



Reasons for Creation of Important and Sacred Numbers and Their Reflections in Architectural and Urban Spaces

Hossein Soltanzadeh^{1*}

¹Associate Professor of Architecture, Faculty of Architecture and Urban Planning, Islamic Azad University, Central Tehran Branch, Tehran, Iran.

Received 27 January 2016;

Revised 5 April 2016;

Accepted 21 June 2016

Abstract: This research was an attempt to study reasons for creation of some of the important and sacred numbers and their reflection in architectural and urban spaces. This subject matter is important because significant and sacred numbers were used in design and construction of a number of historical spaces. The research objective was to discover some of the reasons for formation of important and sacred numbers and their reflection in architectural and urban spaces. The research questions are: How and why were some numbers considered important or sacred? How the important and special numbers are reflected in urban and architectural spaces? The research theoretical framework is based on the idea that important and sacred methods were used in design and construction of a number of architectural and urban spaces (especially religious spaces) as well as public spaces. The idea also holds that architectural and urban spaces are reflections of civilization and culture of the society they belonged to. The descriptive analytical research method and sometimes the historical-interpretative research method were used for this research, because the research data consisted of historical and qualitative data. Architectural and urban spaces in Iran formed the dependent variable, and important or sacred numbers were the independent variable in this research. The statistical society mainly covered Iran, but examples of other important cultures are also referred to. Research results indicated that phenomena such as some of the numbers related to human organs, natural and cosmic system numerical properties of the earth, some of the structural qualities of geometrical forms, a number of religious events and phenomena, the internal structure and order of arithmetic, and relationships between numbers are factors influencing formation of important and sacred numbers.

Keywords: Sacred Numbers, Symbolism, Culture and Numbers, Traditional Architecture.

INTRODUCTION

There are discussions of some sacred important numbers in a number of books, but it seems the reasons for importance of many numbers are not accurately described and some related examples and notions are only mentioned in these books. Hence, such information cannot result in a precise understanding of the reason(s) for formation of special sacred numbers and may even sometimes lead to the misunderstanding that a number is used in a work for the purpose of symbolism, whereas other phenomena and factors (e.g. structural, aesthetical, and practical factors) may lead to utilization of a number in a work of architecture. Hence, people may consider the usage as an act of symbolism. An example is Jörg Kurt Grütter's description of number four which is as

follows: "Number four denotes the four directions of the sky and the four seasons and thus it is considered a cosmic number. The symbolic concept of number four is very ancient and has found its way to the bible. For example, consider the four bibles and the four arms of cross" (Grütter, 1996, p. 321). However, the four seasons and four directions of the sky are relative phenomena.

Some researchers believe the east was the origin of mathematics in the ancient world. Ahmad Hami states that Greek alphabet originally belonged to Phoenicians and they were writing from the right to the left until the 10th and 11th centuries. They also lacked accurate knowledge of multiplication, because they used the Abjad numbers, which they owed to Phoenicians and 2000 was their largest number (Hami, 1976, p. 107).

* Corresponding author email: Hos.soltanzadeh@iauctb.ac.ir



The Pythagoreans believed that the universe was measurable using simple mathematics and integers and they also believed that the system did not include non-integers. However, when Hippasus found that the relation between the sides and diameter of a rectangle cannot be expressed with integers, a part of the early Pythagorean worldview collapsed (Schimmel, 2007, p. 25). In the Pythagorean system numbers were divided into odd and even numbers, and odd numbers referred to the right side, male, light, and good while the even numbers referred to the left side, female, darkness, and evil. It could be stated that one of the most important reasons for the odd/even classification was generalization of the parity system to numbers and other natural phenomena. It is also said that Plato believed all even numbers to be ominous (Schimmel, 2007, p. 26), and this belief was universal.

Some special numbers are used in most or many religions including monotheistic religions. In addition, these numbers also exist in religions and schools which were solely humanitarian and were not divine religions for a while. For instance, numbers 3, 4, 8, and 12 were used in arrangement of some hints and teachings in Buddhism (Rahol, 1975, pp. 33, 140).

THEORETICAL FRAMEWORK

Mathematics and the numeral system are one of the most important and substantial components of human knowledge and helped ancient humans discover the world gradually. The resulting understanding was sometimes partly imprecise and inaccurate and was accompanied by false beliefs. Hence, numbers were considered special at those times. In this regard, Cassirer puts: After time and space, numbers are the third great formal concept governing the mythical structure of this world...The odd magic of numbers has been a substantial force in formation of spirituality and human's self-awareness. It is also proved that number is a magical link that connects different awareness forces and integrates feeling, intuition and senses. Hence, number plays the same role the Pythagoreans define for coordination (Cassirer, 1999, pp. 224, 241).

