SCIENCE FOR THE BENEFIT OF MANKIND

FAN VA TURMUSH

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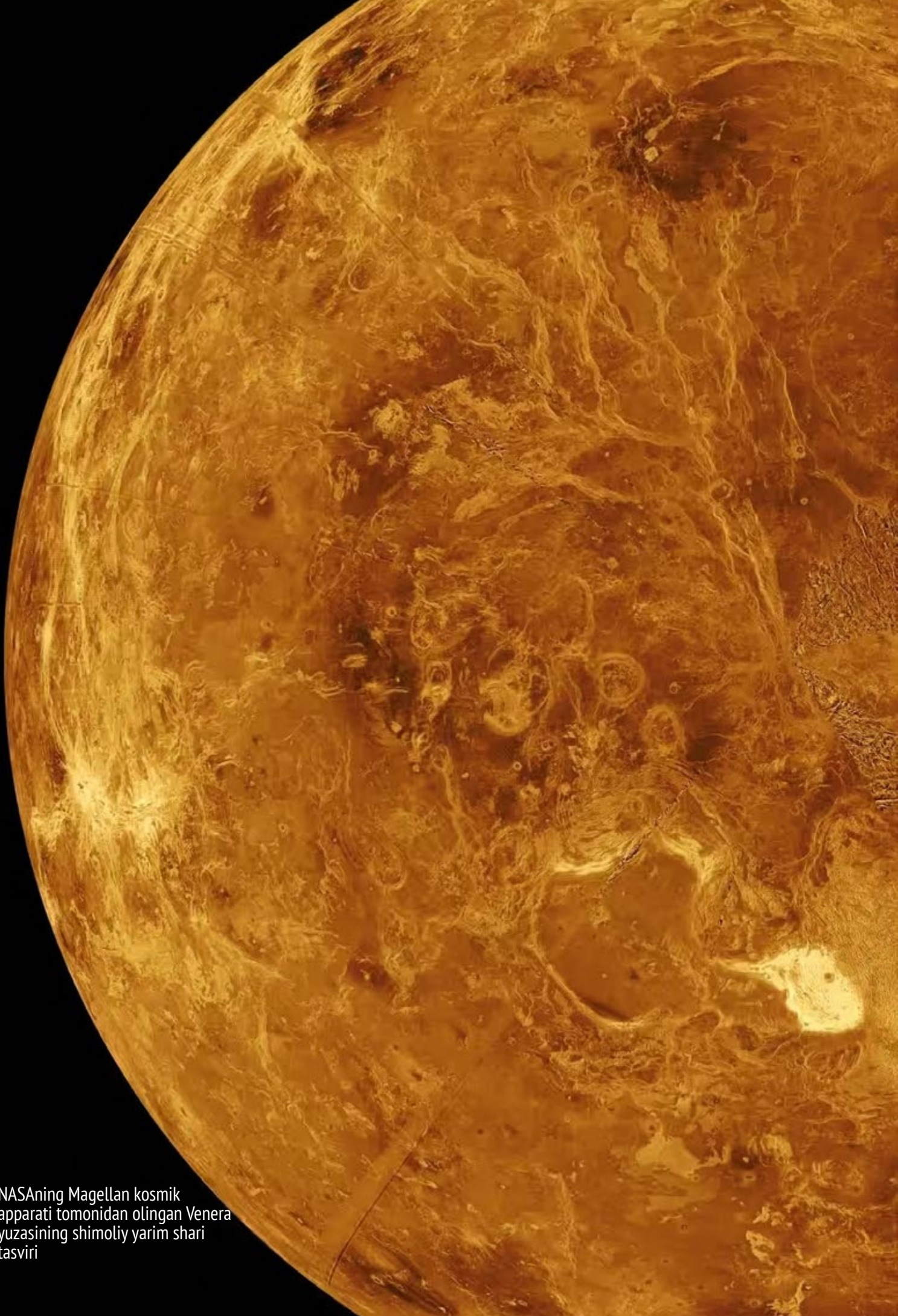
NATIVE LAND - A GOLDEN CRADLE

- The Third Renaissance and the «green economy»
- Mysteries of the Universe: high-energy cosmic particles
- Small hydroelectric power plants - a new strategy in energy development
- Creators versus machines
- Mountain cities on the routes of the Great Silk Road



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EDITORIAL

Dear readers!

Spring has come to Uzbekistan. The sun has begun to illuminate the fields of our farmers with its life-giving rays. In anticipation of a bountiful harvest, seeds are sown. Buds appear on the trees, nature is revived. But it is no secret that a number of emerging global problems and the significant role of the human factor in them require solutions that are important for the modern era. Problems such as climate change, air pollution and growing demand for natural energy are accelerating this process. President of Uzbekistan Sh.M. Mirziyoyev in his speech at a meeting of the Legislative Chamber of the Oliy Majlis (Parliament) specifically focused on the issues of ecology and climate change. After a detailed study of the issue and based on the recommendations developed, he declared 2025 the "Year of Environmental Protection and the Green Economy."

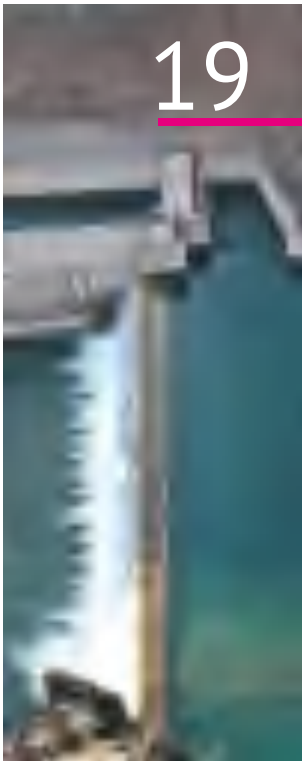
The impact of each environment manifests itself differently in different sectors, as people's minds develop immunity to it. Humanity begins to see solutions and interpretations of global problems from its own point of view, based on local conditions. As of today, these views have not changed, but, on the contrary, have been further developed, becoming one of the factors shaping people's views on life. In this year's issues, we will pay special attention to the problems of nature conservation and alternative energy.

In the last issue we talked about neutrinos. And this time, taking into account the suggestions received from readers, we present to your attention a short article about neutrinos written by Academician Babamurad Akhmedov. Academician Romen Zakhidov, based on interesting facts, will tell about the stages of development of hydropower, the original basis of the energy sector of Uzbekistan, covering 100 years – from 1926 to the present. As always, in the third block we warn about another important aspect of Artificial Intelligence: the threat to the copyright of creators. Nonna Jamgaryan writes about the legal status of artificial intelligence and its designation as a new institute of civil law. Artificial Intelligence allows people today to very quickly access books, newspapers, magazines and other printed materials. Currently, access to this data takes only a few minutes, and they cover huge distances. But there were times when people used different methods to exchange information. Professor Bakhtiyor Babajanov in his article gives examples of poems written on ceramic vessels. These poems, sometimes written for Sufi, sometimes for commercial purposes, contain interesting information about their time.

And, as always, we have allocated a platform for young reserchers in our journal. Also, new publications and an interesting world for children are presented.

Dear reader, we wish you a pleasant spring mood and interesting reading!

CONTENT



I. NUMBERS RULE THE WORLD

II. THE NATURE AND MAN

III. THE WORLD OF ENGINEERING AND INFORMATION TECHNOLOGY

VI. SOCIETY, HISTORY, CULTURE

HEADINGS:

The Third Renaissance and the "Green Economy"

The interview with the deputy of the Oliy Majlis of Uzbekistan, Academician **Akmal Kholmatovich Saidov** was conducted by the Editor-in-Chief of our journal, **Akbar Khakimov.**

A. Khakimov: *How do you understand and interpret the definition of the term "Third Renaissance"?*

A. Saidov: In general, it should be noted that the etymological meaning of the word Renaissance in European literature is defined as Revival and has its chronology - proto-Renaissance, quattrocento, late Renaissance, etc. Historically similar processes took place in the East and even in earlier centuries than in Europe. Thus, the First Eastern, or, as it is also called, Muslim Renaissance in Central Asia dates back to the 9th-12th centuries. The Second Eastern Renaissance, which received the name "Temurid Renaissance" in literature, took place in the 14th-15th centuries and is associated with the creative activities of Amir Temur and the Temurids.

As for the Third Renaissance, declared by our President in 2021, in my opinion, it is an integral part of the New Uzbekistan movement, which began with the inauguration of Sh. Mirziyoyev as President on December 14, 2016. I believe that the concept of the "Third Renaissance" covers all fundamental aspects of our lives. Thus, it is difficult to imagine our future without a respectful attitude to cultural heritage, spirituality, and conservation of nature; without accelerated economic development and progressive political initiatives; without taking into account the role of modern new information technologies or artificial intelligence, etc. That is why I understand the idea ofthe Third Renaissance in a broad sense.

A. Khakimov: *Can you, as an Academician and a scholar, answer to what extent our social sciences in Uzbekistan, their direction and development processes, meet modern requirements?*

A. Saidov: The question is very relevant. Indeed, the Academy of Sciences is a complex, structured organization. It is not limited to natural or technical sciences. Social sciences are also important. In general, today in the "New Uzbekistan," the role of social sciences is no less important than the role of natural or technical sciences. In my opinion, the most important task of social sciences should be to answer the question, "What kind of society are we building?" It is necessary to understand this concept, turning the "New Uzbekistan" into a nationwide movement and building the Third Renaissance, linking it with the concept of the "New Uzbekistan". A representative of each science, each representative of the social sciences, be it a historian, art historian, orientalist, economist, or lawyer. It is from this point of view that we must reveal the facets of the "New Uzbekistan". It is necessary to answer the question practically: "What is the contribution of social sciences to the "Third Renaissance"? Today, lawyers, as representatives of social sciences, must answer the practical question, "What should a sovereign, democratic, legal, social, and religious state in Uzbekistan be like, and what should its features be?" In general, the question arises, how should we evaluate the contribution of these sciences to the development of society and economic and social progress? For example, in the natural sciences, it is easy. Such aspects as the number of patents issued and the amount of profit received can be compared with economic indicators. But in the social sciences, it is very difficult. Especially in history and art history. In economics, everything is probably much simpler. In jurisprudence, the role of lawyers in the development, adoption and implementation of these laws is invaluable. For example, lawyers took an active part in the development of all laws adopted over these seven years. For example, the new version of the Constitution of Uzbekistan, adopted on April 30, 2023, will be the Basic Law of the "New Uzbekistan". The implementation of the program ideas set out in this constitution is not only the work of lawyers. I would like to make a practical proposal. If a major analytical study were developed by representatives of all disciplines, including social sciences, on the topic of "New Uzbekistan and the Third Renaissance", this would be our practical response to the demands made on social sciences today.

A. Khakimov: *In your proposal, you mention "research", and before preparing research, I think that a major international conference should be held...*

A. Saidov: I think that in order to conduct fundamental, final, multifaceted, comprehensive research, it is necessary to carry out certain organizational work. Therefore, it is advisable to request the opinion of representatives of various social sciences and hold an international scientific conference on this topic. Why do I say "international"? To participate in it, it is necessary to attract not only Uzbek scientists studying the problems of Uzbekistan, but also international researchers interested in the topic of Uzbekistan. For example, it is necessary to study and promote the national cultural heritage of Uzbekistan to use the ca-

Deputy of the Oliy Majlis, Academician Akmal Saidov, and Director of the Center for Science Promotion of the Academy of Sciences of the Republic of Uzbekistan, Akbar Hakimov

pabilities of the entire world community. If we hold "round tables" within the framework of traditional cultural congresses or use conference venues, we will get an answer to the question of what such work and research should be. As a result of the discussions, a work entitled "New Uzbekistan and the Third Renaissance" may be published.

A. Khakimov: *On the eve of 2025, our esteemed President addressed our people on television with New Year's greetings. In his address, he said, "In the current very complex international situation, Uzbekistan is making confident steps towards social and economic development. The main reason for this is the unity of our society. The main reason for the harmony in our society is that we are united in our actions and act in the name of the ideas that unite our people." In your opinion, is this atmosphere of unity, cohesion, and solidarity due to historical mentality or some other circumstances?*

A. Saidov: Historically, Uzbekistan has always been inhabited by representatives of many nationalities and has been distinguished by the spirit of tolerance. Interfaith tolerance has always reigned in Uzbekistan. Representatives of many religious movements have always been present here, and now sixteen religious denominations live in an atmosphere of peace and tolerance. This intercultural understanding has always worked harmoniously in our region, forming this environment. Our region has historically always been characterized by communication in several languages, and there have been no recorded cases of any restrictions or discrimination based on language. For thousands of years, interethnic, interreligious, intercultural, and interlingual harmony and tolerance have formed the basis and are an important factor in the new socio-political environment that has emerged in Uzbekistan today. Currently, in the environment created by the "New Uzbekistan" and the initiatives of our president, the concept of "New Central Asia" has entered the lexicon. What was the situation in this "Central Asia" seven or eight years ago? Geopolitical, geo-economic, and geo-cultural misunderstandings and several problems. These are border problems, water problems, and humanitarian problems. Today, these problems in "Central Asia" have been practically resolved. At least concerning Uzbekistan. Who, in your opinion, is the initiator of the creation of this environment? It is Uzbekistan and its president. This was especially noted by the world community, including the heads of international organizations, including the UN Secretary-General, Antonio Guterres.

A. Khakimov: *As a member of parliament and a politician, could you explain the issues of environmental protection and the "green economy"? For what reasons did we declare this year the "year of the green economy"?*

A. Saidov: Both internal and external reasons can be given here. For example, for internal reasons, we lost the Aral Sea within a generation. As a result of this unreasonable human policy, the Aral Sea tragedy occurred - its consequences are not limited to Uzbekistan or Asia. Because the composition of the salts rising into the atmosphere from the bottom of the Aral Sea is such that it was found even on tea plantations in India. Salts of the same composition were found in the forests of Brazil. This is a global problem. This is why our President raised this issue in his speech

As part of the "Art&Science" project, Deputy of the Oliy Majlis and Academician Akmal Saidov held a meeting with the staff of the Center for Science Promotion of the Academy of Sciences of the Republic of Uzbekistan

at the UN General Assembly in September 2017 and all subsequent speeches on environmental protection and climate protection, and these initiatives are supported by the entire international community. For example, today, a "green economy" is necessary for each of our citizens. Without a clean environment, humanity itself is under threat. Humanity may disappear tomorrow. It is impossible to live in a constantly polluted environment. That is why the whole world and Uzbekistan are parties to all international documents adopted at the international level, for example, the Paris Agreement and all the others, and on the other hand, the worst thing is that these international documents are often not implemented. Even large countries that have joined this agreement turn a blind eye to this. But let's talk about the last three speeches of our president at the international level, dedicated to environmental protection and the green economy of Uzbekistan. In his speeches at the UN Climate Change Conference COP28 in the United Arab Emirates in 2023, at the COP29 conference in Baku last year, and the recently concluded Development Week in the United Arab Emirates, he once again emphasized that attention to climate change and the economy, especially the green economy, is not limited to Uzbekistan, the Central Asian region, or the Middle East; it is a global problem. As a lawyer, I think we should create another tradition: we should adopt the "Environmental Code".

A. Khakimov: *I noticed one decree on social networks. "From June 1, 2024, Uzbekistan will begin to limit payments for electricity in the event of waste collection debt." What do you think about this decree?*

A. Saidov: Such issues need to be discussed more broadly and in more detail. Perhaps this clearly defined example should not be implemented throughout the country. Perhaps, in one region that has had the greatest impact on the environment, it should be adopted as an experiment, and after testing it for a year or two, if this experiment yields positive results in this region, it should be implemented throughout the country. If the result is not positive, the text of the decree should be revised. In general, when adopting laws, we must proceed from the principle of "measure seven times, cut once" and more carefully measure the results.

A. Khakimov: *We are now talking about the tragedy of the Aral Sea and water, but the population of Uzbekistan lives mainly in cities. What other projects can be implemented in our large cities, such as Tashkent, to solve many environmental problems and make life easier for the population? What is your opinion on this issue?*

A. Saidov: First of all, on the problem of the Aral Sea, the entire world community must act together. The President of Uzbekistan has come up with an extremely indicative initiative. Within the framework of the "Green Space Movement", to ensure the planting of trees and radical changes in the territory of the Aral Sea. Secondly, preventing dust storms and the spread of toxic salts will significantly contribute to climate change in general. This is one example; another is the spread of the "Green Space Movement" throughout Uzbekistan. What does this mean? Trees, forests, in turn, serve as a source of oxygen for each city. In this sense, the leadership is currently emphasizing the need to significantly increase green areas and green spaces in Tashkent. In this regard, every organization, whether governmental or non-governmental, civil society or business, must collectively contribute to this national movement for green spaces.

Mysteries of the Universe: high-energy cosmic particles

Bobomurat Akhmedov,
Academician

As is known, high- and ultra-high-energy particles are of considerable interest in space astrophysics, among which, especially recently, a special place is occupied by a mysterious and not yet fully studied particle, the neutrino.

And it is far from accidental that neutrinos have once again presented another scientific sensation. Thus, on February 12, 2025, a sensational article was published in the journal Nature (The KM3NeT Collaboration. Observation of an ultra-high-energy cosmic neutrino with KM3NeT // Nature. 2025. DOI: 10.1038/s41586-024-08543-1) by the KM3NeT collaboration with a message about the registration of a neutrino with an unprecedentedly high energy of hundreds of PeV (PetaelectronVolts), which is tens of times higher than the energy of the previous record holder registered under terrestrial conditions. This neutrino undoubtedly flew to us on Earth from deep space, but its source and mechanism of birth remain a mystery.

Another sensational event in the world of neutrinos was the date of February 13, 2023, when it was established that the Earth was pierced by a cosmic neutrino of unprecedented energy. More precisely, this particle grazed tangentially: moving from west to east, the particle first entered the shallow waters of the Mediterranean Sea south of Sicily, then the thickness of the underwater soil, and, flying almost horizontally, again exited the soil into the deep waters of the central basin of the Mediterranean Sea. And somewhere along this path, the neutrino experienced a collision with another particle and turned into a muon of ultra-high energy, which, having spent its energy over several kilometers of trajectory, illuminated the Mediterranean depths with a short but bright flash of light. This extremely rare event would have gone unnoticed if the giant neutrino telescope KM3NeT had not been nearby - a scientific installation that tracks signals from ultra-high-energy neutrinos. The resulting particle, a muon, flew through a "thicket" of vertical chains of light-sensitive elements that, like kilometer-long seaweed, were attached to the seabed. This underwater fireworks display lasted for a few microseconds, but several thousand sensors captured the emitted photons and transmitted all the information to the control room of the unique neutrino telescope KM3NeT, and the event it registered was assigned the code designation KM3-230213A.

Scientists have established that neutrinos come in three different varieties or types and can change their variety right on the fly during their movement. The Nobel Prize in Physics for 2015 was awarded to scientists for the discovery of these spontaneous neutrino transformations, the so-called neutrino oscillations. In addition, it was established that neutrinos participate only in weak interactions with other particles, which is why the probability of their interaction with

Illustration of the KM3NeT deep-sea neutrino telescope in the Mediterranean Sea. Source: DALL-E neural network

matter is extremely small. A moderate-energy neutrino is capable of piercing through not only the Earth but also the Sun without ever hitting a single atom. For such neutrinos, our planet and even people themselves are just empty space.

All these properties make neutrinos a unique tool for studying the depths of space. The fact is that the life of the Universe consists not only of the calm glow of stars, but also of a wide variety of explosions, shock waves, catastrophic absorption of matter by black holes, and other cataclysms. Space catastrophes are capable of accelerating elementary particles to insane energies, orders of magnitude higher than all the achievements of terrestrial accelerator physics, including the LHC (Large Hadron Collider).

At the same time, the process and methods of registering astrophysical neutrinos of ultra-high energies have their difficulties. The main problem is that the Earth is bombarded by a huge flux of neutrinos coming from the Sun, as well as atmospheric neutrinos produced by collisions of high-energy cosmic rays with molecules high in the Earth's atmosphere. Solar neutrinos are not a problem; their energies do not exceed tens of MeV (megaelectronvolts). But "atmospheric" neutrinos may well be high-energy, with energies in the GeV (gigaelectronvolt) and TeV (teraelectronvolt) range. Even if neutrinos with energies of about 1 TeV come from some distant source from time to time, this weak cosmic signal will be completely obscured by the flux of neutrinos of "terrestrial" origin. It is possible to reliably eliminate the background of atmospheric neutrinos only at energies of hundreds of TeV, or even better - PeV (1 PeV = 1000 TeV), and to register neutrinos of such enormous energies, detectors a kilometer in size are required. Moreover, they should be located not on the surface, but at depths of several kilometers, to shield the detector from external radiation.

Fortunately, there is no need to build a kilometer-scale setup; it is enough to find a cubic kilometer of transparent water or ice and fill it with optical modules — light sensors capable of capturing individual photons. Suitable conditions can be found at the bottom of a sea or a deep lake — or in the depths of the Antarctic ice sheet.

