄语中表达负面评价功能,在汉语中表达贬义、褒义和中性概念,并有新的隐喻意义存在,反映了中俄语言文化的概念特征。

关键词: 毒性; 形容词“有毒的”; 语义发展; 大众传媒

语言词汇层面对社会中所发生的所有变化最为敏感,人类生存的任何领域的变化也很快会反应在这个语言层面上,因为根据E. S. Kubryakova的说法:“人类社会和人类认知的不断发展为人类生活和活动的各个方面提出新的语言名称任务”[1, p. 3]。在不断变化的世界中,语言称名功能的结果之一是词汇的语义转变(词义扩大、缩小和转移),并且词的旧含义开始与新含义产生差异。语义发展是与词语使用变化相关的语言变化的一种形式。本文将基于俄汉语材料对“毒性”一词及其派生词的语义发展进行分析。

在现代俄汉语中我们注意到了由语言外部和内部因素而导致的语义变化。外部因素包括社会、政治、经济和文化习俗等;内部因素是语言本身在发展过程中的变化和完善。其中,内部因素可以是认知空间和词汇量的扩展[2, p. 84],甚至是词汇、句法和语法的变化。

T. P. Skorykova提出:“如今我们在全球化进程和信息技术发展背景下观察到的俄语深入发展在这几个方向进行:模糊功能风格的界限,将新的科学术语引入现代新闻业,放松文学语言的规范,呼吁在新闻业使用俗

语，新闻语言行话的使用以及形成互联网交流领域新的功能风格等”[3, p. 172]。因此，在各种内外因素的影响下无论是俄语还是汉语词汇语义的变化都是大势所趋。

语言学家P. A. Shcherbo, E. V. Ganapol'skaya等人对语义发展进行了大量的研究，包括分析多语义结构、词语的语义变化，并提出了语义词汇建模方法等。V. A. Plungyan强调：“为了识别一种现存语言中最具活力的结构并分析其未来发展趋势，有必要转向口语元素，而不是受传统和规范的限制[4, p. 8]。从结构的独特性来看互联网交流的语言很特别，因为虽然形式上该语言以书面形式呈现，但实际上它是自发的书面口头言语。值得注意的是，社交网络作为当今流行的交流形式，正在向大众媒体靠拢，正如研究人员S. Rastegari和C. Z. Bahadivand所指出的那样，小文章、声明和其他这样的信息经常会发布在社交网络群组中[5, c. 288]。

对社交网络、博客和流行杂志网站的分析表明，近年来汉语“毒性”及其衍生词已在各个传播领域广泛传播。《牛津英语词典》还将形容词“有毒的”评为2018年“年度词汇”，这足以证明其得到了广泛的使用。毫无疑问，这个词素的重现吸引了俄罗斯和中国语言学家的科学兴趣。V. A. Buryakovskaya, O. A. Dmitrieva, K. M. Shilikhina, Yi Liqun、苏雪敏、曹星辰和叶慧萍等研究人员致力于从性别语言学、心理语言学、文化研究和人际关系心理学等角度来研究名词“毒性（токсичность）”和形容词“有毒的（токсичный）”。

对博客圈和大众媒体来源的分析表明，如今形容词“有毒的”已经获得了专业精神病学家、心理学家、非专业培训师以及博客作者所使用的科学术语的地位，并且发展了隐喻性概念[6, p. 137]。

#### 材料与与方法

本研究材料来源于：俄语词典和汉语词典，俄罗斯国家俄语语料库（НКРЯ）和汉语语料库“BCC”，大众媒体文本，以及搜索引擎“Yandex”和“百度”的网页资讯。

研究采用了以下方法：一般科学假设演绎法、连续抽样法、描述法、情境分析法、解释分析法。该研究基于以下假设：“毒性”一词在俄语和汉语中的语义发展按照不同的规律发生，因此具有民族文化独特性。

#### 研究与结论

不断变化的世界语言图景引起了语言学家的兴趣，在俄语中，“有毒的”一词来自古希腊语（toksikon pharmakon），与用来涂箭的毒药有关。在俄语的《学术小词典（Small academic dictionary）》中，“毒性”一词有以下定义：“意义属性。形容词：有毒的。气体的毒性”[7]。通过对俄语国家语料库的分析，我们发现“毒性”一词的直接概念最早出现在与有毒物质描述相关的化学、医学和生态学文本中。当然值得注意的是，“毒性”一词在这些领域是一个相当负面的概念。比如有以下例子：

*Increased toxicity of serum and urine of schizophrenics, especially cerebrospinal fluid, has been proven (V. A. Gilyarovskiy. Psychiatry. Ch. 20-29 (1935))*（已

证实精神分裂症患者的血清和尿液，尤其是脑脊液中的毒性增加（B. A. 吉利亚罗夫斯基，精神病学，p. 20-29, 1935））[8]。

*It also turned out that further growth of the carbon chain in the nafarin molecule reduces the toxicity of the compound without reducing its anticoagulating effect on the blood (E. Gruzinov. Rodents and ... cardiovascular diseases // "Chemistry and Life", 1965)*（研究还表明，萘法林分子中碳链的进一步扩展可降低该化合物的毒性，而不会降低其对血液的抗凝作用（E. 格鲁济诺夫，啮齿动物和……心血管疾病 // “化学与生命”，1965））[8]。

在20世纪70年代“毒性”一词的语义朝着意想不到的方向发展。这也使得我们追溯有形容词“有毒的”出现的上下文成为可能。在俄语国家语料库中有以下上下文：

*But Anton Denikin in Voronezh should have; every dog there forgot him, but every dog needs to remember him. In short, yes. This vile poisonous fanatic, this toxic old man, he - no, he did not give me a complete cure for moral infirmities - but saved my honor and breath (no more, no less: honor and breath) (Venedikt Erofeev. Prose from the magazine "Veche" "(1973))*（但在沃罗涅日的安东·邓尼金应该去，那里的每只狗都已经忘记了他，但需要的是每只狗都记住他。总之就是这样。这是个卑鄙恶毒的狂徒，是个有毒的老头，他——不，他没有彻底治愈我的道德弱点，但他拯救了我的荣誉和呼吸（不多不少：荣誉和呼吸）（韦内迪克特·埃罗费耶夫，散文来自杂志“Already”，1973））[8]。

随之出现了以下上下文：

*We have little of it, so they import it from abroad, in particular from chaste America. Studio "Troma" produces funny horror films full of vomit, blood and shit. With good humor and comic perversions. The film "The Toxic Avenger" by Lloyd Kaufman is the calling card of this brand (Alexander MESHKOV. "Terrible garbage crap" was brought to us // Komsomolskaya Pravda, 2003.03.17)*（我们几乎没有这个，所以他们从国外进口，特别是从有德行的美国进口。“Troma”工作室制作充满呕吐物、血腥和粪便的滑稽恐怖的电影，还有充满幽默感和喜剧性的变态。劳埃德·考夫曼的电影《有毒的复仇者》就是这个品牌的标志。（亚历山大·梅什科夫，“可怕的垃圾”被带到我们面前 // 共青团真理报，2003.03.17））[8]。

我们清楚地看到，“有毒的”这个形容词已经超越了它的传统含义，其兼容性发生了变化：客体（事物）的特性被主体（人）（老人，复仇者）的特性所取代。而根据材料的语境分析，“有毒的”这个形容词带有讽刺的比喻含义，传达出负面的评价含义。然而，该语料库仅包含该时期此类材料的两个例子，因此，隐喻意义的使用才刚刚出现，并未广泛传播。

在2008年美国金融危机的影响下，“有毒的”一词的含义得到了新一轮的发展。在此期间，“有毒的”一词开始被用来表征名词经济、债券、资产、基金以及物质和经济领域的物体，具有负面的隐喻意义，这也无疑是获得语义扩展的证据。其中例子包括：

*The global economic crisis of 2007-2010 was “noted” in the Oxford Dictionary of English, in particular, by the terms “toxic debt” - debt with a very high risk of non-repayment, and “quantitative easing” - monetary -state credit policy, which involves flooding the market with liquidity to stimulate the economy (the Oxford Dictionary has been updated with “vuvuzela” and the verb “to friend” // RIA Novosti, 2010.08.19)* (《牛津英语词典》中特别“指出”了2007年至2010年的全球经济危机, 其中的术语包括“有毒的债务”(toxic debt)——具有非常高的不返还风险的债务, 以及“量化宽松”(quantitative easing)——国家的货币政策, 涉及向市场注入流动性以刺激经济等(《牛津词典》新增词“呜呜祖拉”和动词“加好友”//俄新社, 2010.08.19)) [8]。

随着时间的推移, “有毒的”一词在政治和社会领域开始出现新的语义, 有毒的社会、有毒的国家等。值得注意的是, “有毒的”一词在这些短语中的字面意义上仍然继承着负面评价功能, 比如:

*Specialists from the Massachusetts Institute of Technology (MIT) have created the artificial intelligence Nightmare Machine, which turns ordinary photographs into images from horror films. The algorithm processes images of people and attractions in various styles: “haunted house”, “inferno” or “toxic city”. The results of the machine’s operation were published on the Nightmare website (St. Basil’s Cathedral was turned into a monastery of ghosts // lenta.ru, 2016.10.24)* (麻省理工学院 (MIT) 的专家们创造了人工智能 Nightmare Machine, 它可以将普通照片变成恐怖电影中的图像。该算法能处理各种风格的人物和景点图像, “鬼屋”、“地狱”或“有毒的城市”。机器的运行结果公布在 Nightmare 网站上(圣瓦西里大教堂变成了鬼魂修道院//lenta.ru, 2016.10.24)) [8]。

根据在 Yandex 搜索查询的结果显示, 自 21 世纪初以来, “有毒的”一词越来越多地出现在描述人际关系的背景中。一些最常见的名词短语包括: 人、朋友、男朋友、女朋友、父亲、母亲、妻子、丈夫、男人、女人、老板、关系、行为、沟通、交流等。根据语料库的研究, 词位“毒性”和形容词“有毒”在俄语大众传播意识中获得了与负面、破坏性等相近形容词的联想。毫无疑问, 在这样的语用功能下, “有毒的”这个形容词仍然传达着负面评价功能, 并且其隐喻含义也得到了更广泛的发展, 成为言语和媒体中的流行语, 而互联网就是促成这种语义发展的因素之一。在俄语国家语料库的报纸子语料库中可以找到以下上下文:

*“I was married. “I’m divorced,” the actress said briefly. According to her, the reason for the breakup was “very bad.” Samburskaya admitted that she fought for a sick and toxic relationship. However, it was all due to incompatibility. The actress said that if a person regularly insults another, then it is better to end the relationship there (Samburskaya told why her first marriage fell apart // Moskovskiy Komsomolets, 2019.06.01)* (这位女演员简短地说: “我结过婚, 也离了

婚”。据她说，分手的原因“非常糟糕”。桑布尔斯卡娅承认，她为一段病态且有毒的关系奋斗过。但是，这一切结果都是因为不合适。这位女演员说，如果一个人经常侮辱另一个人，那么最好结束这段关系（萨姆布尔斯卡娅讲述了她第一次婚姻破裂的原因 // 莫斯科共青团员，2019.06.01）[8]。

正如我们所看到的，随着社会客观因素的发展，“毒性”及其形容词“有毒的”的语义发生了很大变化。除了表达其主要含义外，形容词“有毒的”在社会政策、经济、文化、人际关系等领域还具有隐喻功能，反映对某种现象或人的负面评价。学者K. M. Shilikhina在她致力于分析“有毒的”一词语义的研究中，确定了形容词“有毒的”与名词组合时指代关系、行为及其参与者以及这些行为的结果的上下文。换句话说，这个词的语义存在隐喻。因此，在互联网交流中，使用了“有毒的文本”、“有毒的游戏”、“有毒的慈善”、“有毒的管理”、“有毒的行为”、“有毒的男子气概”等短语[9, p. 91]。因此，在俄语中，名词“毒性”不再仅用于化学和医学领域，它已进入其他使用领域，例如形容词“有毒”。

在汉语中，单词“毒性”由“毒”和“性”这两个字组成，其中汉字“毒”最早出现在中国古代的东汉时期许慎的《说文解字》中，那时特指有毒的植物。在中国古代人们没有区分药和毒，而是将它们混称为毒药，他们认为只要是治病的药都是毒。魏晋以来，毒大多指那些药性强烈，服下后容易出现毒副作用的药物。在《在线汉语词典》中，单词“毒性”表示毒物危害人或其他生物的特性[10, p. 412-413]。其中“毒”指的是有害的性质或有害的东西：毒气、毒药、毒蛇；“性”指的是人或事物的本身所具有的能力、作用等：性格、个性[11]。从字面意义上看，名词“毒性”的使用方式与俄语相同，例如：

“暴露接触”的途径主要包括皮肤接触、饮水、呼吸、食用受污染土壤生长的食物。“毒性”，即化学属性，不同物质的不同毒性会影响我们的健康（人民日报2017年04月20日）[12]。

在回答中国非典病人死亡率为什么比较低的问题时，钟南山说，由于流行病学的毒性、染病人群不同等原因，以及中国对非典病人集中管理治疗是降低死亡率的重要措施，中西医结合治疗也起到一定作用（人民日报海外版2003年07月14日）[12]。

基于对中文Bcc语料库中包含语言单元“毒性”及形容词“有毒的”的1760个上下文的研究，我们确定“毒性”一词的语义首次在20世纪40-80年代发生变化，比如：

有些戏虽然不很健康，毒性也不大的可以修改。坏的剧目经过批评讨论，可以修改。有一点必须提出的，今天的观众和艺人们的觉悟跟以前完全不同了（人民日报1957年03月19日）[12]。

打倒“四人帮”后，这“毒性”仍在某些干部头脑中作祟，在他们眼里，“权比法大”，依仗自己有地位、有资历、有“后台”，肆无忌惮，为所欲为（人民日报1983年01月23日）[12]。



正如我们所看到的，“毒性”一词的新语义开始在政治和文化领域展露头角。根据上下文，明显可以看出，在描述“帝国主义国家”、“戏曲”以及““四人帮”的政治行为”中，单词“毒性”表现了负面的评价概念。因此可以证明，使用“毒性”一词来发挥语用评价的功能是政治话语的特征之一，也成为描述某些对象的便捷手段。

自20世纪80年末开始，随着科技的发展，“毒性”一词开始开始在信息和通信领域被使用。在中外软件交流过程中，一款电脑病毒流入了中国，导致“有毒的”一词的使用范围扩大。这一时期，俄语中也出现了计算机病毒的名称，但对语言材料的分析表明，“毒性”一词尚未得到相应的语用应用，而在汉语中，“毒性”一词的使用范围却有限。“毒性”一词再次扩大，例如：

用户中毒后，除了发送带毒网址外，还会发现：自己的任务管理器、鼠标右键以及音频设备等功能，被全盘禁止使用。“毒性”发作到最后，中央处理器被100%占用，计算机彻底死机（文汇报 2005年7月25日）[12]。

2008年，美国爆发的金融危机对汉语词汇也产生了很大的影响。这一时期的汉语中，单词“毒性”以及形容词“有毒的”与俄语一样，同样也出现在了金融领域中，新闻中开始出现新的短语，如“有毒的资产”、“有毒的债券”等：

“收购万亿“有毒资产”美元贬值预期加剧”；

“美有毒资产剥离计划详解”[13]。

近年来，我国生活水平、网络信息技术和社会生产水平显着提高，人们开始注重个人尊严、健康生活方式和人际关系心理。流行语“毒性”和“有毒的”已在互联网、社交媒体和日常对话中使用，在中国搜索引擎《百度》搜索“有毒的人”得到了约33,200,000个结果，“有毒的朋友”——12,400,000个结果，这表明该词含义又得到了扩展。并且，“有毒的”一词常用于隐喻性描述，如“有毒的人”、“有毒的朋友”、“有毒的老板”、“有毒的父母”、“有毒的婆婆”、“有毒的男朋友”、“有毒的女朋友”等等，甚至可以应用于整个人际关系领域，例如：“这十种“有毒”的朋友还是敬而远之吧”；“小心！这6种“有毒”的人可能就在你身边”；“什么是‘有毒的人’”。此外，诸如“有毒的网站”、“有毒的玩具”、“有毒的手机”、“有毒的舞蹈”等短语开始定期出现在媒体和口语中，这也与互联网的快速发展、用户的现代意识、传播渠道的变化有关。

我们发现，在这样的标题中，单词“有毒的”表现的是贬义的评价概念。但在中国的社交网络以及日常口语中，将一个人比喻为“有毒的”也包括褒义和中性的概念，比如：当对方说话很风趣，很搞笑时；当对方干事不行，还喜欢吹牛的时候；当别人跳舞很吸引人的时候等等，在这些情况下评价对方“你有毒”表现的就不仅仅是负面的概念。

值得注意的是，汉语中“毒性”或“有毒的”一词的语义发展方向与俄语不同。中国语言学家Yi Liqun指出，在汉语中，形容词“有毒的”获得

了“传染性的”和“有害的”的含义，并被用于文化领域，不仅形成了贬义和中性的含义，而且还形成了褒义的含义[14, p. 309]，我们通过分析相关上下文也证实了这一事实。“有毒”一词除了具有“传染性”、“有害性”、“有瘾性”等含义外，还包含幽默、自嘲、不满、抱怨等含义，比如：

“我的手有毒，永远挑不到甜甜的西瓜，好想哭”（来自微博）。在这种背景下，自我讽刺是显而易见的。

“腾讯视频是有毒吧，一个电视一个电视盒，两个都打不开云视听，一个闪退，一个会导致重启，真的无语！”（来自微博）。在这种情况下，也使用了“有毒的”一词，但表达的是抱怨、不满等负面情绪。

分析表明，社会、政治、经济和技术的发展是词语语义发展的“营养介质”。在汉俄语中，词素“毒性”广泛用于各种语境，并且具有不同的词源，在各自的语言和文化中获得了独特的含义，并获得了具有明显评价功能的隐喻意义。在俄语中，“毒性”和“有毒的”这两个词一直沿袭其原有的负面概念，具有“传播性”和“破坏性”的特点；在汉语中，“毒性”和“有毒的”这两个词有贬义、中性和褒义的含义，除了表达“传染性”、“有害性”的含义外，还包括“自嘲”、“幽默”、“抱怨”等含义。

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## STRUCTURAL AND FUNCTIONAL EVOLUTION OF VARIOUS TYPES OF CONDITIONAL COMPOUND SENTENCES IN THE RUSSIAN LANGUAGE (IN COMPARISON WITH CHURCH SLAVONIC)

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摘要。本文属于历史和比较语法领域，致力于研究印欧语系语言中不同类型的条件复合句的演变。研究发现，古斯拉夫语和教会斯拉夫语的主要联合是条件联合«а ѡе» = “如果”，有时与助词would一起使用，主要在非真实条件句中，有时用于助词的含义。在古俄语中，条件连词更加多样化，随着时间的推移，由于存在动词“is”的形式与疑问助词“is”的合并，形成了现代条件联合“if”。在教会斯拉夫语中，从句由相同的条件从句联合引入，而在古俄语中，条件联合的种类更多，其中一些是在组合联合的基础上形成的。随着时间的推移，俄语中的大部分条件句联合都消失了，只有一种专门的条件句联合保留了下来，用于语言的文学形式。在教会斯拉夫语和俄语中，将条件句区分为“真实的”、“潜在的”、“不真实的”和“一般的”要比在拉丁语和希腊语中更困难，这又归因于动词条件语气形式的形成历史，以及组合和从属连接的混合程度更高。

关键词：俄语、教会斯拉夫语、复合句。

**Abstract.** *The article belongs to the field of historical and comparative grammar and is devoted to the study of the evolution of different types of conditional compound sentences in the languages of the Indo-European family. During the study, it was found that the main union of the Old Slavonic and Church Slavonic languages was the conditional union «аѡе» = “if”, which was sometimes used with the particle would, mainly in unreal conditional periods, and sometimes it was used in the meaning of a particle. In the Old Russian language, conditional conjunctions were more diverse, and over time, as a result of the merger of the form of the existential verb “is” and the interrogative particle “is”, the modern conditional union “if” was formed. In the Church Slavonic language, subordinate clauses are introduced by the same conditional subordinate union, while in the Old Russian language there is a greater variety of conditional unions, some of which are formed on the basis of compositional ones. Over time, most of the conditional unions of the Russian language were lost, and only one specialized conditional union remained for the literary form of the language. The differentiation of conditional periods as*

*“real”, “potentially futural”, “unreal” and “generalizing” in Church Slavonic and Russian is more difficult than in Latin and Greek, which in turn is due to the history of the formation of the forms of the conditional mood of the verb, as well as a greater degree of mixing of the compositional and subordinate connection.*

**Keywords:** *Russian, Church Slavonic, compound sentences.*

In Church Slavonic, as in Old Slavonic, the types of conditional periods did not have such rich structural diversity as was the case in the history of Greek and Latin. This, in our opinion, can be explained by a less extensive system of forms of the subjunctive mood of the Old Slavonic and Church Slavonic verbs, which, in turn, was due to the origin of the subjunctive mood in these languages. The form of the subjunctive mood in Church Slavonic, and even earlier in the Old Slavonic language, in its origin, is directly related to the past tense form of the verb. Moreover, in this case, we can say that the first South Slavic influence did not have a significant analogizing effect on the forms of the subjunctive mood of the Old Slavonic language, and when translating the first texts of the Holy Scriptures, the Byzantine Greek system of forms of the subjunctive mood, which has a large tense and voice paradigm, was translated into the Old Slavonic language with a small number of forms, while the indicative system of the Old and Church Slavonic verb was multi-component and contained four types of past tense (including different types of aorist, absent in Latin), the present tense (also the simple future tense for perfective verbs) and two more complex future tenses.

Let us dwell in more detail on the past tense forms of the Old Slavonic and Church Slavonic verbs, which also functioned quite well in the Old Russian language.

**The past tense** of the verb in Old Slavonic, Church Slavonic and Old Russian is represented by 4 forms, which are divided into simple and compound. The simple forms of the past tense are the *aorist* and the *imperfect*, and the compound forms are the *perfect* and *plusquaperfect*. Each form of the past tense had its own semantics.

**The aorist** denoted an effective, one-time, instantaneous action in the past and was formalized by peculiar suffixes: (-*ox*, -*ux*), connecting the stem of the infinitive and the personal ending (*нес-ти* / *literal unit нес-ox-ъ*). All that remains of the aorist in modern Russian is the particle *б*, which serves to form the conditional mood of verbs, the particle *чу* (from the verb *чуми*), used in poetic texts.

**The imperfect** denoted a long-term repeated action in the past and was formalized by a suffix (-*ях* / -*яш*-), connecting the stem and ending (*нести*: 1<sup>st</sup> person singular *нес-ях-ъ*)

**The perfect** denoted an action in the past, the result of which was observed in the present. The perfect was formed with the help of a grammatical connective

- the verb *быти* in the present tense - and a conjugated verb expressing the lexical meaning of the participle in -I (*нести*: 1<sup>st</sup> person singular *Есмь несл, несла, несло*). Subsequently, the auxiliary verb was used less and less often in the sentence, and only the participle began to express the semantics of the past tense. It is in this form that the past tense form is fixed in the Russian language (knew, thought, heard). Due to the fact that the modern form of the past tense of the verb is a participle in origin, it does not have the category of person, but has the category of aspect.

**The plusquaperfect** denoted the so-called “long past” tense, i.e. an action that preceded some action in the past. The plusquaperfect could be formed in two ways. In the first method, the verb *быти* in the form of the imperfect appeared in the copula, and the semantic component was the participle in -I of the conjugated verb (*нести*: 1<sup>st</sup> person singular *бяхъ неслъ, несла, несло*). In the second method, the participle ending in -I, which expressed the lexical meaning, was combined with the perfect of the verb *быти* (*нести*: 1<sup>st</sup> person singular *есмь былъ неслъ, есмь была несла, есмь было несло*). The first method of forming the plusquaperfect was less productive than the second. From the second type of plusquaperfect, the following units have been preserved in the Russian language: *once upon a time* in the beginning of fairy tales, particles *было, бывало* (*сказал было, сживали бывало*), etc. In the entire paradigm, plural participles in -л, both in the perfect and in the plusquaperfect, which is lost as a category, there is a loss of generic differences, as a result of which a single plural form is consolidated in the past tense (*несли*), which is a masculine form in origin. Aorist plusquaperfect: бѣ несл. Probably, the loss of all conjugated forms of the past tense in the history of the Russian language can be explained by the presence in the Russian language of a strong category of verb aspect, which, as the global history of languages shows, is more ancient than the category of tense. And in the Russian language it is as much semantic as it is grammatical.

In the category of type, characteristic of Slavic languages, a system of relations of different orders is combined, representing in origin two successive historical layers: the difference between the completeness and incompleteness of an action and the difference in duration of an action [1, p. 348]. Those languages that do not have a grammatical category of aspect have a developed system of tenses, which compensates for the lack of aspect (German, English). The oldest written monuments of the Old Russian language show that at the beginning of the historical period the opposition of the perfect and imperfect forms was only emerging, as indirectly evidenced by the branched category of tense of the Old Russian verb.

In modern Russian, the opposition of verbs of the perfect and imperfect forms is grammatically connected with the opposition of the forms of the simple future and the present tense, respectively, which are formalized by the same personal

endings of the verbs. Thus, in our opinion, it was the well-developed category of aspect in the Russian language that caused the loss of conjugated forms of the past tense verb, and in the subjunctive mood system allowed the formation of only one form, which, as in the compound forms of the past tense, is based on the participle in -л.

**The subjunctive mood** in the Old Slavonic, Church Slavonic and Old Russian languages was an analytical form and was formed in the Old Russian language using the aorist forms of the verb *быти* in combination with the participle in -л: *аж быхъмъ что тако оучинили* /Smolensk charter 1229/. And in the Old Slavonic language you can also find an auxiliary verb with an ancient stem in -би: «бити». Almost all forms of the auxiliary verb are gradually lost. All that remains is the form of 2-3<sup>rd</sup> person singular, which turns into a modal, often conditional particle would. It is probably for this reason that the composition of the system of conditional periods of the Old Slavonic, Church Slavonic and Russian languages is not as diverse as in Koine Greek and Latin. However, as a result of a comparative analysis of the text and translations of the Gospels, we were able to identify several types of conditional periods of the Church Slavonic and Russian languages, corresponding to their Greek and Latin analogues. Let's give an example of each of them.