As stated by some researchers, some mathematical knowledge and experience used to be exchanged between nations. It is also reported that the names of some numbers have the same origins in some ancient languages. For instance, number 6 is called "Sas" in Sanskrit, "Hex" in Greek, "Sex" in Latin, "Shast" in Russian, and "Shesh" in Persian (Taton, 1985, p. 66).

Some sciences, such as mathematics, had two functions/dimensions: one dimension belonged to

functional affairs, whereas the other belonged to supernatural notions and social beliefs. In other words, they believed they could interfere with the nature through unusual and supernatural means, but it seems that in the past sometimes there was no distinct border between the nature and metaphysics as there is today. In the middle ages in Europe, sciences were classified into the three groups of sciences, known as "major reason expression" (grammar, logic, and eloquence), and four sciences of "major reason" (arithmetic, music, geometry, and astronomy) (Burckhardt, 2010, p. 70). Theoretical philosophy or wisdom (sapience) was generally divided into three types: supernatural science, mathematics, and natural science. Basics of mathematics were also divided into four categories: geometry, science of numbers, astronomy, and music (Shirazy, 1990, p. 74).

Documents from the technical and architecture treatises and textbooks of the past indicate that some technical and professional textbooks only discussed professional aspects and almost overlooked numerical and geometrical symbols. An example is the "Vault Azaj" treatise penned by Ghiyāth al-Dīn Jamshīd al-Kāshī (the ninth century A.H.), who was a mathematician and astronomer involved in illustration of architectural vaults and calculations of areas and elements. He was supposedly the designer of the Samarkand observatory. No clear description of numerical symbolism in architectural spaces is available in this treatise, although he was so fond of mathematics that he wrote the following in his "Meftah al-Hesab" in praise of God: "The God who is the unique creator of beings is worth praising as he is the peerless connector of various numbers..." (Ghiyāth al-Dīn, 1987, p. 11)

In today's era, similar to the ancient times many people and thinkers believe in significance or sacredness of some numbers, although interpretations and meanings of some numbers differ by individuals. Marin Lings' statement about numbers could be mentioned as an example of this case: "Among single digits there are two numbers with substantially divine meanings which are superior to others: one and seven. The whole existence is played between number one and seven similar to alpha and omega. One is the creator. Two is soul. Three denotes the heavens. Four refers to the earth. Five stands for human, which is the core of the four elements, four directions, and four seasons in its ether or fifth element form. Six is the primitive man who was created on the sixth day. God blessed the seventh day and called it sacred (Book of Genesis, 2, p. 3)." (Lings, 2002, p. 116).



Numbers and arithmetic were used in different forms to predict or interfere with world events. By criticizing this form of calculation, Ibn Khaldun considers it “semi arithmetic” and introduces it as follows: “There is a group of foretellers that have defined rules for prediction of supernatural events. These predictions are neither spiritual perceptions nor Ptolemaist astronomical predictions” (Ibn Khaldun, 1968, p. 214).

Some of the Factors and Phenomena Involved in Creation of Important and Sacred Numbers

Many factors and phenomena have been involved in formation of some of the important and sacred numbers and a brief introduction of them is presented in the following.

Human Body Numeric Properties

One of the most important phenomena that attracted human’s attention from the numeric point of view was body organs, and human could easily recognize numbers 1, 2, 4, 5, 10, and 20 in his body. Some body organs such as the head and nose are one. Some others like the eyes and ears are two. Others such as the hands and feet are four. Hand fingers are five. Fingers of both hands are ten, and the number of toes and fingers are twenty. These are the least human body numbers which were easily recognizable for primitive humans and they considered these numbers vital, honorable and sacred. One of the first numeral systems was the decimal system, which is still used by humans and base of 20 is also still used.

Natural Order of Universe

The natural sequence and order of day and night, which follow each other as well as the movement of the moon from the full moon to the smallest crescent (when it vanishes and emerges again) and its repetitive rhythm which last for 12 iterations and 365 days (360+5) in a solar year were among the important yet relatively simple facts discovered by human societies especially urban societies. This information led to development of calendars for adjusting the time accurately. Therefore, numbers such as 12 and 360 (12×30) attracted the attention of human societies, and these numbers were valued by all advanced ancient civilizations whose calendars were based on movements of the sun.

In societies whose calendars were based on movements of the moon, a month equaled 28 or 29 days and 14 days formed half a month. Half of the 14 days is 7 days which make a week.

