IJIAET International Journal of Innovative Analyses and Emerging Technology

| e-ISSN: 2792-4025 | http://openaccessjournals.eu | Volume: 2 Issue: 2

Scientific Research of Central Asian Scientists

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Abstact: This article examines the research and scientific works of Central Asian scholars on the principles of geometric harmony and proportion in architecture.

Keywords: geometry, tradition, principle, proportionality.

It is known from history that in the Middle Ages in Central Asia were highly developed science, culture, art, architecture and urban planning. The beauty, elegance and grandeur of the rich historical and architectural monuments and historic urban planning monuments created in our country during this period amaze and fascinate people. Well, the scientific study of the mysteries of the construction of these buildings, ie the geometric harmonization used in architecture, traditions, proportionality, ratio, gives us the need to theoretically study the scientific works of scientists who created at that time.

In Central Asia (from the beginning of the IX century to the beginning of the XIII century) the growth of science and culture has a positive effect on the development of world science.The great mathematician, astronomer, geographer Muhammad Musa al-Khwarizmi (790-847) was one of the founders of the science of alrebpa in our country, naturalist and sociologist Abu Bakr al-Razi (864-925), Abu Nasr Al-Farabi (872-950), one of the founders of Eastern philosophy, famous encyclopedic scholars Abu Ali ibn Sina (980-1037)and the scientific works of Abu Rayhan Beruni (973-1048) and other scholars contributed to the development of science[1.1; P-31.].

Dozens of Muhammad Musa al-Khwarizmi's works have come down to us in full, in parts, or in pieces. These works alone show that Khwarizmi was a scholar who made a major contribution to human civilization. The American historian of science George Sarton called Khorezmi "the greatest mathematician of his time, if all the circumstances are taken into account, one of the greatest mathematicians of all time". This assessment is due to the unique role of Khwarizmi in the history of mathematics.It is well known that he founded the science of Khworezmian algebra, the term of which is derived from his work "Kitab mukhtasar min hisab aljabr valmukobala". But sometimes it is argued that Khworezmi only systematized the method of solving linear and quadratic equations known to him before him. This idea arose because the Khworezmian work began on this theme.Its introduction explains the purpose for which the book was written: I have interpreted “Aljabr val mukobala hakida kiskacha kitob” on algebraic calculus, which covers simple and complex problems of arithmetic, for it is necessary for men in the distribution of inheritance, in the making of wills, in the distribution of goods, in justice, in trade, and in all kinds of transactions, as well as in land surveying, canalization, geometry, and various other similar works".The book consists of three parts. The first part of its 15 chapters is called "Kitab almuhtasar filjabr valmukobala" and is devoted to the statement of pure mathematical facts.[2.1].

We know from mathematics that the methods of solving first and second degree equations, the rules and their solid proofs, the concept of "irrationality" and the rule of "signs", a set of problems in algebra,

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

writing in the decimal system was introduced due to the work "Arithmetic", the rules of measuring surfaces and volumes in geometry, the Pythagorean theorem and other facts prove that Khorezmi conducted in-depth research in this field.

The encyclopedic scholar Abu Ali ibn Sina, who left a deep mark in almost all fields of science of his time, also achieved great success in the field of mathematics and geometry.Ibn Sina's “Usul 'ilm al-handasa” is an important mathematical source in the development of mathematics, especially geometry.This work has been comprehensively studied by many scholars, including; Hajjaj ibn Yusuf (786-833), Thabit ibn Qurra (830-901), Abu Nasr al-Farabi (860-950), Abu Rayhan Beruni (973-1048), Ibn Sina (980-1037), Umar Khayyam (1048 -1131) and Nasir ad-Din at-Tusi (1201-1274) wrote their commentaries on the work.

Ibn Sina's method ilm al-handasa consists of 15 articles, each of which has its own title.The play contains 424 sentences, 5 postulats and 9 axioms. According to Handasa-Ibn Sina, it is the first mathematical science. It is based on a straight line, its parts and overlaps, circles, ratios, similar planes, proportions, middle proportions and their interrelationships, progressions, operations on progression, spatial geometry, polygons, end and middle dividers, polygons, straight forms, etc[1.2; P-22.].