Real conditional period:

**According to Matthew.: 5, 30**

καὶ εἰ ἡ δεξιὰ σου χεὶρ σκανδαλίζει σε, ἔκκοψον αὐτήν καὶ βάλε ἀπὸ σοῦ· συμφέρει γάρ σοι ἵνα ἀπόληται ἐν τῶν μελῶν σου καὶ μὴ ὅλον τὸ σῶμά σου βληθῆ εἰς γέενναν [6, p. 14]

Et si dextra manus tua scandalizat te, abscide eam, et projice abs te : expedit enim tibi ut pereat unum membrorum tuorum, quam totum corpus tuum eat in gehennam. [5]

и3 їще десназ твоS рука соблажнсетъ тS, ўсэчы2 ю5 и3 верзи т себе2: кне бо ти2 є4сть, да погилбнетъ є3ди1нъ т кдъ твои1хъ, г не всE тѣло твоE ввержено будетъ въ геенну [2]

And if your right hand causes you to sin, cut it off and throw it away from you, for it is better for you that one of your members should perish, and not that your whole body should be cast into hell. [3]

In the Old Russian language, one can give a construction with a later conjunction “if”, which is already more similar to the conditional conjunction of the modern Russian language; it is complicated by target relations, but also fits the definition of a real conditional period.

“If anyone keeps it secretly, let it be announced” [4, p. 220].

And one more complex real conditional sentence with the conjunction “even” = “if”:

“Even if it is shared with him without punishment, then... you are not of a filial nature” [4, p. 220].

Most of the subordinating conditional conjunctions of the Old Russian language were lost over time and replaced by a specialized conditional conjunction “if”.

Potential-futural conditional period:

ἐὰν δὲ ὁ ὀφθαλμὸς σου πονηρὸς ᾖ, ὅλον τὸ σῶμά σου σκοτεινὸν ἔσται. εἰ οὖν τὸ φῶς τὸ ἐν σοὶ σκότος ἐστί, τὸ σκότος πόσον; [6, p. 17]

Si autem oculus tuus fuerit nequam, totum corpus tuum tenebrosum erit. Si ergo lumen, quod in te est, tenebrae sunt: ipsae tenebrae quantaerunt? [5, s. 1]

Гще ли цко твоЕ лукаво будеть, всЕ тѣло твоЕ темно будеть. Гще у5бо свѣтъ, и4же въ тебѣ, тмА є4сть, то2 тмА кольми2; [2]

if your eye is bad, then your whole body will be dark. So, if the light that is in you is darkness, then what is the darkness? [3]

These examples partly demonstrate the ways in which the modern specialized subordinating conditional conjunction “if” is formed in the Russian language from different variants.

“And if a merchant and a peasant builds himself according to the best customs, then a large amount of taxes will be placed on him every year” [4, p. 258]. “If you save me, I will graciously favor you, and I will also graciously favor the falconers” [4, p. 258].

Irreal conditional period:

**According to Matthew.: 24, 22**

καὶ εἰ μὴ ἐκολοβώθησαν αἱ ἡμέραι ἐκεῖναι, οὐκ ἂν ἐσώθη πᾶσα σάρξ· διὰ δὲ τοὺς ἐκλεκτοὺς κολοβωθήσονται αἱ ἡμέραι ἐκεῖναι [6, p. 57]

Et nisi breviati fuissent dies illi, non fieret salva omnis caro: sed propter electos breviabuntur dies illi [5]

И# гще не б1ша прекрати1лицз дн1е w4ны, не бы2 к6w спаслацз вска пл0ть: и3збранныхъ же ради прекратстцз дн1е w4ны. [2]

And if those days had not been shortened, no flesh would have been saved; but for the sake of the elect those days will be shortened. [3]

In the later period of the Old Russian language, there are already conditional unreal periods with the conjunction “if” and the formed particle “would”, and in apodosis the particle could be absent:

“And if the authorities did not interfere with us, your pilgrims, and they gave us freedom, and we untied the bells, and exchanged them for wine in Kashin. (Kalyaz. Chelob., 120)” [4, p. 262].

Generalizing conditional period:

Τότε ὁ Ἰησοῦς εἶπεν τοῖς μαθηταῖς αὐτοῦ· Εἴ τις θέλει ὀπίσω μου ἐλθεῖν, ἀπαρνησάσθω ἑαυτὸν καὶ ἁράτω τὸν σταυρὸν αὐτοῦ καὶ ἀκολουθεῖτω μοι [6, p. 40]



Tunc Jesus dixit discipulis suis: Si quis vult post me venire, abneget semetipsum, et tollat crucem suam, et sequatur me. [5]

Тогда і съ рече ѱчнѣнѣмъ своибѣмъ: ꙗще кто хощеть по мнѣ изйти, да отвержетъ себе и зъ возьметъ крестъ свой и зъ по мнѣ грздеть: [2]

Then Jesus said to His disciples: If anyone wants to come after Me, let him deny himself, and take up his cross, and follow Me, [3]

Examples of Old Russian language:

“Would there be someone who would give it to him, and he would write down his petition. (Cal., I, 1680)” [4, p. 63]. “If someone brought you a son alive, he would be the one you would bestow upon him. (Rybn., 120)” [4, p. 63].

### Conclusions

Thus, we can conclude that the main union of the Old Slavonic and Church Slavonic languages was the conditional union «аще» = “if”, which was sometimes used with the particle would, mainly in unreal conditional periods, and sometimes itself was used in the meaning of a particle. In the Old Russian language, conditional conjunctions were more diverse, and over time, as a result of the merger of the form of the existential verb “is” and the interrogative particle “whether”, the modern conditional conjunction “if” was formed. In the Church Slavonic language, subordinate clauses are introduced by the same conditional subordinating conjunction, while in the Old Russian language there is a greater variety of conditional conjunctions, some of which are formed on the basis of coordinating conjunctions. Over time, most of the conditional conjunctions of the Russian language were lost, and only one specialized conditional conjunction was preserved for the literary form of the language. The differentiation of conditional periods as “real”, “potentially fuital”, “irreal” and “generalizing” in Church Slavonic and Russian languages is more difficult than in Latin and Greek, which in turn is due to the history of the formation of the forms of the conditional mood of the verb, as well as the greater the degree of mixing of coordinating and subordinating connections.

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现代法语作家散文中带有颜色含义的词组合的分类  
**CLASSIFICATION OF WORD COMBINATIONS WITH COLOR  
DENOTATIONS IN THE PROSE OF MODERN FRENCH AUTHORS**

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注释。本文致力于分析法语中的颜色符号。本文的目的是通过比较和成分分析，识别和研究法语中颜色符号的语义特征、它们的转换潜力及其形成的构造类型。研究材料是现代法国作家的小说：米歇尔·布西、凯瑟琳·潘科尔、埃里克-埃马纽埃尔·施密特和奥雷莉·瓦洛涅斯。

关键词：颜色、颜色符号、颜色符号、转换、隐喻、构词分析、法语。

**Annotation.** *This article is devoted to the analysis of colour denotations in French. The aim of this article is to identify and study the semantic features of colouronyms, their transformational potential and the types of constructions formed by them in French by means of comparative and component analyses. The material of the study is novels of modern French authors: Michel Bussy, Catherine Pancol, Eric-Emmanuel Schmitt and Aurélie Valognes.*

**Keywords:** *colour, colouronym, colour denotation, conversion, metaphor, word-formation analysis, French language.*

The concept of colour exists at the intersection of several sciences (fields of cognition), such as physics, anthropology, physiology, psychology and linguistics. The texts of many French writers consist of: “the author’s speech-thought activity, designed for the recipient’s response, for his perception” [7, p. 101]. It is no exaggeration to say that the study of colour denotations has received wide coverage in linguistics in the works of both Russian and foreign scientists [2, 8, 9, 10,11]. For example, colour denotations have been analysed at the syntactic and morphological level by such famous novelists as N.M. Vasilieva and L.P. Pitskova. The

authors rightly point out the fact that: “Certains substantifs qui marquent la qualité d’un objet acquièrent des marques formelles d’adjectifs, notamment la possibilité d’être déterminés par les adverbes: *Au fond, elle avait des goûts très peuple.* (Simenon); *un bleu plus ciel* (Bazin), *ces yeux idéalement marron* (Sagan)” (Some nouns denoting the quality of an object acquire the formal features of adjectives, in particular the ability to be defined by an adverb) [3, c.213]. In other works by linguists I.E. Koptelova, I.A. Fadeeva colour terms were studied in the context of economics on the material of the English language [4,5,6].

In this article, following G.V. Ovchinnikova, along with such notions as “colour designation”, “colour name” and “shade”, which are fixed in the scientific language, we will use the term colouronym as a synonym to the above-mentioned terms, denoting “a colour or a shade of colour obtained unnaturally, artificially, chemically as a result of mixing paints” [9, c. 98].

Coloronyms belong to cultural codes, they are a way of expressing people’s mentality, cultural references and values, as well as their change during a certain historical epoch. Their representation by lexemes reflects the centuries-long process of society’s cultural development, captures and transmits various clichés, images and symbols from generation to generation.

Do colouronyms depend on how a person perceives the world (it may be completely arbitrary) or, on the contrary, how we perceive them is influenced by language? There are two approaches to this question. For relativists, language determines perception. The latter, in turn, influences our perception of conceptual space. In this connection, one cannot but agree with the opinion of the French linguist N. Delbecq, who emphasises: “*Le monde n’est donc pas une réalité objective existant en et de par elle-même. Il nous apparaît toujours d’une façon ou d’une autre par le biais de notre activité qui consiste à catégoriser sur base de notre perception, de nos connaissances, de notre état d’esprit; bref, à partir de notre condition humaine*”. (The world is not an objective reality existing by itself. It always appears to us in one way or another through our activities based on our perception, knowledge and way of thinking, simply put the human condition). [15, p. 32]. Universalists adhere to the hypothesis that there are 11 basic categories of colour names (black, white, red, yellow, green, blue, brown, grey, purple, orange and pink) that are common to all languages [12].

In French there are several degrees of classification of colour designations, the following are distinguished:

***couleurs primaires (primary/main colours)*** — ***bleu, jaune, rouge*** (blue, yellow, red);

***couleurs secondaires (secondary colours)*** — ***vert, orange, violet*** (green, orange, purple);

***couleurs tertiaires (tertiary colours or shades)*** — obtained by mixing primary and secondary colours.

Two novels by Michel Bussy (*N’oubliez jamais; Nymphéas noirs*); a novel by Catherine Pancol (*Les yeux jaunes des crocodiles*); a novel by E.-E. Schmitt (*La femme au miroir*) and a novel by Aurélie Valognes (*Mémé dans les orties*) were taken for the analysis of colour denotations. The comparative analysis allowed us to identify the following lexico-semantic classes of colouronyms:

1) with the differential semeem “name of the country”

*Alors qu’Ellen tendait à Alina un kleenex dans un délicat emballage vichy bleu, Bastinet insista* [13, p. 189]

*Une cravate vichy en coton, signée Burberry* [13, p. 251]

*Elle faisait les vêtements de Marion et des trucs inutiles pour la maison, des torchons ou des nappes. Et chaque fois, avec le même tissu vichy rouge* [18, p. 194]

2) with the differential semeem “historical and cultural epoch”

*Le regard inquiet de Laurenç Sérénac embrasse les couleurs de la pièce, le tissu crème tendu au mur, le jaune vieilli de la parure du lit, le noir marbré de la cheminée, l’or des bourgeois, l’acajou du chevet* [14, p. 236] (In this example we are talking about a room furnished with antiques. Such colouronyms as *le noir marbré*, *l’acajou du chevet* can also be attributed to the group of colouronyms with the differential semeem “name of materials, stones and minerals”, and the colouronym *le jaune vieilli* “aged yellow” formed by the model “N+A” can be attributed to the group “description of clothes”). *Le conservateur change encore de pièce et jette un regard noir sur une gardienne qui semble plus occupée par la couleur rouge de son vernis à ongle que par celle de la robe du cardinal qui interroge Jeanne d’Arc dans la toile de Delaroche* [14, p. 245] (In this case, the red colour of the watchwoman’s nail polish is associated by the hero with the colour of the cardinal’s robe who interrogated Joan of Arc)

3) with the differential semeem “the name of plants, flowers, vegetables, fruits”

*Sa peau de pêche semble avoir été ciselée dans la même étoffe que le châle de coton* [14, p. 118] (The main character has peach-coloured skin exactly like her cape).

*Stéphanie Dupain a posé une veste de laine sur sa robe jaune paille* [14, p. 137]

*Le jour de son mariage, Chef arborait une veste en lurex vert pomme et une cravate en cuir écossaise* [16, p. 81]

*Iris, en long chemisier blanc et pantalon de lin bleu lavande, restait la plupart du temps silencieuse et n’intervenait dans la conversation que pour la relancer* [16, p. 86]

*Un jour, elle avait acheté des sandales en crocodile vert amande – vues aux pieds d’Iris –, et elle arpentait le couloir de l’appartement, attendant qu’Antoine la remarque* [16, p. 92]

*Ses plus beaux faits d'armes vont du **bleu roi à l'orange carotte**, en passant par le **violet aubergine** et le **rose barbe à papa** [18, p. 57]* (In this context, the colouronym *bleu roi à l'orange carotte* “royal blue with orange-carrot” can also be assigned to the group with the differential seme “historical and cultural era”, and the colouronym *le rose barbe à papa* “pink cotton candy” to the group with the differential seme “product name”; however, it is worth noting that in this case the colour as well as the flavour of cotton candy itself is influenced by the colouring agents, since the colour pink mentioned will be: chewing-gum “chewing gum flavour”, fraise “strawberry”, vanille “vanilla”, grenadine “pomegranate” and pomme d’amour “apple on a stick in red caramel”)

*Sur le rebord du toit un papillon se jucha. Ses ailes, **jaune citron** à l'intérieur, vertes à l'extérieur, oscillaient, telle une respiration [17, p. 22]*

4) with differential semes “name of an animal/insect”, “shape of an object”

*Dans l'autre pièce, les Anglais n'étaient pas trop de deux pour tenter de faire ingurgiter à leur bébé un pot de légumes **vert grenouille** [13, p.118]*

*À l'aide d'une pince en inox, elle attrapa les deux cuisses de canard confites. **Rouge carmin** [13, p. 225]* (This colouronym *rouge carmin* came from the pigment carmine, derived from the substance of the females of such insects as the wheatgrass or wheatworm, and has therefore been assigned to this group).

*Elle a enfilé une veste froissée qui jure avec sa jupe **vert bouteille** [14, p. 326]*

5) colouronym with the differential seme “the name of rocks, precious stones, building materials”

*Ellen pointa un doigt **émeraude, bague et ongle coordonnés**, pour signifier à Bastinet de ne pas intervenir et précisa [13, p.191]* (the colour of the stone matches the nail polish, namely emerald)

*Elle s'était elle aussi enroulée dans un peignoir Calvin Klein. **Couleur rubis** [13, p. 228]*

*Vêtue de noir elle aussi, mais court vêtue. Un blouson de cuir coupé à la taille posé sur une robe de **velours anthracite** [13, p. 402]*

*Ils enroulent leurs dix doigts autour de la balustrade de **fer forgé vert** [14 p. 240]*

C'est là aussi qu'un beau jour d'octobre 1970, il avait vu arriver René Lemarié, un jeune gars, de dix ans son cadet, dont la taille étranglée de jeune fille s'évasait jusqu'à des épaules de cariatide ; le crâne rasé, le nez cassé, le teint **rouge brique**, un sacré gaillard ! [16, p. 214]

*La reine Elisabeth avançait, vêtue d'une longue robe du soir **turquoise**, un sac noir pendant à son bras [16, p. 396]*

*Une petite pièce, baptisée Powder Room en lettres roses sur la porte grise, faisait office d'antichambre où s'ouvriraient quatre autres portes **gris perle encadrées de filets de peinture rose** [16, p. 546]*

*D'une main lourde, elle poudre son teint **olivâtre de Terracotta**, puis ses paupières d'ombre assortie à sa tenue [18, p. 48]*

*Avec sa mâchoire carrée, ses **yeux bleu acier** et cette coupe trop courte sur les côtés, il ressemble à un militaire [18, p. 61]*

*Par chance, les nuages s'effiloçaient et laissaient place à la lune. Une lumière **minérale, dure et grise**, délimitait des formes sans couleur sur la terre [17, p. 133]*

6) colouronym with the differential semeem “phenomenon of nature, surface and space above the Earth's surface” + “article of clothing” with this differential semeem

*La lune peignait la nuit en **clair-obscur** [13, p. 132]*

*Myrtille Camus était vêtue d'une robe d'été **bleu ciel, colorée de grosses fleurs d'hibiscus mauves** [13, p.148]*

*Du sang bouillonnait de sa poitrine, inondant son pull **vert marécage** [13, p. 372]*

*Je n'avais presque pas dormi depuis trois jours, mais ce n'était pas seulement la fatigue qui m'aspirait dans une sorte de trou **blanc cotonneux** [13, p. 400]*

*Ferdinand est ébloui, il ne distingue plus très bien le scintillement de l'océan qu'il fixe depuis des heures. **Le ciel est d'un bleu de carte postale** [18, p. 172]*

*Ces deux êtres arboraient les mêmes teintes, vert tendre et **jaune ensoleillé**... [17, p. 414]*

7) a colouronym with the differential semeem “product name” when describing a person or environment

*Joséphine contempla le visage si pur, si doux de son amie, les minuscules taches de son sur le nez court et légèrement retroussé, **les yeux miel brûlés de vert étirés en masque** et secoua lentement la tête [16, p. 46]*

*Ses plus beaux faits d'armes vont du bleu roi à l'orange carotte, en passant par le violet aubergine et le **rose barbe à papa** [18, p. 57]*

***Le ciel laiteux** distillait une lumière enveloppante, dépourvue d'ombres [17, p. 453]*

8) with the differential seme “neon, fluorescent shades and others”

*Les lueurs de la plage déserte dansaient sur Mona. **Le rouge néon** du casino, le jaune sable des halogènes [13, p. 132]*

*Le plastique brille de toutes les couleurs, du **jaune fluorescent au rouge pompier**, même si **le classique vert kaki verni** domine [14, p. 186] (rouge pompier - «fire red» a common shade of racing cars; le classique vert kaki verni - classic lacquered khaki green) Elle quitta la piste pour rejoindre le bar à la lumière **bleue d'aquarium** [17, p. 35] (**bleu d'aquarium** – аквариумный синий)*

*Anny était donc passée prendre la vieille actrice, laquelle avait enfilé une robe qui créait de faux volumes sur son corps informe : un popotin et une brassière en*

*mousse vert fluo se greffaient au fourreau en velours noir* [17, p. 300] (vert fluo - fluorescent green)

A separate group includes colouronyms included in phraseological phrases:

a) with the component “*blanc, blanche*” (white)

*Ou, glissa Alina d'une voix blanche, il y a une troisième hypothèse...* [13, p. 389] The use of this combination “une voix blanche” with verbs of speaking translates as a muffled, voiceless/passive voice, sometimes colourless at all

*Vous êtes blanc comme un linge, encore plus pâle que tout à l'heure* [18, p. 183] “être blanc comme un linge” – white or pale as linen/sheet

*Bref, à leurs yeux, je suis passée d'oisie blanche à femme coupable* [17, p. 105] (In short, in their opinion, I went from being a simpleton (naive girl) to a criminal).

b) с компонентом “noir” (black)

*Joséphine fronça les sourcils, elle lui jeta un regard noir* [16, p. 383] **Jeter (lancer) un regard noir** – stare/throw an angry, unkind look at someone

c) with the “jaune” (yellow) component

*Arrivée dans la rue, elle tourna vers Anne un visage jaune de colère* [17, p. 376]

d) with the component “vert” (green)

*Le froid vert, piquant, du printemps la glaçait* [17, p. 470] **Le froid vert** in this context refers to the cold that is characteristic of the spring period

*C'était ma femme qui avait la main verte* [18, p. 109] “Avoir la main verte” – to be the kind of person who grows everything like a yeast; to be a great gardener by nature.

It should be added that, for example, Michel Bussy in one of his novels, namely “Nymphéas noir” gives one of the heroines not only violet-coloured eyes, but also a voice: *Les yeux mauves se posent sur lui. Elle ajoute : –Pas forcément un peintre tchèque... Juste quelqu'un... Même sa voix a la couleur mauve* [14, p. 69, 238]. The author's use of this kind of metaphor indicates that M. Bussy has endowed his heroine with a memorable and colourful appearance and voice that the reader will not forget.

In turn, Catherine Pancol in her novel «Les yeux jaunes des crocodiles», interacting with the reader, uses the method of association and suggests them to guess what time of the year we are talking about, using a whole palette of colouronyms: *Elle lui faisait ses vitrines, s'occupait de mettre en valeur la promotion du mois – flûtes à champagne, gants de cuisine, tabliers, lampes, abat-jour, photophores –, participait à la sélection des commandes, lançait la « note » de la saison, saison bleu, saison fauve, saison blanche, saison dorée...* [16, p. 66]

The data collected in this study allow us to see certain trends in the semantics of colour denotations. Thus, in our opinion, the most productive and predominant today in modern French fiction are colouronyms with differential semes with



“the name of plants, flowers, vegetables, fruits” and “the name of rocks, precious stones and building materials”.

“Identity manifests itself at many levels of human existence. Along with culture, language also participates in the process of self-identification” [1, p. 502].

Today modern French authors make a choice in favour of colour as an element of identity and through it endow their protagonists with a vivid image and character. This decision is quite reasonable and logical: the reader thereby finds a similar style (of clothes), colour palette and a path to follow, emphasising his/her individuality.

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性别主流化意识形态对民族和国家的精神、文化和社会安全构成威胁  
**THE IDEOLOGY OF GENDER MAINSTREAMING AS A THREAT  
TO THE SPIRITUAL, CULTURAL AND SOCIAL SECURITY OF  
THE NATION AND STATE**

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摘要。本文强调了性别意识形态的潜在文化和社会后果。通过分析，我们揭示了“性别”一词及其内容在社会文化背景下的演变。此外，研究了性别意识形态产生和发展的历史，确定了其思想根源和文化后果。这些发现证实了在传统人类价值观和公共道德规范的背景下，性别主流化思想是不可接受的，以及从其进化方面来看，性别意识形态缺乏发展前景。

关键词：性别、性别、性别认同、性别意识形态、性别主流化、道德、人权。

**Abstract.** *This article highlights the potential cultural and social consequences of gender ideology. The analysis carried out allows us to reveal the evolution of the term “gender” and its content in the sociocultural context. In addition, the history of the emergence and development of gender ideology has been studied, its ideological roots and cultural consequences have been identified. These findings confirm the unacceptability of the ideas of gender mainstreaming in the context of traditional human values and norms of public morality, as well as the lack of prospects for the development of gender ideology from the point of view of its evolutionary aspects.*

**Keywords:** *sex, gender, gender identity, gender ideology, gender mainstreaming, morality, human rights.*

Every day we are faced with deviations from traditional male and female lifestyles and we observe a gradual distortion of the importance of family and gender roles within it, we are also faced with insufficiently adequate ideas of modern

youth about masculinity and femininity, formed under the influence of Western stereotypes. At the same time, one of the most important, in our opinion, is the problem of the spread of gender ideology, which poses a threat not only to the evolutionary prospects of humanity in the foreseeable future, but also to the spiritual and moral security of the nation and state today.

For a more in-depth study of the phenomenon under consideration, we will define the content of the basic concepts.

Initially, the term “gender” arose and was used as a way to indicate differences in the grammatical gender of words [1, p.65]. Currently, the term “gender” is used to describe various characteristics associated with a person’s masculinity or femininity, it also includes psychological and social aspects related to culture, in contrast to the concept of “sex”, which covers only anatomical and physiological characteristics [2]. , With. 22].

Thus, the concepts of “gender” and “sex” are not synonymous, much less identical. Some researchers point out that gender can be defined as a social construct that has a more significant impact on a person than its inherent attributes [3, p. 160-165].

Gender identity is an individual’s awareness of his masculine or feminine qualities and positioning himself in accordance with a certain gender [4, pp. 37-40].

The traditional binary gender system allows only two forms of self-identification - man or woman. It is important to note that according to medical, psychological and social norms, gender identity generally corresponds to an individual’s biological sex.

Gender self-determination is a conscious and free choice that allows a person to establish his identity and choose the trajectory of his further development in accordance with his own gender [5, p.15]. Thus, considering the issue of gender self-determination, taking into account the binary concept of biological sex, suggests two possible options for self-determination: a woman who defines herself as a woman, and a man who defines himself as a man. If biological sex does not match one’s gender identity (for example, a woman who identifies as a man or a man who identifies as a woman), it is called a transgender identity. Although such cases do not conform to traditional social norms and the usual value system, they are not considered a psychological or psychiatric disorder, since they have been excluded from the list of mental disorders [6, p. 503-505].

The term “non-binary gender identity” is now used to refer to gender identities that do not conform to the traditional binary system. It brings together different gender identities that do not conform to or transcend the binary system. Within the concept of non-binary gender identity, gender identity can be a combination of male and female genders (bigender and trigender), can change over time (gender-fluidity) or be completely absent (agender) [7, p. 211].

According to gender ideology, the term “gender” is defined as a set of social and cultural stereotypes that should be abandoned and each person given the opportunity to freely choose and determine their gender identity and sexual orientation, encouraging individual self-expression [8, p. 35-48].

The active implementation of the principles of gender ideology began to penetrate Western Europe around the end of the 20th - beginning of the 21st century. Countries such as Germany, Sweden and the Netherlands have become the vanguard in this area: for example, in Germany the right to choose a third gender when filling out a questionnaire was proposed, and in 2018 this right was enshrined in the Law “On the Third Gender”; in Sweden, neutral kindergartens began to be introduced, and in 1998, changes were made to the education law prohibiting the spread of “outdated” (traditional) gender stereotypes [9; 10]. The starting point of this movement can be considered the signing of the Amsterdam Treaty by the European Union in 1997, which established the ideology of gender mainstreaming as the official ideology of the European Union. The concept of gender mainstreaming, as defined by the European Commission, means an effective strategy aimed at achieving gender equality, which denies the existence of innate differences between men and women and argues that people should determine their identity not on the basis of biological sex, but on the basis of their own preferences. According to gender ideology, gender should be viewed as a social construct, which implies acceptance and respect of any kind of sexual orientation; a person has the right to an independent and free choice of his gender identity, and any attempt to condemn or oppose this choice is discrimination.