Schematic of an ultra-high energy neutrino flyby recorded by a deep-sea sensor system in the Mediterranean Sea

Accordingly, in the 21st century, work began on deploying three neutrino telescopes with an eye on the kilometer-scale. These were the IceCube project at the South Pole and the Baikal-GVD detector at the bottom of Lake Baikal, and a little later the KM3NeT setup in the Mediterranean Sea joined the race for neutrinos. It is easy to imagine the complexity of the work on creating scientific instruments of such a scale, especially considering that the radiation-sensitive elements must be installed at a depth of many kilometers, and in the case of IceCube, frozen into the ice. The deployment of these installations has stretched over a decade or decades, but fortunately, it can be done in stages. Every year, specialists add one or more "garlands" — chains with optical recording modules strung like a net every few dozen meters. And such a neutrino telescope begins to work with several garlands, and confidently "sees" atmospheric neutrinos interacting with water particles based on the registration of radiation. But since such a detector captures the light emitted by electrons or muons flying by only in a small volume of water or ice, the probability of catching or registering ultra-high-energy neutrinos is small. As new garlands are added, the sensitive volume of the telescope increases, the probability of registration grows — and sooner or later the detector will be lucky enough to catch a neutrino with an energy of the order of PeV or higher. The IceCube collaboration was the first to achieve this, announcing in 2013 the detection of two neutrinos with energies of several PeV. Even if some initially had doubts about the interpretation of the first two events, a full statistical analysis published a year later reliably proved that IceCube confidently "sees" astrophysical neutrinos arriving from deep space, and a significant part of them are born in blazars, extremely active nuclei of distant galaxies. The origin of cosmic rays (CR) remains one of the key mysteries of astrophysics. One of the possible sources of ultra-high-energy CR are processes occurring in the vicinity of supermassive black holes (SMBH), located in the centers of active galaxies and quasars. Particles accelerated in the vicinity of SMBH can leave this galactic system and become cosmic rays that reach the Earth. Modern experiments such as the Pierre Auger Observatory, Telescope Array, IceCube register these particles, confirming the connection of ultra-energetic cosmic rays with active galactic nuclei and black holes. A number of decrees of the President of the Republic of Uzbekistan Shavkat Mirziyoyev have become a powerful incentive for the development of physics and astronomy in Uzbekistan in recent years, including Resolution No. PP-5032 "On measures to improve the quality of education and improve scientific research in the field of physics" adopted on March 19, 2021. An important indicator of the development of this scientific direction is the training of highly qualified young scientific personnel. It should be noted here that after 2016, in the era of the development of New Uzbekistan, which coincided with the modern era of triumphant revolutionary discoveries in world astronomy,

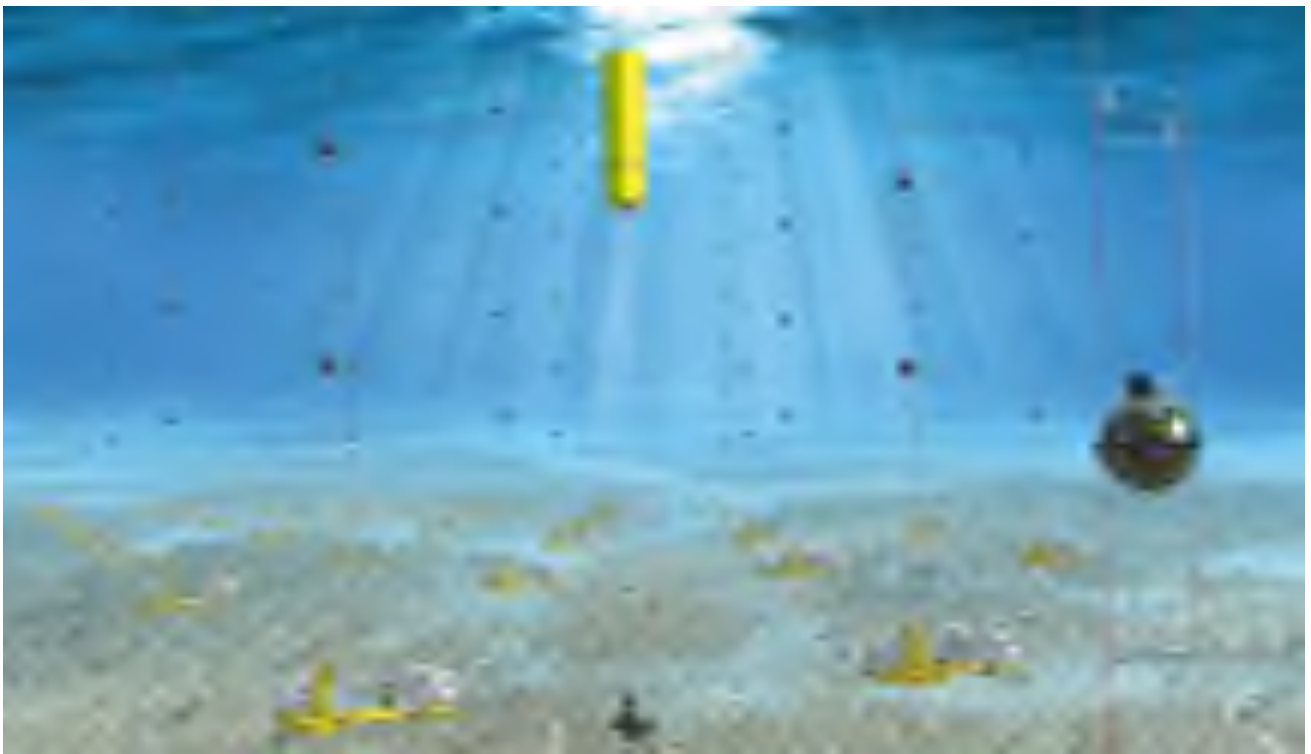
a large number of dissertations were defended in the field of relativistic astrophysics. Moreover, the number of publications of domestic scientists on relativistic astrophysics, carried out in international journals with a high rating, exceeds the mark of 100 articles annually in the Web of Science database, and Tashkent has become a world-famous scientific center for high-energy physics and astrophysics.

An example of this is the Alexander von Humboldt Fellow, Doctor of Physics and Mathematics Arman Tursunov, a young astrophysicist who devoted a number of his studies to the origin of high-energy cosmic rays in the vicinity of supermassive black holes through the magnetic Penrose process (MPP) as a potentially effective mechanism for achieving such energies. In particular, he showed that the ionization of neutral particles, such as beta decay of neutrons near the horizon of a black hole, can lead to the acceleration of protons to ultra-high energies. These studies make a significant contribution to the understanding of particle acceleration processes in the extreme conditions that exist in the vicinity of supermassive black holes and their possible connection with the origin of ultra-high-energy cosmic rays. Supermassive black holes are powerful cosmic accelerators capable of accelerating particles to extreme energies. Moreover, such structural objects as jets, accretion disks and coronas of black holes provide the necessary conditions for the generation of cosmic rays that can reach the Earth, revealing the secrets of processes occurring in the most extreme conditions in the Universe. It is pleasant to note the significant contribution to astronomical research of other young talented astrophysicists: a striking example is Akhmadjon Abdujabbarov, who, working together with one of the world's scientific leaders, Professor Luciano Rezzolla, developed a new formalism for describing the silhouettes of SMBHs, independent of the choice of coordinates, which became the basis for his dissertation for the degree of Doctor of Philosophy in Astronomy, which he defended at the age of 31. Professor Farrukh Atamuratov studied the influence of the state of plasma on the silhouettes of black holes, and at the age of 33, he defended his dissertation for the degree of Doctor of Physical and Mathematical Sciences. Professors Askar Abdikamalov and Bakhtiyor Narzilloev (who was recently appointed Director of the Institute of Advanced Studies in Tashkent), whose dissertations were partly devoted to the study of the shadow of black holes, were awarded the degree of Doctor of Sciences at the ages of 28 and 27, respectively, according to the Decree of the President of the Republic of Uzbekistan dated October 29, 2020, No. UP-6097.

In our time, the long-awaited era of observations of cosmic objects - black holes - has arrived. More than a century after Einstein developed the general theory of relativity, it has become possible to test whether it correctly describes gravity in the strong field regime in the extreme conditions of the vicinity of black holes. In this sense, images of black holes and gravitational waves from black hole mergers are a test bed for comparing Einstein's theory with alternative theories of gravity. With further increases in the accuracy and sensitivity of astrophysical observations, we will be able to study in detail the space-time near the black hole and find answers to fundamental questions of black hole astrophysics, including the origin of ultra-high-energy neutrinos coming to Earth.

And it would not be an exaggeration to say that one of such mysteries of the Universe, requiring its further knowledge and careful study, is today the mysterious high-energy particle, the neutrino, which will remain in the field of view of scientists for many, many years.

Researchers are in the process of deploying the new photovoltaic modules of the KM3NeT underwater telescope



Unique national technology of dimensional processing of materials

Erkin Abdukarimov,
Doctor of Technical Sciences,
Honored Inventor of Uzbekistan

First of all, it is necessary to characterize the below-described electrical discharge technology of dimensional processing of materials, its features and operating principle, and then show its unique capabilities and practical application. As is known, electrical discharge technology of processing materials is based on the destruction of the near-surface region of the processed material under the action of an electric or electric spark discharge created between the surface of the material and a metal electrode, which, as a rule, is a fairly thin metal rod.

The history of the creation of the electrical discharge method begins in 1938, when the Soviet scientist L.A. Yutkin discovered the ability of a series of electric spark discharges to lead to the emergence of form-forming hydraulic shocks on the surface of the product, the separation and ejection or evaporation of small drops of the substance of this product. To process products using this method, short (up to 0.01 seconds) electrical pulses following one another are used. The pressure created by the particles of the discharge plasma that hit the metal surface causes local erosion and the release of small particles or drops of the intensely heated substance of the metal product being processed. These processes lead to the periodic formation of point microdestructions, and then to the desired change in the shape, size, roughness and other characteristics of the workpiece. As is known, this method was effectively used in the USSR during the Second World War, primarily for the destruction and removal from the surface of combat torpedoes of drills, taps and other tools stuck in them, broken during the production of the necessary technological holes. As a result, unique expensive parts were no longer sent as scrap for remelting, but were reworked. This saved significant production and financial resources, and the authors of this development were encouraged by the highest state prizes, awards and were elected academicians. It should be noted that precision cutting of metals using an electric spark was also mastered for the first time in the world by the Soviet scientist B. Stavitsky. Initially, it was believed that electrical erosion would also find its application in the technology of ultra-deep drilling of metal products. The implementation of this idea was carried out by teams of researchers in scientific centers of the USSR and foreign countries. However, they failed to obtain significant results since the bar characterizing the maximum drilling depth with a simple electric spark was not overcome due to the jamming of the holes created by pieces of the material itself, formed during the spark effect.

A natural question arises: if this technological method was developed and used for a long time, then what was the peculiarity of its modernization and the creation by scientists of Uzbekistan for the first time in the world of a unique type of fine-dimensional electrical erosion technology for creating deep holes?

It is known that any customer who requires metalworking services always asks questions: how to do everything on time, avoid unnecessary costs, and guarantee high-quality products? It was with such an order for the creation of thin calibrated tubular holes in refractory superhard tungsten nozzles of plasma thrusters of spacecraft, received from one of the enterprises of the Ministry of Medium Machine Building of the USSR in the mid- to late 70s of the last century, that the history of the application of the electrical discharge machining method for these purposes in Uzbekistan began. This important state order was received and also timely and efficiently executed by the Institute of Electronics of the Academy of Sciences of Uzbekistan (now the Institute of Ion-Plasma and Laser Technologies named after U.A. Arifov of the Academy of Sciences of the Republic of Uzbekistan). Moreover, the products obtained at the Institute were successfully used on spacecraft AES (Artificial Earth Satellites) 728 and 780 of the “Cosmos” series. At that time, Erkin Abdukarimov, a candidate of technical sciences, was appointed responsible for solving this problem. At the same time, they proposed replacing the traditional polycrystalline tungsten product with an oriented monocrystalline sample, which increased the service

Photographic portrait of Soviet scientist and inventor L.A. Yutkin, author of the electrohydraulic effect (EHE)

Electroerosion machine and products manufactured with it

life of plasma engines by more than 10 times due to the high resistance of the tungsten monocrystal to destruction during a large number of thermal cycles of the plasma engine. To implement this important task, the Institute's specialists initially used the traditional method of drilling through holes in tungsten blanks with thin carbide drills. However, this simple method was labor-intensive, required many hours of drilling the blank, led to the damage of many scarce carbide drills that wore out in the process, and even to their breakage and jamming in the already formed thin hole. This resulted in the rejection of the Customer's individual and scarce workpiece being processed without the possibility of its reuse.

The analysis conducted by the Institute's scientists showed that for drilling through calibrated holes, it is advisable to use the electric spark method, but the depth of the hole drilling primarily depended on the efficiency of supplying the dielectric working fluid to a great depth in the electric spark discharge zone. This liquid serves to remove the resulting products of spark destruction from the processing zone. Tubular electrode tools, with which it is possible to pump the working fluid to a great depth, turned out to be the most suitable for these purposes. However, during the electrical discharge drilling of through holes, the presence of a growing core of the substance itself inside the tubular electrode gradually worsens the circulation of the working fluid, and the further process stops already at a small depth of the holes. It is for these reasons that an innovative solution to this problem was proposed in the laboratory of the Institute of Electronics under the leadership of E. T. Abdukarimov, namely, to replace a simple solid metal electrode with a combined electrode-tool of a tubular type, consisting of a rod-shaped needle metal electrode enclosed in a hollow dielectric shell adjacent to it and moving along its axis. Moreover, a working fluid - ordinary tap water - entered the thin channel between the tubular hollow dielectric shell and the metal electrode, which washed out the smallest metal particles created by the electric discharge from the formed hole. This allowed such a combined electrode-tool to freely penetrate to a considerable depth into the customer's tungsten products being processed and make or pierce thin through holes of the required size (diameter and depth) quickly enough, without damaging the products or breaking the electrode. Having made sure that the created electrode tool was operational, E. Abdukarimov decided to obtain copyright for this invention and assert his priority. At that time, such a document was the USSR Author's Certificate for an invention. To obtain the Certificate, it was necessary to draw up and send a corresponding application to Moscow to VNIIGPE (All-Union Research Institute of State Patent Expertise), which was done. As a result, the accepted application passed the examination, which, during the initial review, confidentially noted that applications for inventions on this topic, like the "perpetual motion machine," are not accepted for consideration. This was justified by the fact that many institutes were unable to solve the problem of drilling deep holes using an electric spark (electroerosion), and they had to abandon this idea due to the impossibility of its practical implementation. In addition, according to the private opinion of the examination, a person from the periphery without the appropriate training and base could not solve this problem. Finally, after two years of correspondence, VNIIGPE was forced to recognize this invention. As a result, E. T. Abdukarimov protected his first invention for the "Method of Electrical

Profiled copper and brass components with precision holes produced by electrical discharge machining (EDM)

Discharge Piercing of Deep Holes" with the USSR Author's Certificate for Patent SU1407711A1 with priority from 1979. The new method of electrical discharge piercing of deep holes proposed by him was carried out by an electrode-tool in the form of a metal rod enclosed with a gap in a thin-walled capillary dielectric tube (shell) and protruding from it, and also differed favorably from the known methods. In this case, the process of electrical discharge machining was carried out by a composite electrode tool, and the metal rod protruding from the dielectric shell could move axially synchronously, just like the thin-walled dielectric shell itself. The versatility of the implementation of this method for creating very deep holes in products was that there was practically no limit to the use of ultra-thin-walled capillary dielectric tubular shells and the placement of metal electrodes of ultra-small diameters inside them. Rod electrodes-tools slightly exceeding the thickness of horsehair, were used to pierce ultra-thin holes, and tungsten was chosen as their material, as the most heat-resistant metal. Heat-resistant elastic braiding of an electric cable served as a dielectric shell. The process of piercing holes was carried out automatically using an electronic system and a power supply unit developed in the laboratory and patented abroad.

The purpose of the new inventions proposed at the Institute for 2 devices - a unit and a combined electrode tool—was to expand the technological capabilities of processing by ensuring the drilling of deep holes in hard-to-reach places and the extraction, if necessary, of a jammed or broken small-diameter tool from the hole. The originality of the design of such a composite electrode-tool allowed not only to increase the depth of the drilled holes but also to create on its basis a new class of electrical discharge machines, including small-sized ones. The portable electrical discharge unit created by the authors contains a housing in which the mechanisms for feeding the combined electrode-tool and its movement along the axis and rotation with control over the depth of the hole being created were placed. When the shell moves, the working fluid enters the interelectrode gap and removes metal particles formed by the electric discharge from the hole formed by the electrode. To make deep holes, the portable unit is installed on a stationary machine.

These two inventions of the Institute were also protected by USSR Author's Certificates for "Devices for electrical discharge piercing of holes" with priority from 1986, authors - E.T.Abdukarimov and H.A.Vakhidov, patents SU1664484A1 (1991) and SU1731489A1 (1991). Both of these inventions relate to the field of precision engineering, in particular, to electrical discharge machining of electrically conductive products and parts.

The development and licensing of the new domestic technology began in the mid-1980s. It should be especially noted that out of more than 60 developments submitted by the Uzbekistan Academy of Sciences to the USSR LITSENZINTORG, only one - electrical discharge piercing of thin deep holes - was selected and recommended for patenting in foreign countries and selling a license as the most innovative.

As a result, in 1984, numerous negotiations were held, and a successful direct demonstration was held at the Institute of Electronics of the Academy of Sciences of Uzbekistan of the operability and virtually waste-free capabilities of high-speed processing of products of this method on blanks provided by Swiss experts. And a decision was made on licensing. As a result, based on a license agreement, in 1986, this unique domestic technology of electrical discharge machining of superhard and refractory materials was sold to the well-known company "Georg Fisher" (Switzerland), specializing in the production of high-precision metalworking machines. The amount of this transaction was 600 thousand Swiss francs. Thus, for the first time in the history of Uzbekistan, a domestic scientific and technical development of world class was sold for a huge price at that time. At the same time, several employees of the Institute of Electronics and the Presidium of the Academy of Sciences of Uzbekistan and Moscow organizations that contributed to the successful completion of this event were encouraged with cash prizes. Worldwide recognition of the achievements of domestic technology for creating super-deep thin holes. One of the first recognitions of the priority and uniqueness of this domestic technology took place in 1986, when its author E. T. Abdukarimov participated with his inventions in the Exhibition of Technologies at the USSR Exhibition of Economic Achievements in Moscow and was awarded a silver medal.

Inventor E.T.Abdukarimov is the author of 25 foreign patents issued for electrical discharge machining in eight leading countries of the world (USA - 4 pat-

ents, Russia - 7 patents, as well as 2 patents in Switzerland, France, Canada, Great Britain, Sweden, Italy, and the European Union, respectively). For high achievements in scientific, technical, and inventive activities, E.T. Abdukarimov was awarded the honorary title of Honored Invetor of Uzbekistan in 1988, and in 1991, he was awarded the academic degree of Doctor of Technical Sciences. In 1998, E.T.Abdukarimov's inventions were demonstrated at the 28th International Exhibition of Inventions in Geneva (Switzerland) and were awarded a diploma and a bronze medal.

Thus, the Uzbekistan Academy of Sciences has developed a method and technology that have no analogues in the world for precision and fine electrical discharge machining of deep holes of various diameters and profiles in any electrically conductive materials: - superhard (alloys of refractory materials, titanium alloys, etc.); - refractory (tungsten, molybdenum, tantalum, niobium, etc.); - viscous and plastic (copper, brass, etc.), as well as in dielectrics. Based on this technology, a new class of electrical discharge machines of various modifications (stationary vertical, horizontal, and portable, small-sized, like an electric drill) was created at the Institute of Electronics of the Academy of Sciences of the Republic of Uzbekistan. The developed electrical discharge machines are simple in design and operation, have low energy and metal consumption, and are more than 10 times cheaper than existing foreign analogues. These machines implement waste-free technology and also use ordinary tap water as a working fluid and for removing erosion products from the material processing area. In some parameters and technological capabilities, they still have no world analogues and implement waste-free, environmentally friendly technology. It allows it to pierce:

- super-deep holes of various diameters from 0.3 mm to 5 mm and higher with a ratio of the hole depth to its diameter over 200, with a deviation from the axis and a diameter tolerance of +0.05 over a length of 100 mm;

- figured and shaped blind holes and cavities, as well as thin connecting channels in the workpieces with a variable cross-sectional profile in depth, including with a reverse processing angle, and diameters of internal cavities exceeding the diameter of the inlet hole by more than 2 times.

This could not be done by any of the other existing methods. Electrical erosion can be used to form holes of various shapes, shaped cavities, profile grooves, and slots in carbide blanks and to harden metal tools and conduct electric printing, grinding, cutting and other operations.

This domestic technology belongs to the new generation of methods, to the class of fine and high-precision metal-cutting and metalworking technologies. Today, the technology created in Uzbekistan has become widespread in various areas of industrial production. Examples of successful applications of domestic electrical erosion technology are the following:

- flashing of the required shape of thin calibrated holes in the nozzles of plasma thrusters of spacecraft;

- ultra-precise fine processing of blades of steam, gas turbine engines and hydraulic turbines; propellers of engines of sea and river vessels of various sizes and capacities;

- precise adjustment of the dimensions of the surfaces of metal parts for various purposes and other products of mechanical engineering.

It should be noted that at the International Instrument Exhibition in 1991, the company "Japex" (Japan) demonstrated a 200-millimeter tungsten rod pierced through with a millimeter hole. Representatives of the company stated that this unique product was made using a perfect technology using deionized water under a pressure of 100 atmospheres on a machine weighing a quarter of a ton and costing 50 thousand US dollars. At the same time, the tubular electrode used by the company costs 15 US dollars, and piercing such a rod requires 10 of these tools. At this exhibition, it was noted that "Honored Inventor of Uzbekistan Erkin Abdukarimov showed a 300-millimeter tungsten pencil, pierced with a millimeter hole using his technology, using tap water on a machine weighing only 15 kg and costing several hundred rubles. This technology pierces any metal with ordinary wire dressed in a "shirt."

In the publication "DIVO Russian Book of Records and Achievements" (source https://bibliotekar.ru/divo/40-8.htm) in the chapter "HUMAN ACTIVITIES":

Section Science and Technology: "Inventions and Discoveries" after the information subsections: - "Invented electric welding" (1882 - inventor N.N.Benardos) and - "Synthetic rubber" (1928 - Academician S.V.Lebedev) there is a subsection "The thinnest long hole" (1991 - inventor Erkin Abdukarimov), which reports that:

"The longest small-diameter holes in the world can be pierced by the inventor from Uzbekistan Erkin Abdukarimov. In 1991, he built a machine that pierces a 300-millimeter tungsten rod with a hole 1 millimeter in diameter. The inventor began to manufacture a new class of electrical discharge machines that can pierce multiple parallel and even-shaped holes with a variable depth profile in any metal." In the new real

Demonstration by E. Abdukarimov of a new class of electrical discharge machines (EDMs)

conditions of independent Uzbekistan, E. Abdukarimov continued his scientific creative work. He worked on the problem of further expanding the capabilities of a unique technology and took on the realization of his long-standing dream - piercing holes in dielectric materials (ceramics, glass, etc.) using a spark. In 1996, the work of the Institute of Electronics of the Uzbekistan Academy of Sciences "Deep Electrical Discharge Piercing of Holes" won the most prestigious grant in Japan from the Ministry of Education, and its author received the right to work for 6 months at the Institute of Welding and Melting of the University of Osaka JWRI (Japan) as a visiting professor. In 2000-2001, E.T. Abdukarimov worked in Japan twice for 3 months as a visiting professor at the University of Akita Prefecture and carried out joint work on the creation of an industrial prototype of a small-sized electrical discharge machine. In 1996, the author of inventions in the field of fine electrical discharge technology, E.T. E.T.Abdukarimov, together with other scientists of the Institute of Electronics of the Academy of Sciences of the Republic of Uzbekistan, doctors of science N.Kh. Dzhemilev and E.G. Nazarov, was awarded the State Prize of Uzbekistan named after Biruni for a series of works, "Interaction of a complex of atoms with the surface of a solid body: new technologies and devices", which created industrially mastered new types of mass spectrometers, electrical discharge installations and machines, surface-ionization sensors, and gas detectors. It should be noted that these scientists are representatives of the world-famous Uzbek scientific school created by Academician Ubay Arifov in the field of physical electronics and electronic technologies, which fruitfully operates in the Institute of Ion-Plasma and Laser Technologies of the Uzbekistan Academy of Sciences, which bears his name. The achievements of scientists of this Scientific School continue to amaze the world with their new scientific discoveries and technologies at present.

