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# Scientific research works of foreign scientists

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***Abstract:*** This article reviews the research and scholarly works of foreign scholars on the principles of harmony and proportion in architecture.

***Keyword:*** Geometrical, dynamics, tradition, principle.

## Introduction

According to the scientific definition of the French researcher Viollet le Duc, equilateral and equilateral triangles are the basis of proportionality. The famous French theorist and restorer of architectural monuments, Viollet le Duc, believed that architecture was based on the laws and principles of government, with our organs of vision, that is, with the eyes, with proportions, with hearing. Le Duke believed that the Greeks and then the Gothic architects adopted a 45-degree two-sided equilateral right-angled triangle with sides "a", "a" and √2a half-squares to establish proportional relations: equilateral triangle with sides "a" and height √3a; The Egyptian triangle with sides 3,4,5 and the resulting rectangle 5: 8. Viollet le Duke was the first to identify the triangular and square figures that formed the basis of the arch texture, including the golden ratio, expressed as a 5: 8 numerical ratio[1.1; P-19.].

The method of arithmetic and modular relations has the same results, and within the usual approximations of dimensions, the application of triangles consequently gives both opposite simple method relations, said the French scientist O Shauzi.

In establishing proportionality, they noted that the ratios used in Egypt often give the same results. This is the Egyptian triangle (3: 4: 5) with the help of which it is 3: 8; 4: 5; 4:10; Scale proportions forming 5: 8 ratios were used in the buildings. O.Shauzi notes that this gives an almost clear golden rule (the difference is only 0.007).In addition to the products of the Egyptian triangle, O. Shauzi also shows other ratios. Both ratios, expressed as ratios of 6: 7 or 7: 8, obtained from the ratio of the side and height of an equilateral triangle, differ only geometrically in one thousandth of the geometric equivalent [1.1; p-19.].

He pays special attention to the rectangular construction of Greek classical architecture, and it was the American D.Hambij who introduced the system of architectural proportions.

Rectangles D.Hamburg are of two types: static and dynamic rectangles. If the ratio of the sides of the first type includes right angles (square, half-square, double square, etc.) represented by simple integers, the second type, according to L. Hambij, irrational relations are divided into three rectangles: a: √2a, a:

 

√3a, a: √5a. and calls these (√2, √3, √5) right angles. He also proves that the golden ratio can be built based on the square [1.1; P-20.].

As a result of the research of the German scientist A. Zeissing, he explains that the ratio of gold in the example of the Greek statue Apollo is due to the fact that all the dimensions of the body parts are divided by the golden section of the whole. His idea is, "We divide the whole into two unequal proportions, if the ratio of the parts is the same as their ratio to the whole, that is, it gives the result of the golden section."A. Zeasing leaves examples from the natural and inanimate world in order to prove that this law is universal [1.1; p.23.].

The Russian scientist I.Zholtovsky concluded from the basic rules of A.Zessing's law of proportion that the golden section for architecture and forms of organic nature served as a general law. It determines the ratio of 0.528: 0.472 in the form of its function in addition to the basic 0.618: 0.382 gold ratio. In his opinion, this ratio is closer to the square and more "viable" than the shape of a pure square. Therefore, when analyzing the forms of Greek architecture I. Zholtovsky, in addition to the golden ratio, uses this intermediate "function", which is derived from it, and introduces in the theory of proportions ratio 0.507:0.493 in addition to the above 0.528:0.472 and called them functions of the "golden section"[1.2; p-147.].

Russian scientist K.N. Afanasev proved that the basis of the proportions of ancient Russian chromium are modular ratios 1: 1, 1: 2, 1: 4, 2: 3, 3: 4, 4: 5, 5: 6, 5: 7, 20:21 , they are in the product: with a measure of length, the author defines a ratio, a square, an equilateral triangle, as well as numerical ratios. K N Afanasev focuses on the use of another right-angled Egyptian triangle with sides 20, 21, 29 in ancient architecture. K.N. Afanasev emphasizes that the proportions in ancient Russian architecture are based on a modulus equal to the diameter of the central dome of the temple, a multiple of its length.K.N. Afanasev's scheme of proportionality is organically consistent with Vitruvius and his theoretical concepts [1.1; p-26.].

Russian scientist I.Sh.Shevelev describes the gold ratio in a special way.At the heart of his doctrine of proportionality, which he articulated in the 1960s, is the “Theory of Double Square and Two Dimensions”. According to Shevelev, in determining the memorial forms in the Russian churches, two measurements of length were used simultaneously: integer ratios were measured with one sarjin bilai, and irrational ratios were determined with another.