Within the framework of traditional values, gender mainstreaming contradicts the moral norms, respect for biological characteristics and moral orientations that play a key role in our definition of humanity. In other words, gender ideology is a deliberate policy of dehumanizing humanity. Russian scientist P.D. Tishchenko points out that any interventions in human nature, including the deconstruction of human sexuality, inevitably lead to a person’s complete loss of his humanity [11, p. 116]. It is difficult to disagree with the opinion of Metropolitan Hilarion of Volokolamsk, who criticized gender ideology, calling it an ideology of deception and a tragedy for modern Western Europe and the world as a whole [12]. At the same time, it is gratifying that gender ideology is sharply criticized not only by Russian culture and scientific elites, but also by progressive Western sociologists, philosophers, doctors - independent and sensible people who do not defend any ideological, political or religious positions. Mark Regnerus, a doctor of sociology and professor at the University of Texas, conducted a study on the impact of same-sex parental relationships on adult children. A significant result was the finding that children raised in families of homosexual couples face serious psychological and mental problems in comparison with children raised in traditional couples.

Naturally, this study caused strong criticism, with a demand not to disseminate its results publicly [13, p. 752-770].

In his article “Gender Mainstreaming - a Secret Revolution,” German sociologist G. Kubi also emphasizes the dangerous consequences of gender ideology, noting that their source is philosophical relativism. According to relativistic postulates, there is no objective truth, since reality is perceived subjectively [14]. Thus, under the pretext of tolerance and gender equality, gender and sex-role identities are actively being destroyed, with the explicit goal of destroying biological differences and introducing a new concept of social progress, seeking to create a new person, devoid of standard physical and intellectual characteristics that exceed the limits of “ordinary humanity” [11, With. 115].

The historical prerequisite for the emergence and spread of gender ideology in Europe in the 19th and 20th centuries is associated with the emergence and active development of feminism. At the same time, it should be noted that feminism of that period focused mainly on the socio-political sphere, seeking to ensure equal rights for men and women, while not addressing sexual and gender aspects. New ideas were introduced into the understanding of the topic by Simone de Beauvoir in her work “The Second Sex,” where she expanded the understanding of the term “sex” to include not only the biological, but also the sociocultural context. In her work, she noted that “a person is not born a woman, but becomes one” [15, p.88].

Subsequently, the theoretical basis of gender ideology was formed and developed by Dr. J. Butler, professor of philosophy from the University of Berkeley (USA, California). Her research was presented in the acclaimed book *Gender Anxiety: Feminism and the Subversion of Identity*. In this work, Butler rejects the idea of biological sex and argues that differences between men and women are sociocultural in nature and the result of social constructions. The ideas that formed the basis of gender mainstreaming insist on doubting the existence of feminine and masculine principles, thereby refusing to recognize their natural essence. Currently, such a statement is becoming the main axiom of gender ideology, according to which a person’s gender is formed in the process of upbringing and is not an unchanged attribute from the moment of birth. Refuting this statement, I would like to recall the sensational story of David Reimer, which occurred in Canada in the 1970s of the last century. Born a boy, David lost his genitals in infancy due to illness. The parents followed doctors’ advice to undergo sex reassignment surgery and a course of hormone therapy and raised the baby as a girl, in the hope that, due to the child’s age, he would identify with his newly acquired identity. However, as a teenager, David (now Brenda) exhibited clear signs of masculine behavior, preferring toys, games and clothing that corresponded to his genetic gender identity. As a teenager, his father revealed the truth to David, after which he made three suicide attempts. As a result, David decided to return to his true gender identity

and again underwent gender reassignment surgery and hormone therapy. Despite the seemingly successful outcome (David married and adopted three children), the new lifestyle did not help cope with his psychological problems, and at the age of 38, David Reimer committed suicide. This is one of many cases that prove that the gender socialization of children is not able to influence the formation of their gender identity.

In the context of all of the above, it is important to note two significant regulations adopted in the Russian Federation: the law banning transgender transition, which came into force on July 24, 2023, and the decision of the Supreme Court of the Russian Federation declaring the MOU LGBT an extremist organization, adopted on November 30, 2023.

Regarding the first regulatory act, it should be noted that despite the fact that the law was subjected to fierce criticism from LGBT activists, human rights activists and the medical community, it undoubtedly contains positive nuances. It is obvious that the adoption of this law is due to a strategy aimed at preserving traditional values listed in Decree of the President of the Russian Federation of November 9, 2022 No. 810. However, the view of lawyers on this bill is that it violates the right to life enshrined both in the Constitution of the Russian Federation and in international documents, as well as the right to non-discrimination. The international non-governmental organization Human Rights Watch, in turn, recognized this law as a violation of human rights. At the same time, doctors argue that in this case the legislation prevents the guarantee of full medical care for persons diagnosed with transsexualism. Here we note once again that transsexualism, as well as a number of other gender dysphorias, were removed from the list of mental disorders, according to the version of the International Statistical Classification of Diseases and Related Health Problems ICD-10, and included in the list of issues related to human sexual health according to the ICD -eleven.

This raises a very logical question: if gender dysphoria is considered a disease according to both ICD-10 and its updated version ICD-11, then why do LGBT activists fight for the right to freely express its symptoms, rather than strive for effective treatment?

And here it is important to turn to the roots of gender ideology: if it is based on philosophical relativism, including ethical relativism, then the absolute nature of morality is denied. In other words, if we abandon the principle of binding moral norms and allow their content to change depending on various factors (socio-political situation, current ideology, cultural revolution, etc.), then moral guidelines begin to blur or even disappear. Rejecting all established norms of behavior and moral ideals, freedom of expression becomes a priority, which ultimately leads to the gradual disappearance of spirituality. Thus, we can conclude that most LGBT activists are just posers and provocateurs who are quite successfully trying

to destroy traditional social norms, relying on so-called “human rights.” As E. Martin-Joganson points out: “Any licentiousness and any lust can be found with a “moral” justification if we use the requirement of individual rights as a fundamental principle. However, rights are secondary due to the fact that any right is initially intended to be a continuation of moral values... Life values, on which the moral foundations of society have been built for centuries, millennia, are distorted and collapsed to such an extent that everything that was rightfully considered previously a pathology, a disease, is announced and for part of society really becomes the norm” [8, p. 35-48].

From a socio-cultural perspective, the question of recognizing the LGBT fashion model as extremist has a clear answer: aggressive propaganda and demonstrative behavior of sexual minorities cannot be recognized as a social norm either from a moral or a legislative point of view, no matter what “human rights” and “freedom of choice” are talked about .

At the same time, the moral question is what to do with people who have already gone through a transgender transition, or those who clearly identify as homosexual or experience gender dysphoria and are unable to accept their genetic gender identity? At the moment, neither medical science nor ethics provide answers to these questions.

It is important to take into account that decisive bans will only provoke even greater demonstrations among adherents of countercultures and outrageous people, and at the same time complicate the process of self-identification and self-acceptance for those who have problems in this area.

The modern Western world has become a symbol of a new freedom - freedom of morals and self-expression, which has become the main value. Unfortunately, not everyone realizes that the establishment of such new liberal “values” in the mass consciousness is the beginning of an anthropological catastrophe.

From the point of view of social philosophy, humanity finds itself in a unique situation of the synthesis of classical and non-classical cultures into a post-non-classical one. The dominant principle in the study of all phenomena and processes of human life has become “human dimensionality”, the refusal to use binary categories and the transition to a multidisciplinary approach in research. In the context of such cultural transformations, the risk of “dehumanization” of humanity increases significantly. The process of dehumanization of modern society poses a threat not only to the security of the individual, but also to the nation and the state as a whole, and taking into account evolutionary perspectives, it is necessary to understand that under the cover of the principle of tolerance and the postulates of gender ideology, humanity risks ending its existence as a biological species.

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管理日常教育空间的哲学和教育学原理  
**PHILOSOPHICAL AND PEDAGOGICAL PRINCIPLES OF  
MANAGING EVERYDAY EDUCATIONAL SPACE<sup>\*1</sup>**

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摘要。在文章中，作者表明以人为本的方法将发展过程定义为有机体与生俱来的个人特征，并认为这种特征在发展过程中引导人格走向个体形成、个人自主和自我实现。人格被理解为自己发展的中心，包括日常生活教育空间中成长的来源和驱动力。作者表明，一个人通过他的内心世界、通过他的日常经验领域来感知客观现实，这可能会限制对外部世界的感知。以人为本的教育系统中的交互设计主题不是技术操作链，而是协调日常实践组成部分和组织社会系统间对话的哲学和教育学原则。

关键词：日常生活、个性、教育空间、文化、以人为本的方法、价值观、理想、规范。

**Abstract.** *In the article, the author shows that the person-centered approach defines the development process as an innate personal characteristic of the organism and considers this characteristic to guide the personality, in the process of its development, towards individual formation, personal autonomy and self-actualization. Personality is understood as a center of self-development, including sources and driving forces of growth in the educational space of everyday life. The author shows that a person perceives objective reality through his inner world, through his field of everyday experience, which can limit the perception of the external world. The subject of interaction design in a person-centered educational system is not a chain of technological operations, but philosophical and pedagogical principles for coordinating the components of everyday practices and organizing dialogue between social systems.*

**Keywords:** *everyday life, personality, educational space, culture, person-centered approach, values, ideals, norms.*

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As a socio-philosophical direction, the humanistic approach was formed in the middle of the twentieth century and is associated with the theoretical works of such scientists as S. Buhler, S. Jurard, S. Cohen, A. Maslow, R. May, G. Allport, C. Rogers, etc. The fundamental conceptual idea is the model of the person-centered approach of K. Rogers. [Rogers, 1994, p. 233]. The person-centered approach “represents the most uncompromising and holistic alternative to the sociodynamic and psychodynamic paradigms in education” [Podlinyaev, 1997, p. 133].

The person-centered approach defines the development process as an innate personal characteristic of the organism and considers this characteristic to guide the personality, as it develops, towards individual formation, personal autonomy and self-actualization. Personality is understood as the center of one’s own development, including the sources and driving forces of growth. The basic idea of a person-centered approach can be defined as follows: each person has the ability to understand himself, change the “I-concept” and for self-managed behavior.

The student’s personality becomes a meaningful element in the educational process. A personality is understood as a unique and integral humanitarian system, capable of self-learning, focusing on its own motives, feelings, interests, needs, and capabilities. Thus, the model of education from the process of assimilation of knowledge, skills and abilities turns into a process of changing the internal cognitive experience of the student, directly related to his entire unique individuality.

On the other hand, since man, as K. Rogers claims, “... is social; he has a deep need for relationships” [Rogers, 1983, p 312]. The person-centered approach recognizes the importance and role of factors influencing the development of personality from the sociocultural everyday reality, from other people.

The field of everyday experience is what is potentially accessible to consciousness, perceived as part of the inner world of the individual. The field of everyday experience is a “road map” of the territory, which is the reality in which a person exists. A person perceives external reality through his inner world, through his field of everyday experience, which can limit his perception of the external world.

“Self” is the central concept in K. Rogers’ concept. The “Self” is a totality that includes bodily and symbolic, spiritual everyday experience. According to Rogers, when all experiences are assimilated into the “self” and become part of its structure, there is a tendency to diminish what can be called self-consciousness. Behavior becomes spontaneous, the expression of relationships becomes less guarded, as the “self” accepts these relationships and the behavior itself as part of itself. “Self” is a system of internal relations, phenomenologically connected with the external everyday world and revealed to a person in his “I”.

In person-centered education, special efforts are considered necessary that can connect the truly distant and objectively alien world of culture with the student’s everyday experience, and stimulate his personal interest in problems that in the

past were the subject of creativity of cultural figures. Making the content of education a living property of the student's personality, placing it not in the memory, but in the soul, and enriching the intellect with it, would mean solving the problem of humanizing culture. V. N. Syrov draws attention to the fact that everyday life is, first of all, a way of constituting reality. This is a special code, the main function of everyday life is the adaptation of the individual to the world of society. The work of the structure of everyday life is understood as a set of configuration and reconfiguration procedures. Thus, everyday life appears in the form of a kind of matrix for the production of meanings, the creation and transformation of all kinds of objects [Syrov, 2010].

The subject of interaction design in a person-centered educational system is not a chain of technological operations, but a way of coordinating spontaneous and organized components of everyday interaction, organizing dialogue between social systems. In this methodology, management activities constantly take into account uncertainty and randomness. The fundamental principle is management based on self-government: the removal of external coercion, coupled with a meaningful creative task, creates an environment for joint everyday and independent creative work.

To implement such a methodology, completely different forms of educational work are required than those that are usual for personally alienated learning. The methodology of person-centered education has not yet been developed in detail, but it is clear that project, research, and discussion methods of organizing educational activities occupy a central place in it. The project method originates from the one created by J. Dewey. [Dewey, 1924, p. 34-62] laboratory schools. This way of constructing educational activities expresses the tendency to create conditions in organized education that are close to everyday and natural. First of all, this concerns the properties of the everyday educational environment itself, which in such conditions becomes significantly more rich and diverse than is achievable under the traditional method. The properties of the everyday educational environment and the style of interaction embody the values of teachers, their ideas about the norms and ideals of educational activity. In a person-centered system, it is the everyday educational environment, and not the sequence of one's own actions, that is the object of the most careful design for the teacher. The concept of everyday life, the everyday life world, reflects not only the subject, his intellectual focus on objects, but the world to which it is directed. The objective world is included in the concept of everyday life, but not in itself, but taken from the side of the subject, seen through his eyes, illuminated by his meaning. This world in the construct of everyday life appears as a background, a horizon of the world into which we "get used to as historically living beings." Everyday life is a special form of life, the main focus of which is the preservation and reproduction of the life of the individ-

ual and society. In everyday life, we think, perceive the world, rejoice, experience in accordance with traditions and habits and stereotypes formed in us. And all this is based on a natural desire to live, survive, preserve oneself and one's world. Thus, the main functions of everyday life are preservation, survival, reproduction, development and preservation of man and society, which makes it a sociogenetic process of civilization. The most characteristic features that clarify the phenomenon of everyday life are the following features. Firstly, waking attention, constant concentration on one or another fragment of reality, was discovered by A. Schutz [Schütz, 2003]. Secondly, "I"-centrism, that is, the research is conducted from the position of a given subject, the starting point is his here-and-now, the consideration comes from within his situation. My subjectivity is the center of my everyday life. Everyday life is characterized by repetition, stereotyping, and the associated clarity of what is happening. The stereotype of everyday life is a condition of communication. Life is understandable because it is stereotypical. Behavioral matrices and schemes facilitate sociocultural interaction [Zolotukhina-Abolina, 2003, p. 33–34]. The next important aspect of everyday life is its intersubjectivity. Communications are not just a significant component of the everyday life world, but also a way of its existence. Everyday life is a reality common to all of us, it exists in constantly renewed contact between people, its components are human meanings. The social world in which we live is constituted by people acting in concert. The main essential property of a person is his subjectivity, which, being inside, is intentionally directed outward and strives to go out. M. M. Bakhtin [Bakhtin, 2003, p. 7–68] argued that man has no internal territory, he is always on the threshold, on the border. What I denote by the concept of "everyday life of an individual" is an expression of his essence. A person's everyday life is his inner life world, objectified externally. In a person-centered system, the level of design detail is limited by the principles of uncertainty, according to which it is impossible to provide for all the details. It is impossible to describe in advance the path of formation and development of personality, but it is possible to design the desired properties of the everyday educational environment.

The properties of the everyday educational environment mean, in essence, quite simple things. The style of interaction in the environment can also be characterized by a greater or lesser degree of trust, freedom, and independence. During the formation of the system, organizers have to expend great efforts to maintain the desired parameters of its internal environment, necessary to maintain the chosen style of interaction. Within the framework of postmodernism, it was shown that the life of a modern person has not become more stable and reliable. During this period, it became noticeable that human activity is carried out not so much on the basis of the principle of expediency, but rather on the randomness of appropriate reactions in the context of specific changes. Within the framework of

postmodernism (J.-F. Lyotard, J. Baudrillard, J. Bataille) the opinion is defended that it is legitimate to consider everyday life from various positions in order to obtain a complete picture.

In modern society, human behavior is largely determined by the function of consumption. Moreover, it is not human needs that are the basis for the production of goods, but, on the contrary, the machine of production and consumption produces needs. The language of things classifies the world even before it is represented in ordinary language, the paradigmaticization of objects sets the paradigm of communication, interaction in the market serves as the basic matrix of linguistic interaction. There are no individual needs and desires; desires are produced. Accessibility and permissiveness dull sensations, and a person can only reproduce ideals, values, etc., pretending that this has not happened yet. Existentialists believe that problems arise in the daily life of each individual. Everyday life is not only a “knocked-out” existence, repeating stereotypical rituals, but also shocks, disappointments, and passions. They exist precisely in the everyday world. This allows us to consider the phenomenon of everyday life from four positions: activity, need, consciousness, ability, which determine the sphere of everyday life.

Essentially, it's about establishing everyday traditions, and they build slowly. The educational system (school, institute, group of students with a given teacher, etc.) goes through the process of developing its own everyday culture, the path from a random collection of unrelated people to a single integral team. Internal interaction consolidates the system and contributes to the growth of its integrity if these processes proceed constructively, under democratic management through the use of approval procedures. How coordinated the organizing team acts in a group of students determines whether this group will go through a common path, a path of formation, and whether common values and a common language will be established there. Only under this condition will participants in the interaction be able to obtain a genuine educational effect.

If the main value of the system is the free development of the individual in accordance with his abilities and inclinations, then the everyday educational environment should be quite rich - in a poor and rigidly structured educational environment, the probability of carrying out the necessary set of meetings for different individual paths of development is small, freedom of choice itself cannot be realized if there is nothing to choose from.

The integral quality of the everyday educational environment, expressing its ability to support the creative activity of the participants in the interaction, a sufficient level of its emotional and intellectual tension is called activity. The quality in question is manifested in the ability of the everyday environment to support learning, stimulate a questioning attitude towards the world and a creative search for answers to emerging questions.

In the person-centered methodology, it is taken as an axiom that everyone has their own educational effect. Moreover, there is no way to predict what it will be like for a particular person in a given situation. But in the activating everyday educational environment, there is a very high probability of an incident occurring that will arouse personal interest, provoke a crisis of competence, will contribute to the stabilization of an already restructuring system of models, or will strengthen the consciousness of one's own competence - in a word, depending on the stage of development and degree of maturity of the individual, his education in one way or another.

A person, being in an activating everyday educational environment, rich in fruitful opportunities for his development, makes a choice, rushing towards those that turn out to be the most significant for him. The development of the individual culture of each participant in the interaction is associated with the improvement of the everyday context - the cultural tradition of a given educational system. A necessary condition for this way of existence of this institution is the retention of a creative, research position by teachers working in it.

The need to create conditions under which students and teachers could freely express creative activity is seriously discussed in the pedagogical and philosophical literature of the 21st century. Theoretical concepts and already tested models for organizing an open and rich everyday educational space in which spontaneous activity can freely manifest have appeared and continue to appear.

The teacher's retention of a research position within the framework of teaching a specific subject can be ensured if the teacher has to consider the science being taught not only from the inside (internalism), but also from the everyday space of culture, when educational interaction involves the study of the entire process of science development (externalism). Such an expansion of the subject area radically changes the position of the teacher, bringing it closer to the position of the student - after all, no one can claim complete knowledge, representing on behalf of the entire culture. Questions that require expanding the horizon of knowledge can arise among all participants, and the group, including children and adults, turns into a learning community - a community of students or even a learning community. Its members work together to create an energizing daily learning environment for themselves.

The coincidence of general and personal interests is characteristic of emerging communities that have set the goal of overcoming routine patterns of activity and, accordingly, developing and attempting to apply new methods. Joint creative activity greatly contributes to the establishment of a favorable psychological atmosphere: a joint search for answers to unexpected questions that arise, mental onslaught, brainstorming not only meaningfully develop the culture of the system,



but also establishes a psychological climate, contributes to improving the style of interaction, and creates a favorable everyday educational environment.

In an atmosphere of trust and acceptance of each person as he is, people cease to be wary of each other, hide behind social roles and discover their true everyday existence. A specific effect of interaction in such successfully developing communities is a feeling of naturalness and freedom. At the same time, many participants experience a significant change in personality traits, and the educational process accelerates sharply, and the educational system reaches the level of self-managed changes.

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从心灵无形理论的角度看现代世界的心理健康。或者谁是心灵和心灵的载体？  
**MENTAL HEALTH IN THE MODERN WORLD FROM THE POINT  
OF VIEW OF THE INTANGIBLE THEORY OF PSYCHE. OR WHO  
IS THE CARRIER OF PSYCHE AND MIND<sup>1</sup>?**

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注释。本文概述了非物质心理理论的主要规定，并证实了没有一个个体从出生起就拥有人类心理——心理和精神的来源和传递者是社会。该理论提出了个人和群体心理现象毫无根据的对立，并得出结论，即整个社会以及个人都可能患有抑郁症、神经症和精神病。批判性地重新思考了非理性主义和唯意志主义的哲学方向。考虑了现代世界文化中非人性化的某些方面。

关键词：非物质心理理论、心理、精神、群体心理学。

**Annotation.** *The article outlines the main provisions of the Immaterial Theory of the Psyche, and also substantiates that not a single individual from birth possesses a human psyche - the source and transmitter of the psyche and mind to subsequent generations is society. The idea is developed about the unfounded opposition of individual and mass mental phenomena and the conclusion is drawn that society as a whole, as well as individuals, can suffer from depression, neuroses and psychoses. The philosophical directions of irrationalism and voluntarism are critically rethought. Some aspects of dehumanization in modern world culture are considered.*

**Keywords:** *Immaterial theory of the psyche, psyche, mind, mass psychology.*

I will not dwell on a detailed presentation of the Immaterial Theory of the Psyche. It has been published several times in Russian and English (7-12, 20-26). Therefore, I will briefly recall only its main conclusions.

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<sup>1</sup> In accordance with modern concepts, the psyche is defined as a set of mental processes and phenomena (sensations, perceptions, emotions, memory, etc.) and as a specific aspect vital activity animals and person in their interaction with the environment. In contrast, reason is characterized as the highest degree of the thought process, the ability of a person to think and reason logically, creatively, rationally, abstractly.

First, its key point: The presence of a healthy brain is a necessary, but not sufficient condition for the formation and adequate functioning of the human psyche - language programming is required.

This theory also substantiated a number of significant conclusions.

Firstly, the brain and psyche are two closely related, but fundamentally different systems.

Secondly, the brain and nervous system are material and regulate the activity of all internal organs, physiological reactions and adaptive functions of the individual, that is, man, as a representative of the biological species *Homo Sapiens*.

Thirdly, the psyche is immaterial. This is an information structure that is formed on the basis of language programming only in a social environment and regulates all social functions of a person. It is this structure that makes us individuals.

This is best demonstrated by involuntary experiences of raising human children in animal communities. Of course, they remain individuals, representatives of the species *Homo sapiens*, but they do not become individuals and are not able to connect to social Consciousness (1). However, they acquire the language and behavioral programs of the animal community where they managed to survive (17).

The pseudo-scientific literature describes at least a dozen semi-mythological experiences when newborns were placed in a space isolated from society, they were looked after, fed, swaddled, but did not enter into verbal contact with them at all. The main interest of the would-be experimenters was to try to find out: what language will the children speak? Naturally, they did not speak any language. Moreover, they did not develop the human psyche at all. And here we must make another important conclusion: no specific person is the bearer of the psyche.

The carrier and transmitter of the human psyche is the society surrounding the baby. And the second most important conclusion: language is an external function of the psyche or its real objectification. The psyche is structured by language, which indirectly denotes all objects and phenomena. Moreover, the formation of the psyche occurs only during the period of its manifestation in early childhood (5). Later, the child may learn some words and concepts, and even some forms of behavior, but he will never become a full-fledged personality, since the period of manifestation (formation of the human mind) has been missed (17).

The next important conclusion: the absolute majority of those who become individuals acquire the language, the system of thinking, the ideas and values that operate in the society around them.

Scientists have long searched for the psyche in the structures of the brain and created various pseudo-physiological and pseudo-psychological terminologies to describe mental processes in the form of certain brain mechanisms of the psyche.

They supposedly studied and treated the psyche, but in fact, they studied and treated the brain. A number of fundamentally new conclusions and approaches, both to psychology in general and to the analysis of world processes, follow from the Immaterial Theory of the Psyche.

In principle, these ideas have a long history. Even Karl Jaspers wrote in 1913: “Every person is what he is only because at one time a completely definite historical (and not just universal) foundation was laid.” “Real mental life is unthinkable outside of the traditions transmitted to him through the human community among which he lives” (19). That is, what we call intelligent life is, in fact, introjected (but one might say imposed) by traditions, ideas and principles cultivated in the surrounding society. This means that these principles can have many variations, and once formed, even if they can be corrected, they still remain dominant. We really see this in the behavior of young migrants, raised on the false ideas of the occupation of their countries by Russia, which, on the contrary, ensured their entry into world culture and brought scientific and technological progress.

Let’s turn to Freud and his idea about the unfounded opposition of individual and mass mental phenomena. As the author emphasizes, in this opposition “... loses much of its sharpness upon closer examination,” due to which the psychology of the individual “... from the very beginning is also at the same time a social psychology...”. Then Freud complements this conclusion with the thesis about the need to consider each individual person not as an independent subject, but “...as a member of a tribe, people, caste, class, institution...” (14).

In addition, if we present this thesis in reverse, we can conclude that society, entire countries and peoples can suffer from depression, neuroses and psychoses. It is difficult to find another explanation for the nationwide neurosis of the Russian revolution of 1917, when everyone who was wearing a hat and pince-nez, and even more so in a cassock, became an enemy and was subject to destruction and the Orthodox people cheerfully and joyfully robbed churches. It is also difficult to find an explanation for the nationwide psychosis in Nazi Germany in the thirties. It is even more difficult to find an explanation for the ideas of pathological anti-Russianism in the modern Western world.

Now turn to the ideas of representatives of the philosophy of irrationalism and voluntarism. At one time, the term “voluntarism” acquired an exclusively negative connotation, although initially it was used to denote a philosophical movement that considers will to be the basis of all things, the driving force of development, in some way contrasting will with reason. At a certain period in the development of philosophy and psychology, these theories were simply discarded, and, it seems, in vain.

On the one hand, voluntarism absolutized the complete freedom of will and actions of a particular person and on the other, all volitional impulses in volunta-

rism were considered as unknowable, blind forces that “guide” a person through life. Subsequently, it was recognized that voluntarism is especially dangerous in the system of power and in pedagogy. That is, when certain power figures and the teacher is one of the very first power figures (and the prototype of all subsequent ones), propose or even insist on some unrealistic or utopian idea and force students, and in the case of power figures - force the entire society to follow their demands.