How to fight termites

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Termites are ancient insects that appeared on Earth at a time when mammals and most flowering plants did not exist, and their social lifestyle is older than that of ants and bees, and formed 2 million years ago.

Excessive abundance of termites is typical for tropical forests. During the survey of a small area in Cameroon, 43 termite species were found, in a special site for collecting wood chips in Ghana – 32 species, and in one of the reserves in western Malaysia, 52 termite species were found on one hectare of equatorial tropical forest. It was found that termites live on all tiers of a 30-meter tree, from the ground to its top, feeding on vegetation, dry wood, fallen leaves, humus and lichen. The utilization of 20-30%, and in some places up to 50% of fallen plant remains by termites once again demonstrates their role in the detrital food chain of tropical forests. They grind up dry branches, stems and other plant debris, carry them to their nests as food reserves and store them in their food chambers, thereby increasing soil fertility.

According to the laws of biology, the availability of food necessary for survival is one of the main factors that ensures the development of a species. Termites usually feed almost exclusively on cellulose, which is the most common substance on Earth after minerals. Wherever there are trees, roots, bushes, grass or any rotting vegetation, humus and manure containing cellulose residues, termites find an endless supply of food. According to scientists, termites are currently a fast-growing species, rapidly expanding their habitat, and their activities directly affect global metabolic processes. The biomass of termites is three tons of biomass for every person living on Earth. Like all living organisms, termites participate in metabolism, consuming food, converting it into energy and plastic mass necessary for the needs of the body, and releasing metabolic products and energy into the environment. However, their ability to digest food, i.e. cellulose, assimilate atmospheric nitrogen, have a huge biomass and exhibit high activity, and thus participate in metabolic processes, undoubtedly acquires global proportions.

While recognizing the important role of termites in nature, it is worth noting separately that there is no other insect in the world that, like termites, would cause such serious and systematic damage to many man-made structures and objects.

Throughout their historical development, termites have steadily increased in number, penetrating into urbanized biogeocenoses and, as a result, significantly expanding their range. The main parameters that determine their distribution are associated with the adaptation of these insects to living in various habitats, which is due to their high adaptive potential developed in the process of natural selection. According to their food characteristics, termites are xylophagous insects, that is, they are distinguished by the fact that they consume any products containing cellulose; if in nature they feed on the remains of dried plants, trees and shrubs, then in buildings and structures – on any products containing cellulose that have undergone secondary processing, for example, technical wood and cardboard.

Termites, building large, characteristic nests in cracks between walls, window and door frames, in ceiling beams, in a thick layer of soil on roofs and

Termite eggs (a); worker castes (b); soldier castes (c); winged reproductive individuals (d);

a

b

Plant remains; residential buildings (a); termite-damaged structures (b)

under floors of residential buildings, historical monuments, industrial, hydraulic and other buildings and structures, cause enormous damage, actively feeding on wood and other plant products. Termites also cause serious damage to railway sleepers and telegraph poles. In addition to wood and plants, they feed on paper, cardboard, fabrics, felt, wool and 70 other types of various materials.

Termites are insects that live in highly developed communities. In this respect, they have much in common with ants and bees. They live in large colonies consisting of many thousands of individuals, in underground nests or in special structures. Termites in a colony are divided into several phases and castes, which consist of workers, soldiers and sexually mature individuals, differing from each other in appearance and function (Figure 1).

Due to the damage they cause, termites are a real disaster not only for us, but also for all countries with tropical and warm climates. The destruction of homes, furniture, clothing and footwear, the drying up of various wild plants, trees and grain crops, the weakening of irrigation canals, piers, barges, dams and culverts due to damage by termites and their destruction under the pressure of water, as well as the destruction of priceless cultural monuments, archival materials, rare books, priceless works of ancient masters, wood carvings and wooden sculptures, wooden structures of buildings and structures, clearly shows how serious and dangerous the damage caused by termites is.

Overall, no country has fully assessed the damage caused by termites. Detailed calculations show that if in the United States termite damage in 1938 was $40 million; in the 1950s it was $100 million; in the 1960s it rose to $250 million; in the 1970s it was $500 million; and in 1982 it reached $1.17 billion. By the early 2000s, while $2 billion was spent annually on termite control, the damage from losses exceeded $1 billion. According to the National Pest Management Association, in recent years termites have caused economic losses of more than $5 billion annually.

In the Indian subcontinent, termites of the species *Microcerotermes munor* and *Odontotermes borni have been observed* gnawing at the roots of Eucolyptus citriodosa trees, causing 30% of the plants to dry out. In northern China, *Odonthothermes formosanus* and *Macrocerotermes barneyi cause extensive damage to reservoirs and dams. In the US state of Florida, Coptotermes formosanus* were found to have nested on the 14th floor of a high-rise building, causing damage to the structures.

Currently, science has identified 30,000 species of termites, of which 120 are listed as pests. There are 7 species of termites in the CIS countries. Of these, two species are widespread in Uzbekistan: the Turkestan termite (Anacanthotermes turkestanicus Jakobs, 1904) and the large Transcaspian termite (Anacanthotermes ahngerianus Jakobs, 1904), which in recent years have caused serious damage to wooden structures of residential buildings and other structures in almost all regions of Central Asia, including Uzbekistan, especially in the Republic of Karakalpakstan, Khorezm, Surkhandarya and Kashkadarya regions, resulting in dangerous, and in some cases extremely dangerous situations. At the same time, damage to historical monuments and structures is of great con-

cern. World-famous historical monuments in Central Asian cities such as Bukhara, Samarkand and Khiva are also under threat from termite damage.

According to the latest data, termites have currently damaged 20,000 homes in Uzbekistan; 98 social facilities; 46 cultural and historical monuments; 75 manufacturing plants; and 1,082 hectares of open space.

Our state has been paying great attention to this problem for a number of years, in particular, the **Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 605 of November 16, 2023 "On measures to further improve the activities of the Republican Center for Termite Control" was adopted** , and in accordance with the order of the President of the Academy of Sciences of the Republic of Uzbekistan No. 4-114 of November 20, 2023, the State Institution (State Institution) "Republican Research Center for Termite Control" was created on the basis of the Republican Center for Termite Control of the Academy of Sciences of the Republic of Uzbekistan.

Based on numerous complaints recently received from residents and relevant organizations that buildings and structures are becoming unsuitable for habitation due to termites, on November 4, 2024, **Resolution No. 734 "On approval of the Regulations for the provision of a public service for identifying housing damaged by termites and other insects and recognizing it as unsuitable for habitation"** and **Resolution No. 735 "On measures to improve the effectiveness of anti-termite measures in the republic" were adopted.**

The adoption of these regulations shows how urgent the termite problem is today.

All over the world, having abandoned the treatment of wooden structures of buildings and structures with toxic preparations, the emphasis is now on the rational use of the biological properties of termites with the help of food baits.

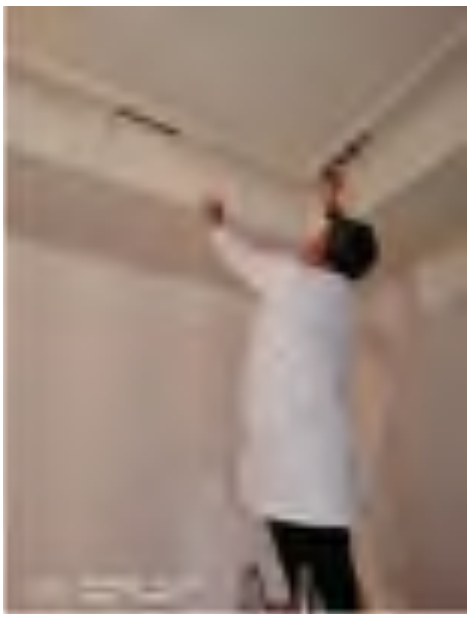
It has been proven that attracting termites with food baits and then placing poisoned food in the area can be an effective, economical and, at the same time, environmentally friendly method of comprehensive termite control. However, despite all efforts to control termite populations, their habitat is expanding. Therefore, the use of fundamentally new insecticides in the fight against termites, based on the unique features of the collective lifestyle of these insects, the study of their processes of food production, nesting and mutual nutrition, digestion, intercellular chemical communication and the creation of control agents that rationally use these subtleties, is of great scientific and practical importance.

The National Research Center for Termite Control of the Uzbekistan Academy of Sciences has a laboratory called "Termite Bioecology" and a production department. The laboratory "Termite Bioecology" conducts in-depth scientific research on the biology and ecology of termites of the genus Anacanthotermes, common in Uzbekistan.

The Center constantly monitors the spread and harmful activity of termites in populated areas, natural and historical monuments, strategic objects, residential buildings and open areas of the republic, constantly improves and implements into practice the technologies of production of feed and methods of their application used to combat termites. By developing and applying new types of baits against termites of the genus Anacanthotermes, we can prevent the occurrence of emergency situations, protecting wooden structures in the territory of populated areas, on historical and cultural monuments, social facilities and buildings (Figure 2).

Currently, the Center has two types of baits that have high biological effectiveness in termite control, and these baits are the only means of control to completely eliminate termite damage.

c



d

e

The process of installing anti-termite baits on termite-damaged buildings; a historical and cultural monument

a

b

Samples of baits for termite control, cylindrical (a) and envelope-shaped (b), manufactured at the Republican Scientific Research Center for Termite Control

Feed (bait) No. 1. The production of feed, which is currently widely used in the fight against termites of the genus *Anacanthotermes*, was modernized and established, and is a pathogenic and toxic product. The inner part of the cylindrical cardboard body, with evenly spaced holes on the outer surface, is filled with a mass of crushed plant material (sunflower stems), impregnated with an insecticidal substance.

This development is the first example of termite feed with high biological efficiency, which is widely used as a means of fighting termites in all regions of our Republic where they are common - in residential buildings, on historical and cultural monuments, other structures, and has potential for export to the CIS countries.

Food (bait) No. 2. The "Antitermite" bait with a new exterior and composition, rectangular in shape, measuring 140×40×10 mm. The body of the bait is a smooth rectangular shape measuring 20x7 cm and is made of cardboard in the form of an envelope, closed on one side, a food substrate is placed on the other side, then closed. A new composition has been developed as a food base for the bait, containing 60±5 g of crushed sunflower stalks soaked in carbohydrates and a chemical preparation (0.05 g). The total weight of the bait is 30±5 g, of which 5 g is cardboard, the weight of the food mixture or a natural component (carbohydrate + vitamin + mineral).

The chemical compound fipronil used in both of the above baits was impregnated into a food substrate that termites like to eat, the substrate itself was placed in a cardboard capsule, which increased the likelihood of affecting only the termites themselves, which resulted in high biological efficiency in buildings and structures infested with termites, without harming the environment or warm-blooded animals. In recent years, applications for these developments have also come from Central Asian countries such as Kazakhstan and Turkmenistan, where termites of the genus *Anacanthotermes are widespread* .

Based on many years of experience of the National Research Center for Termite Control in eliminating damage from termites - signs of termite poisoning begin to appear 30 days after laying any food (bait). The death process intensifies over 3 months. The residual effect lasts for at least 6 months.

Thus, on the basis of the State Institution "National Research Center for Termite Control" of the Uzbekistan Academy of Sciences, continuous production of toxic feed against termites of the genus *Anacanthotermes will be organized* .

Also, one of the main tasks of the center is to create a new design of the new generation bait "Antitermite" and introduce it into the practice of fighting termites, and from year to year work is carried out to improve the bait body, food substrate, termiticide substance and termite attraction, i.e. attractant properties.

Small hydro power plants - new strategy in the energy development in Uzbekistan

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Stable development of energy is the basis for economic and social progress of each state. In Uzbekistan, despite rich reserves of natural gas and coal, issues of modernization of the energy sector through the priority and efficient use of environmentally friendly renewable energy sources (hydraulic, solar, wind, nuclear) are increasingly relevant today.

In this regard, it will be interesting to present individual stages or time periods of development of the founder of the energy sector of Uzbekistan – hydropower, covering almost 100 years – from 1926 to the present.

In the initial period (1926 – June 1941) Uzbekistan was supplied with energy exclusively by hydroelectric power plants (HPPs), mainly low-power or small HPPs built on the Bozsu canal, known since ancient times, which were part of the Chirchik-Bozsu cascade and used the water of the Chirchik River. The first-born of Uzbekistan's energy sector was the Bozsu HPP-1 with a capacity of 4.0 MW, built according to the GOELRO plan in 1926. Then, up to 1941, 3 new HPPs were built, and the total capacity of this cascade increased to 109.74 MW.

During the WWII, 5 more new hydroelectric power plants were built, and the capacity of the Chirchik-Bozsu cascade of hydroelectric power plants increased more than twofold and reached 235.74 MW. This made it possible to meet the needs for electricity and, accordingly, energy security, both for republican production facilities and for large factories evacuated from Russia, Belarus and Ukraine, and located mainly in the Tashkent region in the Chirchik River valley. And it was thanks to the developing hydroelectric power that the activities of large factories solving general state tasks of wartime (1941-1945 in former USSR) were organized in the territory of the Tashkent region, mainly for the needs of the front and the rear, as well as employees and specialists of Uzbekistan working there together with scientists and engineering and technical workers who arrived from Russia, Belarus and Ukraine. And therefore, it is historically important that it was in Uzbekistan in the second half of 1941 that for the first time in the world a territorial production and technical hydropower cluster, already in the modern sense, was organized and worked fruitfully for a number of years. It is noteworthy that this cluster in terms of creation was more than 40 years ahead of the widely known scientific and production innovation cluster in the Sunny Silicon Valley (Palo Alto, Stanford University, California, USA).

Further, in the post-war period and up until 1960, energy supply to Uzbekistan was carried out at the expense of existing and construction of new hydroelectric power plants, the capacity of which reached 362 MW. Then, in connection with the discovery and intensive development of a number of hydrocarbon mineral resources (coal, gas) in the country, the consistent active construction of 8 large thermal power plants (TPP), as well as the high-mountain Charvak hydroelectric power plant (1972, capacity 666 MW) began. In the period 1960-1972 and up until 2021, Uzbekistan's electricity needs began to be met by the combined action of thermal and hydroelectric power plants. Moreover, although in 1972 The total capacity of hydroelectric power plants in the country exceeded

Photo of the first hydroelectric power plant in Uzbekistan – the Bozsu Hydroelectric Power Station (initial view of the station in 1927 on the left, and its condition in 2020 on the right)

Charvak Hydroelectric Power Station (on the left – the upper reservoir with a storage capacity of 2,006 million cubic meters; on the right – the lower channel with a view of the dam, 168 meters high, and the powerhouse building)

1200 MW, which constituted only 15% of the total capacity of the energy system of Uzbekistan.

It should be noted that if in 2019 the generating capacity of all power plants in Uzbekistan reached 13.1 GW, including the share of thermal power plants was 85%, hydroelectric power plants - 14% and other power plants - about 1%, then at the end of 2022 the capacity of thermal power plants was already 14.0 GW (almost 89% of the total capacity), and hydroelectric power plants reached 1.5 GW (or 10%). That is, the contribution of hydropower to the country's energy supply during this period in percentage terms was constantly decreasing, despite the undoubted importance of hydropower and the existing significant hydropower potential of mountain rivers.

This potential is confirmed by the data of the book "Water management of Uzbekistan – present, past and future" (Tashkent, 2015), according to which there are 17,777 natural watercourses on the territory of Uzbekistan, including in the basins of the main rivers of the country: Amu Darya – 9930 and Syr Darya – 4926 small rivers and mountain streams, many of which are suitable for the creation of small and micro hydroelectric power plants.

At the same time, the real hydropower potential of Uzbekistan is also estimated to be quite high. According to official data, the country has more than 400 small rivers and large streams, most of which are suitable for the construction of small hydroelectric power plants. Today, there are more than 70 hydroelectric power plants in the country, their total capacity, including small hydroelectric power plants, is 2.5 GW.

Therefore, one of the priority areas for the development of renewable energy during the period of independence and sovereignty of Uzbekistan is also the creation of small hydroelectric power plants, mainly built on mountain rivers.

Small hydroelectric power plants (hydropower facilities with a capacity of 0.1 to 10 or more MW) allow not only to improve electricity supply, but also to rationally use water resources, ensuring economic efficiency and environmental safety. We invite readers to familiarize themselves further with new events and practical steps taken in Uzbekistan in this practically important area of hydropower.

It is known that most of the small hydroelectric power plants built in the country are located in mountainous areas and remote from main power grids, while playing an important role in providing the local population with electricity and work. In December 2024, when the President of the Republic of Uzbekistan Shavkat Mirziyoyev got acquainted with the activities of a small hydroelectric power plant on the mountain river Ugam, it was noted that the country has the potential to build up to 2,000 small and micro hydroelectric power plants.

Small hydroelectric power plants: place and importance in the energy system of Uzbekistan.

Today, small hydroelectric power plants, with a capacity of up to 10 MW and more, are becoming an integral part of the energy system of Uzbekistan. Their main purpose and advantage are:

• *Local power supply:* the ability to provide electricity to every populated area, farm or small region without connecting to the general national power grid.

• *Efficiency:* the cost of producing hydroelectric power is 2-3 times lower than other energy sources.

• *Environmentally friendly:* the operation of hydroelectric power stations does not result in CO2 emissions into the atmosphere and makes it possible to save up to 5.9 thousand tons of coal or 3.9 million m^3 of gas per year.

• *Water recycling:* allows the power of water flow

along a river to be used multiple times to generate hydroelectric power.

A typical example is the small hydroelectric power station "Ugam-1" with a capacity of 1.48 MW in the Tashkent region, which annually generates 11.8 million kWh of environmentally friendly electricity and will ensure uninterrupted power supply to 5 thousand households, as well as tourist and recreational facilities in the mahallas of Chorbog, Khumsan and Ugam. Moreover, due to this hydroelectric power station, about 4 million^{m3} of natural gas will be saved annually. gas. This hydroelectric power station is equipped with modern, efficient hydroelectric units and an automated control system, and domestic materials and equipment were used entirely during its construction.

The development of hydropower in Uzbekistan has entered a new stage in connection with the adoption of Resolution No. PP-44 of 2021 by the President of Uzbekistan Shavkat Mirziyoyev. This resolution defines the main directions of hydropower development, including the construction of a number of small hydroelectric power plants in the country. The Concept for the Development of the Hydropower Industry of Uzbekistan for 2020-2024 was also adopted and successfully implemented in stages.

In connection with the implementation of this Concept, starting in 2024, the Republic began implementing a number of large-scale projects for the construction of small hydroelectric power plants, as an important vector direction for the development of energy in the coming years. This provides for bringing the hydroelectric potential to an indicator of at least 15% of the total volume of generated electricity by 2030.

In particular, for this purpose, in addition to the planned construction of small hydroelectric power plants, the implementation of a number of relatively small projects to create micro-hydroelectric power plants (their capacity up to 0.2 MW) is envisaged. Thus, a micro-hydroelectric power plant with a capacity of 200 kW, capable of generating 1.5 million kWh annually, was built on the diversion channel of the Zaamin reservoir in the Jizzakh region. The cost of construction was $322 thousand, and this micro-hydroelectric power plant in Zaamin ensures uninterrupted power supply to thousands of people.

The main directions of development of hydropower in Uzbekistan include the following:

- increase until 2030 hydropower capacity by more than 2.7 times from 2200 to 6000 MW, for this purpose new hydroelectric power plants, including small ones, are currently being designed, as well as attracting foreign and private investment for their construction;
- introduction of legal benefits for entrepreneurs building small hydroelectric power plants, who, in accordance with the Decree of the President of the Republic of Uzbekistan of 2022, can receive land plots for lease for 20 years, while tax benefits and guaranteed purchase of hydroelectric power by the state are provided;
- wide development of international cooperation in the field of hydropower, thus, the parent enterprise of JSC "Uzbekgidroenergo" is currently implementing projects to create small hydroelectric power plants together with partner companies from Germany, China and Japan.

A typical example of the prospects for the development of hydropower in Uzbekistan shows that if by December 2024, in the Tashkent region alone, 25 hydroelectric power plants with a total capacity of 1,330 MW (60% of the country's total hydroelectric capacity) were operating, then by 2028 it is planned to commission an additional 23 new small hydroelectric power plants with a total capacity 1.8 times greater, or 2,400 MW.

An important example is the 55 small hydroelectric power plants operating in the Surkhandarya region, which annually save 582 million m³ of natural gas and provide electricity to 850 thousand households.

Advanced technological innovations are increasingly being used in hydropower production. Modern advanced technologies play a key role in increasing the efficiency of small hydropower plants, includ-

Small hydropower plant "Ugam-1" on the mountain river Ugam, a tributary of the Chirchik River

Micro-hydropower plant in Zaamin, Jizzakh Region

ing To increase their efficiency, automated control is widely used, so the automated system at the Ugam-1 hydroelectric power station ensures uninterrupted and safe energy supply.

In the energy sector of Uzbekistan, localized production of equipment, including turbines, is increasingly being used: for example, the small hydroelectric power plants “Ugam-1” and the hydroelectric power plant in the Navoi region operate 100% on domestic components.

In the hydropower industry of Uzbekistan, the construction of cascade systems is traditionally practiced. In addition to the Chirchik-Bozsu cascade with 20 hydroelectric power plants of varying capacity , built mainly before 1970, as well as a number of hydroelectric power plants under construction and design in the Chirchik River basin and its tributaries, 2 cascades of hydroelectric power plants have also been created on the Great Fergana Canal, which annually generate 72.89 million kWh of electricity.

In addition, Uzbekhydroenergo JSC, for the first time in the country, announced a tender for the construction of a new cascade on the Akhangaran River in the Namangan region, including 5 small hydroelectric power plants - Kyzyldarya, Suvlisay, Dukentsay, Kamchik and Kuyi Koksu, with a total capacity of 46.6 MW, generating 179 million kWh of electricity annually, within the framework of a public-private partnership, worth 106.9 million US dollars. In this cascade, the most interesting example is the Kamchik HPP in the Pap district - one of the most complex hydroelectric structures in Central Asia, which converts the energy of the water pressure coming through a tunnel into electrical energy.

At the same time, it is necessary to note the difficulties in the development of small hydroelectric power plants:

- small hydroelectric power plants are technically complex construction irrigation and energy facilities, especially hydroelectric power plants located on riv-

Туполангская ГЭС, Сурхандарьинская область

Machine hall of the hydropower station with a hydraulic turbine

Design view of the standard small hydropower plant "Kamchik"

ers in mountainous and remote areas, therefore special requirements are imposed on their design, construction and operation;

- construction and operation of small hydroelectric power plants may have a negative impact on the natural environment, aquatic ecosystems and the landscape of the area. When implementing new projects, it is necessary to strictly comply with environmental conservation requirements;

- the negative attitude of local residents living in the area near the construction of small hydroelectric power plants may also be influenced by the alienation of land and the disruption of the natural landscape. When designing hydroelectric power plants, it is necessary to hold discussions and consultations with local residents before implementing hydroelectric power plant projects and take their interests into account;

- the construction and operation of small hydroelectric power plants require significant financial resources, in connection with which it is necessary to attract external and internal investors and take measures of state support.