Analysis of the most perfect architectural monuments built in different periods and in different countries (Egypt, Greece, ancient Russia), adherence to the principles of geometric harmony, ie mathematical connections expressed by the ratio of numbers 1,2 and √5 unite the articulation of monuments in all directions.The link in the general form is an invariant law of the relation of subsequent articulations. Thus, the distribution of geometric harmony is not limited to the narrow historical scope of a particular period. The immutability of adherence to geometric harmony in the masterpieces of world architecture seems to be related to the objective laws of perception. Rhythmic structure, connections based on the ratio of numbers 1,2 and √5. Before the years BC welcomed the nature of perception, otherwise the objects observed in such a sequence would not have been selected by the millennial history of society.Because it seems so natural, we observe the same connections in living nature, but the apparatus of human visual perception and the developmental process of life on earth are subject to the same laws of nature, the ideal of beauty. This golden ratio is one of geometric harmony relationships. Attempts to use the golden ratio in modern architectural practice have not yielded sufficient results. This is not explained by the imperfection of the method used, but by the specificity of the gold part. The gold ratio is moderately proportional.As the main link of geometric harmony, the golden ratio principles of geometric harmony are

easily found in the observed structure[1.3; p.98-99.].

The beginning of the study of the architectural heritage of Central Asia dates back to the end of the XIX acp and the beginning of the XX century. A well-known restorer and researcher of Central Asian architecture is the Russian scientist B.N. Zasynkin.

One of the most complex works of B.N. Zasynkin with the participation of folk masters was the restoration of the mausoleum of Amir Temur (Gur-e-Amir) in Samarkand in 1943-1950, Under his leadership, work was carried out to strengthen the rebranded dome of the mausoleum and restore its coverage by the brigades of masters Akram Ukmurov and Mukhammad Yunusov.Only due to the restoration of Sherdor Madrasa, Ismail Somoni Mausoleum and Amir Temur Mausoleum (Gur-Amir) B. N. Zypkin's name is included in the historical record. However, the scientist's activity was not limited to ancient monuments, but his talent and knowledge were used in the restoration of Samarkand, Bukhara, Khiva and other monuments of Central Asia. Among them were the graphic reconstruction of the Ulugbek Observatory in Samarkand, the study and restoration of the King Zinda ensemble, the strengthening of the White Palace( Aksaray) mausoleum in Samarkand, the repair of the Miri-Arab madrasah in Bukhara. B.N.Zasynkin identified the existence of a modular system in the construction of architectural forms of the Raboti Malik caravanserai in Navoi region.

L.N.Voronin and Sh.E. Ratiyas showed certain proportions of architectural forms of Barak khan madrasah in Tashkent. It was known that the front of the madrasa was built in eca gold ratio.The study of the proportions of the Barakhan mausoleum in Tashkent (16th century) allowed Sh.E.Ratiya and L.N.Voronin to draw the following conclusions: the composition of the facade of the mausoleum is subject to the diameter of the main circle in terms of its size and relationship, and the parameters that have a simple multi-relationship with this diameter; the dimensions of the main elements of the structure are subject to the “golden ratio”.

The authors of the article do not analyze the techniques of the masters, but try to determine the working style of design and proportions that existed in the 16th century, the construction of the monument in question, they do not try to establish objective laws, which makes the structure complex architecture. shapes and proportional structure.

In the late 1930s, Sh.E. Ratiya carried out detailed architectural measurements and research at the Bibikhanum Mosque in Samarkand. He draws the history of the mosque on a modular grid, making the sides of the cells equal to the diameter of the minaret of the western mosque of the monument. According to him, the unit of length is 73 cm, which is a multiple of that modulus. Based on his research, Sh.Ratiya even worked on a graphic reconstruction of the mosque building, which was completely destroyed at that time. Although subsequent studies have yielded great clarity on the architecture of the mosque building, this work of Sh.Ratia has left a significant mark on the history of revealing the methods of construction in the acos of Central Asian architectural forms. Because he was the first to focus on the modular system in the development of the architectural forms of this building.

H.B. Baklanov's research on modular cells was of great importance in discovering ways to achieve harmony in Central Asian memorial forms.