Turning to one of the most prominent representatives of voluntarism, Arthur Schopenhauer (1788-1860), and his work of 1818, “The World as Will and Representation” (18), we find a compelling argument for the inherent tension between our sense of freedom and the reality of determinism. The author posits that, a priori, everyone believes they are entirely free, capable of altering their course in life and becoming someone else. However, a posteriori, individuals discover that they are not truly free, but subject to the constraints of necessity. This leads them to a realization that they are compelled to manifest the same character, often one that they themselves do not fully endorse, throughout their lives, effectively playing out the role they have inadvertently assumed until the very end.

Schopenhauer is called the main pessimist in the history of philosophy. He argues that there are no universal rules, because the will subordinates the mind, while the will is irrational. That is, the free will of an individual does not exist; it is subordinate to the world’s irrational will. Particularly noteworthy is the philosopher’s emphasis on the egoistic character, which, according to the author, is characteristic of most people. This character can (under certain conditions) go from ordinary everyday egoism to extremes, as the author writes, up to the readiness to kill a person in order to grease his boots with his fat.

Schopenhauer’s follower, Friedrich Nietzsche (1844-1900), develops these ideas and concludes that the world will, which Schopenhauer wrote about, is in its essence the will to power, and not just the desire to be. These ideas are developed by the author in 1874 in the work “On the benefits and harms of history for life” (2, 3, 6).

Why am I giving this excursion into the philosophy of irrationalism? Let’s take a closer look at modern world events from a philosophical and psychological point of view. What will we see? We will see that the so-called elite of the collective West has been following the path of irrational and selfish development for several centuries, which is based on the desire for power over the whole world, even despite the real threat of its complete destruction. At the same time, such an ideology is being implanted in Western countries with the help of powerful financial, political and volitional efforts over the entire population of these countries, implanted with the help of lies, falsification of history and modern events. It is implanted in preschool institutions, then in the education system and through the suppression

of any dissent in the adult population. At the same time, the main conductors of the new ideology are the education system and the media, almost completely controlled by the ruling elites of the Western world.

The propaganda of dehumanization is actively propagated, starting from a very early age, when the child still has virtually no critical thinking, and this propaganda appeals to the basest needs and desires of a person. As S. Freud noted, such drives are characteristic of all people, therefore each individual person is partly an enemy of culture, since culture is what imposes prohibitions (15). However, no one likes prohibitions. Moreover, the richest people in the world, as well as a certain part of those in power, with their demonstrative disregard for the norms of morality, morality and even laws, certainly confirm this conclusion.

I will return to this thesis once again and try to emphasize its significance. Since base desires really exist, and culture, as the experience of recent decades shows, is too thin a fabric, it is necessary not only to morally condemn such desires, but, with the support of government agencies, to strictly punish legally for any of their manifestations and popularization. In our country, this is already happening with the emergence of the sprouts of a new state ideology, which, of course, could be created, but it is much better and more reliable to cultivate.

It is believed that there is no ideology in the West, but what has been constantly instilled in new generations since the 20th century? They are told that we live in a world of unbridled competition of all against all, and the high principles of human coexistence are clearly being replaced by the principles of commodity fetishism and the sacralization of material success. The Western media deserves special attention and their daily propaganda (or rather, the imperative and indirect suggestion) of the ugly image of the enemy, the role of which Russia is consistently promoting with its historical (high!) traditions, vast territory and countless natural resources.

Paranoid delirium regarding a supposedly wild and aggressive Russia is instilled in all Western media. Moreover, it is being instilled against the backdrop of growing public pessimism, degradation of the institution of family, and the active popularization of the feminist, childfree and LGBT movements. Adding to this the growth of drug addiction and crime, the legalization of prostitution and pedophilia, the ideas of transgenderism, the degradation of Western democracy and institutions of government, the unbridled growth of armaments and terrorism, the growing popularity of right-wing forces, nationalism and fascism in many Western countries.

I am not a supporter of the ideas of conspiracy theories and world government. But combining the Immaterial Theory of Mind with the latest theses, we could draw certain conclusions. More precisely, we must admit that with strict control over the education system and the leading media, that is, over all information

transmitted to society, it is possible, over the course of two or three decades, to form among the population of a single country or even among the population of a dozen countries any ideology, any value system and any morality. Let me clarify - from the highest to the most base and misanthropic.

In conclusion, I want to express confidence that this ideology of dehumanization has real authors and conductors who, most likely, understand the psychology of the masses no worse than we do. In addition, I want to express confidence that the source of this ideology is not in the Islamic or Orthodox world, not in China and not in India, which profess qualitatively different spiritual values.

One last thing. From the point of view of the Immaterial Theory of Mind, modern approaches to mass psychology and mental health cannot be considered outside of the broadest and most highly qualified approach to social therapy. The psychological community must recognize its special role and its special responsibility in the formation of such social policies.

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东河三角洲的 BRACTEOLATAE GRAEBN. SENSU LATO 组(香蒲属, 香蒲科)  
的杂交种

**INTERSECTION HYBRID OF SECTION *BRACTEOLATAE*  
GRAEBN. SENSU LATO (*TYPHA* L., TYPHACEAE) IN THE DON  
DELTA**

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注释。介绍了一种用于改造后的顿河三角洲(俄罗斯南部欧洲地区罗斯托夫地区)的渐渗杂交种香蒲×多韦尔迪(*T. angustata*×*T. grossgeimii*)。这种等级的杂交种的出现不仅得益于三角洲分支的人为开发增加,还得益于环境和生物隔离因素。人们已经注意到,*T. angustata* 具有通过致畸作用(非分化杂交)在受干扰的栖息地中形成人为分类群的高能力。在俄罗斯南部水库的更新世冷却和干旱期间,植物群中也发生了类似的过程。在顿河三角洲(Mokraya Kalancha 分支),它们出现在密切相关的物种 *T. angustata* 和 *T. grossgeimii* 之间。

关键词: 渐渗杂交种香蒲×多韦尔迪, 香蒲属, 顿河三角洲, Mokraya Kalancha 分支(俄罗斯南部欧洲地区)。

**Annotation.** *An introgressive hybrid *Typha* × *doweldi* (*T. angustata* × *T. grossgeimii*) for the transformed Don delta (Rostov region, southern European Russia) is presented. The emergence of a hybrid of this rank was facilitated not only by the increased anthropogenic exploitation of the delta branches, but also by factors of environmental and biological isolation. The high ability of *T. angustata* to form technogenic taxa in disturbed habitats through teratogenesis (non-divergent hybridization) has been noted. Similar processes occurred in the flora during the Pleistocene cooling and aridization in the reservoirs of southern Russia. In the Don delta (Mokraya Kalancha branch) they were found between the closely related species *T. angustata* and *T. grossgeimii*.*

**Keywords:** *introgressive hybrid Typha × doweldi*, genus *Typha* L., Don delta, *Mokraya Kalancha* branch (southern European Russia).

A special type of hybridization is introgression [Bobrov, 1982; Natho Günther, 1974 (Bobrov, 1982; Natho Günther, 1974)], in which backcrossings of interspecific hybrids occur with the original parent species. In 1968 K.M. Zavadsky wrote that such hybrids arise occasionally and are not retained in populations, since they are eliminated during repeated backcrosses due to low adaptability [Zavadsky, 1968]. However, other examples are known in the genus *Typha*. In 1843, from the south of France (Lyon) D.-A. Godron [Godron, 1843] described *T. glauca* Godr. (*T. latifolia* × *T. angustifolia*). The hybrid is known in Poland [Nowińska, Gawrońska et al., 2014], in Finland, Sweden, and North and South America [Smith, 1962, 1967]. In Russia – *T. glauca* was discovered by A.N. Krasnova on Lake Zaulomskoye (Vologda region) It should be noted that ×*T. glauca* are well distinguished in nature by the presence or absence of a gap between the parts of the inflorescence. It is more difficult to distinguish such hybrids in nature among species of the section *Bracteolatae*, where the gap between the parts of the inflorescence is a characteristic feature. This may be why there is little information about them in the botanical literature. Hybrids of this rank are classified by foreign and domestic evolutionists as convergents [Takhtadzhyan, 2007; Tsvelev, 1973; Natho Günther, 1974 (Takhtajyan, 2007; Tzvelev, 1973; Natho Günther, 1974)], since they have greater potential for further evolution compared to their parent taxa. Introgessants are a source of promising lines of evolutionary development.

Our studies in the Don delta showed that the introgressive *Typha × doweldi* apparently arose in a non-divergent way, but as a result of teratogenesis [Glukhov, Charchota et al., 2005 (Gluchov, Charchota et al., 2005)]. This was evidenced by its anomalies in the delta branches

The purpose of the work is to consider the taxonomy of the hybrid *Typha × doweldi* A. Krasnova & Pol'china.

The material was herbarium collections. T. N. Polshina, collected in the coastal banks of the *Mokraya Kalancha* branch (Elizavetinskoye rural settlement). The collection of material was carried out in August 2021 according to the method of A.P. Shennikova. The *Wet Kalancha* is considered the most water-bearing branch, its length is 22 km, the average width is 180–300 m, the average depth is 5–10 m. When studying pistillate flowers, the comparative morphological method (Wettstein-Komarov) was used. Photographs of cattails were taken with a Canon Power Shot D 30 camera. Herbarium material is stored in the Herbarium of the Institute of Biology and Biology of the Russian Academy of Sciences (IBIW).

As a result of the research, the introgressive hybrid *Typha × doweldi* A. Krasnova & Pol'china was described. Below is its description.

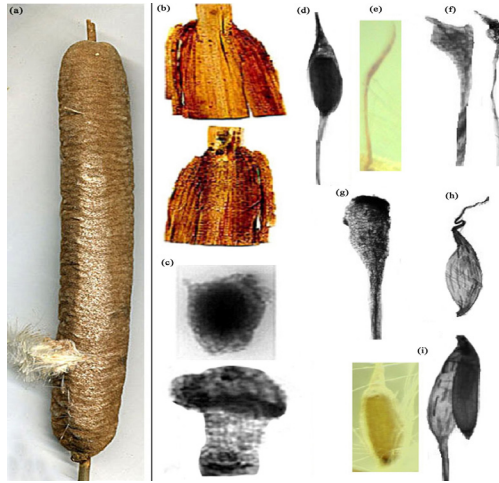
*Typha × doweldi* A. Krasnova & Pol'china. Hibrid new (sect. *Bracteolatae* Graebn. s. l.).

Perennial. Rhizome  $\geq 100$  cm. Caulis of 150 cm altitude. Stem leaves narrow-linear, 0.7 cm in width, on apex long acuminate. Vaginas are long, the blade, are at different levels, directed downwards, membranous along the lobes are membranous along with rafids and warts. The stamen part and pistillate with intervale 4 cm. The stamen part of 20 cm long is not preserved. The pistillate part is broadly cylindrical, grey-brown 21–23 cm long, 2.2–2.5 cm in diameter. After flowering, pale brown, whitish. Pestle flower 8.2 mm long. The stigma narrow-line, 1.7 mm long, with and rafides. The styles 2.8 mm long. The ovary 2.2 mm long, oblong-fusiform in the middle expanded, the gynophore 1.5 mm long. The bractled in number 2 or 3, at the top extended, widened with a finger-like protrusion in the middle. Degraded pestle flowers (carpodia) 8 mm long, light brown, on top of the clavate with a long edge and rafides. Hairs of the gynophores are numerous, shorter than stigmas. The ovarium oblong-fusiform. Fruits are small, narrow-elliptical. Flowering IV–VI, fruiting VI–VIII. – Cattail doweldi (Named after Alexander Borisovich Doweld, botanist, paleontologist, protistologist, researcher of the Sarmatian flora in the southern regions of European Russia).

Type: Rostov region, Azov district, right bank of the Don River, arm of the Wet Kalancha, alluvial-gley soil with ionization; cattail communities. 23. 09. 2021. T.N. Polshina (Fig. 1) (IBIW).

Rostov region, Don Delta, armo (sleeve) Wet Kalancha

Differs from *T. grossgeimii* and *T. angustata* in height of 250 cm, by the gentle lobes of the sheaths of the stem leaves with rafids and warts; broadly cylindrical, pale brown, grey-brown color of pistillate spadix; bracts at the top dilated with rafids; small oblong, beveled seeds.



**Figure.** *Introgressive hybrid microfiles × Typha doweldi* A. Krasnova & Pol'china: (a) – the spadix pestil; (b) – fragments of stem leaf (on the inside with warts and raphids); (c) – warts magnification 40; (d) – ovary; (e) – stigma; (f) – bracts with a spike; (g) – carpodium; (h) – pericarp with raphides; (i) – seed in the pericarp.

Introgressive hybrids in *Typha* were considered by A.N. Krasnova. in works on the Vologda region [Krasnova, 2018 (Krasnova, 2018)]. In the reservoirs of the Rostov region, similar processes of crossing occur in the branches of the Don delta. An active role in these processes belongs to the archaic species *T. angustata*, which was widely known in Russia and the former USSR. However, recently the species has been indicated synonymously with *T. australis* and *T. domingensis*. The discovery of *T. angustata* in the Don delta showed that the species was mistakenly downgraded in status. *T. angustata* persists in the arms (arms) of the delta, where it has formed hybrids and anomalies with closely related species, including *T. grossheimii*, which is widespread in the Caspian basin and Central Asia (Central Asia). The closest localities of *T. grossheimii* are known from the Azov region (*Republic of Ukraine*) and the Caspian region (*Lower Volga*). A few populations of *T. grossheimii* were discovered by T.N. Poland in 2017 in the vicinity of the village. Kagalnik, where it is greatly suppressed [Krasnova, Pol'china, 2020].

*Typha × doweldi*, found in the coastal areas of Mokraya Kalancha, apparently formed as a result of repeated crossing. The original species differs from *T. angustata* in its flat vaginal lobes filled with raphidas and warts; It is similar to *T. grossheimii* in the whitish-gray color of the pistil part, as well as numerous bracts with a hook-shaped tooth. According to K.M. Zavadsky, N.N. Tsvelev and A.L.

Takhtadzhyan [Tsvelev, 1979; Takhtadzhyana, 2007 (Tsvelev, 1979; Takhtadzhyana, 2007)] introgression played a special role in past eras. At the present stage, such hybrids that have not formed into taxa, with increased anthropogenic impact, form unstable taxa and disintegrate or are subsequently adsorbed by parent species. However, the *Typha* × *doweldi* we described has a rather unique habit – a powerful (heterotic) plant 250 cm tall. It has some new features - raphides and warts in all organs. Such changes are mechanisms of adaptation to the technogenic environment and are fixed hereditarily. As a result, the prerequisites for the formation of a new technogenic species are created.

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斑叶龙血树叶对额外背面指向的蓝光和红光的 CO<sub>2</sub> 同化反应  
**CO<sub>2</sub> ASSIMILATION RESPONSE OF VARIEGATED DRACAENA  
FRAGRANS LEAVES TO THE ADDITIONAL ABAXIALLY  
DIRECTED BLUE AND RED LIGHT**

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摘要。双面植物叶片具有明显的解剖背腹不对称性，但人们对其功能性背腹不对称性了解甚少。考虑到海绵状叶肉仅吸收一小部分近轴入射光，因此栅栏状叶肉和海绵状叶肉的光合作用饱和度之间的差异仍未得到充分研究。在这方面，低远轴向上光的影响令人感兴趣。在这项工作中，研究了 CO<sub>2</sub> 同化动力学对额外的近轴和远轴蓝光和红光 (AdLL) 光的响应。使用与非色散红外 CO<sub>2</sub> 传感器连接的气流室评估 CO<sub>2</sub> 同化动力学。如果将蓝色和红色 AdLL 应用于浅绿色（但不是正常绿色）区域的背面，它们会导致净 CO<sub>2</sub> 同化水平 (PN<sub>2</sub>) 显著增加，约为光化光 (PN) 诱导水平的 70–75%，尽管 PN<sub>2</sub> 值比 PN 低 4 倍。这意味着，穿过深绿色栅栏叶肉到达海绵叶肉的极低光照会使该海绵叶肉的光合作用饱和，而穿过浅绿色栅栏叶肉到达海绵叶肉的强光不会使其饱和。这种矛盾现象的原因尚不清楚。

关键词：栅栏叶肉、海绵叶肉、CO<sub>2</sub> 同化、叶片背腹不对称、叶片向上变亮、杂色植物。

**Abstract.** *Functional dorsoventral asymmetry of the bifacial plant leaves is poorly understood while they have a pronounced anatomical dorsoventral asymmetry. The difference between the degrees of saturation of photosynthesis in the palisade and spongy mesophyll is still remains weakly studied considering*

*that spongy mesophyll absorbs only small fraction of the adaxially directed incident light. In this connection, the effects of low abaxially directed upward light are of interest. In this work, the responses of CO<sub>2</sub> assimilation kinetics to the additional adaxially and abaxially directed blue and red low light (AdLL) light were investigated. CO<sub>2</sub> assimilation kinetics was evaluated using air flow chamber connected with the nondispersive infrared CO<sub>2</sub>-sensor. If the blue and red AdLLs were applied abaxially to the light green (but not normal green) sectors, they caused a significant additional increase in the net CO<sub>2</sub> assimilation level ( $P_{N2}$ ) which was about 70-75% of that induced by actinic light ( $P_N$ ) despite the  $P_{N2}$  value was 4 times lower than  $P_N$ . It means that a very low light reaching spongy mesophyll across the dark-green palisade mesophyll saturates photosynthesis in this spongy mesophyll, whereas a stronger light reaching spongy mesophyll across the light-green palisade mesophyll does not saturate it. The causes of such a paradox phenomenon are unclear.*

**Keywords:** palisade mesophyll, spongy mesophyll, CO<sub>2</sub> assimilation, leaf dorsoventral asymmetry, upward lightening of leaves, variegated plants.

The asymmetric (bifacial) division of leaf tissues is characteristic of higher plant species [1]. Leaves possessing it often have a cuticular layer on the upper (adaxial, usually facing the light source) side that is poorly permeable to CO<sub>2</sub> and water vapor. The epidermal cell monolayer is located below the cuticular layer and still below there are one or more layers of palisade mesophyll, the cells of which are tightly packed together, thus minimizing apoplastic transport of these gases. The spongy mesophyll which follows below the palisade mesophyll is characterized by the presence of large intercellular spaces extending to the lower epidermal layer and stomata embedded in it. Moreover, the stomata are absent in the upper layer epidermal layer in many species [1].

Evidently, the cells of sponge mesophyll have much better access for CO<sub>2</sub> compared to palisade mesophyll. At the same time, the palisade mesophyll adsorbs a significantly higher fraction of incident light, exceeding that of sponge mesophyll by a factor of 5-20 [2]. The observed paradox indicates a possible involvement of anoxygenic photosynthesis in the total photosynthetic activity of palisade mesophyll. The anoxygenic photosynthesis (in a wide sense, not only in relation to bacteria) is based on the thylakoid electron transport processes that do not lead to water photolysis and NADPH reduction (and, consequently, to carbohydrate synthesis), but, however, generates the proton gradient and ATP synthesizes [3]. In the higher plants these processes may be based on the cyclic electron transport around photosystem I (CET-PSI) [4] and photosystem II (CET-PSII) [5,6].

The question arising from the above is: Does the additional abaxially directed light induce additional CO<sub>2</sub> assimilation in the environment when photosynthesis



is saturated by the adaxially directed actinic light? In other words, does the spongy mesophyll appear to be saturated simultaneously with the palisade mesophyll when the latter is saturated by the upward (adaxially directed) light? Would the additional adaxially and abaxially directed blue and red lights have similar or different effects considering different blue and red light penetration into (absorption by) the leaf? In this relation, chlorophyll deficient tissues are of special interest as their spongy mesophyll is shielded much less compared to the palisade mesophyll.

In this work the variegated *D. fragrans* (*deremensis*) 'Lemon Lime' plants was investigated. We studied effects of abaxially (compared to adaxially) directed low additional red and blue lights on the CO<sub>2</sub> assimilation level when they were turned on after 20-min adaptation under red or blue saturating actinic light. We showed that such effects appeared only in the case of the light-green (not dark green), chlorophyll-deficient leaf sectors.

Experiments were carried out with 30-40 cm *D. fragrans* plants having normal (dark) green and light green leaf sectors. It is known as a shade-resistant plant although it may survive in the forest edges and savannahs [7,8]. The experimental plants were grown in the greenhouse at an photosynthetic photon flux density (PPFD) of approximately 80-100 μmol photons m<sup>-2</sup> s<sup>-1</sup>, light:dark regime 14:10, air temperature 23-26°C, relative soil humidity 58-63%.

Earlier we showed that chlorophyll content in the light green leaf sectors of *D. fragrans* is 6-8 times lower and chlorophyll absorption of white light is 1.78 - 1.47 times lower compared to normal sectors, but their CO<sub>2</sub> assimilation rates were very close.

Cuttings of normal green and light green sectors of *D. fragrans* leaves were placed in a flow glass chamber (100 ? 50 ? 5 mm) fed by a pneumatic line communicating with a digital gas flowmeter, humidifier, gas flow stabilizer and gas balloon with compressed air [9]. The air flow was adjusted to 100 ml min<sup>-1</sup>, and relative air humidity was 60%. The input CO<sub>2</sub> level was 450 ppm. The output of the chamber was connected with a nondispersive infrared CO<sub>2</sub>-sensor IRM300 (SemeaTech, China) communicating with PC via USB port. The CO<sub>2</sub> levels were measured every 3 s for 60 min. The data were saved into a text log file, from which the corresponding kinetic curves were obtained. Changes in the CO<sub>2</sub> assimilation kinetics were measured in response to the blue (LEDS, 465 nm) and red (LEDs, 640 nm) actinic light (AcL) and additional low light (AdLL) switching on. Calculations of the initial and additional net CO<sub>2</sub> assimilation rates (P<sub>N</sub> and P<sub>N2</sub>, accordingly, Fig. 2a, in μmol m<sup>-2</sup> s<sup>-1</sup>) were performed as previously described [9].

The obtained CO<sub>2</sub> assimilation kinetics data showed (Figs 1-4) that in all the experiments the output CO<sub>2</sub> level was increased (by the value of dark respiration, R) after placing the leaf sectors into the chamber. Switching on the light caused the CO<sub>2</sub> level decrease (by the value of P<sub>N</sub>). In all the experiments P<sub>N</sub> were only slightly (by 40-120%) higher than R values that is possibly due to that the studied

*D. fragrans* are slowly grown plants especially under the relatively low PPFD used for growth.

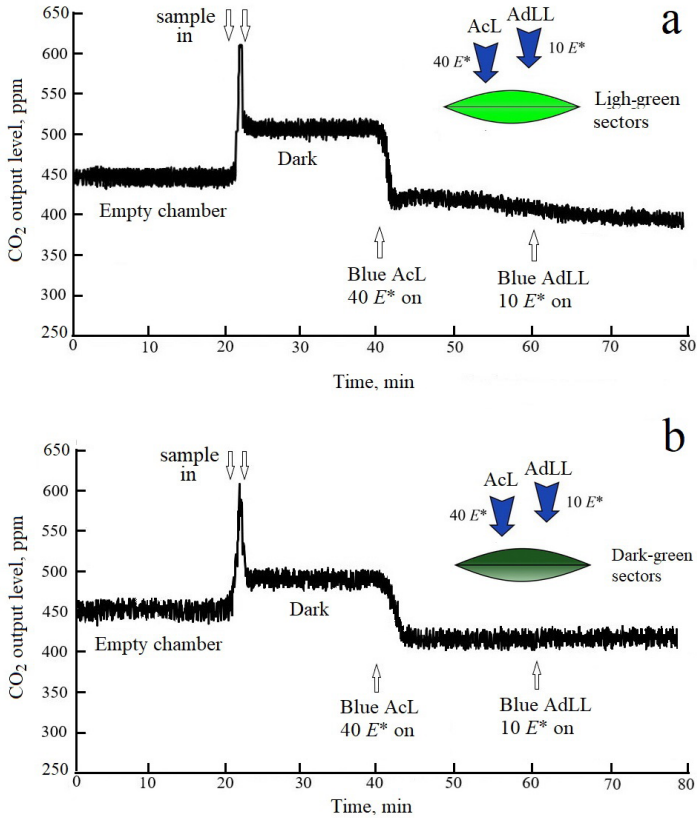
Light-green and dark-green sectors did not differ from each other in the CO<sub>2</sub> levels induced by the AcL of the same color (blue or red). It confirms results of the earlier works demonstrating that chlorophyll-deficient leaf tissues may provide a photosynthetic level (CO<sub>2</sub> assimilation) close to that of normal green tissues. Particularly, Więckowski and Ficek [10] showed that light-green leaves of variegated-leaf chimera of *Acer platanoides* contained 12 times less chlorophyll than normal green leaves but were only 20% lower in the photosynthetic rate. Close CO<sub>2</sub> assimilation levels in light- and dark-green leaves of variegated *D. fragrans* were also measured in our previous work (Chalenko et al., 2024, in press).

When the blue and red AdLLs were applied abaxially to the light green sectors (Figs 2a and 4a), they caused a significant additional increase in the CO<sub>2</sub> assimilation levels ( $P_{N_2}$ ) which was about 70-75% of that induced by AcL ( $P_N$ ) despite the  $P_{N_2}$  value was 4 times lower than  $P_N$ . At the meantime, the adaxially directed AdLL (control) of the same PPFD and color did not caused the additional CO<sub>2</sub> assimilation in the light-green sectors ( $P_{N_2}=0$ ) (Fig 1a and 3a). It clearly suggests that oxygenic photosynthesis in the palisade mesophyll of *D. fragrans* light-green leaf sectors is not saturated at 40  $\mu\text{mol m}^{-2} \text{s}^{-1}$  in contrast to that of the palisade mesophyll while also assuming that spongy mesophyll possesses mostly the oxygenic photosynthesis and palisade mesophyll possesses mostly anoxygenic photosynthesis [9]. However, unexpected results were obtained with the normal green leaf sectors. In this case we have not found any CO<sub>2</sub> assimilation rate responses to switching on the AdLL independently of whether it was directed adaxially or abaxially or whether the blue or red light was applied (Figs 1b, 2b, 3b and 4b). It means that a very low light reaching spongy mesophyll across the dark-green palisade mesophyll saturates photosynthesis in this spongy mesophyll, whereas a stronger light reaching spongy mesophyll across the light-green palisade mesophyll does not saturate it. The causes of such a paradox phenomenon are unclear. In overall, the data obtained in this work have shown that additional low upward lightening may be potentially useful for increasing the plant's productivity at least if they are chlorophyll-deficient. These data also support our previous results (Lysenko et. al., 2023) suggesting that regulation of the functional dorsoventral asymmetry of bifacial plants still remains to be poorly known.