The development of small hydroelectric power plants makes a significant contribution to the energy sector of Uzbekistan, and also has an impact on the quality of life and additionally creates a number of socio-economic effects, including:

- creation of new jobs - the construction of each hydroelectric power station provides jobs for up to 100 local residents;

- stability of water flows improves irrigation of agricultural lands in areas near hydroelectric power plants;

- development of tourism, for example, natural green landscapes around the hydroelectric power station on the Ugam River and other mountain rivers attract many tourists.

Thus, the development of small hydroelectric power plants in Uzbekistan is not only a new strategy for ensuring the country's energy independence, but also a new stage in the economic development of the mountainous and remote areas of the Republic. State support, attraction of foreign and domestic investments, introduction of advanced foreign technologies and participation of local communities will ensure success in this direction. In the future, with an increase in the number of small hydroelectric power plants to 2000, Uzbekistan can become the center of "green hydropower" in Central Asia.

Copyright and Artificial Intelligence

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Artists have always played an exceptional role in the life of humanity, being conductors of cultural values, emotions and meanings of the plots of the paintings they create. However, today artists are faced with an unprecedented threat, the source of which is generative models of artificial intelligence. These models are capable of creating images and works that can replace or even surpass human labor in speed and quality of execution, including works of art.

It is important to note that artificial intelligence (AI) itself is also the fruit of human scientific creativity and a key driver of technological progress. Thanks to its ability to optimize processes and create new content, AI has a positive impact on marketing, business, medicine and other areas of activity.

However, one of the key problems is that AI is trained on huge amounts of data, which often includes works of artists and illustrators used without their consent and without appropriate licenses.

Many experts have spoken about this problem. For example, artist Sarah Anderson, Kelly McKernan and Carla Ortiz believe that AI directly violates the copyright of artists by using their works as educational material without consent. Similar opinions have been expressed by other academic authors, such as Alina Skidzik, Michael D. Murray, Jessica Gilotte and others, noting that copyright legislation for artistic works in many countries has not kept up with the pace of development of AI technologies. Since this problem has affected the whole world, it also applies to the CIS countries, including Russia and Uzbekistan.

Until now, Russia and Uzbekistan have not seen any lawsuits between artists and AI developers similar to those that have taken place in other countries. However, legal aspects related to AI and copyright are being actively discussed in the CIS countries.

For example, in Russia, issues related to AI and copyright are under active discussion. In particular, the Chairperson of the Intellectual Property Court Lyudmila Novoselova noted the need to develop legal approaches to new digital elements, including AI. She emphasized that society will have to determine the rights and restrictions for AI, and the courts will have to develop the corresponding legal positions.

There is also interest in the legal regulation of the functioning of AI in Uzbekistan. The article by Professor U.Sh.Sharakhmetova examines the concept and legal status of AI as a new institute of civil law of the Republic of Uzbekistan. The author analyzes the legislation of the country and at the same time proposes to define the legal status of AI in the legislation of Uzbekistan.

Thus, despite the lack of specific court cases between artists and AI developers in Russia and Uzbekistan, these countries are actively working to understand and regulate the legal aspects related to the use of AI in the creative sphere. In this regard, this article examines this problem comprehensively, by comparing the most developed legislative systems of the USA, Great Britain and the EU countries, and also proposes possible solutions to protect the interests of artists and developers of artistic AI models.

Basic principles of copyright and protection of artists.

The first mentions of copyright date back to the 15th century, when Venetian printers received exclusive rights to publish books. Copyright, close to modern, began to form in the 18th century , with the adoption of Queen Anne's Act of 1710 in Great Britain and the Copyright Act of 1790 in the United States. In Europe, the foundation was the Berne Convention of 1886, which united countries around international standards for copyright protection. Copyright, as we see it today, has gone through many changes through judicial precedents. For example, in the United States, the Feist precedent Publications v. Rural Telephone Service (1991) established the originality test, which requires a work to contain a minimum level of creative uniqueness to be protected by copyright. In the UK, a similar principle was upheld in the Lucasfilm case Ltd v. Ainsworth (2011). In the EU, the Infopaq process has become key International A / S v . Denmark Dagblades Forening (2009), which confirmed the need for the author's "own intellectual contribution" to a work.

With the development of generative AI, disputes between artists and the developers of its models have moved into the realm of litigation. Thus, in the United States in 2023, a high-profile lawsuit was filed by artists Sarah Anderson, Kelly McKernan, and Carla Ortiz against the companies Stability AI, Midjourney, and DeviantArt. The artists claimed that these companies illegally used their works in the process of training the AI, thereby infringing their copyright. The defendants, for their part, insisted that there was no direct copying, arguing that the models were only learning styles, not directly copying the works themselves.

A similar lawsuit was filed by Getty Images vs. Stability AI in the UK. Getty Images said millions of its images were illegally used to train the Stable neural network Diffusion. While Stability AI appealed under the text and data mining exceptions, but the case remains pending.

While these cases highlight the challenges of protecting artists' works under traditional copyright law, many artists and illustrators are finding technological solutions to the problem on their own. One proposed solution is for artists to add special marks, or watermarks, to their works to signal that the work should not be used to train neural networks. This approach is in line with the EU's Digital Single Market (DSM) Directive, but its effectiveness depends on the integrity of the AI developers themselves. Another more aggressive measure, known as "image poisoning" of an artwork, subtly disrupts the pixels of an artwork without significantly altering it to the human eye. Tools like Glaze or Fawkes impair the ability of an AI model to learn and reproduce the style or content embedded in the poisoned image.

While such "poisoning" can harm a model's performance, it is by no means a blanket protection, as sophisticated AI algorithms can adapt to or ignore the introduced violations.

In addition, some artistic creators use traditional digital rights management principles or participate in commercial licensing platforms that are specifically designed for training AI. In these scenarios, companies wishing to train their AI models on high-quality works of art can do so legally by paying a license fee, ensuring that artists are compensated as they are and that their work is used in a traceable manner. However, technical copyright protections can still be circumvented, and many AI developers collect data from broad public sources without regard for the preferences of specific content owners. Therefore, incorporating changes to modern copyright law at the legislative level remains crucial to removing barriers between the two sides of the debate – creators and AI developers.

How can AI companies defend themselves against lawsuits?

It should be noted that today, lawsuits initiated by artists against companies developing neural networks are becoming more common and resonant. Such lawsuits can significantly harm technology companies, slowing down the development of innovation and holding back scientific progress. To minimize such risks, neural network developers should consider in advance several approaches that have already proven their worth in judicial practice or can be effective in preventing possible lawsuits.

One of the most common and proven legal tools is the doctrine of fair use ("Fair Use" in the United States) and the similar doctrine of fair dealing ("Fair Dealing" in the United Kingdom). These legal mechanisms allow the use of copyrighted works without prior permission if the purposes of the use meet certain criteria, for example, if the use is educational, research, transformative and does not significantly harm the market value of the original used.

Creative process of the developer in creating an AI neural network

A notable example of the applicability of this doctrine is the high-profile Google Books lawsuit. In the mid-2000s, Google began an ambitious project to digitize millions of books without the express consent of authors and copyright holders. The goal of the project was to create a giant, free digital archive where users could search for books and view fragments of their texts in electronic form. Numerous authors and publishers immediately filed lawsuits against Google, claiming that scanning and storing their books without consent violated copyright. This lawsuit caused a wide public outcry. However, after lengthy proceedings, in 2015 the US Court of Appeals for the Second Circuit ruled that Google's actions were lawful, as they fell under the Fair Use doctrine. The court recognized that the Google Books project was transformative in nature, significantly different from the original works in form, purpose, and nature of use, and also did not create a direct threat to the market for original books, but on the contrary, helped the development of culture and science.

Another argument for the defense of AI neural network companies may be the lack of legal protection for artistic style. Copyright in the US, EU and UK only protects expressed and recorded works, not abstract ideas, concepts or artistic styles. For example, the famous American case Baker v. Selden (1879) emphasizes that ideas in themselves cannot be protected by copyright, and only specific forms of their expression are subject to protection. Similar logic was confirmed in the British case Designers Guild Ltd v. Russell Williams (2000), where the court emphasized that only specific and recorded parts of a work are protected elements, not general artistic techniques or trends. This means that companies can confidently claim that neural networks do not copy individual works, but only learn to recognize artistic techniques and methods that are free to be borrowed.

The third possible defense argument is the analogy of the neural network learning process with human learning. After all, the neural network, like an artist, studies works, evaluating many samples and then creating its own unique works. At the same time, the neural network does not copy or reproduce individual works, does not store or sell original works. From a legal point of view, this argument is important, as it demonstrates that the neural network learning process is comparable to the human learning experience, when a student artist or aspiring illustrator visits museums and galleries, looks at the works of great masters and thus learns to create their own works without conflicting with the artists' copyright.

To reduce the risk of lawsuits and protect themselves as much as possible from legal claims from artists, neural network development companies can follow the following recommendations.

The first is the creation of a transparent and clear system of licensing materials for neural network training sets. Companies should use only licensed materials or works in the public domain, licensed under open licenses (for example, Creative Commons Zero), or directly negotiate with copyright holders on licensed use. For example, companies can cooperate with well-known image selling platforms (Getty Images, Shutterstock), concluding licensing agreements and fairly compensating authors for the use of their work.

Companies can also create special public registries and give artists the right to register their works in order to be fully or partially excluded from the training samples of neural networks. This will make neural network training more transparent and provide artists with a convenient tool for protecting the copyright to their works.

The next recommendation is based on the legal principle of "safe harbor." This principle is reflected in the US Digital Millennium Copyright Act and the EU Copyright Directive. According to this principle,

Diagram of the AI neural network training process for recreating an artist's painting

platform companies can be protected from direct legal liability for hosting or using copyrighted content if they promptly remove such content upon request from copyright holders. Here is how the principle is formulated in US law: "A service provider is not liable for infringement of the copyright of a third party if it promptly removes or disables access to the material upon receipt of notice of infringement from the copyright holder."

Thus, the application of the above principles and recommendations will allow companies to effectively protect their interests, while ensuring a fair approach to the use of artists' works and balancing between the technological development of AI and the protection of the copyrights of creators.

Who owns the copyright to AI-generated works?

One of the most controversial issues in modern

The painting by artist Carla Ortiz (left) and the image created by the AI trained on her 'poisoned' work (right)

legal practice is determining the copyright holder for works created not by humans, but by AI. Today, the principles for determining authorship of such AI works differ in the US, UK, and EU.

For example, in the United States, according to the current Copyright Act (1976), the copyright holder can only be the person who directly created the work. This position was further confirmed by the US Copyright Office in 2023, explicitly stating that works created solely by neural networks without direct human participation cannot be protected by copyright, since the law requires the presence of a creative human contribution. This creates a situation in which AI-generated works find themselves in a legal vacuum, since they cannot be registered either for the developer of the neural network, or for the user who made a request to create a specific artistic work, or for the company that owns this AI model. For example, in the high-profile case of "Thaler v. Perlmutter» (2023), a US court upheld the position that a work of art created solely by AI has no copyright holder, since, according to US law, only a person – the creator of the work – can be recognized as an author.

In the UK, on the contrary, the legislation takes a more flexible position. According to the Copyright, Designs and Patents Act (1988), the author can be considered not only the person who created the work, but also the person who "organized and controlled the process of creating the work." The EU legislation also does not provide a direct answer to the question of the ownership of works created by AI and is still based on the principle of the presence of a creative human contribution. However, the existing legal uncertainty around this issue has already become obvious and requires the development of new approaches and solutions.

There is currently some discussion in academic circles about granting a special status to such works as "objects of limited copyright" or creating a separate category of intellectual property specifically for AI-generated works. This would allow for a differentiated legal protection regime, granting limited rights to the companies-developers or users who direct and control the work of neural networks, provided that there is transparency regarding the sources of data used to train the neural network.

An objective solution to this issue must take into account the balance of interests of all parties: artists seeking to retain control over the use of their works, companies investing resources in the development of AI technologies, and society interested in cultural development. For now, such changes are under discussion, and the question of who owns the copyright to works created by AI remains open.

Thus, the problem of protecting the rights of artists in the era of AI requires a comprehensive approach that will maintain a balance between the rights of creators and technological progress . The solution to this issue lies not only in the legislation, but also in the development of ethical principles, standards and international cooperation. Only through the joint efforts of states, the international community and legal experts will it be possible to ensure the improvement of copyright for created works of art, which is fair both for their creators and for the developers of artificial intelligence.

Court hearing regarding the lawsuit on the case of copyright infringement by the artist

On the problems of systemic thinking

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As is known, the analysis of any problem consists of human mental activity, which requires the most use of logical thinking. In this regard, it is most important to understand the advantage of considering the substance/object under study *(lat. substantia - essence)* precisely from the standpoint of systems thinking.

If the substance under study, subjected to the methods of system analysis, is called a real entity or simply an object, then in most cases, during the course of the analysis, we seem to imperceptibly penetrate into the substance itself. Sometimes, in the process of analysis, we obtain a sufficiently satisfactory result, and sometimes, the result revealed is not sufficiently acceptable, and then it is inevitable to return to the analysis of this problem again and again. As in life, so in the choice of any system, the necessary decisions are directly made by the person himself. To obtain the right decisions, he turns to various aspects or approaches of his thinking.

There are many methodological approaches to defining the concept of human thinking. For example, thinking is the highest level or stage of human cognition; thinking is the process of human cognition of the surrounding real world; Thinking is the creation of ideas about objects and phenomena, the search for connections between them and solutions to problems. In the well-known literature, the main goal of human thinking is also designated: to comprehend the information received about the substance/object of study, to recognize the deep connections and properties of objects and phenomena in them, to track their cause-and-effect relationships, to find optimal solutions to problems and to generate new ideas .

It should be noted that there are many well-known scientific works with different approaches to the concept of system analysis. It has been established that for a number of reasons, system analysis is a very complex mental procedure. Analysis of the development of research methodology, characterized by the terms: “system theory and system analysis, system approach”, and, more recently, - namely “system thinking” shows that a generally accepted, standard interpretation of these concepts has not yet been found. Various sources of information tell in detail and at length about the advantages of system analysis, and it is considered as if the reader is a researcher, and basically he already knows and applies the methods of system analysis himself. And therefore, the authors of these publications offer for discussion many methods for improving system analysis. Although, a sufficiently clear methodology for approaching the system analysis itself has not yet been proposed.

The development of methods of thinking and the widespread use of new modern means of computer technology, the development of computer applications and technologies, as well as methods of artifi-

Using systems thinking when working on a project

Schematic representation of the systems thinking process

cial intelligence for solving various problems, as well as managing production processes, require from the researcher of each profile the appropriate level of education and skill, at the proper level of knowledge, in using methods of systems thinking in analysis, modeling, optimization of calculations, as well as the synthesis of optimal systems.

The human brain of the 21st century is distinguished by the possibility of two types of thinking. The first type of thinking is, so to speak, ***useless or passive thinking***. This is when, regardless of whether the brain has a task or not, it still wants to solve something. Even if you do not demand a solution to some issue, any thought – information that enters the brain will seem to spin around in your head many times. At the same time, a bunch of complications accumulate in the brain – it endlessly repeats the same thing inside us, like an eternally grumbling old maid (the book «Sri Aurobindo, or the Journey of Consciousness», author Satprem, 1970, 193 p.). A thinker who understands this seeks methods that help reduce the influence of passive thinking - the almost continuous «hum of the brain - buzzing of the thinking mind in our life, a person of the 21st century.» All techniques, starting from simple meditation exercises and including methods of yoga, religious understanding and other types of education are dedicated to calming the thinking activity of a person, reducing the influence of his passive useless thinking. Therefore, researchers who have achieved calming their thinking activity or switching it to solving other necessary problems achieve certain successes.

Professor Jonathan Bendor's approach to problem-solving using fundamental building blocks

The second type of thinking is goal-oriented thinking. It is aimed at solving some issue (task, problem, etc.). It is when talking ***about systemic thinking*** that we need to proceed directly from the use of this second type of thinking. In this case, after selecting a task, the substance/object being studied is analyzed systemically to solve it. We can talk about several levels of systemic thinking in this second type of human thinking.

Zero level (or we can say - zero stage or stage) **of thinking.** Here the analysis is carried out without much detail. This is essentially ***a simple everyday analysis.*** Sometimes this contributes to the emergence of simply erroneous solutions to the problem under study.

Let us give a simple example from production activities. Due to the complexity of the analyzed problem or the managers' ignorance of the transition to higher levels of thinking and without a comprehensive understanding of the analyzed problem, a number of production engineering and technology enterprises suffered. In particular, due to an incorrect management decision, there were multimillion-dollar losses

Schematic representation of the human thought process

during the implementation of a direct extraction oil extraction line for the production of vegetable oil in the 1970s. And there are quite a lot of such management errors in other production industries, including agricultural ones.

First level thinking. In this case, the analysis of the substance is carried out with a certain detailing of the substance. This is ***the beginning of a systemic approach,*** and ultimately gives some positive result.

The second level of thinking. Here the substance is analyzed with a certain level of detail and with possible consideration of the mutual influence of some of its parameters. This allows for a more realistic ***systemic approach to be implemented when analyzing the problem.***

The third level of thinking. In this case, the substance analysis is carried out with its comprehensive detailing and with the definition of the mutual influence of all the most important parameters of the substance. This is a more ***advanced systemic approach.*** Based on this approach, major problems of the socio-economic development of states were once solved at the state level, for example, in the USA by Abraham Lincoln, Theodore Roosevelt and others, in Uzbekistan by Usman Yusupov, Sharaf Rashidov and others, as well as by great thinkers - Deng Xiaoping (China), - Lee Kuan Yew (Singapore), statesmen of Japan, etc.

The fourth level of thinking. At this level, ***system analysis*** is carried out with the definition of a number of sub-substances in the hierarchical stages of the analysis being carried out, as well as their parameters and the mutual influence of the parameters of each sub-substance and the substance itself. Such analysis should be used in determining the optimal conditions for managing organizational systems, in engineering sciences and technological practice based on artificial intelligence. Researchers, using the methodology of the fourth level of system thinking, will be able to overcome many errors, thereby reducing financial costs and losses, as well as possible risks in obtaining correct results.

A researcher, studying the methods of systemic thinking of the substance of the study, receives an additional creative stimulus for revealing the potential of his personality, this helps him consistently demonstrate his abilities and talent, form knowledge and analyze systems and processes in turn, acquire the ability to find and use optimal management solutions. This contributes to an increase in the thinking potential of researchers as a whole, as well as an increase in their dedication and effectiveness in the creative analytical process.

Thus, systems thinking is an integral part of the creative process and human thinking in general.

Mountain cities on the routes of the Great Silk Road

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For centuries, the vast mountain ranges of Central Asia were perceived as uninhabitable, thought to be inhabited only by small herding nomadic groups and scattered small villages. However, as a paper published in the journal Nature in recent months argues, recent scientific and methodological advances in Uzbek archaeology are fundamentally changing this view.

Research conducted using high-resolution laser scanning technology LiDAR (**Li ght D etection and R anging), mounted on an unmanned aerial vehicle (UAV), i.e. a drone , show that in the mountainous areas of the Zaamin and Bakhmal districts of the Jizzakh region of our country, a thousand years ago, there were large cities previously unknown to science. In the Middle Ages, these regions were located within the historical and cultural territory called Ustrushana. The discovery of these archaeological ruins, called Tashbulak and Tugunbulak, has a great impact on our understanding of the socio-political structure of such empires as the Turkic Khaganate and the Karakhanid state, which played an important role in the development of urban planning, the transcontinental trade network of the Silk Road and the formation of the Uzbek people in the 8th - 11th centuries.** In addition, this latest discovery challenges our long-held ideas about the urban culture that developed in mountainous areas and demonstrates the ability of medieval society to adapt to difficult environmental conditions and maintain a complex urban infrastructure.

1. Discovery of forgotten mountain cities

Archaeological research into these historic urban centres was initiated in 2011 by an international research team led by Farhad Maksudov, a research fellow at the National Archaeological Centre of the Academy of Sciences of the Republic of Uzbekistan, and Michael Frachetti, a researcher at the University of Washington (St. Louis, USA). They conducted fieldwork on the Morguzar (Snake's Trail) mountain range in the Jizzakh region, which had not been thoroughly explored by archaeologists before, and during preliminary observations discovered fragments of ancient ceramics and remains of architectural structures at the top of the mountain range, indicating human habitation in the area. Excavations at this pasture, which local shepherds call "Tashbulak" ("Stone Spring"), at an altitude of 2,100 metres above sea level, revealed a new archaeological site of approximately 12 hectares – a large ancient settlement previously unknown to science.

Further research has shown that the city had a sophisticated urban infrastructure, including a defense system, a planned road network, and specialized production centers. The presence of irrigation canals confirmed the strategic flexibility of these mountain communities and their ability to support agriculture in difficult natural conditions. Artifacts and trade goods found show that Tashbulaq was deeply connected to the Silk Road economy, indicating that the city was an important hub for the movement of goods such as textiles, ceramics, and metal products.

Additional surveys conducted in 2015 revealed another major city, Tugunbulak, covering an area of almost 120 hectares. This site had a larger and more complex urban planning system than Tashbulak, and included the remains of planned residential areas, administrative buildings, and industrial production areas. Surveys using joint UAV-LiDAR (drone-mounted laser scanner) technology revealed the presence of a large architectural complex at this urban center, confirming that the city may have served as a civic, religious, or administrative center. The regional planning system of Tugunbulak indicates the presence of a high-level administrative apparatus, proving that the city served as a major center of trade and governance.

Extensive research in recent years has revealed the existence of smaller satellite settlements around these larger cities, suggesting the existence of a complex network of regional cooperation in the Middle Ages. These smaller settlements may have served as agricultural supply centers or specialized production complexes that supported the economic activities of Tashbulak and Tugunbulak. These discoveries con-

Excavation process of the remains of two medieval cities – Turgunbulak and Tashbulak

firm that urban development along the mountainous sections of the Silk Road was a more complex phenomenon than previously thought. Typological studies of pottery found in these settlements and radiocarbon dating of artifacts indicate that these cities expanded and then shrank at certain periods, which may be related to natural environmental changes and geopolitical conditions.

2. LiDAR and the Future of Archaeological Research

The scientific achievements at Tashbulak and Tugunbulak have opened a new page in the archaeology of the Great Silk Road, in which advanced technologies play an increasingly important role in shaping research paradigms.

Due to the difficulty of conducting research in mountainous areas, traditional archaeological methods have proven insufficient to determine the full extent of these settlements. However, the use of LiDAR technology has revolutionized the field by revealing hidden structures beneath dense vegetation and layers of sediment accumulated over many years. LiDAR's ability to create high-resolution models of the earth's surface has allowed us to study the size and complexity of these sites with unprecedented precision.