The special role and importance of geometry in the work of an architect is very important, writes Al-Farabi: "Riyaz al-bina - the art of building management, there are many geometric masterpieces, such as the design of architectural structures"[1.3; P-51]. According to Al-Farabi, the square and part of the circle (circular curves) serve as gauges in architecture. In addition, the results of many of Farobi's researches, his researches on rational and irrational numbers, trigonometric formulas, as well as geometric shapes in the field of science prove that he has a place and place in the direction of exact sciences.

Another great scholar who created in our country in the IX-XI centuries was Abu Abdullah Khworezmi, one of the most knowledgeable and leading scholars of that time. Mafatih al-Ulum (The Keys of Knowledge) is a unique encyclopedia that covers almost all major disciplines of the time. The author explains the content of each science in the Middle Ages through interpretation.

Abu Abdullah Khorezmi's classification of sciences describes the state of mathematical sciences in the Middle East. Khworezmi interprets the mathematical concept not as a voluntary creation of the mind, but as a reflection of certain aspects of the objective world, the relations of objects. Continuing Farobi's ideas, the author divides arithmetic into two: theoretical and practical. He enriched some aspects of theoretical arithmetic by considering formal numbers as well as cubic numbers. Handasa(geometry) is also divided into theoretical and practical parts, which indicates that at that time it was as highly developed as other mathematical sciences [1.4; 19-б.].Handasa is a science studied in those days, proving that it is now our science of geometry.

This is the result of scientific research, the high level of development of mathematics and geometry in the Middle Ages and its expression in architecture and urban planning, i.e. in the design of buildings, construction of large cities, arrangement of cities,geometric harmony proves its influence on the application of traditions, the application of symmetry, ratios, proportionality, population distribution, the development of harmony in architecture.

L.I. Remnel, Sh.E.Ratiya, V.L.Voronina were the first researchers of geometric harmony and proportion in Central Asian architecture. After that, Central Asian scientists M.S.Bulatov, P.Sh.Zohidov, K.S.Kryukov, I.E.Pletnev, G.A.Pugachenkova, V.M.Filimonov, S.G.Khmelnitsky and M.K.Akhmedov, A.S.Urolov carried out a number of scientific researches.The work of L.Yu. Mankovskaya and N.E. Smolina in this area is also noteworthy.

To date, the traditions of geometric harmonization and harmonization of building forms in medieval

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

architecture and urban planning in Central Asia have long been scientifically proven and recognized in practice [1.5; p.154.].

M.S. Bulatov is a scientist who has conducted extensive theoretical research, both theoretical and practical, and achieved scientific results in this area in solving the problems of manual harmony.

As a result of this scientist's scientific research, he linked the philosophical attempts of the Classical East and Ancient Greece to the cosmic life of human life.This also applies to architecture, where he founded the doctrine of harmony in the universe and revealed the science of harmony and a new theme of the universe (space) in architecture.

In his view, the connection of the ancient civilized peoples of Man with the Cosmos is materially embodied in the architecture of religious buildings, in their focus on the rising of the stars in the days of equinox, in the opening of the inner space of temples to heaven. This was achieved in the following ways: a hole was drilled in the zenith of the dome, or they hid the roof of the main room of the temple, or created an open hall for worshipers. The use of archeostronomic methods in the study of the monuments of the Classical East, Ancient Greece, Rome, as well as the monuments of Bactria, Parthia, Sogdia and Khworezm found in recent decades allows to show their location poles with concrete examples [1.6; p-51.].

M.Bulatov comprehensively studies the social, philosophical and aesthetic views of the scientists of the Middle East, the treatises used, and conducts a comparative analysis of the methods of making many monuments, buildings and ornaments. The result proves the existence of the science of memorization design in the Middle East, which is related to geometric techniques and is related to the mathematical sciences in Al-Farabi's classification of sciences.

M.Bulatov Oriental architecture handicrafts, in addition to the design of buildings and structures, taking into account a number of urban planning issues (earthquakes and natural and climatic conditions), selection of comfortable living spaces, residential hygiene, sunbathing and ventilation of rooms, construction of city buildings and structures in the form of a variety of architectural complexes (ensembles and complexes), construction of dams and bridges, digging canals, gardening and other issues. The essence of the style of harmony inherent in the architecture of the Near and Middle East.M. Bulatov is an adaptator of geometric (irrational) and modular (integer) relations to the structural-tectonic and artistic image system of buildings [1.5;p.155].Insulation and ventilation of buildings (Ibn Sina), "Construction of buildings, fortresses in cities and shrines" (Rashid al-Din), construction of dams and canals (al-Khwarizmi, Buzdjani, Rashid ad-Din), issues of gardening and horticulture, etc., based on the reports of Al-Kindi, al-Farabi and Bayhaqi scientifically substantiated that it was created in the region.