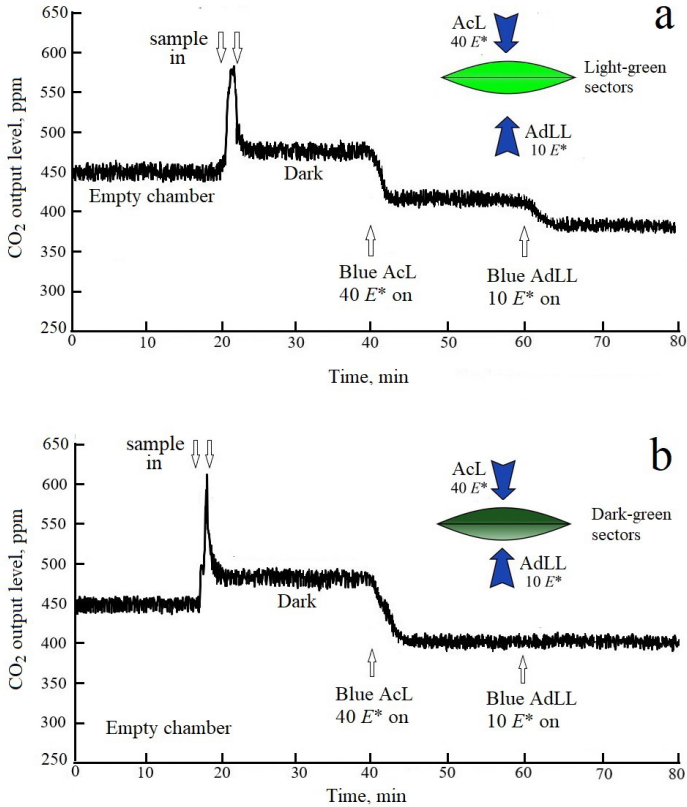
The project was supported by the Russian Science Foundation under grant No. 22-14-00338, <https://rscf.ru/project/22-14-00338/>, and performed in Southern Federal University (Rostov-on-Don, Russian Federation).

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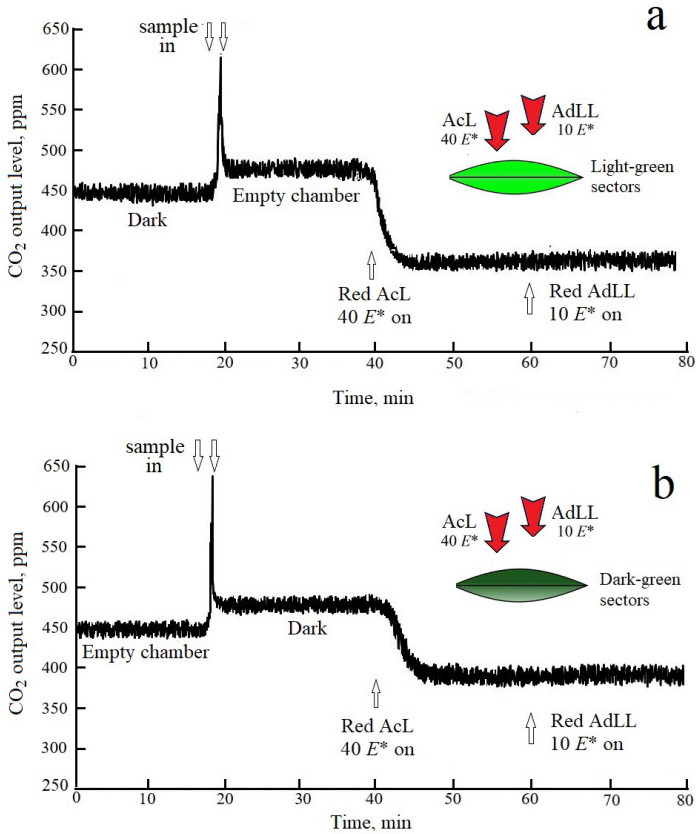
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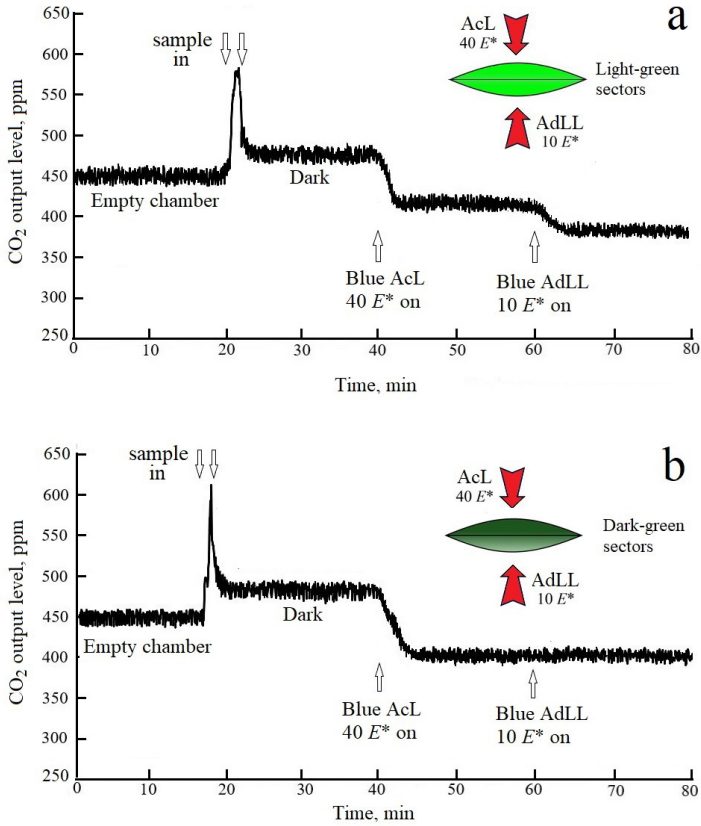
**Figure 1.**  $CO_2$  assimilation kinetics induced in the light- (a) and dark-green (b) sectors of *D. fragrans* leaves by the adaxially directed blue actinic light (AcL) and adaxially directed blue additional low light (AdLL). Typical curve.  $E^*$  is the PPFD in  $\mu mol m^{-2} s^{-1}$ . For the light-green sectors:  $P_N = 5.2 \pm 0.4$  at  $p = 0.5$ ,  $n = 8$ ;  $P_{N2} = 0 - 0.2$ . For the dark-green sectors:  $P_N = 5.1 \pm 0.4$  at  $p = 0.5$ ,  $n = 8$ ;  $P_{N2} = 0$ .



**Figure 2.**  $\text{CO}_2$  assimilation kinetics induced in the light- (a) dark-green (b) sectors of *D. fragrans* leaves by the the adaxially directed blue actinic light (AcL) and abaxially directed blue additional low backlight (AdLL). Typical curves.  $E^*$  is the PPFD in  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . For the light-green sectors:  $P_N = 5.2 \pm 0.4$  at  $p=0.5$ ,  $n=8$ ;  $P_{N2} = 4.3 \pm 0.3$ . For the dark-green sectors:  $P_N = 5.0 \pm 0.4$  at  $p=0.5$ ,  $n=8$ ;  $P_{N2} = 0$ .



**Figure 1.**  $CO_2$  assimilation kinetics induced in the light (a) and dark-green (b) sectors of *D. fragrans* leaves by the axially directed red actinic light (AcL) and axially directed red additional low light (AdLL). Typical curves.  $E^*$  is the PPFD in  $\mu mol\ m^{-2}\ s^{-1}$ . For the light-green sectors:  $P_N = 8.5 \pm 0.6$  at  $p = 0.5$ ,  $n = 8$ ;  $P_{N2} = 0$ . For the dark-green sectors:  $P_N = 8.7 \pm 0.6$  at  $p = 0.5$ ,  $n = 8$ ;  $P_{N2} = 0$ .



**Figure 1.** CO<sub>2</sub> assimilation kinetics induced in the light- and dark-green sectors of *D. fragrans* leaves by the adaxially directed red actinic light (AcL) and adaxially directed red additional low backlight (AdLL). Typical curve. E\* is the PPFD in  $\mu\text{mol m}^{-2} \text{s}^{-1}$ . For the light-green sectors:  $P_N = 8.8 \pm 0.6$  at  $p=0.5$ ,  $n=8$ ;  $P_{N2} = 6.4 \pm 0.5$ . For the dark-green sectors:  $P_N = 8.7 \pm 0.6$  at  $p=0.5$ ,  $n=8$ ;  $P_{N2} = 0$ .

老年人消化系统解剖和功能水平上个体化致病反应的形成  
**FORMATION OF INDIVIDUAL PATHOGENIC REACTIVITY  
OF THE BODY AT THE LEVEL OF THE ANATOMICAL AND  
FUNCTIONAL DIGESTIVE SYSTEM IN ELDERLY PEOPLE**

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简历。介绍。衰老是与年龄相关的变化，在身体发育过程中均匀发生，早在老年之前就开始了，并导致身体适应能力的逐渐增加的限制[1]。

目标。这项研究的目的是开发老年人个体致病反应的类型以及在解剖和功能消化系统水平上形成这种反应的机制。

研究材料和方法。我们已经发表了个体反应类型的分类以及身体解剖和生理系统的个体反应类型。

结果。随着人类衰老，结肠会发生以下变化，即其长度增加，肌肉收缩减弱；肠腔内压力降低。运动能力减弱到一定程度，以至于食糜通过结肠的时间会显著延迟。结肠腔内的微生物群落发生变化。老年人的乳酸杆菌和双歧杆菌数量要少几个数量级。所有这些特点都有助于形成单发或多发性憩室[3]。

结论。在老年人和高龄人群中，由于消化系统的解剖和功能特点以及病因（致病）因素的特点，在消化解剖和功能系统层面形成了以下最常见的个体致病反应类型，形式为胃食管反流病、急性、慢性胃炎、急性胰腺炎、肠炎、结肠炎和结肠息肉，恶性肿瘤发生率较高。

关键词：个体反应性分类；个体致病反应；消化解剖和功能系统；胃炎；肠炎；结肠炎。



**Resume. Introduction.** *Aging is age-related changes that occur uniformly during the development of the body, beginning long before old age and leading to a gradually increasing limitation of the adaptive capabilities of the body[1].*

**Goal.** *The aim of the study is to develop the types of individual pathogenic reactivity of elderly people and the mechanisms of formation of this reactivity at the level of the anatomical and functional digestive system.*

**Materials and methods of research.** *We have published a classification of types of individual reactivity and types of individual reactivity on anatomical and physiological systems of the body.*

**Results.** *With human aging, the following changes in the colon are noted, namely, its length increases, muscle contraction weakens; pressure in the intestinal cavity decreases. Motility is weakened to such an extent that the passage of chyme through the colon can be significantly delayed. The microbiocenosis in the lumen of the colon changes. Older people have an order of magnitude lower number of lactobacilli and bifidobacteria. All these features contribute to the formation of single and multiple diverticula [3].*

**Conclusion.** *In elderly and senile people, due to the anatomical and functional features of the digestive system and the features of etiological (pathogenic) factors, the following, most common types of individual pathogenic reactivity are formed at the level of the digestive anatomical and functional system in the form of gastroesophageal reflux disease, acute, chronic gastritis, acute pancreatitis, enteritis, colitis and polyps of the colon intestines with a high incidence of malignancy.*

**Keywords:** *Classification of individual reactivity; individual pathogenic reactivity; digestive anatomical and functional system; gastritis; enteritis; colitis.*

### **Introduction.**

A comprehensive study of the functional and morphological states of the digestive system revealed an increase in the rate of age-related changes as the body ages. Age-related changes in the organs of the gastrointestinal tract form a lower level of adaptability of the elderly and old people to endo- and exogenous influences, increases the incidence of acute and chronic diseases, changing the clinical picture of emerging or existing diseases, increasing the risk of complications, the appearance and severity of adverse drug reactions reactions [1].

Geriatric gastroenterological problems in humans have been studied by a number of domestic scientists [1; 2]

The purpose of the study is to develop the most common types of individual pathogenic reactivity in elderly people and the mechanisms of formation of this reactivity at the level of the anatomical and functional digestive system.

**Research methods.** We have published a classification of types of individual reactivity and types of individual pathogenic reactivity at the level of anatomical and physiological systems of the body (Fig. 1; Fig. 2) [3; 4].

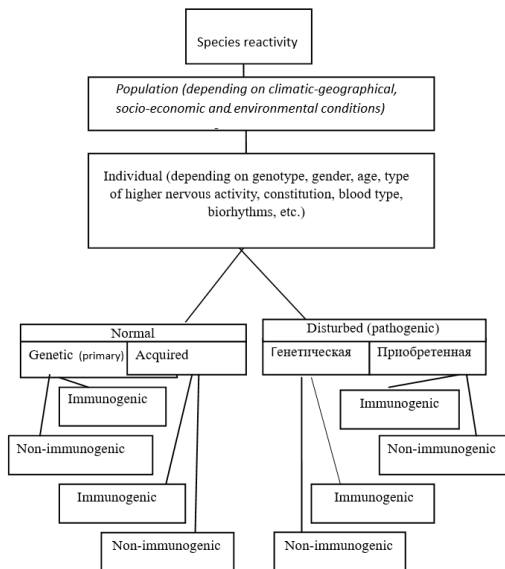


Figure 1. Types of individual reactivity (L.N. Ivanov, M.L. Kolotilova)

	Individual pathogenic reactivity at the level of anatomical and functional systems	
RS reactivity		CNS reactivity
Primary (genetic)   Acquired		Primary (genetic)   Acquired
BS reactivity		VNS reactivity
Primary (genetic)   Acquired		Primary (genetic)   Acquired
DS reactivity		ES reactivity
Primary (genetic)   Acquired		Primary (genetic)   Acquired
HS reactivity		CVS reactivity
Primary (genetic)   Acquired		Primary (genetic)   Acquired
US reactivity		BJ reactivity
Primary (genetic)   Acquired		Primary (genetic)   Acquired

OS reactivity			HO VA reactivity	
Primary (genetic)	Acquired		Primary (genetic)	Acquired
MS reactivity			OS reactivity	
Primary (genetic)	Acquired		Primary (genetic)	Acquired
Immunocompetent ICS system			DFSreactivity	
Primary (genetic)	Acquired		Primary (genetic)	Acquired

**Figure 2.** Individual pathogenic reactivity of anatomical and functional systems (L.N. Ivanov, M.L. Kolotilova)

DS - respiratory system, BS- blood system, DS - digestive system, HS- hepato-biliary system, MPS - urinogenital system, ICS - immunocompetent system, OS - organ of sight, MS - muscular system, CNS - central nervous system, ANS - autonomic nervous system, ES - endocrine system, CVS - cardiovascular system, BJ- bone and joint, HO- hearing organs and vestibular system, overlying skin - OS, DS - dentofacial system.

**Research results.** Individual pathogenic reactivity of the body is a reactivity that occurs after exposure to a pathogenic agent and does not ensure the body's adaptation to these pathogenic agents while maintaining homeostasis [3; 4].

As a person ages, the esophagus becomes curved, lengthens, and moves away from the midline. The mucous membrane of the organ is pale in color, contains fewer secretory cells, and the vascular pattern is more pronounced than in young people. Atrophic changes develop in the mucous membrane and muscle layer. The muscular layer of the esophagus in an aging person changes segmentally with the replacement of smooth and striated muscles by connective tissue, leading to a decrease in tone and intraesophageal pressure, a decrease in the strength and speed of tonic contractions, the formation of esophageal dyskinesia in hypotonic or spastic variants, as well as the appearance of diverticula. According to the spastic variant, these changes underlie the difficult passage of the food bolus through the esophagus [1].

According to the hypotonic variant, the noted functional and structural features in elderly people contribute to the formation of individual pathogenic reactivity at the level of the esophagus in the form of gastroesophageal reflux disease (GERD) to the influence of etiological agents. GERD is a condition that develops when the contents of the stomach and the symptoms it causes in the patient are refluxed into the esophagus, causing heartburn, regurgitation and possible reflux esophagitis. The prevalence of GERD in Russia is 13.3%, and in people over 60 years of age - 26.5% [1].

According to studies by geriatric gastroenterologists [1], as a person ages, diffuse atrophic processes in the stomach increase, occurring earlier on the surface of the organ, and later in the deeper layers of cells. As the body ages, the thickness of the gastric mucosa decreases due to a decrease in the glandular zone, in particular due to a decrease in the number of tubular glands and secretory cells in all parts of the stomach. Atrophy of the gastric mucosa in old people is accompanied by a decrease in the secretion of hydrochloric acid and digestive enzymes, which, in combination with a decrease in the function of the liver and pancreas, is accompanied by impaired digestion, absorption and metabolism of proteins, fats, carbohydrates, and vitamins [1]. In the gastric epithelium, the amount of neutral mucopolysaccharides decreases, the number of parietal glands decreases with a disorder in the structure of mitochondria and lipoprotein complexes. Mucin granules are found in the chief cells and the number of pepsinogen granules decreases. As a person ages, the muscle fibers of the wall undergo fatty degeneration, and signs of myocyte atrophy appear - the formation of vacuoles. In old people, changes in the vascular bed supplying the stomach are observed, when dilatation of the gastric veins and desolation, tortuosity of capillaries, rupture and desolation of anastomoses of intrawall vessels occur, the length of the capillary network decreases, pericapillary spaces increase, and vascular endothelial cells change. During the aging process, pepsin production decreases because the cells that produce pepsin are located deeper. With aging, the periodic motor activity of the stomach changes [1]. All this contributes to the development of hypoxia and secondary ulcerative lesions in older age groups.

In our opinion, in older people, due to the consumption of poor-quality, contaminated food, and long-term use of medications, individual pathogenic reactivity develops at the level of the digestive system in the form of acute and chronic gastritis.

It is known that with age in people, the activity of neurohumoral regulation processes and the intensity of biosynthesis of prostaglandins, which are an important component of the protective system of the mucous membrane of the gastroduodenal system, change somewhat. With the aging of the human body, the relationships in the prevalence of parts of the autonomic nervous system change, namely, in people of the older age group, the adrenergic system dominates over the cholinergic system. This change is accompanied by a decrease in the trophism of the gastric mucosa and duodenal mucosa. A number of experts admit that the formation of ulcers in the stomach and duodenum in elderly patients is associated with impaired microcirculation in the mucous membrane. The main factors of aggression are hypoxia and anoxia, which are atrophic and metabolic disorders in the wall of these organs. Peptic ulcer disease in patients of older age groups, as a rule, develops against the background of diseases such as hypertension, chronic nonspecific lung diseases, etc.

With age, the balance of protective and aggressive factors is disrupted, which leads to a weakening of the trophism of the mucous membrane of the stomach and duodenum and the development of peptic ulcers. In the process of aging, a decrease in general and local immunity occurs, which leads to disorders of the gastric barrier, the entry into the bloodstream of undigested, partially digested food proteins, waste products of microorganisms with the development of immune inflammation, when the functions of T-lymphocytes decrease, the reaction of T-lymphocytes decreases, stimulating effects of interleukin-2. The formation of ulcers in the stomach and duodenum in elderly people is facilitated by disrupted microcirculation processes in the mucous membrane of the gastroduodenal system. The development of peptic ulcers increases with the use of  $\beta$ -blockers, aspirin, and other drugs. The noted morphofunctional changes in the stomach and duodenum under the influence of pathogenic factors form a pathogenic individual reactivity, manifested in the form of a nosological form of gastric ulcer.

Taking into account the pathogenic individual reactivity at the level of the anatomical and functional digestive system, we have developed our own theory of the etiology of gastric ulcer called “Neurogenic-genetic theory of the etiology of peptic ulcer” [5].

From 55-65 years of age, the process of pancreatic atrophy reduces the number of functioning acini and cells. The first signs of morphological changes in the exocrine part of the pancreas are detected in people aged 40-50 years, when its mass decreases, coarsening of the connective tissue stroma of the organ is noted, fibrosis of interlobular and interacinar spaces is formed, desolation of the capillary network, deformation and expansion of small, medium and large excretory ducts with obliteration of individual sections. As a person ages, the exocrine function of the pancreas changes. With aging, the amylase content in pancreatic secretions changes to the least extent, and the lipase content changes the most, despite the common sites of formation of the noted pancreatic enzymes [1].

All of the above-mentioned features of the pancreas in elderly and old people when exposed to etiological agents contribute to the formation of individual pathogenic reactivity at the level of the exocrine pancreas in the form of acute pancreatitis. Acute pancreatitis in elderly and old people is initially aseptic inflammation of the pancreas, which can damage surrounding tissues, distant organs and systems [1]. Among acute diseases of the abdominal organs, acute pancreatitis ranks third after acute appendicitis and acute cholecystitis.

As a person ages, the number of connective tissue elements in the small intestine increases. The area where membrane digestion occurs decreases; the sorption properties of enterocytes decrease; the production of intestinal enzymes decreases, the activity of intestinal enzymes of the small intestine involved in parietal digestion decreases. The renewal of the epithelial layer of the mucous membrane of the

small intestine slows down; the rate of absorption in the small intestine decreases; the duration of intestinal absorption increases [1]

The above-mentioned features of the duodenum under the influence of etiological factors contribute to the formation of individual pathogenic reactivity of the anatomical and functional digestive system in older people at the level of the duodenum in the form of chronic duodenitis. Chronic duodenitis is a long-term disease with the development of structural inflammatory-dystrophic, dysregenerative changes in the mucous membrane of the duodenum, leading to atrophy of the mucous membrane and accompanied by a violation of the basic function of the duodenum [1]. At the same time, primary chronic duodenitis is independent. Secondary chronic duodenitis is considered as a complication or concomitant disease. Elderly, old people are characterized by an asymptomatic course or vague pain syndrome.

As a person ages, the following changes are observed in the colon, namely, its length increases, muscle contraction weakens; the pressure in the intestinal cavity decreases. Motility is weakened to such an extent that the passage of chyme through the colon can be significantly delayed. The microbiocenosis in the lumen of the colon changes. Old people have an order of magnitude lower number of lactobacilli and bifidobacteria. All these features contribute to the formation of single and multiple diverticula [1].

These features in elderly and senile people contribute to the formation of individual pathogenic reactivity in the form of colitis, as well as in the form of the formation of colon polyps with a high incidence of malignancy.

Conclusion. In elderly and senile people, due to the anatomical and functional characteristics of the organs of the digestive system and the characteristics of etiological (pathogenic) factors, the following, most frequently occurring types of individual pathogenic reactivity at the level of the digestive anatomical and functional system are formed in the form of gastroesophageal reflux disease, acute, chronic gastritis, acute pancreatitis, duodenitis, enteritis, colitis and colon polyps with a high incidence of malignancy.

We believe that knowledge of the types of pathogenic reactivity of the body and the mechanisms of their development in conditions of interaction with pathogenic (etiological) environmental factors makes it possible to reduce the proportion of pathological aging, increase the number of people with physiological aging, and increase the threshold for the development of pathogenic reactivity in the general population.

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高等教育初期吸烟与非吸烟青少年体质指数

**BODY MASS INDEX IN SMOKERS AND NON-SMOKERS YOUTHS  
AT THE INITIAL STAGE OF RECEIVING HIGHER EDUCATION**

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摘要。本文对俄罗斯联邦五所大学的 274 名青少年学生的吸烟者和非吸烟者的体重指数 (BMI, g/cm) 进行了分析。为了评估 BMI, 作者开发了一种“人体发育评估方法”(计算机程序国家注册证书编号 2008615639), 并获得了俄罗斯联邦国家注册计算机程序数据库“俄罗斯联邦儿童和青少年身体发育: 沿身体长度的区域体重回归量表”的证书编号 2023623997。该研究首先确定, 无论居住在哪个地区, 青少年学生的 BMI 都处于规范值水平。其次, 短期吸烟对 BMI 没有显著影响。第三, 从绝对值来看, 不吸烟的年轻男性的 BMI 更高。

关键词: 年轻男性、大学生、体重指数、吸烟。



**Abstract.** *The article provides an analysis of the body mass index (BMI, g/cm) in tobacco smokers and non-smokers of 274 adolescent students from five universities in the Russian Federation. To assess BMI, the authors developed a “Method for assessing the physical development of people” (Certificate of state registration of computer programs No. 2008615639) and received Certificate No. 2023623997 of the Russian Federation on state registration of a computer program database “Physical development of children and adolescents of the Russian Federation: regional body weight regression scales” along the length of the body.” The study, firstly, established that the BMI of adolescent students, regardless of their region of residence, is at the level of normative values. Secondly, short-term tobacco smoking does not have a significant effect on BMI. Thirdly, in absolute terms, BMI is higher in young men who do not smoke tobacco.*

**Keywords:** *young men, university students, body mass index, tobacco smoking.*

**Relevance.** For young men who have become university students, the beginning of their studies is often accompanied by a change in climate, usual living environment and way of life, daily routine and nutrition, which can affect changes in body weight. The health of student youth is of particular concern and interest, because its preservation at a young age determines its condition in subsequent age periods. Numerous studies indicate the negative impact of tobacco smoking on quality of life, respiratory system function, mental health, pregnancy, intrauterine development of the fetus, sports, and mortality [1, 3, 4, 6]. Thus, according to WHO, about 100 million people died from smoking in the 20th century. We can explain the addiction of young people to nicotine from the standpoint of the physiological teachings of Academician A.A. Ukhtomsky about the dominant [5, 8]. The fact is that nicotine has a toxic effect on the neurons of brain cells, causing them to become so addictive that it is difficult or even impossible to get rid of. Therefore, we consider the toxic effects of tobacco on the central nervous system to be a dominant and difficult to control phenomenon that requires detailed understanding from various biochemical and physiological positions.

The state of health, education and physical development (PD) of schoolchildren and students is the key to preserving the labor and defense potential of our country. Much attention has always been paid to the issues of assessing the morphofunctional state of students living in various regions of the Russian Federation. The state of health and physical development (PD) of secondary school students and students is the key to preserving the labor and defense potential of our country. At the same time, the deteriorating health of the young population of Russia is causing some concern [2, 7, 9], which is often associated with a decrease in the level of physical activity. Therefore, scientific research aimed at developing regional standards for physical development of modern children, adolescents and

young people is relevant and in demand. Today it should become a mandatory rule that a university physical education teacher, when starting classes with students, must have a clear idea of their health and morphofunctional state. At the same time, the arsenal of his research should include simple methods for assessing health and morphofunctional state, allowing them to be applied in any conditions of the educational or training process.

One of the most important indicators of RF is BMI, which has not been sufficiently studied among modern high school students and adolescent students at universities in the Russian Federation.