LiDAR data analysis revealed extensive defensive systems, a network of urban roads, and multifunctional architectural features, suggesting that these settlements were not seasonal settlements but stable urban centers with complex infrastructure. The discovery of trading areas, smelting workshops, and ceremonial complexes confirms that these cities had a high level of economic diversification. LiDAR also revealed new roads, irrigation canals, and underground water supply systems, allowing for a more detailed reconstruction of medieval urban planning.

In addition, LiDAR images revealed the remains of an extensive water management system, including ponds and canal networks. This discovery is particularly important because it sheds light on the hydraulic engineering strategies used to support urban populations in arid and mountainous regions. The presence of agricultural terraces confirms that these cities had local food supply strategies, which in turn indicates that they were not entirely dependent on external food sources, but were able to sustain themselves

Excavation process of the remains of two medieval cities – Turgunbulak and Tashbulak

through terraced agriculture, water storage systems, and seasonal trade.

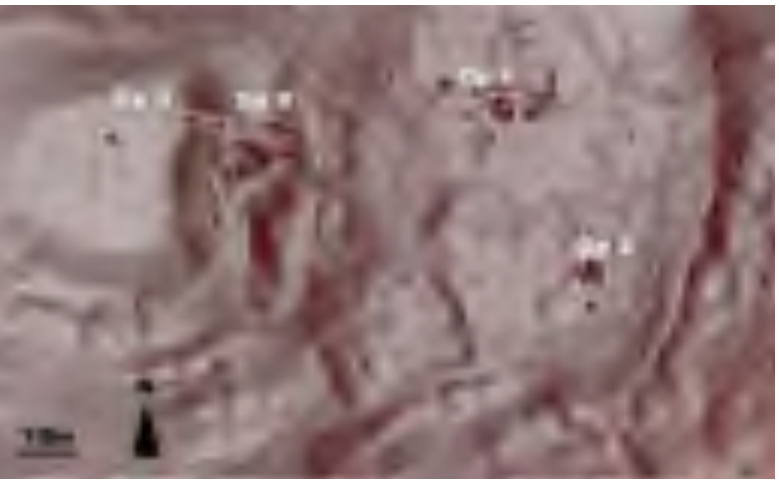
Thanks to these technological advances, scientists can now reconstruct urban landscapes in three dimensions. This makes it possible to visually analyze the growth of ancient settlements, land use dynamics, and infrastructure development. These reconstructions not only serve as an important source for scientific research, but are also important for the preservation of cultural heritage. They also provide virtual access to these unique archaeological sites for the global archaeological community and the general public.

The rapid collection and analysis of data obtained using UAV-LiDAR technology has significantly increased the efficiency of archaeological research, allowing scientists to reconstruct vast urban landscapes with minimal excavation.

3. Social anthropology of medieval mountain towns.

The economic stability of the mountainous cities of Tashbulak and Tugunbulak was closely linked to their strategic location on transcontinental trade routes. Excavations have revealed evidence of extensive metallurgical activity, including iron and steel production, indicating that these cities were important industrial centers for Silk Road traders. Proximity to raw material sources and access to surrounding for-

LIDAR (Light Detection and Ranging) is an important technology widely used in modern topographic surveying with drones



Research conducted using UAV-LiDAR technology (laser scanning of the site area with equipment mounted on a drone)

ests used as fuel facilitated the development of large-scale metallurgical enterprises. In addition, evidence of bronze and copper smelting confirms that these cities had extensive metallurgical expertise and economic ties with neighboring civilizations. Metalworking was not limited to trade: local artisans produced weapons, agricultural tools, and decorative items, which served to strengthen the economic and social fabric of these cities.

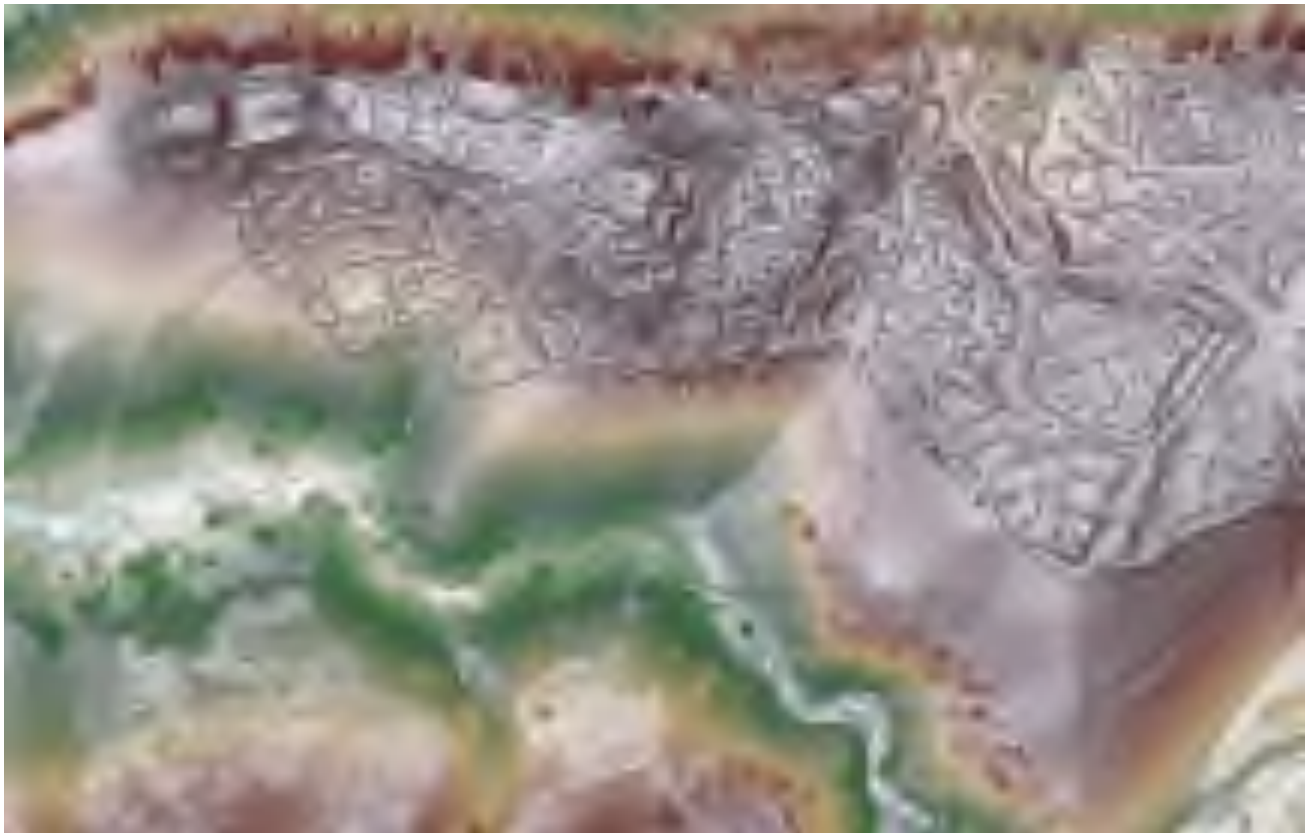
In addition to metallurgy, craft centers were formed in these cities, where textile production, leather processing, and ceramics were developed. Archaeobotanical analysis and analysis of animal remains (archaeozoological analysis) show that in the mountainous and climatically unfavorable areas of Tashbulak and Tugunbulak, only small-grain products were grown on agricultural lands and there were separate gardens of small-fruit crops, while all other agricultural products were brought from afar, that is, from flat areas. These mountain cities were quite important for ensuring the supply of products from long distances. This helped to ensure their food security. Granaries and warehouse complexes indicate that these cities used a centralized system of resource distribution, which indicates a developed administrative management. Imported glazed ceramics and sewing equipment were also found, which suggests that the cities produced high-quality products and, possibly, important goods for distant markets.

The discovery of caravanserais and fortified trading posts along the roads leading to these cities confirms their deep integration into the Silk Road trade networks. These structures not only hosted traders and their caravans, but also served as points of cultural exchange. Here, technological advances, artistic traditions, and ideological views were disseminated among peoples who arrived from different regions.

The coins of Khorezm, Bukhara, Samarkand, Tashkent and Fergana found here, as well as traces of Sogdian and Turkic cultures, show that these settlements had a multi-ethnic and cosmopolitan (multicultural) character. According to written sources, the highest quality steel weapons of Maverannahr were produced in the Ustrushana Mountains, where traders came from Baghdad, Iran, Byzantium and China. Analysis of ceramic dishes and some products confirms that these cities not only produced goods for export, but also consumed expensive imported goods, and therefore had a level of prosperity typical of large trading centers.

Politically, the fortified defensive systems in these areas indicate that the cities of Tashbulaq and Tugunbulaq were strategically important and protected from potential attacks. The discovery of the remains of more than 300 structures in one location suggests

The ancient historical and cultural region of Ustrushana (mountainous areas of Zaamin and Bakhmal districts in the Jizzakh Region). Source: SAIElab/J. Berner/M. Frachetti



that these cities operated under centralized control and were likely linked to larger political structures or confederations, such as the Turkic Khaganate. This challenges traditional notions that mountain settlements were dependent or of secondary importance to the main cities on the plains. In addition, the discovery of warehouses where food and weapons were stored indicates that the cities had a well-thought-out system of governance and a strategy for military preparedness. These cities may have functioned as regional capitals, exerted influence over surrounding settlements, and played an important role in the wider geopolitical landscape of Central Asia.

New findings show that these cities were not just defensive fortifications, but thriving urban centers with complex social hierarchies. The existence of elite residences and special administrative sections of the city confirms that life in these cities was led by a ruling class responsible for resource management, trade agreements, and infrastructure development.

The presence of the oldest Muslim cemetery discovered in Central Asia at Tashbulak indicates that the city played an important role in the spiritual and ideological life of the Silk Road, and was a center of religious and ideological exchange. The Muslim burial rites studied here demonstrate the fusion of various cultural influences, and the architectural styles incorporate elements of various Silk Road civilizations.

The enduring importance of these cities demonstrates that mountain urban centres were more dynamic and influential than previously assumed. A combination of archaeological, ecological and historical research continues to illuminate the multifaceted role of these cities, including their contribution to trade, politics and cultural exchange in medieval Central Asia.

Conclusion

The discovery of Tashbulak and Tugunbulak opens up a new approach to the urbanization of the medieval Silk Road. Once considered remote areas, these mountain settlements are now interpreted as centers of trade, governance, and innovation. The application of modern archaeological techniques has revealed not only the physical structure of these cities, but also restored their historical significance within the wider Eurasian network.

The significance of these discoveries extends beyond archaeology to broaden our understanding of the resilience and adaptability of medieval societies to challenging environmental conditions. The complex infrastructure, economic specialization, and defense strategies revealed suggest that highland settlements played a more important role in regional geopolitics than previously thought. The economic contribution of metallurgy and craft industries made these cities important hubs of transcontinental trade networks, and their governance systems demonstrate a level of political complexity typically found only in lowland cities.

Moreover, these results highlight the need to reconsider historical views on Silk Road urbanization.

Detailed fragment of one site C, shown at an enlarged scale from the previous image (9th–10th centuries AD)

Traditional studies often prioritize lowland centers such as Samarkand and Bukhara, ignoring the role of strategically located but smaller mountain towns. Tashbulaq and Tugunbulaq contradict these views, demonstrating that medieval urbanization was much broader and more diverse than previously thought. Future research may reveal other mountain towns, further expanding our knowledge of the social, political, and economic landscape of medieval Central Asia.

In the future, technological advances and interscientific collaborations will further illuminate these urban landscapes. Integrating LiDAR technology with bioarchaeological and ecological studies allows for more accurate reconstructions of historical land use, population movements, and climate change. As excavations expand and computer modeling techniques improve, the history of Central Asia's mountain cities will be rewritten and our shared understanding of the medieval Silk Road civilizations will be further enhanced.

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Interpretation of historical dramas in the Samarkand theatre

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Theatrical art, which occupies an important place in the cultural life of our people and is an integral part of art, confirms that the first unique example of our national drama was presented in Samarkand. The work «Padarkush», created by the propagandist of the ideas of Jadidism Mahmudhoja Behbudi, became the basis for the emergence of Uzbek drama. The publication of the play «Padarkush» was not only a significant event for Behbudi or the intelligentsia of Samarkand, but also served as an impetus for the revival of social and cultural life in all of Turkestan, to the emergence of new educational communities based on theater lovers[1].

During the years of independence, as a result of a change in attitudes towards history, interest in cultural values increased and the need arose for historical dramas to appear on the stage of Uzbek theatres. "It is known from the history of theatrical art that plays about the distant historical past, although not often found in repertoires, usually arouse great interest... Historical drama in all periods of development of Uzbek theatrical art was a means of expressing important aesthetic principles in the art of directing and acting[2]."

Recently, creative research has been carried out on the stage of the Samarkand Regional Musical and Drama Theater, and plays have been staged of various genres and on current topics. In particular, historical plays and plays dedicated to historical figures were staged. The theater team, in its characteristic interpretation, staged the historical plays "Samarkand sayqali" ("The Charm of Samarkand") by Iqbal Mirza, "Mirzo Ulugbek" by Maksud Shaikhzade, "Bibikhanum" based on the work "Queen of Turan" by Shakhodat Isakhanova, "Ishq bo'stoni" ("Garden of Love") based on the poems "Lison ut-Tayr" by Alisher Navoi, "Sultan dush Sheikh Nizami Ganjavi" by Iftikhar, "Yalangtush Bahadir" by Farman Toshev.

When a work about a historical figure is staged, the viewer is forced to think about how historical events, plots, actions, condition and thoughts of the heroes have significance in our time. The director, turning to a historical work, first of all thinks about influencing the worldview of his contemporaries by various methods and means. He can also use symbolic means and artistic textures so that the viewers, observing the life of a historical hero on stage, can form a broader idea of him.

On the stage of the Samarkand Theatre, in collaboration with Azerbaijani colleagues, another historical dramatic performance was presented about the life and creative work of Nizami Ganjavi, whom Mir Alisher Navoi considered his spiritual teacher, mentioned him among the sheikhs in his "Nasaim ul-Muhabbat", and in the 12th chapter of "Khairat ul-Abror", the first poem of "Khamsa", he said:

He is the poets' king, by the Creator's grace,
The shining jewel in Ganja's proud embrace.
A peerless pearl of noble, timeless worth,
A flawless gem in thought's vast ocean birthed.

The play in two parts and fifteen acts is lyrically passionate and depicts many historical events related to the life and work of Nizami Ganjavi (the author of the drama «Sultan of Souls - Sheikh Nizami Ganjavi» is the Azerbaijani playwright Iftikhar Priyev. The director is the Honored Artist of Azerbaijan Sarvar Aliyev). The poet's poetry collections were widely used. The author reflected the contradictory life and work of the poet Ganjavi in the historical drama, using symbolic expressions and mystical elements.

The work extols true talent and creativity, and such concepts as justice, truth, love and soul are used to promote the main idea. Director Sarvar Aliyev brings the great poet Nizami Ganjavi and the emotional experiences of the heroes of the epic «Khamsa» to the stage. Honored Artist of Uzbekistan Bakhtiyor Rakhimov was entrusted with embodying the image of Ganjavi. Also, a lot of actors are involved in the historical

[1] Riza yev Sh. Jadid dramasi. "Sharq" nashriyoti, 1997. P. 54

[2] O'zbekiston san'ati (1991-2001 year). -T.: "Shar q ", 2001. P. 145

Samarkand Regional Musical Drama Theater

Scene photos from the legendary play "Ishq Bo'stoni" ("Garden of Love"), directed by the Chief Director of the Theater, Sh. Sanakulov, based on Alisher Navoi's work "Qush tili" ("Lison-ut-Tayr"), adapted by Sh. Muradov

performance. Stage and costume designer Bakhrom Safoyev created historical costumes and unique stage decorations reflecting the era and social environment in which Ganjavi lived. Without unnecessary details, he depicted on the stage the modest house of Ganjavi and the majestic palaces of kings and emirs.

Become love's slave—no higher call remains,
What other light for brave hearts still sustains?
Were all the world's soul barren, void of flame,
Who'd see this shelter live, or speak its name?
From love's fierce fire, my smoke spread far and wide,
And reason's eyes I veiled with ash and pride.

The play begins with a poetic excerpt on behalf of Ganjavi. The monologue heard in the prologue of the play makes the initial emphasis in revealing the idea of the play: "The creation of the world is also connected with the pearl of love. That is why I am a poet of love. But my main idea is for the truth to take place in the hearts of people. And lovers too... The truth is great for me. I want the truth to be in the hearts of people – from the sultan to the common man." Since Sheikh Nizami Ganjavi was an outstanding thinker of his time, the rulers wanted him to create in their palaces. But Ganjavi wanted to create freely. The play begins with this dilemma. If the conflict of the heroes of the play occurs between Ganjavi and the court poets, then the internal conflicts and emotional experiences of the poet are also shown on the stage. Court poets such as Muzaffari, the Deaf Poet, the Lame Poet and the Stupid Poet envied Ganjavi's work and hated him.

In the second act of the play there is a scene of conflict between Ganjavi and the poet Muzaffari, in which the personality and aspirations of the poet are revealed. As a comparison, the worldview of the poet Muzaffari, his envy, opposed to true talent, is presented. The director tried to reveal such properties of people through the behavior of the heroes of the play. However, throughout the action, the dynamics of Ganjavi's (Bakhtiyor Rakhimov) performance does not change either at the beginning, or in the middle, or at the end of the play. No twists and turns arise.

The production shows the influence of the Meyerhold Theatre, Meyerhold's direction, his style on the

Historical drama "Yalangto'sh Bahodir", directed by G. Mardonov, based on the script by poet and playwright F. Toshev

Scene from the play "Mirzo Ulug'bek", staged at the historical ensemble "Registon" square in Samarkand

Historical drama "Yalangto'sh Bahodir", directed by G. Mardonov, based on the script by poet and playwright F. Toshev

work of director Sarvar Aliyev, and the use of his forms in the production of the play is noticeable. The reason is that in conversations with the actors, the director told them that it is necessary to use the art of presentation, and not the art of experiences. He emphasizes the need to reveal the character of the image, without succumbing to pathos. "In Meyerhold's methodology, attention is paid to the external technique of the actor. It is known that Meyerhold knew, as Stanislavsky required, that it is important to reflect not the actor's internal experiences, internal sorrows and joys, but to depict them externally - openly, widely, in a visible way, through the use of hands - gestures, eyes, facial expressions, and took into account that this has a deeper impact on the audience[3]. When staging a play, director Sarvar Aliyev makes the following demands on the actors. Therefore, the characters performed by the actors seem sluggish, monotonous, one-sided.

Both in the play and in the stage interpretation, the conflicts of opposing forces are not so sharply expressed. Perhaps, due to this, the viewer can guess how the performance will end. If the composition of the work was consistent, the viewer could not reduce his attention from scene to scene. It can also be added that the play contains scenes with the participation of epic characters from the «Hamsa» of the main character, which determined the incoherence of the composition and the protracted plot. Undoubtedly, increased attention to the plot of the work depends on the presence or absence of a bright plot. «If the plot expresses the main conflicts, then the plot is a chain of events in which these conflicts are realized.»[4] In the performance, this «chain» was broken and damaged the artistic integrity of the work.

A director staging a historical drama must not only fulfill a spiritual task, but also try to paint a deeper picture of the past, studying high morality, faith, and the foundations of our national culture in historical heroes; widely revealing and popularizing them. Young director Gafur Mardonov, who took on such responsibility, staged the historical drama "Yalangtush Bahadyr" by Farmon Toshev on the stage of the Samarkand Theater.

«Yalangtush Bahodir» («The History of Registan») is a one-part, 11-act historical drama about the life and work of the 17th-century ruler of Samarkand, a skilled military leader, statesman, and great builder, Abdulkarim Yalangtushbiy Bahadyr son of Baykhodja, who built the Sherdor and Tillya-Kari madrasahs on the world-famous Registan Square and was also concerned about the improvement of cities. The language of the play is smooth and free of intricate words and expressions, and is understandable to both the reader and the viewer.

The prologue of the play begins with a monologue by the character «Mother Earth». It describes a kind of credo of the title character of the play, Yalangtush Bahadyr. Although the inclusion of this character in the stage production is a positive moment for enhancing its artistic quality, even if it were removed, it would not harm the artistic integrity of the play. On the contrary, it would prevent the events from being drawn out. In order to convey the atmosphere and views of the 17th century, it is composed of scenery depicting the appearance of the palace, the throne and the shield. We understand that the shield depicts the main character's readiness to protect his country and its people from evil forces, evil intentions and invasions. Under the shadow of this shield, state affairs are conducted, conflicts occur in the palace, and a struggle for the throne is underway. The mise-en-scene of the play is built correctly, but in some scenes, moments can be noticed that interfered with the actors. Gafur Mardonov admits that the historical drama was staged in a minimalist style, without unnecessary details, and the qualities of Yalangtush Bahadyr as a fair commander and a ruler-creator were emphasized with the help of symbolism and conventionality.

[3] Maxmudov J. XX asr rejissurasi namoyondalari. - T.: Alisher Navoiy nomidagi O'zbekiston Milliy kutubxonasi. 2015. Pp. 14-15
[4] To'laxo'ja y eva M, Qozoqbo y ev T. Drama nazariyasi. -T.:2014, p. 14.

From this we can understand that the play was staged in a traditional manner, and the actors were asked to pay more attention to their actions and movements than to the inner experiences of historical figures. The conflict, "which is the basis and soul of the drama"[5], unfolds in the play between Bahadir Yalangtush and Babakhoja Muslim. Babakhoja Muslim, in order to seize the throne, tries to overthrow Bahadir Yalangtush, weaving intrigues and conspiring. However, in the stage work the conflict is not expressed so vividly, it is reduced to the level of a collision.

In terms of acting, the talented actor Alijan Khasanov embodied the image of Bahadyr Yalangtush, based on his acting abilities, and focusing on his qualities as a strong commander, a fair ruler, a family man and, in addition, a loving father, a creative person. Actor Farid Rasulov, on the contrary, masterfully portrayed in negative colors the image of Babakhodzhi Muslim, a hypocrite, a conspirator, a slave to his desire for the throne and wealth. Also, actresses Guzal Kurbanova and Shokhsanam Ablakulova masterfully played the daughters of Bahadyr Yalangtush, princesses Iklimabana and Oybibi, incomparable beauties and clever girls, and, at the same time, true to their word and brave when circumstances require it.

We also know from history that Bahadir Yalangtush had a son named Boybek. But due to illness, he died before his father. He was a very smart, reasonable, brave young man. Although Boybek could not participate in battles with his father, he actively participated in state affairs and tried to supervise the construction of a madrasah. But the actor Behruz Kurbanaliev, who played the role of this character in the play, portrayed him very inexpressively. Instead, the character of his younger sister Oybibi came to the fore.