In the Middle Ages it was a guide for Middle Eastern architects. There are serious grounds to say that in the X-XV centuries. Similar to the memoirs of a 16th-century Bukhara master (now housed at the Institute of Oriental Manuscripts of Uzbek Academy of Sciences), there were project works and packages with memorial drawings published by N.B. Baklanov in 1944.G.A. Pugachenkova rightly points out that this scientist's project represented typological solutions for the plans of the xonaka (the interior of the

mosque, the chapel), reservoir, caravanserai (inn)and rabod (Early Muslim frontier fort, later caravansary and Sufi retreat). It is worth noting that they consist of 10x10 cells with square modular cells, which is done by separating the enlarged module. They revealed plans of different levels flattened in the drawn plane. The packaging includes decorative brick structures, arches and angular plans. “Epistle for architects”, manuscripts with a diverse system of architectural drawings and, of course, architectural monuments whose importance is difficult to overestimate are the main sources of our researc [1.4; P-95.].

G.A. Pugachenkova identifies the Monas Dome Mausoleum, the Anau Mosque in Turkmenistan, the Square Square found in New Nisa, the Gur-e-Amir building, and the gas used in the construction of memorials such as Ishratkhan and studies them on a modular basis.G.A. Pugachenkova studies the memorial solution and handicraft construction of the Monas dome mausoleum and draws it on a grid made of semi-gas (53 cm); thus defining a modulus equal to the wall width of the building tarxinint. This amount is half the width of the roof arch (111 cm).

The presence of gas, common to all, without exception. Gas is a Central Asian measure of length, equal to the length of a conditionally transmitted arm that does not have an exact dimension, calculated from this or that shoulder. The size of the gas or areas, but even in the same time interval, in a city it is famous for the memorable harmony of different monuments. Thus, according to the results of my research, the gas content of the buildings of the Gur-e-Amir yard is 66.4 cm, Ishratkhan 73.5 cm; the gas of Bibikhanum mosque (calculated by Sh.E.Ratiya) is 73 cm, the gas of Ulugbek observatory (calculated by M.E. Masson) is 70.2 cm. etc. In architectural construction, the identified gas served as a module rather than as an absolute unit of length [1.5; p.42].

An analysis of the plan of the main building of the Anau Mosque in Turkmenistan made it possible to determine that its basis was a system of squares drawn diagonally to each other. They define the outer and inner contours of the walls, the supporting arches, the entrance arches, the lines of the columnar awnings themselves. However, gas is used here, the length of which corresponds to 70 cm of gas and a modular square. In gas, the thickness of the circular arches, the width of the gaps is 3 gases, the size of the altar bed is 2 gases, and in the division of the front of the building there are many gases: intermediate 13 gases and entrance arches 10 gases, roof supports 2 gases each, side wing loggias 3 gases, the depth of each is from 1 cavity for gas to the side buildings[1.5; 42-б].

A square house with monuments dedicated to Parthian kings was opened in the northern part of the settlement. Next to it are the remains of a wine-cellar, still preserved in some places; and a whole group of production and other living rooms. Many buildings and other remnants of Parthian material culture are preserved in the ancient flooded hills, whose excavations have lasted for many years [1.12; p.29].The scientist manages to draw the history of the "Square House" found in New Nisa on a modular basis.The width of the walls of the house as a module in the "square house" is assumed to be 228 centimeters. The length of the wall of the "square house" was 26 modules, and the side of the courtyard - 16 modules. Similarly, Sultan Sanjar determined the proportions of the mausoleum and the “Arab Ata” mausoleum.

V.L. Voronina makes a detailed analysis of the ancient construction techniques of Central Asia in the VII-VIII centuries and finds that the proportions of architectural monuments are based on a module whose length is multiplied by 105-110 centimeters. Calculates that the unit of length for the XI-XII centuries is 31 cm, and for the period up to the XV century it is equal to the double measure (62 cm).

L.I.Rempel touched upon the problem of proportions in the Muslim Eastern countries. In his major work, Memorial Ornaments of Uzbekistan (1961), he argues that the problem of proportions in the East applies not only to art but also to mathematics. As the science of balance was called in the West during the

Renaissance, the proportions of the “golden ratio” have never been and never have become “the mother and queen of all applied sciences”. In Muslim countries, the proportion of geometric ornaments has disappeared. The proportion of geometric ornaments stems not from the aesthetic requirements and laws of the ideal structure of the human body (e.g., as in ancient art), but from their pure geometric constructions [1.13; 179],Later (1971) L I Rempel concludes that the dynamic rectangles √2, √3, √5 played the same role in the Middle Ages as the “golden ratio” of the Renaissance in the West [1.6; 179].