**Object of study:** Russian university students during adolescence.

**Subject of research:** body length and weight to calculate body mass index.

Research hypothesis: firstly, it has been suggested that among adolescent students, BMI at the initial stage of higher education depends little on the region of residence and is at the level of normative values characteristic of a given period of ontogenesis. Secondly, short-term tobacco smoking does not have a significant effect ( $p>0.05$ ) on the BMI of young men. Thirdly, BMI in absolute values is higher in young men who do not smoke tobacco.

**Objective:** to assess the effect of smoking on the BMI indicator in smoking and non-smoking adolescent students at the initial stage of obtaining higher education in various universities of the Russian Federation.

**Material and methods.** The study involved 274 young men receiving education at five universities of the Russian Federation: Tyumen State University (TSU) - 48 (17.5%), Siberian Federal University (SFU) - 69 (25.2%), Tchaikovsky State Academy of Physical Culture and sports (ChSAPCaS) - 37 (13.5%), Ural State University of Physical Culture - (UralGUPC) 46 (16.8%), Irkutsk State University - (ISU) 74 (27.0%). There were 126 (45.9%) young men who smoked tobacco, and 148 (54.1%) who did not smoke young men.

In accordance with the recommendations of the World Health Organization, we considered students who smoked more than 5 cigarettes per day to be smokers. 64 (50.8%) people smoked tobacco for 2 years, 41 (32.6%) for 1 year, and 21 (16.6%) for less than a year.

There were 168 (61.3%) young men who entered universities from cities, and 106 (38.7%) from rural settlements.

To assess PD, we have proposed a “Method for assessing the physical development of people” (Certificate of state registration of computer programs No. 2008615639). In addition, we are the authors of Database Certificate No. 2023623997 of the Russian Federation “Physical development of children and adolescents of the Russian Federation: regional scales of regression of body weight by body length”, which we use in the examination0

Body length was measured by our proposed stadiometer (RF Patent for utility model No. 153076).

BMI was assessed using the formula:

$$\text{BMI} = \frac{\text{Body weight (g)}}{\text{Standing height (cm)}}$$

The research results were processed on a personal computer using the Statistika program. The significance of the differences was assessed using Student's t-test, and the differences were considered significant at  $p < 0.05$ .

Ethical review. The principles of voluntariness, individual rights and freedoms guaranteed by Articles 21 and 22 of the Constitution of the Russian Federation, as well as Order of the Ministry of Health and Social Development of Russia No. 774n of August 31, 2010 "On the Ethics Council" are observed. The study was conducted in accordance with the ethical standards set out in the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", which was adopted at the 59th General Assembly in October 2008. The authors obtained verbal consent from students to conduct the study and publish the data.

**Results and discussion.**

The measurement results, firstly, showed that we did not identify any significant differences ( $p > 0.05$ ) in the values of body length and weight between smoking and non-smoking young men receiving higher education in various universities of the Russian Federation (Table 1).

*Table 1.*  
*Body length, body weight and BMI among smoking and non-smoking young men from universities in the Russian Federation (M±m)*

Indicators of physical development	University				
	TSU	SFU	ChSAPCaS	UralGUPC	ISU
Smoking					
Body length	177,6±1,9	178,5±1,8	178,2±1,8	177,9±1,9	177,1±2,0
Body mass	72,09±1,71	72,84±1,69	71,62±1,76	72,24±1,71	72,99±1,78
BMI	0,4059	0,4081	0,4033	<b>0,4061</b>	<b>0,4121</b>
Non-smokers					
Body length	178,8±1,8	179,9±1,9	178,7±1,8	179,0±1,9	179,8±1,9
Body mass	74,67±1,68	75,91±1,67	74,37±1,66	75,02±1,72	75,84±1,68
BMI	0,4176	0,4220	0,4162	<b>0,4191</b>	<b>0,4218</b>

Secondly, if we judge the body length of young men from the standpoint of absolute values, then it is greater among students of Siberian Federal University and ChSAPCaS, both among non-smoking and tobacco-smoking young men. It is noteworthy that short-term tobacco smoking does not have a significant ( $p > 0.05$ )

effect on the course of growth processes in young men, regardless of their region of residence (Table 2). But, nevertheless, the measurement results indicate that in absolute terms, the body length of young men who do not smoke tobacco is greater than that of smokers. So, for TSU boys it is 1.2 cm more, for SFU boys – by 1.4 cm, for ChSAPCaS boys – by 0.5 cm, for UralSUPC boys – by 1.1 cm, for ISU boys – by 2.7 cm.

We consider body weight as an indicator of the social well-being of students, indicating the quality of life. Regardless of the region where the university is located, we did not note any significant differences in body weight among young men ( $p>0.05$ ). At the same time, we identified the negative impact of tobacco smoking on such an important indicator of physical development as body weight. A comparative study of body weight showed that among TSU youth who do not smoke tobacco it is 2.58 kg more than among smokers. A similar trend was noted among SFU boys - a difference of 3.07 kg, among ChSAPCaS boys - a difference of 2.75 kg, for Ural State University of Physical Culture boys - a difference of 2.78 kg, and for ISU boys - by 2.85 kg.

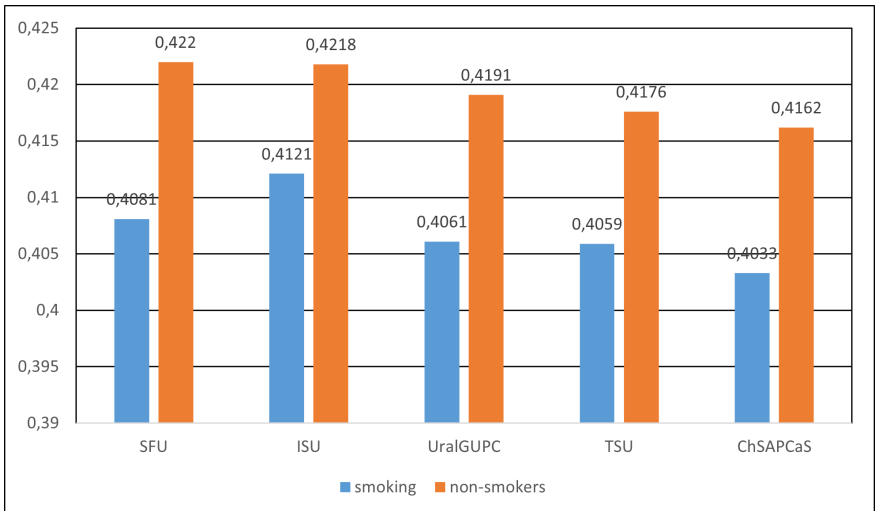
We should note that the basic RF indicators, such as body length and weight in the young men we examined, did not differ significantly ( $p>0.05$ ) from the data of other researchers (Table 2).

**Table 2.**  
*Indicators of physical development of young men in various regions of the Russian Federation*

Author	Year of publication	Body length	Body mass	BMI
Gorst N.A., Gorst Z.R.	2005	179,4	68,5	–
Negasheva M.A.	2007	177,99	67,24	–
Pulikov A.S.	2011	172,3	63,96	–
Lumpova O.M., Kolokoltsev M.M.	2011	176,17	66,22	
Zaitdinov A.I., Mingazov E.N.	2013	173,82	65,2	–
Vyushin G.K., Vikulov A.D.	2014	178,24	66,38	
Nazmutdinova V.I. et al.	2015	178,0	65,5	–
Yasin K.B.	2015	178,0	83,86	–
Bondareva E.A. et al.	2016	178,3	75,0	–
Batsaev A.R.	2016	173,3	68,6	
Kharisova E.Z.	2016	175,6	66,7	–
Chichinina S.V.	2016	176,3	70,2	21,3±1,9
Bazarbaeva S.M. et al.	2017	177,5	69,7	22,1±0,2
Belkina A.A.	2017	177,04	73,47	–
Krasilnikova V.A., Aizman R.I.	2017	174,0	66,1	21,7±0,6

Sidorenko A.V.	2018	178,3	72,32	–
Averyanova I.V.	2018	178,8	68,5	–
Zamkova E.V.	2018	177,8	72,6	–
Borodina G.N., Gerasimova I.N.	2020	177,68	67,86	–
Chinchaeva E.A.	2020	171,6	67,9	22,3±0,4
Yurtaykina M.N. et al.	2020	175,97	75,76	–
Borodina G.N. et al.	2021	179,7	74,0	–
Semizorov E.A. et al.	2021	173,11	70,73	–
Makhsudov R.	2021	173,2	60,8	–
Mikhailova S.V.	2022	176,8	70,5	–
Yurtaykina M.N. et al.	2022	178,63	77,49	23,6±0,4
Litvinova N.S. et al.	2023	178,0	61,8	–

In recent years, the normative BMI values are considered to be 375–420 g/cm<sup>3</sup>, which was also the case in our studies. Analyzing the data obtained, firstly, it can be stated that both smoking and non-smoking young men have no signs indicating excess body weight and obesity. Secondly, the BMI of tobacco-smoking young men studying at universities in the Russian Federation is higher in absolute values than that of non-smokers (Fig. 1).



**Figure 1.** BMI values for smoking and non-smoking young men from various universities in the Russian Federation.

The difference in BMI between non-smoking and tobacco-smoking young men from Siberian Federal University was 0.0139 g/cm, ISU – 0.0097 g/cm, Ural State University of Physical Culture – 0.0127 g/cm, TSU – 0.0127 g/cm, ChSAPCaS – 0.0129 g/cm, which is very insignificant. It can be assumed that at the age of 18-19 years, in young men, the process of body growth begins to complete, while body weight gradually increases as the passport age increases.

Based on the study, we can, firstly, conclude that the basic RF indicators of smoking and non-smoking young men confirm our hypothesis that they are at the level of normative values for a given age period of human ontogenesis. Secondly, BMI, regardless of whether the young man smokes or not, as one of the RF indicators, does not differ from the data of other researchers. Thirdly, young men from various universities of the Russian Federation do not exceed the normative values of body weight and do not show signs of obesity. However, the values of body mass and length among young men who do not smoke tobacco are greater in absolute values, indicating a good level of physical development. In this article we only indicate possible problematic issues that we plan to solve at various methodological levels. One thing is clear: the physiological mechanisms of the dominant of Academician A.A. Ukhtomsky should be considered in drug addiction to tobacco, without analysis of which it will be impossible to counter the pandemic of nicotine addiction.

The authors declare that there is no conflict of interest in the presented article.

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DOI 10.34660/INF.2024.16.49.081

UDC: 613.6.027

R.M.巴耶夫斯基俄罗斯大学生适应潜力值特征（取决于居住地区）  
**FEATURES OF THE VALUES OF ADAPTATION POTENTIAL  
OF R.M. BAEVSKY AMONG YOUNG MEN OF RUSSIAN  
UNIVERSITIES, DEPENDING ON THE REGION OF RESIDENCE**

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摘要。本文根据罗曼·马尔科维奇·巴耶夫斯基的方法，对俄罗斯联邦五所大学 274 名处于学习初期的青春期学生的适应潜力水平指标 (AP, cu) 进行了分析。结果表明，在接受高等教育的初期青春期学生中，AP 取决于多种综合因素。作者认为，首先，区域气候地理和社会条件影响着年轻人身体的适应能力。

关键词：年轻人，俄罗斯大学生，适应潜力。

**Abstract.** *The article provides an analysis of the indicator of the level of adaptation potential (AP, cu) according to the method of Roman Markovich Baevsky in 274 students of the period of adolescence, at the initial stage of study in five universities of the Russian Federation. It has been suggested that among adolescent students at the initial stage of obtaining higher education, AP depends on a number of combined factors. The authors believe that, first of all, it is the regional climatic-geographical and social conditions that influence the adaptive capabilities of the youthful body.*

**Keywords:** *young men, Russian university students, adaptive potential.*

**Relevance.** For young men admitted to universities, the beginning of education is often accompanied by a change in climate, usual living environment and way of life, daily routine and nutrition, which cannot but affect the level of AP. In recent years, the health of students and students has been of particular concern [4], because its preservation at a young age determines its condition in subsequent age periods. The state of health, education and physical development (PD) of school-children and students is the key to preserving the labor and defense potential of our country. Much attention has always been paid to the issues of assessing the morphofunctional state of students living in various regions of the Russian Federation. [3] At the same time, the deteriorating health of the young population of Russia, which is often associated with a decrease in the level of physical activity, is causing some concern. One of the most important indicators for assessing the morphofunctional state of the human body is AP, which has not been sufficiently studied among modern university students in the Russian Federation [1, 2]. AP of the cardiovascular system is one of the fundamental physiological indicators of the level of the functional state of the body.

Therefore, scientific research aimed at developing regional standards for the morphofunctional state of modern youth is relevant and in demand. Today it should become a mandatory rule that a university physical education teacher, when starting classes with students, must have a clear understanding of their health and adaptive capabilities. At the same time, in our opinion, the arsenal of his research should include simple assessment methods that allow them to be applied in any conditions of the educational or training process.

**Object of study:** students of adolescence at various universities in the Russian Federation.

**Subject of research:** adaptation potential according to the method of R.M. Baevsky.

**Research hypothesis:** firstly, it is suggested that among students during adolescence at the initial stage of obtaining higher education, AP depends on the region of residence. Secondly, it is primarily the regional climatic-geographical and social-living conditions that influence the adaptive capabilities of the youthful body.

**Purpose:** to assess the influence of the region of residence on the level of AP of adolescent students at the initial stage of obtaining higher education in various universities of the Russian Federation.

**Material and methods.** The study involved 274 young men receiving education at five universities of the Russian Federation: Tyumen State University (TSU) - 48 (17.5%), Siberian Federal University (SFU) - 69 (25.2%), Tchaikovsky State Academy of Physical Culture and sports (ChSAPCaS) - 37 (13.5%), Ural State University of Physical Culture - (UralSUPC) 46 (16.8%), Irkutsk State University - (ISU) 74 (27.0%). There were 168 (61.3%) young men who entered universities from cities, and 106 (38.7%) from rural settlements.

AP was calculated using the formula:

$$AP = 0.011 \times HR + 0.014 \times SBP + 0.008 \times DBP + 0.014 \times B + 0.009 \times BW - 0.009 \times P - 0.27,$$

where: HR – heart rate (bpm), SBP and DBP – systolic and diastolic blood pressure (mm Hg), B – age (years), BW – body weight (kg), H – height (body length, cm), 0.27 – free term of the equation.

Score: 2.10 – satisfactory adaptation (characterizes sufficient functionality of the circulatory system); 2.11 – 3.20 – functional tension of adaptation mechanisms; 3.21 – 4.30 – unsatisfactory adaptation characterizes a decrease in the functional capabilities of the circulatory system with an insufficient adaptive response to physical activity; more than 4.30 – characterizes a sharp decrease in the functional capabilities of the circulatory system with the phenomenon of failure of the adaptation mechanisms of the entire organism.

Heart rate was calculated by palpation on the radial artery within one minute. Blood pressure was determined according to the method of N.S. Korotkova on the shoulder. Body length was measured with an accuracy of 0.5 centimeters using our proposed stadiometer (Utility model patent RU 153076). Body weight was measured on a lever scale with an accuracy of 50 g.

The research results were processed on a personal computer using the Statistika program. The significance of the differences was assessed using Student's t-test, and the differences were considered significant at  $p < 0.05$ .

**Ethical review.** The principles of voluntariness, individual rights and freedoms guaranteed by Articles 21 and 22 of the Constitution of the Russian Federation,

as well as Order of the Ministry of Health and Social Development of Russia No. 774n of August 31, 2010 “On the Ethics Council” are observed. The study was conducted in accordance with the ethical standards set out in the World Medical Association Declaration of Helsinki “Ethical Principles for Medical Research Involving Human Subjects”, which was adopted at the 59th General Assembly in October 2008. The authors obtained verbal consent from students to conduct the study and publish the data.

**Results and discussion.**

In the formula for calculating the AP according to the method of R.M. Bae-vsky, in addition to age, length and body weight, includes integral indicators of central hemodynamics (HR, SBP and DBP), which we studied in young men in a state of physiological rest in a sitting position. The measurement results, firstly, showed that we did not identify significant differences ( $p>0.05$ ) in the values of length, body weight and central hemodynamics among young men receiving higher education at various universities of the Russian Federation (Table 1).

However, we can note that in absolute terms, the body length of young men studying at Siberian Federal University is 1.2 cm greater than the body length of young men of ChSAPCaS students and 1.1 cm in comparison with young men of TSU. As for body weight, which we consider as an indicator of the social well-being of students and indirectly indicating the quality of life. then in absolute values it was higher among young men from Siberian Federal University and ISU. So, in particular, the difference in body weight between SFU youth and ChSAPCaS youth was 1.54 kg, between SFU and TSU youth 1.24 kg.

**Table 1.**

*Body length, body weight and basic indicators of central hemodynamics in young men from a number of universities in the Russian Federation ( $M\pm m$ )*

Indicators	University				
	ChSAPCaS	TSU	UralSUPC	ISU	SFU
Body length	178,7±1,8	178,8±1,8	179,0±1,9	179,8±1,9	179,9±1,9
Body mass	74,37±1,66	74,67±1,68	75,02±1,72	75,84±1,68	75,91±1,67
Heart rate	75,2±1,7	76,6±1,8	74,2±1,9	77,6±1,6	78,3±1,8
SBP	119,9±2,1	120,8±2,2	120,5±2,3	121,2±2,3	121,4±2,2
DBP	69,5±1,2	71,3±1,4	70,1±1,5	71,7±1,3	71,6±1,4
AP	2,1048	2,1490	2,1102	2,1704	2,1843

We drew attention to the fact that the basic PD indicators, such as body length and weight in the young men we examined, did not differ from the data of other researchers (Table 2).

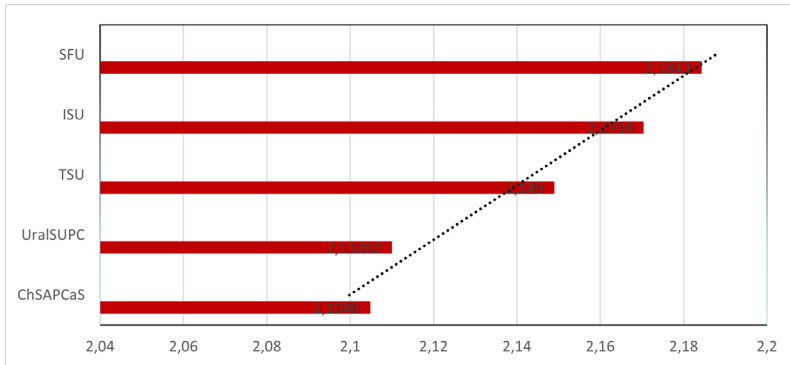
**Table 2.**

*Indicators of physical development of young men in various regions of the Russian Federation*

<b>Author</b>	<b>Year of publication</b>	<b>Body length</b>	<b>Body weight</b>
Gorst N.A., Gorst Z.R.	2005	179,4	68,5
Negasheva M.A.	2007	177,99	67,24
Pulikov A.S.	2011	172,3	63,96
Lumpova O.M., Kolokoltsev M.M.	2011	176,17	66,22
Zaitdinov A.I., Mingazov E.N.	2013	173,82	65,2
Vyushin G.K., Vikulov A.D.	2014	178,24	66,38
Nazmutdinova V.I. et al.	2015	178,0	65,5
Yasin K.B.	2015	178,0	83,86
Bondareva E.A. et al.	2016	178,3	75,0
Batsaev A.R.	2016	173,3	68,6
Kharisova E.Z.	2016	175,6	66,7
Chichinina S.V.	2016	176,3	70,2
Bazarbaeva S.M. et al.	2017	177,5	69,7
Belkina A.A.	2017	177,04	73,47
Krasilnikova V.A., Aizman R.I.	2017	174,0	66,1
Sidorenko A.V.	2018	178,3	72,32
Averyanova I.V.	2018	178,8	68,5
Zamkova E.V.	2018	177,8	72,6
Borodina G.N., Gerasimova I.N.	2020	177,68	67,86
Chinchaeva E.A.	2020	171,6	67,9
Yurtaykina M.N. et al.	2020	175,97	75,76
Borodina G.N. et al.	2021	179,7	74,0
Semizorov E.A. et al.	2021	173,11	70,73
Makhsudov R.	2021	173,2	60,8
Mikhailova S.V.	2022	176,8	70,5
Yurtaykina M.N. et al.	2022	178,63	77,49
Litvinova N.S. et al.	2023	178,0	61,8

Let us note that the heart rate of male university students in the Russian Federation, regardless of their region of residence, indicated their good functional state. Firstly, not a single student had a heart rate that exceeded the limits of normative physiological values, that is, it was less than 60 and more often than 90 beats/min. Secondly, and we consider this especially important, the heart rate in all young men indicated good pumping function of the heart, as it was stably kept in the range from 75 to 79 beats/min. SBP in young men, regardless of region of residence, was also stable within physiological normative values.

Giving an analysis of the calculated values of AP and taking 2.10 c.u. as the norm, we can talk about satisfactory adaptation of the cardiovascular system and, therefore, characterize its sufficient functionality. First of all, this applies only to ChSAFKPCaS, located in the European part of the Russian Federation. In young men studying at universities located beyond the Urals, in Eastern and Western Siberia, we identified, albeit insignificant, but still functional tension in the adaptation mechanisms of the cardiovascular system (Fig. 1).



**Figure 1.** Calculated values of adaptation potential according to R.M. Baevsky among adolescent students at a number of universities in the Russian Federation.

We associate this, firstly, with significant emotional and psychological changes associated with new living conditions for young men. Secondly, the peculiarities of climatic-geographical and meteorological conditions. However, the young men had the opportunity, in addition to classroom learning activities, to actively engage in physical education and sports not only within the university, but also in sports sections.

In this article, we only identify possible problematic issues related to the regional characteristics of the morphological and functional state of students during adolescence, which we plan to solve at various methodological levels.

The authors declare that there is no conflict of interest in the presented article.

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UDC 621.793

使用数学建模识别电腐蚀处理过程中参数的依赖性  
**IDENTIFICATION OF THE DEPENDENCE OF PARAMETERS  
DURING ELECTROEROSION TREATMENT USING  
MATHEMATICAL MODELING**

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注：为保证机械制造复杂产品的电火花加工质量和精度特性，应考虑一组指标：总误差、电极工具制造误差、产品公差、粗糙度参数和平均电流强度。

关键词：数学模型、精度特性、电火花加工、总误差、粗糙度、平均电流强度。

**Annotation.** *To ensure the quality and accuracy characteristics of electrical discharge machining of machine-building complex products, a set of indicators should be taken into account: total errors, manufacturing errors of the electrode tool, product tolerance, roughness parameters and average current strength.*

**Keywords:** *Mathematical model, accuracy characteristics, electrical discharge machining, total error, roughness, average current strength.*

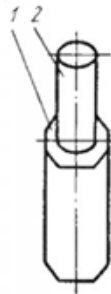
The main properties of mathematical models are adequacy and simplicity, indicating the degree of correspondence of the model to the object under study and the possibility of its implementation. The process of formulating a mathematical model is called problem formulation. Mathematical modeling can be understood as the process of constructing and studying mathematical models. A detailed definition is given in the work: mathematical modeling is an ideal scientific symbolic formal modeling, in which the description of an object is carried out in the language of mathematics, and the study of the model is carried out using certain mathematical methods.

In this case, a mathematical model will help to identify the dependencies of parameters during electrical discharge machining EDM: total error, product tol-

erance, dimensional tolerance tool electrode TE, surface roughness and average current strength.

The design of the TE electrode tool consists of a working part involved in the shaping process and auxiliary elements. The design of the TE must provide base surfaces for installation in the machine spindle and alignment of it relative to the workpiece.

The design of the rod-type electrode-tool is shown in Figure 1 and is made in one piece with a shank, which serves to install and secure the TE on the machine. Such TE designs, in which the working and base parts are made as one piece, are used for EDM of various holes and cavities with a small processing area.



*1 -rod-type tool electrode;  
2 – shank*

**Picture 1.** Design of the TE electrode tool

It has been experimentally established that domestic machines with a processing depth of up to 50 mm distort the horizontal dimensions of the processed profile, which affects the precision characteristics of machine-building products.

The total EDM error is made up of individual components. The error in vertical dimensions (for example, the error in hole depth) consists of errors caused by inaccurate manufacturing of the TE, deviations in the size of the interelectrode gap, inaccurate installation of the TE, and errors in counting its movements during operation. The error in horizontal dimensions consists of errors caused by inaccuracy in manufacturing the TE, inaccuracy in machine settings, temperature deformation of the product, deviation of the interelectrode gap from the specified value and distortion of the shape of the TE caused by wear.

Each of these errors can be minimized if modern measuring instruments or reading microscopes are used during the installation process; Moreover, each error can be no more than 0.01-0.02 mm.

The total error of the EDM is determined by formula 1:



$$\Delta_{am} = \sqrt{\Delta_1^2 + \dots + \Delta_n^2}, \quad (1)$$

where  $\Delta_1, \dots, \Delta_n$  - components of the total error.

The tolerance value for the product must be greater than the total error of the EDM and the manufacturing error of the TE. The product tolerance can be determined by formula 2:

$$\delta_{PR} = \sqrt{\Delta_{am}^2 + \delta_{TE}^2}, \quad (2)$$

where  $\Delta_{sum}$  is the total error of the EDM;

$\delta_{hey}$  - errors in TE manufacturing.

The tolerance for the dimensions of the EDM is established based on the tolerance for the dimensions of the product and the total error of the EDM. The influence of inaccuracy in TE manufacturing on the accuracy of product manufacturing has the following relationship, formula 3:

$$\xi = \sqrt{1 + k^2} - 1, \quad (3)$$

where  $\xi$  is the change in the dimensional error of the product due to the inaccuracy of manufacturing the TE in relative units;

$k$  is the relative error in the size of the TE in fractions of the processing error (it is equal to the ratio  $\Delta TE / \Delta total$ , and less than or equal to  $\delta TE$ ).

It is advisable to choose the tolerance value for the production of TE in the amount of 30-50% of the value of the total error of the TE. The tolerance value will be 0.015-0.1 mm.

After the EDM process, the working surface of the part has a roughness obtained by mutually intersecting and randomly located craters (holes).

Roughness parameters depend on the size and geometry of two types of irregularities: 1 – irregularities that are obtained as a result of the mutual intersection of craters; 2 – irregularities formed due to distortion of the crater profile.

Dimensions of craters obtained as a result of mutual intersection:  $h_k$ . The group of irregularities formed because of distortion of the crater profile is determined by random factors, the determination of which is almost impossible. Thus, the real roughness profile consists of two components: random and systematic (random is on average 10-15% of the systematic). The processing surface is formed from craters that overlap each other and are randomly located. The pulse energy and TE material directly affect the size and shape of the craters. An increase in the size of craters occurs with an increase in pulse energy and a decrease in the frequency of their location.