In the stage production, all means serve a single idea and theme. However, it should be noted that when staging both historical plays, no attention was paid to the music of the work.

The interpretation of these two historical dramas staged on the Samarkand stage led to the following conclusions:

- the topics discussed in historical works and the problems raised in them are relevant and important even today;
- staging a historical drama is an excellent school of skill for the director and actors;
- in the production of a historical work, the role of the artist, composer and, of course, designer is very important. The scenery created by the artist, the stage music of the composer, the costumes created by the designer occupy a special place in the stage interpretation of the historical drama.

The above conclusions show that the experience and methods developed in the production of historical dramas undoubtedly serve its further development.

[5] To'laxo'jaeva M. Qozoqbo y ev T. Drama nazariyasi. - T.:2014, p.31.

Fragment from the production of the historical musical drama "Bibikhonim", directed by the Chief Director of the Theater, Sh. Sanoqulov, based on the novel by writer Sh. Isakhanova "Turon Malikasi" in the script adaptation by T. Israilov

Examples of poetry on the Temurid era crockery

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It is difficult for a modern person to imagine the world around him without books, newspapers, magazines and other printed materials, some of which are actively migrating to the Internet space, expanding access to information. Today, this accessibility is measured literally in minutes and gigantic distances, and the growing speeds and global scale of "delivery" of information have ceased to surprise us.

Even more rarely do we think about how our distant ancestors managed with those meager forms and methods of information exchange that existed, say, in the Middle Ages? Yes, there were manuscripts (historical, literary, legal works) or, say, documents, letters. They became the main form of information communications and exchanges. Their abundance and diversity became the reason for the main attention of modern researchers to these types of sources.

Such manuscripts remained in the libraries of institutions (madrasas, mosques, court houses), or in private collections, and therefore their availability was limited. However, texts were not only written on paper. Everyday objects (ceramics, metal utensils, clothing, jewelry, etc.), architecture, tombstones, and many other items were decorated with texts, which in science are called epigraphy.

Inscriptions on hard objects (epigraphy) became not just information about an object or architectural monument (dates, names of masters, donors, etc.), but were a kind of mirror of elite or mass culture (depending on the status of the object). This primarily concerns inscriptions on dishes. In this case, the inscription became part of the decor of the dishes (especially when artistic types of handwriting were chosen), and its content could reflect not just market demands, but also the ideology of consumers and even manufacturers of this dishware. It is impossible to understand it without analyzing the objects that these guilds of masters produced. Moreover, there is no such information in the manuscripts that have come down to us.

Let us try to present these theses more clearly using the example of ceremonial tableware of the 14th–15th centuries, found in archaeological sites scattered across Greater Central Asia, Iran, the Caucasus and other regions that were part of the states of the late Jochid and later Temurids. They are kept in famous museums and private collections. This crockery was painted with patterns in different color schemes: patterns in black under transparent dark turquoise (sometimes green) glaze, or in blue on a white background (in imitation of Chinese crockery). The inner and outer surfaces of some of this crockery were decorated with inscriptions. According to a number of features, this crockery was clearly intended for both wealthy classes and middle-income groups.

A photograph of one of these bowls has been preserved in the archive of archaeologist M.I. Filanovich (Fig. 1). The text on it is quite legible, but this inscription is not an example of artistic calligraphy. One and a half stanzas of text have been preserved on the fragment. It was possible to find out that the bowl contains a slightly abbreviated version of the *bayts* of the famous poet and mystic Abu Sa'id Abu-l-Khayr Mayhani/Meyhani (967-1049) (*ghazal* No. 104). The full version of the ruba'i on the bowl should look like this:

Figure 2

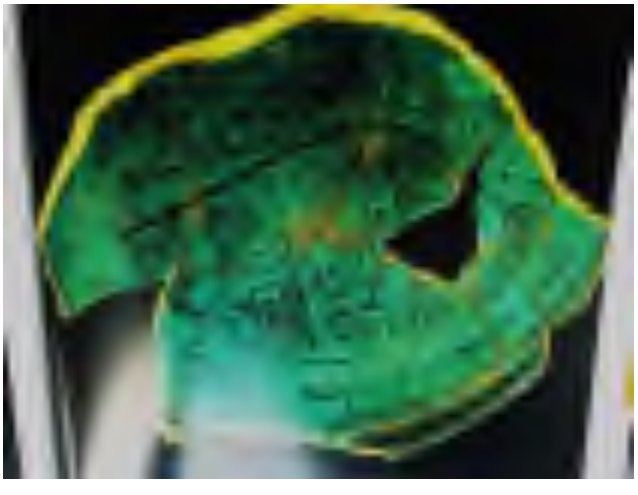

Figure 1

In the flowers [painted] on the surface of the cup my face is visible, / And in the darkness of the jug my [black] hair seems to be thrown. / Let there be a hundred advantages [to the world], for my spirit is everywhere, / And fire knocks at the door of the world, for in it is my [rebellious] disposition.

The mystical poetry of Abu Said Meyhani had a serious influence on the subsequent development of Sufi poetry in the Islamic world. His idea that a mystic who has achieved a special mystical illumination (*ishraq*) is capable of "burning the world," as in the *ruba'i* cited above, was especially often played up in the poetic milieu. First of all, we are talking about expositions of the "special state" (*khal*) of the mystic, in whom his passionate love for the Almighty involuntarily gives rise to feelings of his own exclusivity; hence the feeling of being able to turn the world upside down with his passionate mystical love.

Meikhani's poetry gained no less popularity due to the vivid images and comparisons in his verses and the ease of memorization. His *rubai* and paired *bayts* quickly became quotable, since, while retaining their mystical meaning (as an expression of love for God), they could also be applied to quite earthly feelings.

As for the choice of a fragment of these verses as part of the decoration on the presented bowl, it is probably not worth absolutizing the mystical context of the quatrain, which, in isolation from the entire *ghazal*, can have a completely "earthly", lyrical sound. Alternatively, the choice of the "plot of the inscription" can, for example, be explained by the fact that the potter paid attention to the successful combination of the word "*tabak" (bowl)* in the first stanza, and the word *"garakh"* (jug, deep bowl) in the second, which fully connects the plot of the inscription with the object itself. Apparently, the potter considered these circumstances sufficient to place this *rubai* on his remarkable creation.

Geographically and chronologically, the closest find to the above-described complex of Timurid dishes can be considered a fragment of a bowl discovered during excavations of a bathhouse of the 14th – 15th centuries at the Otrar settlement (published by K. M. Baipakov with an inaccurate translation). The text is written in cursive italics (Fig. 2) . Part of the text is lost. Similar text is found on a metal bowl of the 16th century, kept in the Louvre Museum (plat No : MAO 2282) and on Temurid dishes kept in the Victoria & Albert Museum (inv. No. 374-1897) and in the Hermitage Museum (inv. No. IR -2144).

Based on these analogies, the full text on the Otrar cup should obviously look like this:

You are my friend and I have no other friend in this world but you, // As long as I have a soul and a heart in my body, I will not abandon you. / Let your world correspond to your desires and the will of heaven / Let the Universe be your protector! / Let all your deeds correspond to your desires, / Let God be your guardian! / Completed (text).

Let's take another text on the bowl (Fig. 3), published by the remarkable orientalist A.A. Ivanov (1929-2020). The bowl is kept in the collection of the Hermitage Museum, found in Kubachi (Dagestan).

Translation (A. Ivanov):

I washed the courtyard of the monastery with my eyes [with tears], but what is the use [of this], / This is not a place worthy of a host of dreams about you. This dish was completed in Mashhad in the year 878 [1473/74].

This text is written in the same simple cursive that we see on the Tashkent, Otrar and other similar bowls. In other words, the handwriting is not calligraphic. This couplet on the Kubachi bowl belongs to the pen of the famous poet Shams ad-din Muhammad Hafiz Shirazi (1315-1389) (*ghazal* no. 408). This is the second *bayt* of the first *ruba'i* (quatrain) of Hafiz's *ghazal*. A more complete text of the *ruba'i* looks like this: "*Even the Sun* [*became*] *a mirror of Your beauty , / The dark musk of the incense burner enveloped Your birthmark /* [*In order to see it]* I *washed* [*with tears*] *the expanse of my eyes, but in vain*, */ For there is no corner* [*on Earth*] *worthy of dreams of You*."

The *ghazal* of Hafiz is a description of the spiritual torment and despair of a Sufi who painfully tries to comprehend God ("to see the incomprehensible beauty of the divine face"). However, one (second) *bayt*, given on the mentioned bowls, turns out to be torn out of this mystical symbolism, so close to Hafiz and acquires "worldly" (lyrical, personal) sound, that is, everyday meaning (to the extent that such a definition is applicable to lyric poetry).

We find interesting remarks about the potters of that era in Alisher Navoi. For example, in his work in

Figure 3

Majalis an-nafais (Collection of Rarities) the great poet writes the following about the poet Mawlana Mani:

Mawlana Mani from Mashhad. A handsome, witty and comely youth. His father was a remarkable master of pottery, producing faience pottery (chinni). And his younger brother painted (this) pottery in such a way that even in China they could not make such. He [Mani] was ashamed of the craft of both of them and treated them worse than his slave or his page. For he himself had beautiful handwriting and beautiful speech, and whatever he did, it was worthy (of his talents."

Navoi's last remark requires clarification. It is clear from the context that Mawlana Mani was embarrassed by his father and uncle, mainly because they did not have calligraphic handwriting, although they made and, in Navoi's estimation, painted dishes magnificently. This remark is quite applicable to the above-described and similar dishes of the 15th century: although examples of remarkable artistic craftsmanship, the handwriting of their inscriptions is very mediocre, not possessing the qualities of artistic calligraphy.

Another context of Mawlana Mani's «contempt» for his father and uncle can be interpreted precisely in the sense that they both quoted «cut» texts from mystical (Sufi) poetry, turning it into ordinary (realistic) love lyrics, just right for «gift inscriptions» on dishes intended for the market. In other words, such abbreviated quotations lost their mystical meaning, which, apparently, greatly irritated Mawlana Mani. Moreover, Mani himself (according to Navoi) wrote poetry in a clearly mystical genre.

Thus, an important cultural marker of medieval tableware is epigraphy. Despite the fact that Sufi poetry was chosen as the texts on the tableware, its content was selected and, obviously, perceived in isolation from their Sufi meaning (and almost in spite of it). Even the love lyrics of *ghazals* with an obvious mystical context were applied, rather, to the physiological manifestations of love passion. Then the meaning of the inscriptions really turned out to be utilitarian, for example, as a poetic self-presentation of the master (as in the case of the Tashkent bowl), or as a gift of good wishes, certainly with a complementary subtext, however, within the framework of cultural (literary) traditions familiar to the conventional «consumer», in the context of his perception. Consequently, the market and utilitarian interest of the potters dominated, although it remained within the framework of the cultural codes of the era. This did not mean a complete profanation of the original text, but rather reflected the cultural demands and cultural codes of the conventional consumers of this dishware within the framework of the "popular perception" of this poetry.

It is clear that tableware ceramics, especially ceremonial ones, are not the whole culture. But it is indisputable that it was and remains the main marker of mass culture, remaining, however, a mirror of the ideology of the class that acquired it and that produced these items. Such evidence is especially important if we keep in mind the relative paucity of documents or written evidence that have come down to us, related to the ideology and culture of the urban settlement of the medieval city.

The significance of Abu Rayhan Beruni in the development of the cognitive worldview

Saidagzam Khabibullaev,
Ziyoda Akhmedova,
Ministry of Mines
Industry and Geology

One of the polymaths of the Renaissance in the East, Abu Rayhan Muhammad ibn Ahmad Beruni, was a genius who made an incomparable contribution to the development of world science with his works.

The significance in the world of science of our compatriot, who selflessly worked, making the greatest discoveries in the field of astronomy, astrology, philosophy, mathematics, physics, geodesy, geology, pharmacology, mineralogy, music, history, literary criticism, lexicology, is truly enormous. His contribution to the understanding of existence through a cognitive worldview is an incomparable phenomenon. Biruni was closely familiar with the works of ancient Greek scholars such as Aristotle, Plato, Ptolemy and Euclid, as well as with the works of Indian and Muslim scholars – al-Khwarizmi, al-Farghani, Battani, Razi, Abu Tammam, Ibn Qaisum, Abu Mashar, and wrote commentaries, explanations, corrections and refutations to them. Biruni's attitude towards Aristotle is reflected in his correspondence with Abu Ali ibn Sina. Their correspondence was mainly about Aristotle's works «On the Sky» and «Physics». Beruni mentions Aristotle with great respect as an outstanding polymath of the ancient world.

If the evidence from the life and biography of the thinker, whose greatness is beyond doubt, were studied by many researchers, including Russian scientists V.R. Rosen, V.V. Bartold, I.Yu. Krachkovsky, A.A. Semenov, S.P. Tolstov, A.M. Belenitsky and others. Among foreign researchers, one can mention K.E. Sachau, R.R. Wright, E. Wiedemann, M. Meyerhof, M. Krause, D. Boilot.

The term "cognitive worldview" is one of the necessary elements of any worldview based on knowledge and ideas about the surrounding world. Acquiring various knowledge in this direction is not enough in itself. It is those who can form such an idea and worldview who have a wonderful opportunity to explore the planet Earth, its depths and the natural processes occurring on it and to use it effectively. The scientist realized that in the course of the development of world sciences, humanity recognizes the term «astro-geology» as a science that understands the structure of the planet and the laws of nature. They believe that the laws of humanity and the processes occurring in it can help to understand nature.

It is in the development of this direction that research in the field of neuropsychology in such areas as «cognitive consciousness» and «mechanisms of cognitive awareness» show that to understand existence, not only world knowledge is necessary, but also imagination and the ability to regulate laws. Among other things, for «cognitive thinking» it is necessary to have a neurophysiological system with a unique structure in the human body.

As a result of neurophysiological research, society was shown that people who were defined from childhood as "having a very low level of adaptation to society", "retarded", "with a low ability to acquire knowledge", have a completely different worldview, and they have physiological characteristics based on a completely different order in oral and written speech. Since they understood the world around them differently, the term "dyslexia" was introduced into science - this is an innate disease associated with a person's ability to read and write. It was noted that people with "dyslexia", despite their characteristics, are more creative and inventive than people with normal physiological development. According to

Bust of Abu Rayhon al-Beruni, installed next to the Embassy of Uzbekistan in Washington, D.C., USA

scientists from Cambridge University, dyslexics pay more attention to various nuances (discrepancies in very small details), which helps them understand the world around them differently and create new inventions. Such people have special aesthetic ideas, tastes and skills, among them we can see artists, masters of photography and directors.

In order to form a «cognitive worldview» in a person who perceives existence, evidence, facts, arguments, values, indicators, provided by a huge amount of knowledge, skills and sciences, can be shown as factors that make it possible to present them in an organized manner both in the imagination and in free creativity. It can be argued that Beruni, judging by the structure of his works, systematized such information as an accurate description, evidence that can serve as evidence, value, indicators and place in the surrounding world associated with geographical accuracy.

Beruni was one of the first in world science to develop a theory of the seas. Having calculated the radius of the Earth (this indicator was subsequently studied again and again, the level of accuracy of the information was high), he put forward unique new ideas about the creation of a spherical globe. Among other things, he was able to explain the position of the planet Earth in the surrounding world, vacuum (emptiness in which the movement of particles is not observed at all), which can be taken as a highly developed model of «cognitive worldview», which did not receive a clear definition at that time. Explaining the rules for maintaining equilibrium in space, 500 years before Columbus's voyage, he described the existence of a continent between the Pacific and Atlantic oceans.

Beruni also founded the science of "Geodesy", one of the sciences that not only helps in the formation of skills and abilities of the "cognitive worldview" that we present in this article, but also teaches how to describe it, linking it to a single point in time, land and space. Considering the contribution of this science to understanding the world, historians of world natural science called the 11th century «the century of Biruni».

In an era when human scientific achievements are updated hourly, and technological devices are entrusted with such complex operations as determining the point of existence in the Universe, specialists in the field of geology emphasize the importance of studying the sciences underlying these technologies. Therefore, the creation of maps of the surrounding world and the creation of opportunities for their vertical modeling in the bowels of the Earth also require reference to the works of Beruni.

The study of the work «India» (in some sources it is also called «Mineralogy»), besides providing information about the world around us, the types and properties of rocks, also brought together information on many topics, such as observations of the formation of minerals in rocks, the use of technological devices and methods characteristic of that era, and their market prices.

This work by Beruni, which provided a theoretical basis for the classification of minerals and the processes of their formation, includes the names of more than 30 precious stones and minerals, the identification of their chemical and physical properties, methods of their smelting and experiments, as well as scientific information about almost all precious stones and various ores, as well as their alloys. The work is based on the idea of a method proposed centuries before others (scientists who contributed to geological science) - the concept of «relative gravity» for the classification of minerals. The factor that prompted the translation of «Mineralogy» into Uzbek on the initiative of the Navoi Mining and Metallurgical Plant

Different phases of the Moon, depicted by al-Beruni in his Persian-written "Kitab al-Tafhim"

M. Nabiyev. "Abu Rayhon al-Beruniy." 1973

together with scientists from the Navoi State Mining Institute and the Tashkent State Institute of Oriental Studies, was the information contained in the work on historical excavations, identified locations of their location, formation in the environment and space. In the Mineralogy, the names of 84 classical Arabic poets are mentioned for each precious stone or metal. Among them, classical Arabic poets are mentioned, starting from the pre-Islamic period and ending with those who lived in Ghazni at the same time as Beruni. The poems are mainly short passages of 2, 3 and 4 lines.

It is no coincidence that Beruni so often turned to ancient Arabic poetry, which contains a variety of information about the life of the Arabs and their environment in the pre-Islamic era and the first centuries of Islam. At the same time, they also testify to the existence of this or that word in the Arabic language since ancient times.

The works he created are also significant because they served as important sources for many scientific studies. As a conclusion regarding «Mineralogy», it can be said that a number of works written by Biruni can be considered excellent examples of the first bibliographic sources in Central Asia.

Another famous major work by Beruni is devoted to astronomy and is called «Al-Qanun al-Masudi» (in some sources also referred to as «The Canon of Masud»). Biruni did not indicate in his bibliography when exactly he completed writing the book. However, if we consider that Sultan Masud, who succeeded Mahmud of Ghazni, reigned until 1040, then we can conclude that the book was completed by then.

The book contains discussions, calculations and conclusions on the following issues: the fiery, high-temperature nature of the Sun and stars, the laws of mutual attraction between objects in space and in space, the motion of planet Earth around the Sun, the peculiarities of the transition of the Moon into different colors, the nature of the halo around the Sun, the angle of inclination of the ecliptic relative to the equator, the radius and longitude of planet Earth, the nature of the appearance of dawn and sunset. Beruni developed astronomical methods of geodetic measurements. He created improved prototypes of astronomical inventions. For the first time, a fixed quadrant (the first example of a sextant) with a radius of 7.5 meters was created, in which had an observation accuracy of 2'. This invention was considered the largest in the world for over 400 years.

The way scholars organize their works in bibliographic order is also a unique feature for all eras. It is natural that Biruni's scientific legacy has an encyclopedic value. The scholar, who compiled a list of his scientific works, noted that his books and treatises written before 1035 number 113, and if we include the works written after this period, his scientific legacy can be equated to a treasury of 160 books and treatises. Most of Beruni's works were considered a kind of encyclopedia in his time.

Research shows that 70 of his works are devoted to astronomy, 20 to mathematics, 12 to geography and geodesy, 3 to mineralogy, 4 to cartography and spatial positioning, 3 to climatology, 1 to physics, 1 to botany and pharmacology, 15 to history and ethnography, 4 to philosophy, 18 to literature, and the rest to other disciplines.

Measurement of the Earth's circumference conducted by Abu Rayhon al-Beruni

Rare 12th-century manuscript by Abu Rayhon al-Beruni

Beruni's work «Elementary Concepts of the Art of Astrology» was written in 1029 in Ghazni. Copies of this work have come down to us in Farsi and Arabic. The work is rich in information about the astronomy of that time, the equipment and methods used in it, as well as the sciences associated with it. Beruni's famous capital work «India» - «Tahqiq mo li-l-Hind min maquda maqbula fi-l-aql aw marzula» (« India, or the Book Containing an Explanation of the Teachings Belonging to the Indians, Acceptable by Reason or Rejected») was written in 1030, and this masterpiece was highly appreciated by Western and Eastern, including modern Indian scholars.

Academician V.R.Rosen believed that «in all the ancient and medieval scientific literature of the East and West there is no work equal to it. "Beruni, who accompanied Mahmud of Ghaznavi on his campaigns in India, thoroughly studied Sanskrit there (the scholar notes that at that time he was already over 50 years old), which allowed him to closely familiarize himself with the literature of Indian culture and the scientists of India of that time, and also to create an immortal work about this country. In the year of completion of this work, Mahmud of Ghaznavi died. His son Masud ascended the throne. Beruni also notes in his works that his position significantly improved during this period.

The results achieved by Beruni in determining the latitude and longitude of various places amaze even modern scientists. The great scientist notes that each part of the earth's surface has its own long historical development. It was Beruni who first attempted to seriously study the geological development of some regions of Central Asia, including the Amu Darya Valley. His conclusions about the geological past of the Amu Darya Valley and the formation of the Aral Sea are considered one of the most successful geological analyses of that time. The scientist relies on the theory that "seas turn into land, and land turns into seas."

Beruni's conclusions about the formation of mineral deposits and the significance of rock erosion are of great scientific importance. He proposed a theory explaining the formation and disappearance of mountains based on natural factors. Modern scientific developments not only fully confirm these conclusions, but also create the possibility of their modeling for future generations.

Beruni's ideas, on the one hand, creatively developed the advanced traditions of Central Asian, ancient Greek and Indian thinkers, and on the other hand, the maturity of the scientist testifies to the breadth of his thinking. It is noteworthy that Beruni raised the question of the "cause of causes" - the emergence of man and human society. "The most ancient and famous of ancient stories is the emergence of mankind." Here we see that Beruni takes a rationalistic position regarding the emergence of human society.

In conclusion, it can be noted that it is necessary to study the great scientific legacy of Beruni for many years to come and to increase the achieved results, proving their connection with the concept of "cognitive worldview".

Description of the astrolabe Nastulus by Abu Rayhon al-Beruni. 1228

Regulatory and legal aspects of the development of the art market in Uzbekistan

Shavkat Sultanov,
director of "ART VERNISSAGE" LLC

The history of mankind is represented by two main forms of human activity: creation and destruction. Often the objects of creation and destruction were cultural values. Creation is expressed in the creation of unique cultural objects that form an important layer of history and culture of both individual nations and all mankind.

As is known, the culture of Uzbekistan is bright and original, it was formed over thousands of years and absorbed the traditions and customs of the peoples who inhabited the territory of modern Uzbekistan at different times.