In his view, architectural theory as an art was based on doctrine. The concept and appearance of harmony, associated with criteria such as balance, order, correspondence, kinship, proportionality, had its own historical content, closely related to the whole structure of society. He noted that the geometric structures in the plane and in space, as well as all of these systems, form the basis of compositional principles and have a great influence on technical and constructive solutions, image systems and the typology of architectural forms in general.

Another study by M. Bulatov analyzed the proportions of extant architectural monuments of Central Asia in the IX-XV centuries and found that the system of building technically simple architectural forms based on square, equilateral triangles and their products are divided into more complex, half-square products and extreme proportions. In the works of architects of the XIV-XV centuries, the development of this system leads to the development of new, universal, theometric relations specific to Central Asia. The essence of the method of harmonization in the architecture of the Middle East is to adapt the geometric and modular relations to the constructive-tectonic and imaginary structure (dimensions,

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

decoration) of the work.In practice, this is achieved by the simplest means of connected applied geometry used by computers (Abu-l-Wafo Buzjani's expression) [1.6; p-301].

P.Sh.Zohidov is another scientist who discovered the secrets of memorial harmony and conducted scientific research, analysis and analysis on the buildings built in the Middle Ages.

Well-known master scientist P.Sh.Zohidov discovered the law of dynamic squares, one of the principles of architectural beauty, which has been widely used in architecture, but has been passed on to future generations. He calls this law, which gives irrational relations, the "Memoriy al-konun," and in this place takes a very simple but very correct path: it states that "the order of the harmony of monuments must be sought from the possibilities of a simple pargor (compass) and ruler (plan strip).". From this important point of view, in defining the harmony and regularity of building forms, the ancient architects came to the conclusion that dynamic squares, that is, "using a network of lines drawn on the basis of interconnected squares" and examined this style in more than 100 architectural monuments.[1.5; p.154.].

On the basis of the dynamic squares he discovered, P.SH.Zakhidov built the square history of Sopolli-tepa fortress, one of the ancient monuments of Central Asia, the square house built in Nisa (Turkmenistan) in the II century BC, as well as the square in Bukhara, Analysis and proof of the Samanid mausoleum and other buildings, one of the most beautiful monuments of architecture in Central Asia in the late ninth and early tenth centuries, can be seen in his book Fundamentals of the Canon of Harmony in Architecture.

In his conclusion, P.Sh.Zakhidov writes that the medieval architecture of Central Asia in the region embodied the highest flowering of harmony. It serves as a confirmation of the most intricate entries with architectural monuments. The Samanid mausoleum, along with geometric ornaments, the Arab Ata mausoleum, Bibihanim mosque-madrasa, Ulugbek madrasa and many other monuments allowed to reveal the originality of the creative methods of building and harmonizing architecture.In addition, dynamic squares form a new grid of entries.

K.S. Kryukov is another scientist who has found new ways of the principles of geometric harmony and proportion in our country.

He studies and analyzes the works of our country's scientists in the Middle Ages, the research work of foreign and Central Asian scientists on harmony and proportion, as a result of which he improves the modular system in Architecture. Based on the same modular system, it analyzes and proves the memorials of ancient Egypt, Greece, Rome and Central Asia, and creates a “Tool” (Asbobi)to identify proportional relationships used in memorial forms and express them in simple integers.

In order to facilitate the analysis of the proportions of the architectural forms of the studied architectural monuments, in determining the proportions on the basis of a table compiled by the author, a straight line or a small section to a large whole value is sufficient. The indicator obtained is tabular data, according to which it is possible to determine the proportions of the object under investigation, if there is a correlation. At any scale, the width is divided by the proportional length, which compares the base ratio [1.7; p.64.].