The depth of the craters  $h_k$  is determined by the degree of overlap of the craters. The height of profile irregularities is calculated according to formula (4):

$$RZ = (hk_1 + hk_2 + hk_3 + hk_4 + hk_5) / 5 \quad (4)$$

where  $h_{ki}$  is the depth of one of the five craters at the base length,  $\mu\text{m}$

Based on the fact that the crater has a spherical shape, and the depth of the two adjacent depressions is the same, we find the size of the irregularities  $hk$  at their boundary. Find the protrusion depth  $hl$  using formula (5):

$$h_k = R_i \pm \sqrt{R_i^2 - l_i^2} \quad (5)$$

Since  $hk$  is less than  $R$ , the formula for calculating the depth of one of the five craters will have the form (6):

$$h_{ki} = R_i - \sqrt{R_i^2 - l_i^2} \quad (6)$$

It is known that  $R_i$  can be calculated according to formula (7):

$$R_i = \frac{(h_{ii}^2 + r_i^2)}{2 \cdot h_{ii}} \quad (7)$$

where  $r_i$  is the radius of the formed craters,  $\mu\text{m}$ .

It has been established that with increasing pulse frequency, the magnitude of irregularities  $Rz$  and the center-to-center crater distance decrease significantly. At a frequency greater than the limit value, the surface of the treatment zone consists of craters evenly spaced. With a certain approximation we accept that  $l=R$ . Then the depth of one of the five craters will be calculated using formula (8):

$$h_{ki} = \frac{(1 - \sqrt{\frac{8}{2}}) \cdot (h_{ii}^2 + r_i^2)}{2 \cdot h_{ii}} \quad (8)$$

If we take into account that the sizes of all craters are the same, then we can consider  $Rz \approx h_k$ . Since the size of the crater is determined by the pulse energy, the roughness parameter during electrical discharge machining can be calculated using formula (9):

$$R_a = k_M \cdot W_u^p \quad (9)$$

where  $k_M$  is a coefficient depending on the processing modes, during finishing processing it is taken in the range from 1 to 5. For simplicity of calculations, we use  $k_M = 1$ , since there is no need for accurate calculations;

$p$  is an indicator of the degree of crater shape; in calculations it is taken in the range from 0.04 to 0.3. For calculations we take  $p = 0.15$ ;

$W_u$  – pulse energy (J).

According to this formula, we can conclude that the roughness parameter depends on the pulse energy. Pulse energy is the work done by a single pulse in the interelectrode gap.

It is known that the power realized in the interelectrode gap is numerically equal to the product of the pulse energy and the pulse frequency. The formula for calculating the average power during electrical processing has the form (10):

$$P_{cp} = W_u \cdot f, \quad (10)$$

where  $f$  – pulse frequency (Hz).

Calculation of the average power depending on the average current and voltage is presented by formula (11):

$$P_{av} = I_{av} \cdot U_{av}, \quad (11)$$

where  $I_{av}$  is the value of the average current, A;

$U_{av}$  – average voltage value, V.

Using formulas (10) and (11) we derive formula (12) shown below:

$$W_u \cdot f = I_{av} \cdot U_{av} \quad (12)$$

According to formula (12), the formula for pulse energy during electrical discharge machining, depending on the average current and voltage, will have the form (13):

$$W_u = \frac{I_{cp} \cdot U_{cp}}{f} \quad (13)$$

Substituting the formula for calculating pulse energy (13) into the formula for calculating roughness, we obtain the dependence of surface roughness and average current strength presented in formula (14)

$$R_a = k_M \cdot \left( \frac{I_{cp} \cdot U_{cp}}{f} \right)^p \quad (14)$$

Based on the obtained dependence, we can conclude that roughness has a direct relationship with the average current and average voltage, and has an inverse relationship with the pulse frequency. According to this dependence, we can conclude that in order to ensure the quality and accuracy characteristics of electrical discharge machining of machine-building complex products, the average current strength must be reduced. By reducing the average current, the surface roughness will decrease, that is, the quality of the part will increase.

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恒定扩散通量密度下的质量传导效率分析  
ANALYSIS OF MASS CONDUCTION EFFICIENCY AT CONSTANT  
DIFFUSION FLUX DENSITY

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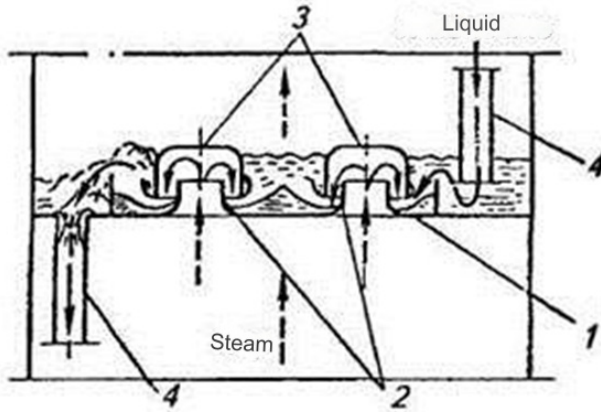
注释。本文提供了在盖板上实施的乳化方案的动力学特性的分析计算。数据指的是均质二元混合物（水-乙酸）。传质效率的计算考虑了允许使用菲克定律的假设。

关键词：泡沫模式、质量电导率、传输单元数 (NTU)、蒸馏塔。

**Annotation.** *The article provides analytical calculations of the kinetic characteristics of the emulsification regime implemented on cap plates. The data refer to a homogeneous binary mixture (water - acetic acid). The mass transfer efficiency is calculated taking into account assumptions that allow the use of Fick's law.*

**Keywords:** *foam mode, mass conductivity, number of transfer units (NTU), distillation column.*

In a continuous normal-barometric distillation column, an aqueous solution of acetic acid is separated into pure ingredients. The system under study is a mixture for which Fick's law is valid. The components forming the solution do not chemically interact with each other in the temperature range under consideration. Although it must be taken into account that acetic acid, like other carboxylic acids, enters into association reactions in the vapor phase, and water vapor dissociates at high temperatures into oxygen and hydrogen. The assessment of mass transfer efficiency is based on a study of the kinetics of transport of water molecules from the liquid phase to the vapor phase, followed by condensation and reflux of vapors enriched with a highly volatile component. Mass conductivity depends on the mode, which is implemented on cap-shaped plates with an active area of 1 m<sup>2</sup>. To develop a large interfacial surface, an emulsification regime is organized. The experimental data are as follows: average bubble size  $d_0=4$  mm, gas content is 60%, foam layer height  $h_{\pi}=0.1$  m (see Fig. 1).



**Figure 1.** Foam mode on a cap plate.

1 – plate; 2 – pipes for the passage of steam or gas; 3 – caps; 4- overflow tubes

To process the experimental results, one should take the standard assumption of MIS for the vapor phase and MIS for the liquid phase. The stated assumptions are justified, since the rate of mass transfer through a permeable surface is an independent parameter. The process is implemented on the bottom plate of the column, from which the bottom liquid of composition  $XW = 0.01$  flows  $\frac{\text{kmol nc}}{\text{kmol mixture}}$ . The mixture is served on a feeding plate and heated to boiling temperature. Steam consumption from the cube -  $\dot{n}_G = 10 \frac{\text{kmol}}{\text{hour}}$  boiler. Fragmented kinetic data are presented in Table 1.

**Table 1**  
*Kinetic characteristics of mass conductivity on the lower plate.*

$\alpha$ , k-nt rel. volatility	m, number of distributions	$\frac{\text{kmol}}{\text{M}^2 \cdot \text{C} \cdot \frac{\text{kmol HK}}{\text{kmol mixture}}}$	$\frac{\text{kmol}}{\text{M}^2 \cdot \text{C} \cdot \frac{\text{kmol HK}}{\text{kmol mixture}}}$	$\frac{\text{kmol mixture}}{\text{M}^2 \cdot \text{C} \cdot \frac{\text{kmol HK}}{\text{kmol mixture}}}$
2.35	2,288	5.1	1	5,041

The experimental results are consistent with the calculated characteristics, confirming the high gas phase resistance characteristic of cap-shaped trays. The calculation of the diffusion resistance of the flow is carried out according to the additivity rule (1).

$$\frac{1}{K_y} = \frac{1}{\beta_y} + \frac{m}{\beta_x} \tag{1}$$

The determination of efficiency  $E_{m_{oy}}$  is carried out according to Murphy's rule (2).

$$E_{m_{oy}} = 1 - e^{-n_{oy}}, \quad (2)$$

where  $n_{oy} = \frac{K_y \cdot A}{n_G}$  is the number of transfer units (NTU) in the vapor phases.

The expediency of the foam regime is dictated by the highly developed contact surface A. The calculation of the surface area is based on the assumption of homogeneity of the dispersed phase and dispersion medium, identical to the permeability of the surface of gas bubbles, and the consistency of the sequential transport of molecules from one phase to another (3).

$$A = \frac{V_r}{V_n} \cdot F_{nyz} = \frac{6V_r \cdot \pi d_{nyz}^2}{\pi d_{nyz}^3} = \frac{6V_r}{d_{nyz}} = 90 \text{ M}^2, \quad (3)$$

Analytical solutions are in good agreement with experimental data, which confirm the feasibility of the emulsification regime. The obtained values of the Murphy efficiency coefficient fully confirm this fact (4).

$$E_{m_{oy}} = 1 - e^{-n_{oy}} = 0,804, \quad (4)$$

$$\text{Where } n_{oy} = \frac{K_y \cdot A}{n_G} = \frac{5,04 \cdot 10^{-5} \cdot 3600 \cdot 90}{10} = 1,633$$

In conclusion, it should be noted that the study of a homogeneous binary mixture is presented, in which substances diffuse at a speed that depends only on the concentration gradient, obeying Fick's laws. In practice, diffusion flux also depends on temperature and pressure gradients. During the transport of gases and vapors, the influence of the pressure factor does not make a significant contribution within the limits of low flux density. Mass transfer under conditions of variable flow densities is a broad and complex problem that requires taking into account the influence of several gradients of intensive characteristics of the ingredients.

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铝合金B95球面铣削加工。控制程序参数对处理后表面质量的影响  
**PROCESSING OF THE SPHERICAL SURFACE OF ALUMINUM  
ALLOY B95 BY MILLING. THE INFLUENCE OF THE CONTROL  
PROGRAM PARAMETERS ON THE QUALITY OF THE TREATED  
SURFACE**

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注释。当通过切削加工金属时，有相当多的因素会影响加工表面的质量。在 V.B. Lishwitz 的作品“切削铝合金时积屑瘤的形成”中，研究了刀具切削刃上积屑瘤形成的现象。本文讨论了一项依赖于上述作者数据的实验，并考虑了在使用球形铣刀铣削时校正影响加工表面质量的某个参数的可能性。

关键词：表面质量、球形表面、粗糙度、控制程序。

**Annotation.** *When processing metals by cutting, there are a fairly wide number of factors that influence the quality of the machined surface. In the work of V.B. Lishwitz "Formation of built-up edge when cutting aluminum alloys" examines the phenomenon of build-up formation on the cutting edge of the tool. The article talks about an experiment that relies on the data of the author mentioned above, and considers the possibility of correcting a certain parameter that affects the quality of the machined surface when milling with a spherical cutter.*

**Keywords:** *surface quality, spherical surface, roughness, control program.*

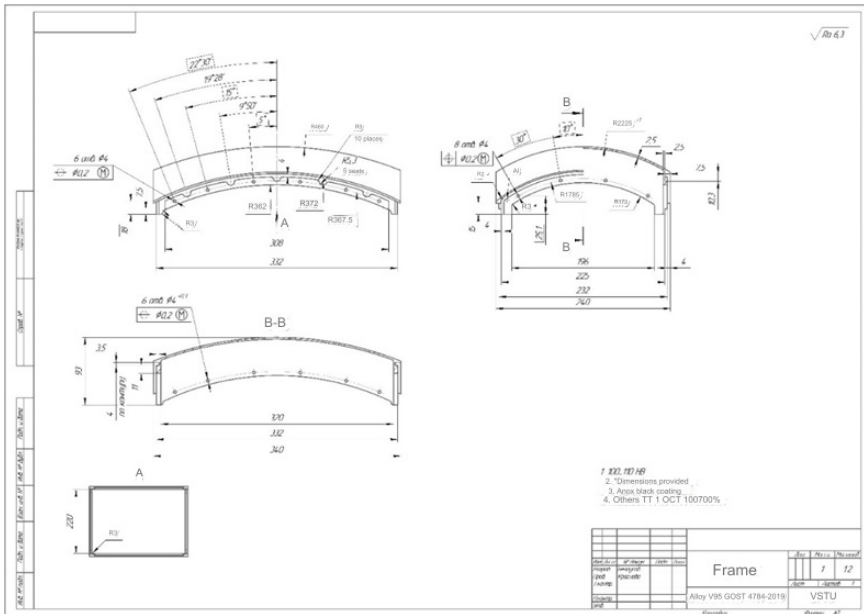
Aluminum is one of the most sought after and widely used metals in the world. It is used in industry, construction, transport, agriculture, and in everyday life. Aluminum alloys are found almost everywhere - from food foil to aircraft parts. The main values of this metal are strength with relatively low weight, resistance to corrosion due to the formation of an oxide film on the surface of the material, high electrical conductivity, and low cost.

Machining of aluminum alloys, as a rule, is accompanied by high cutting speeds without a significant danger of thermal damage, since in this case the cut-

ting temperature is not so high and does not cause accelerated wear of the cutting part of the tool. In his work, V.B. Lischwitz “Formation of built-up edge when cutting aluminum alloys” examines various factors affecting the quality of the machined surface of aluminum alloys Al-8 and Al-4T.

The purpose of the experiment was to process a part made of aluminum alloy B95, some of the surfaces of which were spherical. In this regard, it was decided to project his experience and the data obtained to achieve the necessary quality and accuracy characteristics.

The object of study is a part made of alloy B95, shown in the figure below.



The blank for this part is the B95 plate 120 x 355 x 255 GOST 17232-99.

Unfortunately, it was not possible to use a plate of this size in the experiment. Therefore, instead of this plate, a smaller workpiece was used, but the resulting spherical surface is identical. The experiment was also carried out with a spherical cutter of the M207 series from the NIR company. The tools of this series are recommended for use in processing metals such as aluminum, copper and bronze. The cutter is shown in Figure 2.



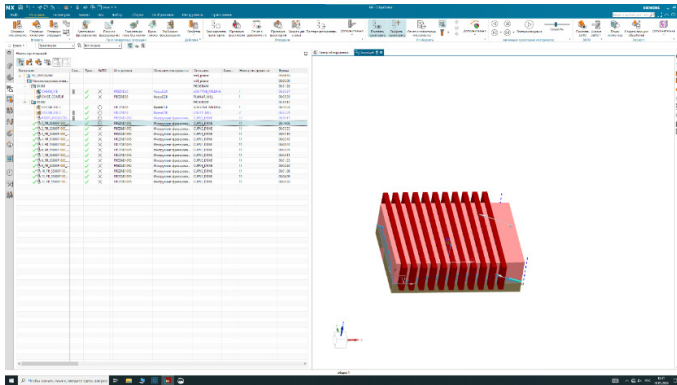


*Figure 2. M207 series milling cutter*

The essence of the experiment is to obtain a spherical surface of similar dimensions with a modern, affordable tool on the Russian market. During this experiment, a spherical surface was machined on different sections of the workpiece with different cutting modes. After this experiment, the resulting roughness was measured, and the relationship between cutting modes and the resulting surface quality was revealed.

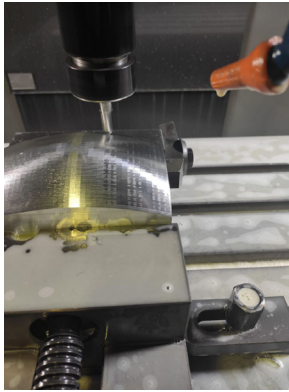
The first stage in the experiment was processing the data that V.B. Lischwitz received in his work, obtaining a workpiece and writing a control program.

To conduct the experiment, a smaller slab of B95 was taken and processed in 2 settings according to a control program in which the entire spherical surface was divided into sections with different cutting modes.



*Figure 3. processing sectors*

The processing result is shown in Figure 4.

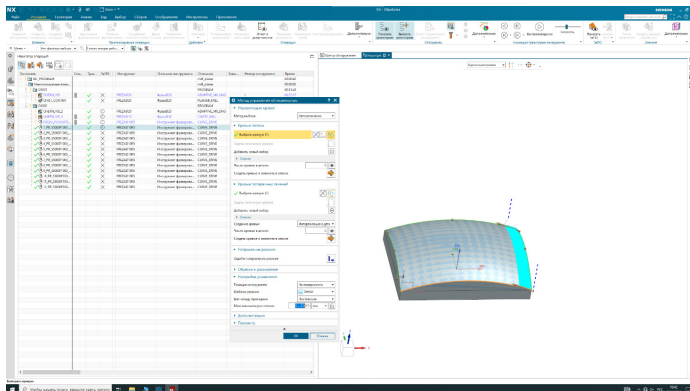


*Figure 4. processed model*

The model clearly shows some unfinished areas of the surface due to insufficient material removal, then we repeated the processing with correction. As a result, it became clear that there was no significant difference in the cutting modes we took, but one feature was noticed.

The second stage included correction of the control program.

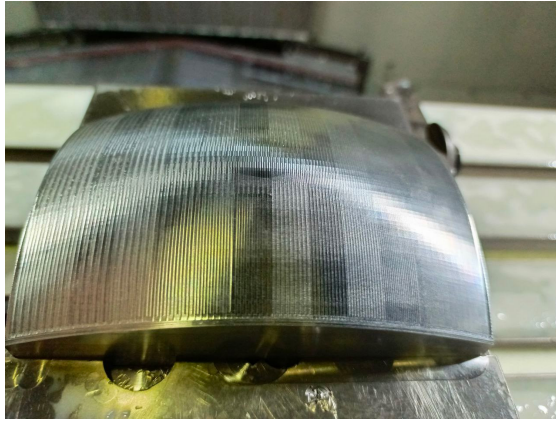
The SIEMENS NX program has a parameter that is responsible for overlapping the previous pass. By adjusting it, we can obtain the required roughness values. This parameter is highlighted in Figure 5.



*Figure 5. overlap distance.*

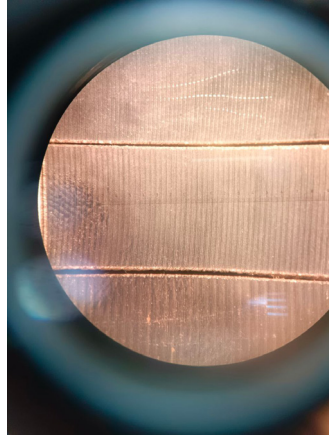
Then the control program was adjusted in such a way that in the same sections of the part where there were different cutting modes, in each subsequent section the amount of overlap increased from 0.1 mm to 1.2 mm.

Then we processed the part again, and the result was the following:



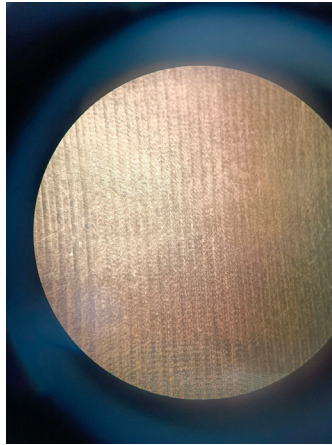
*Figure 6. Result of reprocessing*

The next stage in the experiment was to examine the model and compare the roughness of its sections with roughness samples.



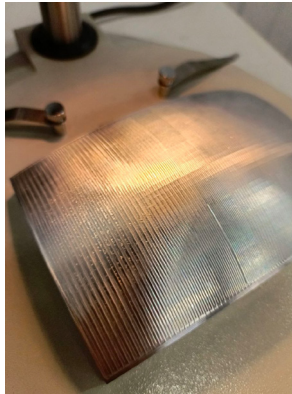
*Figure 7. Roughness samples from Ra3.2 to Ra6.3*

On the part, a roughness of Ra 6.3 is achieved in section 5, but it is preferable to use an overlap of 0.4 mm, where a roughness of 3.2 to 6.3 is achieved.



*Figure 8. 4 processing area*

It was also noted that the supply of coolant from 2 sides is extremely important, since we are working with a curved surface and a defect may result, as in the figure below.



*Figure 9. Defect.*

The final stage in the experiment is to identify the relationship between the resulting roughness and the overlap value parameter in the control program.

One of the most important problems that arise during an experiment and when studying its results is the task of predicting the values of a certain measured quantity depending on the values of another quantity (or quantities). As a result of the experiment, the following values were obtained:

**Table 1**  
*Dependence of roughness on the amount of overlap*

Overlap amount	x	0.1	0.3	0.5
Roughness value	y=f(x)	0.8	3.2	6.3

A first-order finite difference is the difference between the values of a function at adjacent interpolation nodes ( $i = 0.1, \dots, n - 1$ ):  $\Delta y_i = y_{i+1} - y_i$

A finite difference of the second order is the difference of neighboring finite differences of the first order ( $i = 0.1, \dots, n - 2$ ):  $\Delta^2 y_i = \Delta y_{i+1} - \Delta y_i$ .

General view of a finite difference of nth order:  $\Delta^n y = \Delta(\Delta^{n-1} y)$

We express the finite differences of the second and third orders through the values of the function at the interpolation nodes:

$$\Delta^2 y_i = \Delta y_{i+1} - \Delta y_i = y_{i+2} - y_{i+1} - y_{i+1} + y_i = y_{i+2} - 2y_{i+1} + y_i; \quad (1)$$

$$\Delta^3 y_i = \Delta^2 y_{i+1} - \Delta^2 y_i = y_{i+3} - 2y_{i+1} + y_i - (y_{i+2} - 2y_{i+1} + y_i) = y_{i+3} - 3y_{i+2} + 3y_{i+1} - y_i$$

We obtain the formula for linear interpolation using the Lagrange polynomial and entering:  $h = x_{i+1} - x_i, t = x - x_i, q = t/h$

$$F(x) = L_1(x) = y_i \frac{x-x_{i+1}}{x_i-x_{i+1}} + y_{i+1} \frac{x-x_i}{x_{i+1}-x_i} = y_i \frac{h-t}{h} + (y_i + \Delta y_i) \frac{t}{h}, \text{ i.e.}$$

$$F(x) = y_i + \Delta y_i q. \quad (2)$$

Quadratic interpolation is the determination of the intermediate value of a  $y(x)$  function from its three known values  $y(x_i), y(x_{i+1}), y(x_{i+2})$  and under the assumption that the arc of the function in the section  $(x_i, x_{i+2})$  can be replaced by a second-order parabola.

Introducing  $h = x_{i+1} - x_i = x_{i+2} - x_{i+1}, t = x - x_i, q = t/h$  and taking into account that  $y_{i+2} = \Delta^2 y_i + 2y_{i+1} - y_i = \Delta^2 y_i + 2\Delta y_i + y_i$ , we get

$$F(x) = L_2(x) = y_i \frac{(t-h)(t-2h)}{2h^2} + (y_i + \Delta y_i) \frac{t(t-2h)}{(-h^2)} + (y_i + 2\Delta y_i + \Delta^2 y_i) \frac{t(t-2h)}{2h^2},$$

$$F(x) = y_i + \Delta y_i q + \Delta^2 y_i \frac{q(q-1)}{2} \quad (3)$$

It is required to find the intermediate value of  $y$  at  $x=0.2$  using linear interpolation; quadratic interpolation.

Here  $x_1=0.1, h=0.2, t=0.1, q=0.1/0.2=0.5, y_1=0.8, y_2=3.2, y_3=6.3$ .

Finite differences

$$\Delta y_1 = y_2 - y_1 = 2.4 \text{ и } \Delta^2 y_1 = y_{i+2} - 2y_{i+1} + y_i = y_3 - 2y_2 + y_1 = 0,7$$

$$F(0.2) = y_1 + \Delta y_1 q + \Delta^2 y_1 \frac{q(q-1)}{2} = 0.8 + 2.4 * 0.5 + 0.7 * \frac{0.5(0.5-1)}{2} = 0.8725$$

In this experiment, the recommendations of V.B. Lishvits were used., regarding the processing of aluminum alloys. There were no significant differences in

roughness values in different areas of the model surface, but one parameter was discovered that allows one to obtain the required roughness using sufficiently high feeds and cutting speeds with optimal time consumption. The dependence of the resulting roughness at a certain value of the overlap value was also derived; with its help, it becomes possible to predict the quality of the resulting surface.

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石墨和石墨烯的摩擦机理

FRICITION MECHANISM OF GRAPHITE AND GRAPHENE

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摘要。本文提出了一种石墨的摩擦模型，石墨是一堆石墨烯片。该模型基于表面层的厚度，对于石墨而言，表面层为3个单层石墨烯。表面层中产生较大的内应力，导致位错和纳米裂纹的出现。摩擦过程可以描述为表面层的弹塑性变形过程。对于石墨烯，当石墨上发生摩擦时，纳米层起着重要作用，纳米层是一种量子纳米结构。石墨烯摩擦以逐步的方式发生。结果表明，在摩擦过程中，会发生振荡和耗散过程，形成湍流碎片，并发生贝纳德细胞形式的自组织。得出了一个公式，可作为选择由石墨烯或其复合材料制成的减摩涂层的标准。

关键词：摩擦，石墨，石墨烯，表面，单层，变形。

**Abstract.** *The article proposes a model of friction of graphite, which is a stack of graphene sheets. The model is based on the thickness of the surface layer, which for graphite is 3 monolayers of graphene. Large internal stresses arise in the surface layer, leading to the occurrence of dislocations and nanocracks. The friction process can be described as a process of elastic-plastic deformation of the surface layer. For graphene, when friction on graphite, an important role is played by the nanolayer, which is a quantum nanostructure. Graphene friction occurs in a stepwise manner. It is shown that during friction, oscillatory and dissipative processes occur, a turbulent fragment is formed, and self-organization in the form of Benard cells occurs. A formula is obtained that can serve as a criterion for selecting an antifriction coating made of graphene or its composites.*

**Keywords:** *friction, graphite, graphene, surface, monolayer, deformation.*

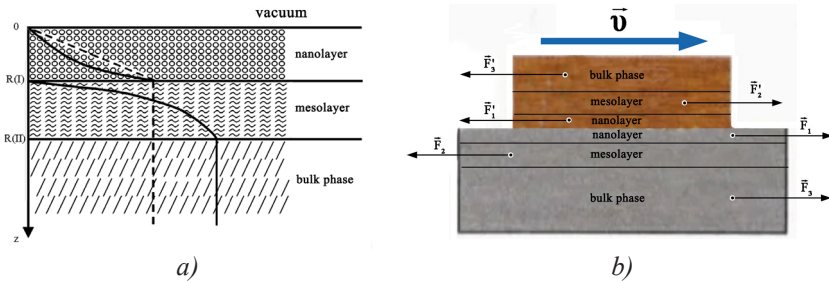
It has now become common knowledge that friction is associated with the surface layer of a solid [1, 2]. Determining the thickness of this layer  $R(I)$  experimentally is a complex task requiring ultra-high vacuum and sophisticated equipment [3]. This task has been solved only for a few substances. For example, for gold  $R(I) = 1.2 \text{ nm}$ , and for silicon -  $R(I) = 3.2 \text{ nm}$  [3], i.e. they represent a nanostructure. We first determined the thickness of the surface layer of solids in [4-6] (Fig. 1a), and friction in [7] (Fig. 1b). The thickness of the surface layer  $R(I)$  is given by the formula [4-6]:

$$R(I) = 0,17 \cdot 10^{-9} \cdot \alpha \cdot v \text{ [m]}. \tag{1}$$

In equation (1) it is necessary to know one parameter – the molar volume of the element, which is equal to  $v = M/\rho$  ( $M$  is the molar mass,  $\rho$  is its density),  $\alpha = 1 \text{ m}^{-2}$  is a constant to maintain the dimensionality ( $R(I)$  [m]). In work [8] it is shown that the surface energy of a bulk metal  $\gamma_2$  with an accuracy of 3% is equal to:

$$\gamma_2 = 0,7 \cdot 10^{-3} \cdot T_m \text{ [J/m}^2\text{]}, \tag{2}$$

where  $T_m$  is the melting temperature of the metal (K).