The traditions of multinational Uzbekistan are reflected in music, dance, painting, sculpture, applied arts and clothing. The art of Uzbekistan is the quintessence of Central Asian cultures, but each region of Uzbekistan has its own unique shades and artistic features.

However, all these cultural and artistic values of Uzbekistan have not yet been available to the world art market due to the lack of developed regulatory, art history and technological aspects of research into masterpieces of art.

It should be noted that cultural values are not only a rich spiritual treasury of humanity, but also an important object attractive for financing. The situation is aggravated by the fact that there is an opinion that if works of art are turned into a commodity, a means of trade, they will lose their artistic value. This is not entirely true. Of course, the area in which trade and art intersect is very controversial and contains many controversial financial, legal, and ethical issues. But there is another side to the coin. From our point of view, collecting and investing in art allows us to preserve and protect art objects, their authors, discover new names or restore forgotten ones.

In developed countries, cultural values have always attracted those wishing to acquire a unique piece of art as their property, thereby profitably investing their money. The art market is one of the oldest investment markets in the world. Thus, the annual turnover of the global art market fluctuates between 25 and 30 billion dollars. According to experts, the volume of the global art market by the end of the current year is projected at $34 billion.

In this regard, there is a practical need to develop the issue of legal regulation of the circulation of cultural property as an object of property rights. It must be recognized that due to the accelerated development of information technology in the world, its entry into all spheres of life, primarily in the financial, economic, and banking spheres, affecting the movement of goods across borders, any property, and especially one that has artistic value and is of high value, is subject to the threat of being involved in illegal economic circulation. It is for this

The first auction of Uzbek art objects held by the auction house "ART VERNISSAGE" and the appraisal company "ART APPRAISAL CENTER"

The Second Auction "Cultural Heritage of Masters of Applied Arts of Uzbekistan" and Auction Catalog 2024 on "Cultural Heritage of Uzbek Painting"

Editions of the Auction House "ART VERNISSAGE"

reason that international legal acts regarding the illegal circulation of cultural property began to be developed in the second half of the 20th century. But in fairness, it must be recognized that the universal conventions constantly adopted at the international level are not able to adequately and promptly cope with the increasing number of controversial legal issues in this area. This is due to the fact that as the international circulation of cultural property becomes more complex, their forms, types, and conditions change. In addition, the rules enshrined in national legislation vary in different states and contain different legal regulatory mechanisms. Due to the original attractiveness of cultural objects, the great demand for them, and at the same time, the lack of full-fledged, comprehensive regulation at the international level, sometimes their inconsistency with national legal systems, the number of disputes over cultural values increases every year.

On the one hand, cultural values are unique works of art, and on the other hand, this is precisely why they are an attractive investment object, which gives rise to a number of theoretical and practical questions:

- the issue of legal regulation and normative consolidation of cultural values in the legal system;
- the problem of the relationship between public and private interests of participants in the international circulation of cultural values;
- problems of forming and concluding standard contracts in relation to cultural values;
- the issue of choosing the optimal method of resolving disputes in the sphere of international circulation of cultural property.

Auctions are regulated by law, although there are some omissions in the formulated norms of international law. For example, the 1970 UNESCO Convention states the essence of an international legal treaty, but does not regulate auction trade; it simply contains general rules for the circulation of cultural property that have a significant impact on auction activities. The main objective of this Convention is to prevent the illegal import, export and transfer of ownership of cultural property. The Convention provides for a number of mechanisms to ensure that this goal is achieved. For example, Article 7(a) of the Convention authorizes States Parties to «take all appropriate measures, in accordance with national legislation, aimed at preventing museums and other similar institutions located on their territories from acquiring cultural property originating in another State Party to the Convention that has been illegally exported after the entry into force of this Convention.»

Thus, the analysis of the legal regulation of the international economic turnover of cultural values has shown that the universal conventions developed at the international level are not able to cope with the increasing number of controversial legal issues in this area. As the international economic turnover of cultural values becomes more complex, its forms and types change, and new legal problems arise. In

The first auction of Uzbek art objects held by the auction house "ART VERNISSAGE" and the appraisal company "ART APPRAISAL CENTER"

addition, the rules enshrined in national legislation vary in different states and contain different legal regulatory mechanisms. It should be especially noted that in the legislation of Uzbekistan, cultural values, which were mostly created more than 50 years ago, are not subject to export outside the state, which significantly complicates the development of the art market of the republic and entry into the world arena.

Based on the above and taking into account the imperfection of the legislative framework of the Republic of Uzbekistan, the Auction House «ART VERNISSAGE» and its appraisal company «ART APPRAISAL CENTER» have developed a Methodological Guide «Assessment of the Cost of Cultural Values» based on the above-mentioned international regulatory documents and principles, as well as the Law of the Republic of Uzbekistan dated September 19, 1999 No. 811-I «On Appraisal Activities», the legislation of the Republic of Uzbekistan in the field of cultural values, the Unified National Appraisal Standard of the Republic of Uzbekistan. The principles and norms set out in the standards NSO No. 1, NSO No. 2, NSO No. 3, NSO No. 4, NSO No. 5, NSO No. 6, NSO No. 9 of the Unified National Appraisal Standard of the Republic of Uzbekistan (ENSO RUz) are also applied to the assessment of the cost of cultural values. The methodological guide contains additional methodological requirements and rules according to which the assessment of the value of cultural property is carried out.

The first successful auctions held in 2023 in Tashkent on the theme "From the creative heritage of masters of fine arts of Uzbekistan" and "Cultural heritage of masters of applied arts of Uzbekistan", as well as in 2024 on the theme "Luminaries of painting of Uzbekistan", organized by the auction house "ART VERNISSAGE" and the appraisal company "ART APPRAISAL CENTER", demonstrated the high efficiency of this method.

In addition, taking into account the above, for the fastest possible integration with the world art market, at the first stage of the formation of the art market in Uzbekistan, in our opinion, it is necessary to resolve the following issues at the level of the state, financial institutions, business and the population:

- adopt regulatory and legislative acts aimed at providing tax benefits and preferences for business representatives who purchase art objects. As world experience shows, in all EU countries tax deductions from income or profit amount to 20 to 40%, in China and Hong Kong 30-35%, and in the USA up to 100% of the market value of the art object purchased by the business entity;

- the banking sector of the economy should create conditions for providing preferential loans to the population and business entities when purchasing art objects, as well as considering art objects as collateral for obtaining loans, including consumer loans;

- adoption of state standards for the assessment of art objects and the establishment of mandatory conditions for the purchase and sale of art objects by state organizations, including museums, only art objects that have an assessment, which will create a platform for the formation of the country's art market;

Exhibition hall of the Auction House "ART VERNISSAGE"

- financial institutions (banks, insurance and investment companies, etc.) to create financial instruments and mechanisms in which high-quality art objects will be considered as property objects, i.e. will be included in the list of material assets with high profitability and will be considered by credit and insurance organizations at the level of real estate or motor vehicles;

- it is necessary to fundamentally reconsider our attitude to art in general, placing the main emphasis on supporting representatives of the fine and applied arts of Uzbekistan. Start purchasing not copies or reproductions of paintings on the Internet, but highly artistic works of masters of art of Uzbekistan, which have a corresponding price for works of art, and also introduce the practice of insuring art objects;

- to create healthy competition among business representatives in creating their own collections of works of art by artists and masters of applied art, on their basis to form a class of collectors of art objects of the New Uzbekistan, as the main driving force of the country's economy;

- it is necessary to generate public interest in acquiring art objects from Uzbekistan as investment objects.

- attract the media, including social networks, to strengthen the popularization of the arts of Uzbekistan through active involvement of the media, including social networks;

- create a mechanism for providing preferential consumer loans for the purchase of highly artistic items of fine and applied art of Uzbekistan.

National-cultural features in the lexicon of Uzbekistan's folk paremias

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Since the paremiological fund of each nation is unique, in world linguistics paremias is considered as one of the means of expressing the cultural features of the language, way of thinking, and psychological state of people speaking a given language. In paremias, historical traces of the beliefs of the people who created them, their way of life, conclusions made based on life observations and experience, their attitude to the events of the surrounding world, and their spiritual and emotional experiences are reflected concisely and meaningfully.

Although the most diverse topics chosen for paremias are common to all nations, they differ from each other in their internal content and assessment of a certain situation or concept based on the social status and worldview of different nations. "Motherland" is one of such topics. Almost every nation in the world has its own beliefs and customs that are unique to it and different from those of other ethnic groups, and such ethnographies are part of the national culture. In the thinking of a person who moves from one region to another, from one society to another, surrounded by representatives of another, different culture, an intercultural conflict arises, and this situation shows that each people, each nation has its own, unique worldview, its values, and this should be treated with respect. This is exactly the situation that is meant in this proverb.

IN EVERY SUPRA – ITS OWN BREAD

The words *supra* and *non*, used in this proverb, serve to figuratively define the diversity of the peoples of the world and their inherent qualities and characteristics. At the same time, these words can also be considered as cultural reference points, indicating that the creator of these proverbs was, first of all, a representative of the peoples of the East. In particular, if we dwell on the word supra, national characteristics are manifested in it even more obviously and uniquely. Such a utensil, which in Uzbek families is mainly used as a "household item similar to a tablecloth, usually made of tanned leather, and intended for rolling out dough and shaping bread", is difficult to find in the everyday life of representatives of other nations. This word has a polysemantic character and has long been used by Afghans and Iranians to designate a *dastarkhan* (tablecloth, set table). In particular, in the works of Navoi, this word serves to express precisely this meaning: "He sat me down and brought *sufra*. On the *sufra* were laid out bread, nuts, and salt." There were also certain rules of etiquette for sitting at the supra or table. For example, the Turks often sit at the *dastarkhan* with their knees on the ground (on their knees, with their legs bent at the knees, squatting), while the Iranian people are accustomed to sitting at the table resting on their heels. The word supra used in the proverb above can be understood in both senses, and in both cases it can serve as an indicator of our national identity. In no country where people are accustomed to eating at the same table is such a household item used. In Uzbek culture, even in those families where they have switched to using tables and chairs, the custom of spreading out the *dastarkhan* has been preserved to this day.

EVERY LAND HAS ITS OWN *BATMAN*

The words used in this proverb serve to help understand that each country has its unique features and relate a person to the past of the people. Although this paremia is addressed to all of humanity, the vocabulary units used in it can provide information about the people who created it. For example, *batman* is an ancient unit of weight measurement – it was used in the countries of the Near and Middle East (Saudi Arabia, Egypt, Syria, Iraq, Iran, Turkey, and India), as well as in Central Asia. According to Sharia, *batman* usually amounted to 0.832 kilograms, but its weight varied in different countries at different times. As can be seen from this commentary, *batman* was used mainly by the Muslim peoples of Central Asia, the Near and Middle East. If *batman, tanap, kulach, chakirim* are alien concepts for the countries of the Far East and Europe, in the same way such exoticisms as foot, inch, *shi, mud*, *so'* (Arabic units of volume measurement) are practically not used in the speech of representatives of Uzbek culture. This shows that the "I" of the nation is reflected in proverbs, which are a mirror of folk wisdom, and that through the names of units of measurement, one can determine the roots of the origin of the creator of the paremia.

NATIVE LAND—A GOLDEN CRADLE

The Uzbek paremiological fund contains many expressions describing the homeland and its unique features. For example, the proverb Native land—a golden cradle says that the land where you were born and raised is like a golden cradle. As is known, in the consciousness of the Uzbek people, beshik (cradle)

Tajik customs – "Women's Tuesday. Bibi Seshanbe."
Photograph from the Turkestan album

is always associated with the word homeland as a cultural unity imbued with the national spirit. This special device, designed for swaddling and rocking a baby, is a "home" for a newborn. The homeland begins with the threshold - the home of each person and his family—and these places, as a small homeland, serve as the primary center of education for children, where they get acquainted with their village, mahalla, and country and learn to be ready to protect it, to contribute to its development and to grow up as its worthy sons, who realize that "the honor of a man is the honor of the people." The canopy of the cradle and other special devices provide the necessary moderate air exchange and comfortable conditions for the calm and healthy growth of the child, while protecting him from various dangers. The word golden, defining the cradle, emphasizes its value. As is known, gold is expensive and does not lose its value over time due to its corrosion resistance. Based on this, in our national culture, it has become customary to apply the expression golden cradle to the house. This homeland protects a person from infancy until the end of their life and never loses its value in their eyes. Beshik (cradle), along with the Uzbeks, has long been used by the Karakalpaks, Tajiks, Turkmens, Kyrgyz, and other peoples of the East. It should be noted here that "realities, regardless of the culture and language in which they arose, are the value of the people who created them. These are words that define the history of objects and phenomena in the studied language, culture, and economy and way of life and are completely or partially different from the words in the compared language", that is, realities characteristic of different peoples can be similar in their nature and functions but should not be the same. The fact that the cradles of one people differ from the cradles of another in shape, colors, patterns, manufacturing method, and tools testifies to the uniqueness of each of them and that the cradle is a national reality.

A DOG DOES NOT BARK AT THE ONE WHO CAME TO THE AUL (IN PEACE)

The word aul, used in the proverb, embodies the reflection in the national consciousness of the idea of it as a homeland, a place where one was born and raised. In their proverbs, the people expressed their love and devotion to their homeland, using vocabulary units that reminded them of their homeland, were specific to their country, and were associated in their minds with the word MOTHERLAND.

DO NOT RUN FROM PEOPLE - YOU WILL SUFFER FROM LONELINESS (LET LONELINESS PERISH). DO NOT RUN FROM BREAD - YOU WILL SUFFER FROM HUNGER (LET HUNGER PERISH)

Bread is the most important everyday food for Uzbeks. The names of food products and dishes also serve as an important component of expressing the "I" of the nation. Our people have always had a special respect for bread. A person who accidentally steps on a piece of bread dropped on the ground will consider it a great sin, and as soon as he notices it, he will try to

remove the piece, down to the last crumb, somewhere to the side. Although bread is a staple food in many countries, for the Uzbek people, it is not just a familiar food but also a symbol of well-being, abundance, and hospitality, and for travellers, it has a symbolic meaning, for example, the meaning of a companion. Whenever the dastarkhan is spread, bread is served first. Also, implying all types of food products under the general name of non (bread), special emphasis is placed on the fact that "one must eat honestly earned bread." Another vocabulary unit from this proverb, reflecting the national colour, is the word qursin. This purely Turkic word expressing "a wish for the disappearance of some negative situation," imbued with Uzbek sincerity, goodwill, and friendly edification based on life's conclusions, is difficult to translate into any foreign language.

ONE'S OWN AIWAN (VERANDA) IS BETTER THAN SOMEONE ELSE'S PALACE

Architectural terms of Arabic origin, such as toq meaning "hemispherical door, space above the gate, arch on the roof" and "hemispherical roof of a building or structure, roof under a dome," and ravoq meaning "roof," "veranda," and "closed corridor"; "richly decorated tent," in combination with each other mean "luxurious buildings, magnificent houses." The use of concrete in Ancient Rome led to the development of arch and dome architecture.

In Central Asia, an ayvan is a roofed structure with one, two, or three open sides, built to suit the climate (mostly summer). This architectural style has long been an important part of Uzbek residential and public buildings (National Encyclopedia of Uzbekistan). The construction of ayvans (terraces) in front of houses was used in Ancient Greece and, under its influence, in many other regions, but they varied in their location, style, and equipment. Placing a sofa and a khantakhta (low table) on the ayvan, using it as a place for eating, drinking tea, and sometimes even meeting guests, demonstrates the national identity of this structure. In this case, the fact that the ayvan, personifying modesty, is preferable to the luxury of a palace testifies to the fact that for the Uzbeks, the homeland is more important than anything else. The fact that the similar proverb Yatnıñ yaglıg tiküsinden, öznüñ kanlıg yuyruk yeğ (the fist of a loved one is better than the fatty food of a stranger) is quoted in "Devoni lug'ot at-turk" proves that this feeling is an original value rooted in the consciousness of the Turks.

THERE IS NO PEOPLE WITHOUT A MASTER, AND NO ROBE WITHOUT A COLLAR

"*Ton*" is a long, open-fronted outer garment, and the fact that this name is also mentioned in "Devonu lug'otit turk" by Mahmud Kashgari indicates that it has existed since ancient times.

The word "*ton*" is an extremely common name for clothing in the Turkic languages. L. Budagov notes that in the Tatar language, it is "*ton*"; in Turkish, *don* means *ton*, boots, or shoes; and in Kyrgyz, it means women's summer outerwear. The fact that this word denotes different types of clothing suggests that it was formed from the name of the raw material from which it is made. If you pay attention to the form and meaning of this word in other Turkic languages, this further clarifies this idea. In particular, in the Khakass language ton is used in the meaning of "fur coat"; in Tuvan, "fur coat", "robe"; and in Nogai, "skin" and "sheepskin coat." On this basis, *tonlav* means "to rip off the skin of a dead or hunted animal", *tonlik* means "skin intended for clothing", in the Tatar language, tun means "*ton*", "fur coat", tunalu means "to rip off the skin". V.V. Radlov believes that this word is semantically related to the word *tin* ("squirrel"), which in Tuvan is used as *diin* and in Bashkir as *tezhen/tiin*. Thus, from the word tin in the meaning of "skin/leather" in the ancient Turkic language, the names of monetary units were formed: *tiyin* in the Uzbek language, *tin* in Tajik, in Russian – *den'gi* (tanga, coin), in Korean – *ton*, in Udmurt – *tuzh*. This meaning of the word tin also exists in the Kazakh, Uyghur, and Turkmen languages. The given lexicographic commentary and analysis additionally confirm that the word *ton* originally meant "skin/leather".

In Uzbek culture, "*ton*" is a long national robe, worn over clothes and lined with cotton [Explanatory Dictionary of the Uzbek Language, p.507], which has special value. Because in many Uzbek traditions and rituals, especially during the ceremony dedicated to the birth of a boy, the elders of the family often dress the child in a robe embroidered with gold. During wedding ceremonies, among the dowry sent from the

Painting "Memory of the Earth", by Bahodir Jalal, 1991

bride's house, there is a richly decorated *ton* ("robe"). During mourning ceremonies, men from the family of the deceased wear a robe (chapan, *ton*). This suggests that in Uzbek culture, the *chapan* (*ton*) accompanies a person from birth to all stages of their life. The fact that the robe is the most comfortable outerwear for Uzbeks, protecting them from the heat in summer and from the cold in winter, also confirms the place of this item of clothing in their culture. The collar is the most important part of the robe. When sewing a robe from *bekasam* and other fabrics, the lining of the collar is not lined with cotton at all or is lined with a very thin layer compared to other parts of the robe and is reinforced with small and very frequent stitches. Thanks to careful processing, the collar of the robe is very durable compared to its other parts, and even if the robe wears out and tears, the collar remains intact. The proverb says that if it is important to have a well-sewn, strong, and durable collar on the robe, it is also important for the country to have a healthy and educated leader who has received a good upbringing. In conclusion, it should be noted that the paremiological fund of each language is a valuable heritage reflecting the culture, traditions, history, national identity, and uniqueness of the people speaking this language. Analysis of the language and content of paremias serves as a key tool in studying the worldview, values, and culture of the people who created them.

Creating time managing mobile applications

Javakhirbek Burkhanov
Student of Andijan Machine-Building Institute

The importance of mobile apps, time management apps, is a perfect combination of technology and psychology. These apps usually provide the following features:

Calendar and reminders: Users can schedule their tasks and set important dates. For example, applications such as Google Calendar or Microsoft Outlook are widely used all over the world.

Google Workspace

Task lists: Apps like To-Do List or Todoist help users organize their tasks. This makes it easier for them to manage multiple projects at once.

Collaboration features: Platforms like To-Do List or Notion are essential for fostering collaboration between teams. These apps allow you to share tasks between teams and track their progress in real-time.

Productivity Monitoring: Apps like Toggl or Clockify help users track how they spend their time, which can help them improve their productivity. Companies and individuals around the world who have achieved success in time and task management use these apps effectively.

Google: Google Workspace increases employee productivity with integrated tools.

Microsoft: Tools like Microsoft Teams and Planner make it easy to work with global teams. Japan widely uses technology tools and time management strategies based on Kaizen principles.

When choosing a mobile application, you should consider the following factors:

a) Ease of use of the interface: the application should be simple and understandable.

b) Synchronization: The application should be able to sync across all devices.

c) Compatibility: Ability to customize according to user needs.

d) Security: It is important to ensure the confidentiality and security of data.

Mobile app development is a rapidly growing area of information technology. Of course, there are several reasons for this :

- the emergence of a huge number of different mobile phones and smartphones;
- actively expanding mobile Internet coverage;
- simplicity and low cost of mobile devices.

The vast majority of mobile devices operate in two operating systems (OS) – Android and iOS, accounting for about 74% and 25% respectively. Accordingly, the share of all other operating systems does not exceed 1%. In absolute figures, the number of active devices based on the Android operating system is 3 billion, and based on the iOS operating system - more than 1 billion. The development of applications for Android and iOS is based on common principles, but there are

also significant differences. First, let's look at the general principles. Regardless of the operating system, any mobile application developer should know how to create interfaces based on layouts that adapt to different screens. Equally important is the ability to create network requests and receive responses to them. The ability to process data is also useful, this primarily applies to the JSON format (data exchange format based on the JavaScript text format), which is the de facto standard for client-server mobile applications.

A mobile operating system is an operating system used for smartphones, tablets, smartwatches, and other personal mobile computing devices that are not laptops.

While computers such as regular/mobile laptops are "mobile," the operating systems used on them are not generally considered mobile because they were originally designed for desktop computers, which historically did not have or need certain mobile features. This line between mobile devices and other forms has become much blurrier in recent years, as new devices have become smaller and more portable than those of the past. Mobile operating systems combine the features of a desktop operating system with other features useful for mobile or handheld use, and typically include a built-in wireless modem and SIM card for connecting to a phone and transferring data. In the first quarter of 2018, more than 123 million smartphones were sold (the highest ever), with 60.2% running Android and 20.9% running iOS. The Android OS itself outsells Microsoft's well-known desktop operating system Windows, and overall smartphone usage (even excluding tablets) is higher than desktop usage.

Before downloading and installing Android Studio it is important to comply with the following requirements.

- Operating system version: Microsoft Windows 7/8/10/11 (32-bit or 64-bit).
- RAM : minimum 4 GB RAM , 8 GB recommended RAM.
- Free hard disk space: minimum 2 GB, 4 GB recommended.
- Minimum required JDK version: Java Development Kit (JDK) 8.
- Minimum screen dimensions: 1280 * 800.

In this regard, one of the convenient and widely used mobile applications is the "USTOZ AL" application, which has the following access system.

Task and time management apps have become an integral part of productivity in the modern world. They help achieve success on different levels: from personal life to work in large corporations. As technology continues to develop, the functionality and capabilities of such apps will expand, making them even more important in the future.