K.S. Kryukov was of the opinion that in addition to the law of dynamic squares, which was widely used in architecture in the past, other "universal" styles could be used, and managed to find a universal law that covers the basics of beauty in all areas of architecture. In his opinion, this law applies not only to the medieval architecture of Central Asia, but also to all the peoples of the Ancient East and European architecture.This universal architectural law includes the law of dynamic squares developed by P.Sh.Zokhidov, as well as a number of rules, such as the ratio of the sides of the "Egyptian triangle" 3: 4: 5 from a right-angled triangle, the famous "Golden Section" ratios in architecture and modular (scale)

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

network. Interestingly, according to this law, all proportions are expressed not in irrational quantities, but in simple whole rational numbers, that is, in modules.

MK Akhmedov is another master scientist who found unique new methods of geometric harmony in architecture, worked on the scientific and theoretical foundations and achieved results.

The scientist conducted in-depth research in this area and identified the method of jam (square) and "Chartak" in the combination and formation of the composition of traditional ensembles of handicrafts in Central Asian architecture and urban planning. In particular, in the system of urban planning, the formation of the population on caravan routes, a series of ensembles of the historic city area and the coordination of buildings in the form of memorial ensembles as well as complexes proved for the first time.

He points out that a number of buildings, such as the Bibi Khanum Mosque and the Ulugbek Madrasah in Samarkand, have a width and height of 1: 2, ie the side of the square and its diagonal. It also determines whether ratios such as 1: √3, 1: √5, or 1: √3, 1: √5, and a series of irrational relationships resulting from them are used. The sides of the Bikajon Bika madrasa in Khiva (19th century) are defined in a different way. In it, the width of the building is divided into a "golden section", a large part of which is placed at an angle of 90 ° by means of pargor and magnified 2 times. 1: (2x0,618) or 1: 1,236. Thus, straight rectangular dates are very different, but have been adopted in proportions based on certain laws. There were also buildings consisting of circles, polygons, and other shaped structures, the dimensions of which were also based on the ideas of proportion and harmony[1.1; p.123.].

Another such teacher of ours is A.S. Uralov. He studied the methods of memory harmony and proportionality of the above scholars, and as a result presented his textbook for architects in the field of architecture "Harmonization and decoration of memorial forms".

In his conclusion, based on the research of our compatriots M.S.Bulatov, G.A.Pugachenkova, P.Sh.3oxidov, K.S.Kryukov, M.K.Akhmedov, as well as Russian and European scientists, we have seen for centuries the proportionality of the architects of the past. and we have talked about the "laws" of the proportions of shapes used in the form of geometric means of harmony, and we have made our readers aware of this mystery.

A.S. Urolov introduced and proved the harmony of memorial forms and the "Law of artistic completeness", which is a novelty in the field, in the art of harmonization of architecture.

A.S. Uralov concludes: Unfortunately, adherence to these principles has now become a personal initiative and intuition of architects. However, the number of "geniuses" who can achieve high intuition in architectural creation is very small, and architects who are considered to be the creators of beauty are needed at every step. So, what to do to get out of this situation?First, modern architects need to check their accuracy in their projects using the proportions specified in the above laws, not limited to personal intuition and visual architectural proportions. Second, architects must be equipped with modern electronic computer technology. This is also the case in design practice. However, even computer-designed architects do not go beyond relying on their own intuitions to achieve the harmony of architectural forms in the early stages of the creative process. The computer itself is not yet in harmony with the form. To do this, it must have an electronic program that harmonically and aesthetically controls the shapes it incorporates. Unfortunately, such an aesthetic electronic program has not yet been developed. Until then, he advised architects to use the laws of harmony discussed above and K.S.Kryukov's “Equilibrium Table”.

In conclusion, in the architectural and creative work of Central Asia, the great scholars and scientists of the Middle Ages (mathematician, astronomer, geographer Muhammad Musa al-Khwarizmi), Abu Nasr

ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022

al-Farabi is one of the founders of Eastern philosophy, famous encyclopedic scholars such as Abu Ali ibn Sina and Abu Rayhan Beruni), which show that the scholars were active not only in the field of science but also in the field of architecture.

Central Asian scientists (M.S. Bulatov, P.Sh. Zokhidov, K.S. Kryukov, M.K. Akhmedov and A.S. Uralov) have carried out a number of scientific researches in solving problems of manual harmony and proportion, of course, the results of scientific work in this area are a source of knowledge for young scientists and architects, which allows them to use these methods in the restoration and restoration of historical monuments in our country, in the development of modern urban planning.

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ISSN 2792-4025 (online), Published under Volume: 2 Issue: 2 in February-2022