**Figure 1.** Scheme of a solid: nanolayer→mesolayer→bulk phase (a); scheme of the motion of atomically smooth graphite on atomically smooth metal surfaces with a constant speed  $v$ .

In the  $R(I)$  layer, the size effect must be taken into account and the surface energy of the  $R(I)$  layer becomes equal to  $\gamma_1$  [9]:

$$\gamma_1 = \gamma_2(1 - R(I)/R(I) + h) \approx 0,3\gamma_2, \tag{3}$$

where  $\gamma_{12}$  is the surface energy at the phase boundary, which is negligibly small due to the second-order phase transition.

To separate the  $R(I)$  layer from the rest of the crystal, energy must be expended, which is called the adhesion energy [10]:

$$W_a = \gamma_1 + \gamma_2 - \gamma_{12} \approx \gamma_1 + \gamma_2. \tag{4}$$

Internal stresses  $\sigma_{is}$  between phases  $\gamma_1$  and  $\gamma_2$  can be calculated using the formula [10]:

$$\sigma_{is} = \sqrt{W_a \cdot \dot{A}/R(I)}, \tag{5}$$

where  $E$  is Young's modulus of elasticity.



Using equations (1)-(5), we calculate the parameters for graphite and graphene.

**Table 1.**  
*Parameters  $R(I)$  of graphite and graphene.*

Carbon	M, g/mol	$\rho$ , g/sm <sup>3</sup>	$R(I)_a$ , nm	$R(I)_c$ , nm	$\gamma_a$ , mJ/m <sup>2</sup>	$\gamma_c$ , mJ/m <sup>2</sup>
Graphite	12,0107	2,26	0.900 (3)	2.46 (3)	2195	130
Graphene	12,0107	2,26	0,246 (1)	0,14 (1)	2652	-

From Table 1 it follows that the thickness of the surface layer of graphite is 0.9 and 2.46 nm. The number of monolayers of graphite is three (3). The elastic parameters are shown in Table 2.

**Table 2.**  
*Elastic parameters of graphite and graphene.*

Carbon	$W_{aa}$ , J/m <sup>2</sup>	$W_{ac}$ , J/m <sup>2</sup>	$\sigma_{isa}$ , GPa	$\sigma_{isc}$ , GPa	$E_a$ , GPa	$E_c$ , GPa
Graphite	2,853	1,690	4,9	1,36	7,59	3,48
Graphene	3,448	-	118,4		1000	-

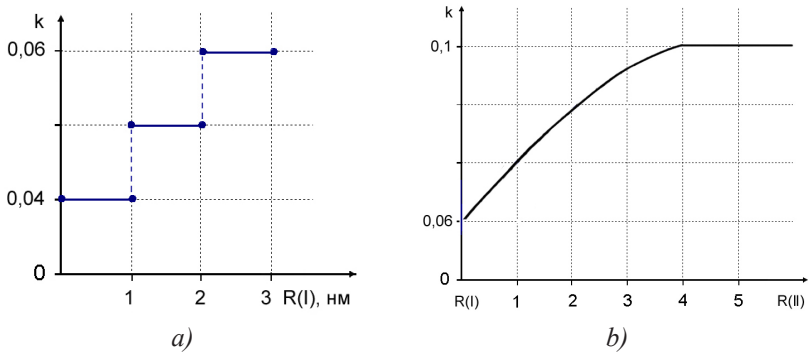
If in Table 4 we take  $\sigma_{isa} = 118.4$  GPa for graphene as 100%, and  $\sigma_{isa} = 4.9$  GPa for graphite as x%, then during the formation of graphene we will obtain a graphene deformation of 4%. If we consider Fig. 1b, as well as Table 2, we can see that the friction process itself can be described as a process of elastic-plastic deformation of the surface layer.

In [11], we proposed the formula:

$$A(r)/A(\infty) = 1 - R(I)/r, \quad r \gg R(I), \quad (6)$$

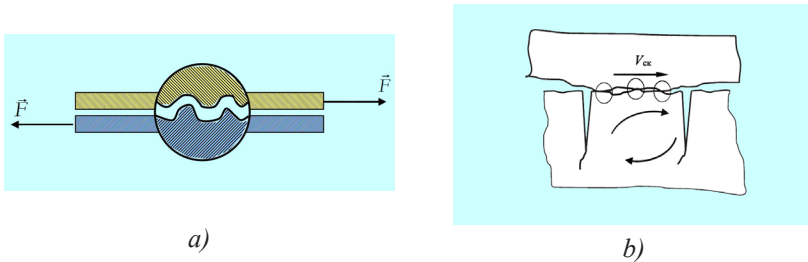
$$A(r)/A(\infty) = 1 - R(I)/R(I) + r, \quad 0 \leq r \leq R(I),$$

where  $A(r)$  is a physical property of the nano- and mesolayer with coordinate  $r$ ;  $A(\infty)$  is a physical property of the bulk sample (bulk phase) (Fig. 9a). If the coefficient of friction  $k$  during the movement of graphite (graphene) on graphite (graphene) is taken as the physical property  $A(r)$ , then at  $1 - R(I)/R(I) + r \approx \exp[-(R(I)/R(I) + r)]$  in the nanolayer  $k(r) = k(\infty) \exp[-(R(I)/R(I) + r)]$ . After this, the friction in the nanolayer, that is, at  $r = 0$  and at  $r = R(I)$  will be equal to:  $k(0) = k(\infty) (1/e) = 0.1/2.72 = 0.04$ ;  $k[R(I)] = k(\infty) (1/e^{1/2}) = 0.1/1.65 = 0.06$ . Here  $k(\infty) = 0.1$  for graphite. As a result, in the graphite nanolayer, the friction will be as shown in 2a. In the mesolayer, the friction will depend on formula 1 in equation (6), with  $1 - R(I) \approx \exp(-R(I)/r)$ . Then  $k[R(I)] = k(\infty) (1/e)$  (Fig. 1a) and the friction will look like in Fig. 2b.

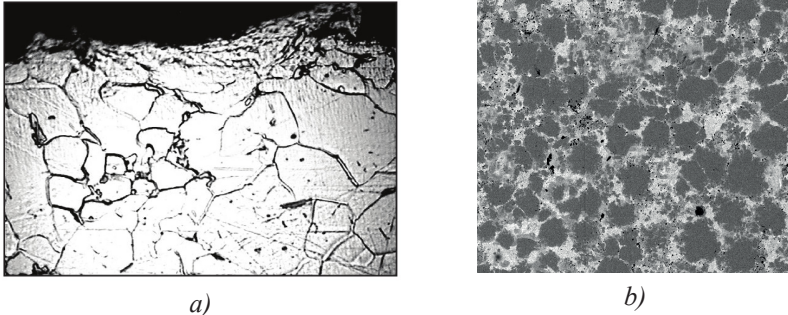


**Figure 2.** Dependence of the friction coefficient in the nanolayer (a) and in the mesolayer (b).

Let us now explain everything said above specifically. As the upper graphite moves along the surface of the lower one, a new surface of nanometer thickness is formed again. This means that friction performs an oscillatory motion (Fig. 3a). Layers R(I), R(II) and the bulk phase have different values of internal friction, which is proportional to the internal stresses  $k \sim \sigma_{is}$  from Table 2. When the graphite from above begins to move, a turbulent fragment arises during friction (Fig. 3b) [12]. This is manifested in the microstructure found on the surface of steel 20 [13] (Fig. 4a) and on our alloy CrNiTiZrCu [14] (Fig. 4b). The same thing happens in graphite.



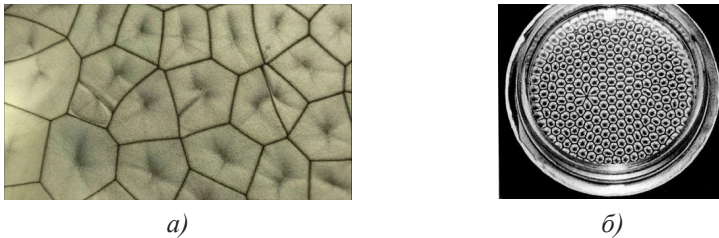
**Figure 3.** Oscillatory motion of friction during the formation of a new surface (a); diagram of the formation of a turbulent fragment (b).



**Figure 4.** Friction surface at the moment of turbulent fragment of a sample made of 20 steel [13] (a) and CrNiTiZrCu alloy (b) [14].

A similar structure in Fig. 4 is typical for Benard cells [15]. Benard cells (Fig. 5) are the emergence of order in the form of convective cells in the form of cylindrical shafts or regular hexagonal figures in a layer of viscous liquid with a vertical temperature gradient. And the temperature gradient  $\text{grad}T \sim k$ , i.e. is proportional to the coefficient of internal and external friction, therefore friction is similar to a viscous liquid. A similar effect was noticed relatively recently [16].

More strictly (see, for example, [15]), when analyzing processes in the Benard system, the Rayleigh number is chosen as the control parameter:  $\text{Re} = gL^3va$ , where  $g$  is the acceleration due to gravity,  $L$  is the characteristic size,  $b$  is the coefficient of volumetric expansion,  $dT$  is the temperature gradient,  $v$  is the kinematic viscosity, and  $a$  is the coefficient of thermal diffusivity of the medium.



**Figure 5.** Benard cells with PMS-10 silicone oil with aluminum powder (a) and (b) with different magnification [15].

Since the kinematic viscosity  $\nu \sim 1/\gamma$ ,  $\gamma$  is the surface energy, it follows from the above expression for the Rayleigh number that the control parameter in our case is  $\text{Re} \approx C L^3 \gamma$ , where  $C \sim \text{const}$ , and  $L = R$  and  $2\gamma = \text{Wa}$ . In other words, if the product  $R(I) \cdot W(I)a$  for moving graphene on the surface of graphite is less than the similar product, then their difference, including the roughness of the rubbing materials, is equal to:

$$\left[ [R(I) \cdot W_{aa}]_{\text{ad\ddot{a}o\ddot{a}i}} - [R(I) \cdot W_{aa}]_{\text{ad\ddot{a}o\ddot{c}o}} \right] + R_a \cdot W_{12} = F = kL, \quad (7)$$

where  $F$  is the friction force during the movement of rubbing materials;  $R_a$  is the roughness;  $L$  is the length of the path of movement;  $k$  is the coefficient of friction;  $W_{12}$  is the adhesion energy between two materials.

Equation (7) can serve as a criterion for selecting an antifriction coating made of graphene or its composites. For graphene, the nanolayer  $R(I)$  plays a role in friction on graphite; its friction occurs in a stepwise manner (Fig. 2).

A measure of the internal friction of a solid is the inverse quality factor  $Q^{-1}$ , which according to Debye is equal to [17]:

$$Q^{-1} = 2Q_{\max}^{-1} \frac{2\pi f\tau}{1 + (2\pi f\tau)^2}, \quad (8)$$

where  $f$  is the sample oscillation frequency,  $\tau$  is the relaxation time, and for graphene  $Q^{-1} = \sigma_{is} = 0.18 \cdot 10^{12} = \delta/\pi$  ( $\delta$  is the logarithmic damping decrement).

The maximum value of internal friction is achieved at  $2\pi f\tau = 1$ . The relaxation time  $\tau$  can be determined for the  $R(I)$  layer, knowing the speed of sound in graphene –  $\tau_1 = R(I)/v$ . The speed of sound in graphene is  $v = 21.3 \cdot 10^3$  m/s [18]. Then  $\tau_1 = 0.0115 \cdot 10^{-12}$  s and  $f_1 = 13.8$  THz. This means that terahertz radiation is observed for graphene (Fig. 6) [19].

Until recently, most of the terahertz spectrum  $f$  was not used due to the lack of both sources and receivers of coherent radiation in this range. Therefore, the terahertz region of the electromagnetic spectrum was called the “terahertz gap” (Fig. 6).

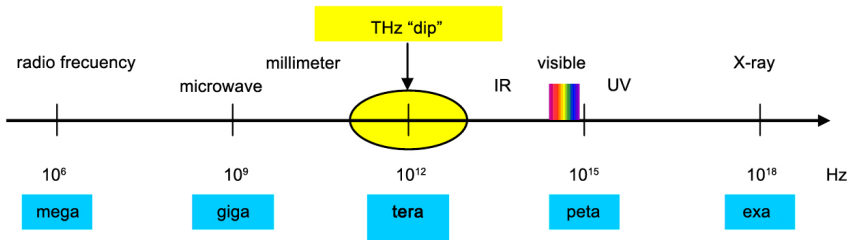
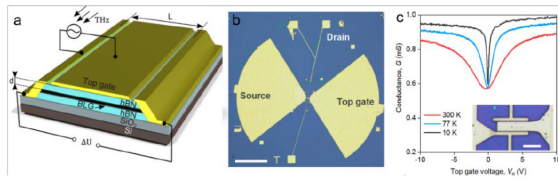


Figure 6. Electromagnetic spectrum and terahertz “gap”

With the advent of the first terahertz quantum cascade laser (QCL) in 2002 [20] and the subsequent significant progress in the development of terahertz QCLs, the “terahertz gap” in the electromagnetic spectrum gradually began to close. The most promising approach to creating effective THz radiation detectors is the use of nanostructures as a sensitive element. Graphene is one of these nanostructures. The work [21] demonstrated the detection mode of THz radiation using field-effect transistors based on bilayer graphene (Fig. 7).



**Figure 7.** (a) Schematic diagram of a field-effect transistor based on encapsulated bilayer graphene. (b) Optical photograph of a typical graphene-based detector. The scale bar is 200  $\mu\text{m}$ . (c) Conductance of a typical DSG-based field-effect transistor as a function of gate voltage  $V_g$ , measured at 300 K, 77 K, and 10 K. Inset: enlarged optical image of the transistor channel.

## Conclusions

The formula (7) we obtained for sliding friction includes the adhesion energy, which means that it belongs to the molecular theory of friction out of the five existing ones today. The adhesion energy is determined by the surface energy of a solid, which is quite difficult to measure. The model of solid-state friction we proposed, using the example of relevant substances – graphite and graphene, includes, in addition to the adhesion energy of two rubbing materials, the thickness of the surface layer of this material. This thickness is determined by us by formula (1) and gives values for solids, including graphite and graphene, in the nanometer range, sending us to the field of nanotribology. Nanotribology or molecular tribology is a direction in tribology associated with the theoretical and experimental study of adhesion, friction, wear and destruction processes at the atomic and molecular scales of surface interaction. Its development was restrained, in our opinion, by the fact that the thickness of the surface layer responsible for the friction process could only be determined in high vacuum on atomically clean surfaces of a limited number of single crystals. Our model, presented in this article, opens a new approach for the theoretical and experimental study of processes in nanotribology.

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无人机航拍精度专家评估

**EXPERT ASSESSMENT OF THE ACCURACY OF AERIAL  
PHOTOGRAPHY PERFORMED USING UNMANNED AERIAL  
VEHICLES**

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**摘要。**如今,无人机在日常生活中得到广泛应用;无人机用于各个领域:从农业到各种货物的运送。第一次无人驾驶飞行是在 1988 年进行的,是苏联的宇宙飞船暴风雪号。无人机的发展迅速增长始于 2010 年。无人机在测地工作中占有特殊地位。使用无人机的优势在于拍摄速度快、拍摄方便,这就是它们的使用越来越受欢迎的原因。对西西伯利亚某油田沙堆的航空摄影 (APS) 和地面激光扫描 (GLS) 获得的数据进行了分析。

本研究的目的是评估 AFS 方法的准确性,以便进一步将该技术应用于散装材料仓库的盘点。地面激光扫描技术被用作参考调查。

**关键词:** 航空摄影、地面激光扫描、精度、3D 模型。

**Abstract.** *Today, unmanned aircraft are widely used in everyday life; drones are used in various fields: from agriculture to the delivery of various goods. The first unmanned flight was made in 1988, it was the Soviet spacecraft Buran. The rapid growth in the development of drones began in 2010. Unmanned aircraft occupy a special place in geodetic work. The advantage of using drones is the speed and ease of filming, which is why their use is gaining great popularity. An analysis of data obtained using aerial photography (APS) and ground-based laser scanning (GLS) of a sand pile at a field in Western Siberia was carried out.*

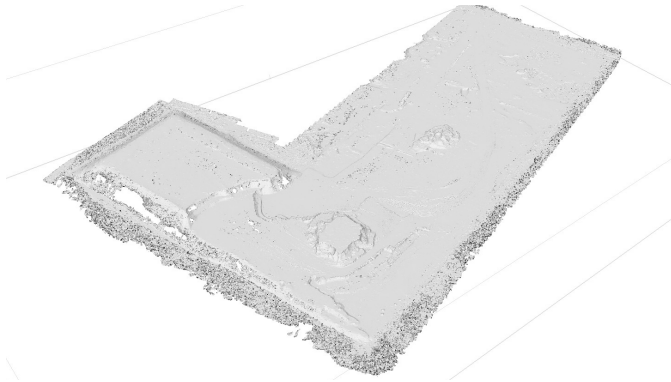
*The purpose of the study is to evaluate the accuracy of the AFS method for further application of the technology for the inventory of bulk materials warehouses. Terrestrial laser scanning technology was used as a reference survey.*

**Keywords:** *aerial photography, terrestrial laser scanning, accuracy, 3D model.*



The development of technology and digitalization in all spheres of human activity have influenced the development of unmanned aircraft. The Government of the Russian Federation has approved the Development Strategy for Unmanned Aviation until 2035.<sup>1</sup> The strategy determines the development of the unmanned aerial industry, ensures technological sovereignty and safety of use of unmanned aircraft systems. Today, methods in modern surveying work can be divided into ground-based, performed using surveying and geodetic equipment (such as GNSS, total stations, levels, etc.) and remote using unmanned aerial vehicles (UAVs). UAVs can carry various payloads: lidar (scanner), digital, infrared and multispectral camera, thermal imager, range finder, etc. [1].

According to the rules for carrying out surveying activities<sup>2</sup>, control of storage volumes is carried out once a year. The permissible difference between 2 independent measurements should not be more than 2%. To carry out the inventory, a DJI Phantom 4 RTK UAV with a D-RTK 2 mobile station was used; control points were installed and linked for control. Flight planning was carried out using DJI-Terra software. The overlap of the images was 75% in the longitudinal direction and 65% in the transverse direction. As a result of the flight and photo processing, the following data was obtained: a dense point cloud (Figure 1), an orthophototransformed image (Figure 2), a height map (Figure 3) and a digital elevation model (Figure 4):



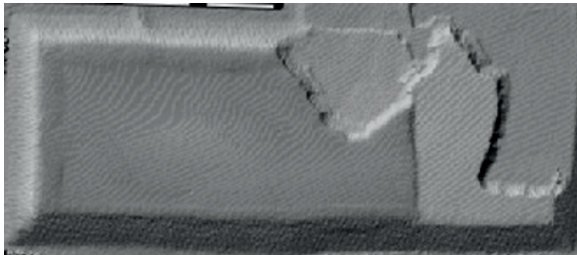
*Figure 1. Solid clouds of points*

<sup>1</sup> Order of the Government of the Russian Federation of June 21, 2023 No. 1630-r

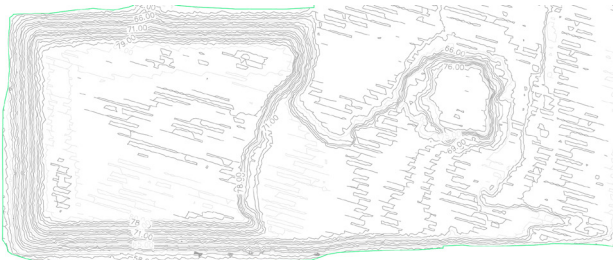
<sup>2</sup> Order of Rostekhnadzor dated May 19, 2023 N 186 “On approval of the Rules for carrying out surveying activities” (Registered with the Ministry of Justice of Russia on May 31, 2023 N 73638)



*Figure 2. Orthophotoplan*



*Figure 3. Fragment of a height map*



*Figure 3. Fragment of a digital elevation model*

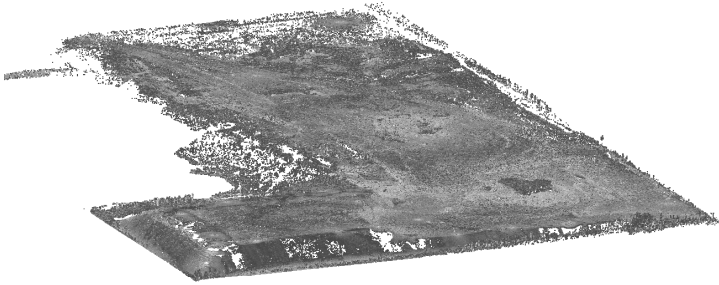
The volume calculation was performed using point clouds in the nanoCad software package (Russian system developer Nanosoft).

To control the accuracy of the data obtained, terrestrial laser scanning was performed using a Trimble SX10 scanning total station.

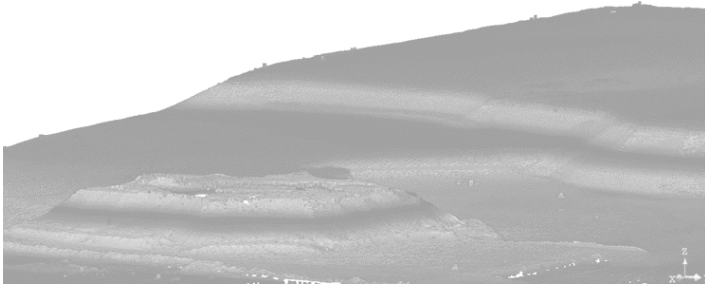
Georeferencing of survey stations took place by scanning special geodetic marks (hereinafter referred to as marks). A tripod with a geodetic mark (included

in the equipment package) was installed above the filming station. After installing the marks, the Trimble SX10 electronic scanning total station automatically calibrates and orients the survey station with marks. Next, the georeferencing of the filming stations was carried out from two marks. The accuracy of the standard deviation in plan and height of optical measurements was no more than +3 mm.

The NLS was performed with a sufficient frequency of scan positions necessary to ensure maximum coverage of the sand storage area with 2 point clouds necessary for creating a DEM (Figure 5, 6).



*Figure 5. Seed point cloud*

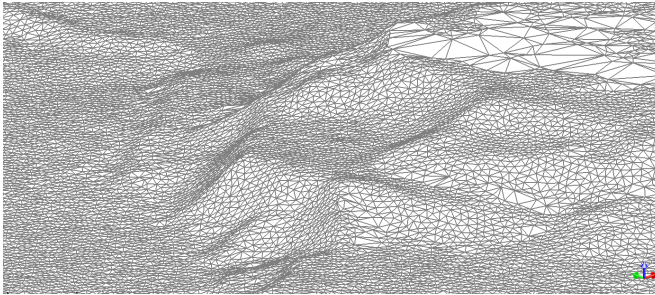


*Figure 6. Processed point cloud*

The final office processing of NLS materials is carried out in specialized Trimble Business Center Advanced software and Trimble RealWorks ADV-TANK software. This software processes data from the Trimble SX10 scanning total station and automatically stitches (interlinks) the laser scanning results into a single point cloud. As a result, the point cloud covers the entire relief located within the survey boundary, regardless of its height.

The result of the NLS is a colored point cloud in AutoDesk and JPG viewing formats (Figure 5).

Next, a DEM was created in the nanoCAD software package and the volume of sand located at the sand quarry storage site was calculated (Figure 7).



*Figure 7. Digital elevation model built from a point cloud*

The volume of sand according to the NLS result was 1,912,126 m<sup>3</sup>.

Comparative analysis of surveys using NLS and VLS methods

Based on the obtained AP data and the NLS data, a comparative analysis of the surveys was performed.

As a result, the remaining sand at the storage site using the AP method amounted to 1,908,081 m<sup>3</sup>.

Using the NLS method, the remaining sand at the storage site using the NLS method amounted to 1,912,126 m<sup>3</sup>.

The difference in sand volume was 4,045 m<sup>3</sup>, which amounted to an error of 0.2% or 1 cm. according to marks from the AP and NLS methods.

**Result:** The research proved the possibility of using AP methods for inventory of bulk materials. The error between the two measurements was 0.2% with a tolerance of 2%.

**Conclusion:** The AP method is affordable, unlike expensive equipment for NLS, and allows you to perform work with greater speed and safety [2].

The results of the experiment show that the described APS method can be used to solve a wide range of problems in various areas, including in hard-to-reach areas. For example, to develop territory planning projects, create and develop digital terrain models and digital elevation models, and monitor construction sites.

If necessary, to achieve maximum planning and altitude accuracy, the AFS can be accompanied by a complex of field geodetic work.

The use of drones allows you to quickly obtain complete, up-to-date and regularly updated information about the state of the study area, with minimal costs.

The introduction of innovative technologies provides a tangible positive economic effect, improves the quality of decisions made and increases the efficiency of facility management.

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