In developing the foundations for the construction of geometric harmony, L.I. Rempel concluded that they also apply to volumetric-spatial shapes. The formation of simple geometric bodies - a cube, a prism, a cylinder, a hemisphere, a spherical-conical dome, a cone, a polygonal pyramid, and others - emerged in the form of a complete system of structures. Considering the possible options for combining these simple geometric objects, L. I. Rempel discovers his own “table” and modular “grid”. [1.7; 226-227].

According to L. Rempel, the thinkers of the Middle Ages of the East also received the concept of the "Golden Section" from the heritage of the ancient world. However, this concept was not introduced in the form of a "canon" inherent in the ideal structure of the human body, as in ancient art, but through computational geometry and manual construction.

V.M. Filimonov's research focuses on identifying ways to make memorial shapes. He writes that the features of the square and the circle correspond mainly to the dimensional-planning solutions of Central Asia. In his view, the problem of sophistication and harmony in Central Asian architecture did not have a separate solution, it was solved on the basis of rheometric constructions, and thus emerged as a consequence. V.M. Filimonov writes, "If the European Renaissance was characterized by conscious pursuits of achieving proportions, there are no such ideas in the Central Asian style."V. Filimonov also denies that the modular system was used in the process of architectural design in Central Asia. However, his conclusions are refuted by subsequent researchers based on real-life examples. V. Filimonov writes that if the European Renaissance was characterized by a conscious search for proportions, there are no such ideas in the Central Asian style, and the harmony of the natural world is irrational. Memory harmony created by the human mind and hand has also had many irrational relationships in the past. In 1791, the development of the textile industry in France led to the discovery of a new measure of length - the "meter" as a result of international trade needs. However, it had nothing to do with the parts and dimensions of the human body. Therefore, the transition to an international metric measurement system has turned the work of architects and its modular expression into a path of pure intuition. The metric system has completely exploited the possibilities of using irrational harmony with the natural world and the human body. Because a special paper called "millimeter" was created, which is based on the meter and reflects the modular system, which left the architects only one way to achieve the compatibility of shapes, and that is to use the module. The metr-based module, on the other hand, does not allow architecture to create a system of proportions that are in harmony with the beauty of nature and the human body.

Based on the golden rule of architecture, the scientist who introduced the concept of "Modular" to science and called this method "Modular" is the French architect JIe Corbusier.He explains: The Parthenon, the Hindu temples, the Gothic churches, ensure complete unity according to the exact dimensions predetermined by the canon.

Moreover, the Greek and others, the carriers of high culture at all times and in all places, they have always and everywhere built and therefore measured. What tools did they have? Through eternity, it meant a permanent, precious chain, because the measure was man himself. These tools had their own names: leg, elbow, finger, heel, tutam (the amount of something that can be grabbed by the hand) and so on. Let’s look

at them directly. It was the human body that served as a convenient tool for the measurements needed to build huts, houses, temples.[1.8; 234-б]. In accordance with the mathematical laws of his idea, the laws of manual harmonization, the scientist created his own law "Modulor". The module features two rows of “golden ratio” systems based on a human comatose, the first of which is equal to 183 centimeters for an adult standing up to Le Corbusier, and the second for a man holding his hand (226 centimeters). He calls the first row the "red series" and the second the "blue series". The series of measurements in both rows are based on gold cut ratios.

In short, in the discovery of the secrets of memory and harmony of foreign scholars (Violle le Duke, D.Khembij, I.Zhiltovsky, K.N.Afanasev, I.Sh.Shevelev, B N.Zasypkin, Sh.E.Ratiya, N.B.Baklanov, G.A.Pugachenkova, V.L.Voronina, L.I. Remnel, Le Corbusier, etc.), the results of their scientific work have a theoretical and practical impact on the field of architecture and make a great contribution.

## References

1. K.S. Kryukov. Proportions in Architecture.Tashkent: 1995. P-19-20-23-26
2. Urolov A.S. Harmonization and decoration of memorial forms.-Samarkand:SSACEI, 2003. P-147
3. Shevelev I.Sh. Geometric Harmony - Kostroma, 1963. P-98-99
4. Bulatov M.S. Geometrical Harmonization in the Architecture of Central Asia IX-XV.M:"Science",1988. P-67-95
5. Pugachenkava G.A. Mechet Anau. -Ashkabod: 1959. P-42
6. Rempel.L.I. Architectural ornament of Uzbekistan. The History of Development and Theory of Construction. Tashkent: 1961. P-179
7. Pugachenkova G.A., Rempel L.I. History of Arts of Uzbekistan: 1965. P - 226
8. le Corbusier. Architecture of the XX century.-Composition of the Perovot in Russian with changes afterword, "Progres"1977. P-234

 