Modern technologies in the web development and their impact on SEO

Khojiakbar Ostanakulov,
Andijan Machine-Building Institute

Today, new technologies are rapidly developing in the web development industry. They not only improve the design and functionality of a website, but also help websites to rank higher in search engines. SEO (Search Engine Optimization) is an optimization process carried out to improve the ranking of a website in search engines, which is important for increasing the visibility of the website and its traffic. Mobile compatibility of a website and improving user experience are also important factors for SEO. Thus, modern web development technologies not only improve user experience, but also increase the efficiency of the SEO process (Figure 1).

Today, the importance of SEO optimization is growing, and the influence of modern web development technologies on such optimization is becoming even more significant. Available scientific literature and Internet sources were studied to analyze the main concepts and methods of SEO and web development technologies. At this stage, examples and practices were studied showing how technologies such as JavaScript, ReactJS, HTML5 and CSS3 affect SEO optimization, and real-life examples and website analysis were used to study the influence of modern web development technologies on SEO. SEO indicators of

SEO (Search Engine Optimization)

Schematic representation of "Structured data vs. unstructured data"

sites were also taken into account – SEO factors such as site speed, adaptability to mobile devices, page load time and the presence of structured data.

Figure 1. The essence of search engine optimization.

The results of the study showed that modern web development technologies have a significant impact on the SEO process. Basically, using technologies such as JavaScript and ReactJS, it is possible to improve the ranking of websites in search engines. The following main results were presented:

• Website loading speed and search engine rankings: With ReactJS, pages are loaded dynamically, which improves the user experience. This, in turn, increases the speed of the site. Search engines like Google consider site speed as a primary factor. Sites that load quickly will have a higher ranking, which will have a positive impact on SEO.

• Mobile Adaptation (Responsive Design): Adapting websites to mobile devices using ReactJS and CSS3 helps the SEO process. Websites optimized for mobile devices are highly ranked by Google. Research has shown that websites optimized for mobile devices perform well in search engines.

• Structured data: Creating structured data for websites using HTML5 and JSON-LD helps SEO. Search engines analyze structured data to properly understand the content of the website, which results in the website being better displayed in search engine results.

• Create dynamic content: Adding dynamic content to your site using JavaScript, such as interactive forms, tables, and animations, improves the user experience. This helps increase visits and repeat visits to your site, which leads to better SEO.

• Analysis using SEO tools: The study examined the SEO indicators of the sites using tools such as Google Analytics, Google Search Console. These tools assessed the site speed, mobile friendliness and other SEO factors. The results show that these indicators have significantly improved on sites that use modern technologies.

In general, modern technologies such as JavaScript, ReactJS, and HTML5 help improve the SEO performance of websites. Using these technologies increases the chances of a website to rank high in search engines (Figure 2).

Figure 2. JavaScript and ReactJs technologies.

Modern web development technologies have a significant impact on the SEO process, helping websites to rank higher in search engines. Especially, the use of such advanced technologies as JavaScript and ReactJS allows for effective SEO optimization by increasing the speed, adaptability to mobile devices, and usability of websites. However, some problems may arise when using these technologies, since modern SEO processes require complex algorithms and technical optimization.

On the one hand, dynamic loading of website pages using ReactJS may present some problems for search engines. ReactJS, especially considering that it is a JavaScript-based system, may not be fully parsed by some search engines. This, in turn, may reduce SEO effectiveness. It is known that search engines need to quickly parse the content of pages and provide users with the most relevant results. If a website is entirely based on JavaScript and search engine bots cannot fully read this code, important information on the site may not be indexed. And this may have a negative impact on search results. However, modern search engines, in particular Google, have the ability to correctly read JavaScript code, and this problem is gradually being solved. It is also possible to prevent these problems by using technologies such as server-side rendering (SSR) or static site generation (SSG). With these methods, the content of the website is pre-rendered and presented in a search engine-friendly HTML format.

On the other hand, making websites mobile-friendly can improve SEO performance. Nowa-

SEO – soft skills

days, most users access the Internet through mobile devices. Google and other search engines highly value mobile-optimized websites and rank them higher in search results. Therefore, web developers should pay special attention to proper mobile optimization when creating websites. However, creating the right mobile design can sometimes be a difficult task. For example, a lot of testing and optimization is required to ensure that a website looks and works correctly on different devices. The processes of loading resources correctly, opening pages quickly, and creating a user-friendly interface should be carefully studied by web developers. It is recommended to use tools such as Google PageSpeed Insights, Lighthouse, and Web Vitals in these processes.

Additionally, creating dynamic content using ReactJS has a positive impact on SEO as it increases interactivity and user engagement on the site. Interactive elements improve user interaction with the site and increase user interest in the site. As a result, users are more likely to stay on the page longer and view more pages. However, care must be taken when creating interactive and dynamic content on the site. Incorrect coding or using unnecessary resources when creating dynamic content can slow down your site, which will negatively affect SEO.

Therefore, when optimizing websites developed using ReactJS and JavaScript, it is recommended to do the following:

Using server-side rendering (SSR) or static site generation (SSG) – these methods help present pages in a format convenient for search engine bots. With SSR, the page is prepared on the server in advance and sent to the user, which allows search engines to index the page faster. SSG allows you to prepare pages during the build and store them as static content. This reduces the load on the site and ensures faster loading. Thus, using frameworks such as Next.js or Gatsby, which are based on ReactJS, can help improve SEO efficiency.

JavaScript is a multi-paradigm programming language

Using Lazy loading and kod splitting technologies – these methods prevent redundant resources from loading at the same time and help pages load faster. Lazy loading allows images and other heavy resources to be loaded only when needed, reducing loading time and improving user experience. Kod splitting technology allows JavaScript files to be broken down into smaller parts and only the necessary codes to be loaded onto the page. These methods not only increase overall page speed but also improve SEO results.

Using meta tags and structured data is important to improve the usability of page content for search engines and improve indexing. Using meta tags such as <title>, <meta description> and <meta keywords> improves the visibility of the page in search engines. Structured data (schema markup) helps to classify the page more accurately and can be displayed in search engines such as Google as rich snippets. This is important for attracting users and increasing organic traffic to the site.

Implementing mobile optimization is necessary to create a user-friendly interface for users and to meet the requirements of search engines. Google gives the highest priority to sites optimized for mobile devices and evaluates pages according to the Mobile-First Indexing principle. To create a mobile design correctly, it is necessary to use responsive design (CSS media queries) and special UI components for mobile devices. It is also recommended to test the page on mobile devices and optimize it using tools such as Lighthouse or PageSpeed Insights.

Overall, the impact of modern web development technologies on SEO is very positive, but they need to be used correctly and effectively. Technologies such as JavaScript and ReactJS are useful for SEO, but there are some technical issues associated with them. For example, poorly coded dynamic pages may not be indexed by search engines or may result in slower page loading speeds. For this reason, web developers are advised to seek advice from experienced professionals and use modern SEO tools. In addition, web development can increase the chances of a website ranking high in search engines by creating an interface that takes into account user needs, ensures fast page loading, and is mobile-friendly.

Thus, modern web development technologies have a significant impact on the SEO process. By using these technologies correctly, you can improve the efficiency of websites, create a user-friendly interface and achieve high results in search engines. At the same time, when using technologies such as JavaScript and ReactJS, it is necessary to consider their impact on SEO and apply effective optimization strategies.

Scientist and restorer Sharif Ilkhamov turns 90

Akmaljon Ulmasov,
PhD

There are many different professions in the world. One of the unique and honorable professions is the profession of a restorer, who gives a second life to both ordinary objects of cultural heritage and outstanding works of art. One of the pioneers of this field, chemist AND restorer, candidate of chemical sciences, Sharif Ilkhamov turns 90.

Sharif Ilkhamovich Ilkhamov was born in 1935 in Tashkent. In 1959, he entered the newly opened chemical-technological faculty of the Tashkent Institute of Textile and Light Industry and graduated in 1965. In 1963-1968, he worked at the Tashkent Paint and Varnish Plant. Sharif Ilkhamov's entry into the field of restoration is associated with the Afrasiab monument in Samarkand. In 1965, it was planned to build a road through the monument, and archaeological excavations were started. A laboratory and specialists were needed to preserve the discovered frescoes and wall paintings. In 1968, Sh. Ilkhamov was hired by the restoration laboratory of the Institute of History and Archaeology. Many archaeologists, restorers, architects, and artists participated in the archaeological excavations of 1965-1967, which were carried out on Afrasiab. In 1970, the Scientific Research Institute of Archaeology was established in Samarkand as part of the Uzbekistan Academy. Sh. Ilkhamov and other scientists began their scientific and creative work in a new place. In addition to Afrasiab, Sh. Ilkhamov worked on such monuments as Sapallitepe, Jarkutan, Fayaztepa, Karatepa, Dalverzintepa, Bolaliktepa, Old Termez, Yarkurgan, Akhsikent, Munchaktepa, Shoatepa, Mingurik and Aktepa.

Sharif Ilhamov with colleagues

In 1968-1972, the Buddhist monument of Fayaztepa was explored. Thanks to the experience and skill of Sh. Ilkhamov, many unique finds from this monument were preserved. In 2005-2006, conservation work was carried out on the monument within the framework of the UNESCO project. Since 1973, large-scale archaeological research has been carried out on the Sapallitepa monument. Sh. Ilkhamov conducted practical experiments on this monument for many years.

In 1977, the adobe walls were preserved with isocyanates. This method was successfully tested in the field, and in 1982, Sh. Ilkhamov defended his candidate's dissertation. The method of chemical conservation developed by him and his colleagues was tested on such archaeological sites as Sapallitepa, Afrasiab, and Aktepa. A special development was created for the preservation of reed coffins found in 1988 at the Munchaktepa site.

Sharif Ilkhamovich was also actively involved in teaching students. One of his first followers, M.A. Reutova, defended her PhD thesis in 1985. Due to his dedication to his work, Sh. Ilkhamov continued to work even after retirement. In 1995-2005, he worked as a chemist-restorer at the Institute of Art Studies of the Uzbekistan Academy of Sciences. At the same time, he taught specialized subjects in the new direction of "Repair of Applied Art Works", created at the National Institute of Painting and Design named after K. Behzad. My first meeting with the teacher took place in 1999. The lively, sincere instructions of the teacher, information related to his scientific and creative activities, made a great impression on us, students. We returned from the expedition with indelible memories and great impressions. One day, the teacher came to the laboratory with a well-known scientist in the country, Academician A.A. Askarov. In his hands was a bunch of ceramic fragments. The teacher asked us, "Do you know what this is?" We did not know. The teacher told us about ossuaries, the history of their origin, their purpose, and extensive religious and philosophical information related to them. According to information, ossuaries were associated with Zoroastrianism; the bones of the dead were placed in them and stored in specially built "naus". Under the super-

Afrosiyob wall painting. 8th century

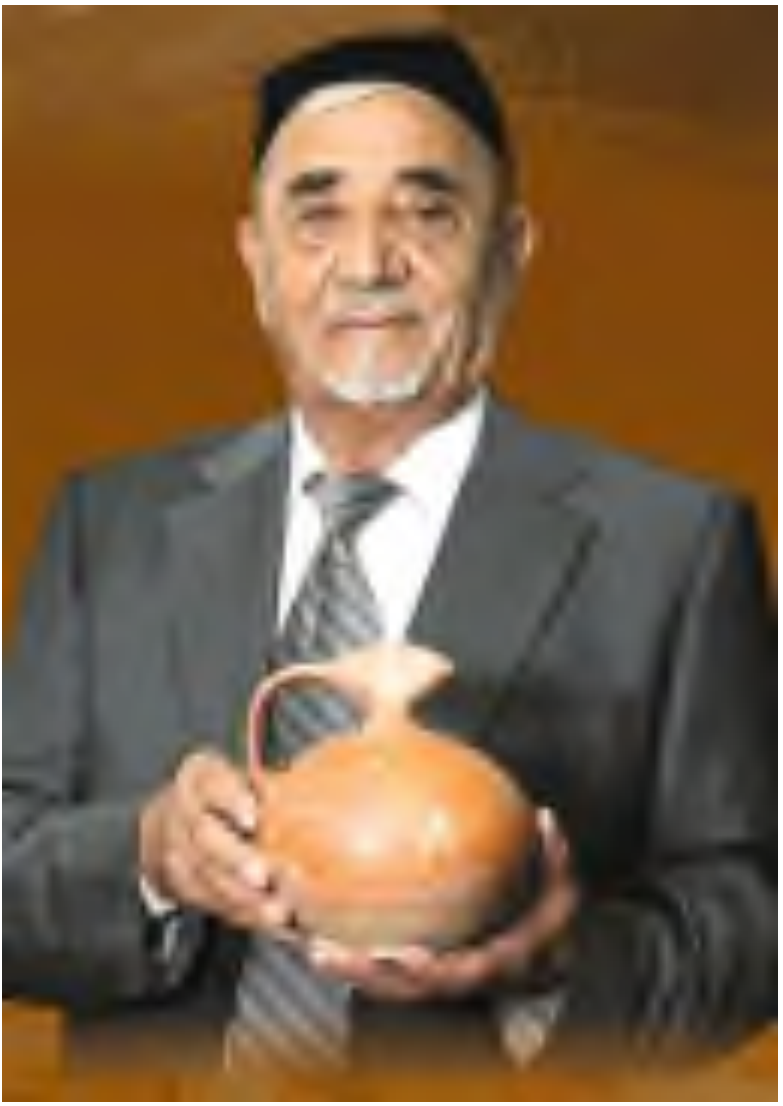

Photo: Sharif Ilhamov

vision of Sh. Ilkhamov, the relief images on the surface of the ossuaries were restored within two months.

A unique find of ossuaries was discovered in the 1970s by archaeologist N. I. Krasheninnikova near Shakhrisabz. Although the ossuaries date back to the 6th-7th centuries, the images on their surface are associated with Zoroastrian beliefs. The work on the restoration of these ossuaries was very successful. The transfer of the restored and reconstructed ossuaries was also memorable. In particular, one of the ossuaries was ceremoniously handed over to the State Museum of History of Uzbekistan, and the second was presented to the Shakhrisabz Museum-Reserve.

At the beginning of 2005, the Academic Council of the Institute warmly congratulated my teacher on his 70th birthday and presented him with a national robe. The teacher expressed words of gratitude and addressed the members of the Council: “Dear colleagues! With your permission, I would like to symbolically present my student with this robe”, and I was called to the “stage”.

It has been 20 years since this event. Although historically this is a short period, over the past years, I have often met with the teacher and received valuable advice from him, and this mentoring from him continues today. We perform together at various events and on television. In conclusion, I would like to wish the Teacher long life, good health, to see how the dreams of his children, grandchildren, and students come true.

Sharif Ilhamov with students

MODERN HISTORY OF UZBEKISTAN: A Textbook for Universities

Author Collective
3rd Revised and Expanded Edition / Edited by Prof., D.Sc. (History), M.A. Rakhimov
Published by the Coordination and Methodological Center for Modern History of the Uzbekistan Academy of Sciences

Publishing House "Akademnashr", Tashkent, 2024, 528 pages

This textbook is the first national educational resource on the modern history of Uzbekistan, covering the period from 1991 to 2023. Based on the academic and educational experiences of leading foreign universities, the book analyzes key aspects of Uzbekistan's societal development, political, economic, and socio-cultural transformations, as well as the country's international relations within the context of global political and economic changes.

The first two editions of the textbook were published in 2018 and 2020. This third edition has been prepared by authors from various interdisciplinary fields within the framework of the fundamental project "New Uzbekistan: Systemic Liberalization and Foreign Policy Strategy for Strengthening Stability in Central Asia."

Approved as a university textbook by the Ministry of Higher and Secondary Specialized Education of the Republic of Uzbekistan.

The textbook was recommended for publication by the Scientific Seminar of the Coordination and Methodological Center for Modern History of Uzbekistan at the Uzbekistan Academy of Sciences on February 19, 2024.

The textbook is published in Russian.

Nizomiddin Makhmudov, Abduvakhob Madvaliev, Ne'mat Makhkamov, Dilrabo Andaniyozova – Compilers

Normative Rules of the Uzbek Language (Punctuation)

Editor-in-Chief: Professor, Doctor of Philological Sciences Erkinjon Odilov
Publishing House "Zamin Nashr", 2021

This book is dedicated to one of the normative rules of the Uzbek language—the structuring of textual phrases using punctuation marks. The literary language, as the most expressive form of the perfection of a national language, operates based on established norms and rules. Mastery of the national literary language in both its oral and written forms is crucial.

In linguistics, the concept of normative rules refers to the existence and applicability of linguistic units in speech that are recognized, studied by specialists, and understood by native speakers. The presence of established normative rules in any language is one of the key factors ensuring the precision of its use and the ease of its learning.

When studying linguistic phenomena and their normative aspects, it is also essential to consider the national characteristics of the language. The book highlights that the Uzbek literary language functions based on the following normative rules: - phonetic, - lexical-semantic, - orthoepic, - accentological, - grammatical, - word formation, - orthographic, - graphic, - punctuation, - methodological.

Particular attention in the book is given to the fundamentals of the normative rules governing the use of punctuation marks in the Uzbek language, both in writing literary texts and in spoken language.

The book is published in the Uzbek language.

Askarov, Akhmadali.

"My Years, Tempered by Labor and Struggle" [Text]: Essay / A. Askarov. – Tashkent: Donishmand Ziyosi, 2024. – 512 p.

This memoir recounts the complex and eventful life journey of a renowned archaeologist and academician. The author shares the experiences and events he has lived through over the years. The book highlights the challenges of maintaining honesty and integrity in life, the kindness of teachers, and the difficulties encountered in the pursuit of science, the obstacles on the path to knowledge, and inspiring examples of support from good people. The work reflects the perseverance and determination of an indefatigable scholar who overcomes hardships and relentlessly seeks knowledge. We hope you will enjoy the book.

The author personally takes responsibility for the facts and opinions presented in this collection.

Recommendations of the Institute of Zoology of the Uzbekistan Academy of Sciences

B.R. Kholmatov, G.S. Mirzayeva, K.J. Rustamov, I.I. Abdullayev, Z.Y. Akhmedova, M.Kh. Khashimova, V.N. Akhmedov

Publishing House "FAN" of the Uzbekistan Academy of Sciences, Tashkent, 2021, 40 pages

This set of recommendations, compiled by a team of researchers from the Institute of Zoology of the Uzbekistan Academy of Sciences, presents materials on methods and technologies for combating termites.

In Uzbekistan, construction widely utilizes wooden structural materials, concrete, metal, and other building materials. However, due to damage caused by fungi and insects, the lifespan of wooden structures is significantly reduced. In fact, the primary damage is inflicted by insects, particularly termites and other pests that destroy materials. Termites consume construction wood, loosen it, and turn it into dust, making the damage they cause to buildings highly significant.

The main purpose of these recommendations is to describe the practical application of termite protection technologies developed by scientists for wooden structures in buildings. The document specifically focuses on the use of the anti-termite agent Anacanthotermes and demonstrates its effectiveness.

These recommendations have been approved for practical use by Resolution No. 13 of the Scientific Council of the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan, dated October 22, 2020.

The recommendations are published in the Uzbek language.

How Bees Communicate with Each Other

Have you ever wondered how insects communicate? It turns out that bees have a special language that allows them to share important information with their fellow hive members. And it's not just sounds or scents—it's an entire "dance"!

For a long time, scientists couldn't understand how bees found their way to blooming flowers. Everything changed in the mid-20th century when Austrian biologist Karl von Frisch discovered an incredible method of bee communication.

When a scout bee finds a field full of flowers, she returns to the hive to share the news. Instead of using words, she performs a special "dance." If the flowers are nearby, the bee describes their location using circular movements. This dance is called the "round dance."

However, if the flowers are far away, the bee moves in a figure-eight pattern while shaking her abdomen. The angle at which the bee moves relative to the sun indicates the direction the other bees should fly, while the frequency of the shaking conveys the distance to the nectar source.

You might wonder, "How do bees see the dance in the darkness of the hive?" It turns out that bees not only watch but also sense vibrations. As the scout bee dances, she produces faint sounds that other bees can detect.

In addition to dancing, bees use scents. When the scout bee returns to the hive, her body carries the aroma of the flowers she visited. This scent helps the other bees quickly recognize the right plants.

The ability to communicate allows bees to work efficiently as a team. Thanks to their dances, they can find the richest sources of food and return home with plenty of nectar.

Interestingly, when the sun is hidden behind clouds, bees use light polarization to navigate. Their eyes are so well adapted that they can perceive light even when it is scattered in a cloudy sky.

Studying the language of bees has helped people understand the importance of cooperation in nature. Today, knowledge about bee dances is used in agriculture to protect these vital pollinators and improve conditions for plant pollination.

So, the next time you see a bee, remember: she is not just a nectar collector, but also a born dancer and an expert navigator!

The Invisible Force: How Air Controls Our Lives

Every day, we are surrounded by something invisible yet essential. We cannot see it, touch it, or hold it in our hands, but without it, neither humans, animals, nor plants could survive. This is air—an incredible substance that governs our world, even when we don't notice it.

Air is a mixture of gases: nitrogen (about 78%), oxygen (around 21%), and small amounts of carbon dioxide, water vapor, and other elements. We often think of air as empty space, but in reality, it has weight, pressure, and even the ability to transfer energy. Thanks to air, we can breathe, clouds form in the sky, and birds soar in flight.

One of the most fascinating properties of air is its pressure. Even though we don't feel it directly, air constantly presses down on each person with a weight of about 10 tons! Why don't we notice it? Because the pressure inside our bodies balances the atmospheric pressure outside. However, when we climb a high mountain or dive underwater, the pressure difference becomes noticeable: our ears pop, breathing becomes harder, and water seems to squeeze our bodies.

Air also plays a crucial role in creating weather. When the sun heats the Earth's surface, the air above it warms up and rises, allowing cooler air to take its place. This process creates winds, storms, and even hurricanes. Without air, rain wouldn't exist—water vapor rises into the atmosphere, cools down, and turns into droplets that fall back to the Earth as precipitation.

But perhaps the most amazing thing about air is that it acts as an invisible bridge connecting all living beings on the planet. When trees release oxygen, it spreads across the Earth, filling the lungs of animals and people. Air carries scents, allowing us to smell flowers, fresh-cut grass, or an approaching storm. Even sound travels through air—without it, we wouldn't hear voices, music, or the sounds of nature.

We rarely think about how important air is in our lives. It doesn't just allow us to breathe but also shapes the climate, creates weather phenomena, and helps animals and plants interact with each other.

So, next time you feel a gentle breeze or take a deep breath of fresh morning air, remember: this invisible but powerful force of nature is silently shaping our world. The wonders of nature are all around us—if we only take a moment to notice them.

Prepared based on materials
from the internet by Sayyora Asatullayeva.

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On the cover: Exposition from the exhibition "Lullaby in the Moonlight" dedicated to the history of the cradle in the Tashkent House of Photography. The author of the project is Binafsha Nodir.

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