Cosmic Order and Events

Some cosmic events could have been involved in formation of some important sacred numbers. An instance is the travel of a complex around the earth in 33-year period, which leads to severe excessive meteor rains in several-day periods. The repetition of the event in 33-year period had been discovered previously, and although the real cause of this phenomenon was unknown, number 33 had a special place. This number was valued by many great and important civilizations, although since 33-year period were long, the significance and symbolic use of this number was not comparable to important numbers such as 12 and 4.

Philosophical Interpretation of Existence and General Worldview of Primitive Human

In many important civilizations of the past the parity of phenomena (which originated from an understanding of human, animal, and plant in nature) was seemingly generalized to all of the world phenomena by some primitive humans. However, some phenomena also contributed to such a classification. For example, day and night were considered to be similar to male and female genders in a dual general classification, and thus, the night was assumed as female and day as male. Similarly, warmth was considered male and cold was female. Fire was male and water was female. The sky was male and the earth was female. The sun was male and the moon was female. Gold was male and silver was female. Lion was male and cow was female. As a result, a symbolism system was established based on parity of phenomena. In this system, numbers were classified into odd and even numbers, and sometimes numbers were divided into the groups of good (blessed) and bad (ominous) numbers.

Some Religious Symbols and Signs

Some signs and symbols were important and sacred for different reasons in every religion. For instance, Noble Quran consists of 114 surahs, and Imam Ali’s Abjad number is 110. Moreover, the total number of letters used in “Bi-smi llāhi r-rahmāni r-rahīmi” is 19 and thus these numbers are important in Islam. In Buddhism and Hinduism numbers such as 18, 38, 39, 56, and ... are important (Bunce, 2002).

Implicit Meanings of Numbers

Some numbers can carry implicit meanings due to their size. For instance, consider number one which refers to uniqueness and the unique God in some religious and



ancient cultures, because this notion is contained within number one. Number 2 is the first number that is larger than one, and thus it is often considered as the sign of multiplicity. It is also the smallest number used to show multiplicity. Number 3 was considered by the Greeks to be the first number that had a beginning, middle and an end. It is also one of the numbers which was most commonly used to commence actions.

Mathematical Relations among Numbers

There are special mathematical relations between some numbers, and this phenomenon has contributed to the significance of some numbers. For instance, concerning numbers 4 and 10, the Pythagoreans believed that since the sum of 4 with its divisors (i.e. 4, 3, 2, and 1) equals 10, these two numbers are special.

Geometrical Composition of Numbers

Due to the geometrical composition of some numbers, links emerged between those numbers and related geometrical shapes and the links sometimes added to importance of those numbers. For instance, number 3 is related to triangle, 4 is related to square, and 5 is associated with circle, hence they were considered as important.

Need for Large Numbers

In the past or present, large numbers were needed to exaggerate the size of some phenomena. Seemingly, many large numbers were resulted from multiplication of two important or sacred numbers. For instance, $10 \times 4 = 40$, $10 \times 10 = 100$, $12 \times 6 = 72$, and $33 \times 3 = 99$.

Interesting Qualities of Some Numbers

Some numbers have interesting mathematical qualities and thus some numbers were considered honorable or sacred. For instance, since the sum of number four with previous numbers is ten, numbers four and ten were considered special and were honored and considered sacred.

Some of the two, three, or four digit numbers had also attractive qualities. Remainder of division of 119 by 2 is 1, and remainder of division of 119 by 3, 4, 5, and 6 is 2, 3, 4, and 5 respectively (Alneski, 1985, p. 120). Many of these examples are available in mathematics and as result some numbers and mathematical properties were considered extraordinary.

Meaning of Numbers and their Reflections in Architectural and Urban Spaces

Zero

Zero is a very interesting symbol which was originally used to refer to nullity and emptiness. However, it seems it gradually gained importance for several reasons in mathematics, mysticism, and some theoretical viewpoints. Many references suggest that zero is an Indian invention which was used in references in the sixth century and was called Shunya by Indians to refer to nullity. In other words, nullity was believed to fill the space between numbers to allow for recognition of the number's place (ones, tens, etc.) (Schimmel, 2013, p. 18). In the eighth century, zero and decimal numbers were introduced to Western lands by Muslims, and thus the numbers 0 to 9 were known as the Arabic numbers for a while (Alsaeed, Parma, 1984, p. 120).

One of the reasons which shows the importance of zero in mathematics is its role as an aid in determining the place of some other numbers on the decimal and hundreds basis. Therefore, it sometimes plays the role of number one. Another important point is the meaning of null or empty, which is used as the void or empty space in some visual arts such as painting, but some researchers have found a relationship between zero and empty space such as courtyard.

One

Some thinkers of the past did not consider one as a number, because they believed it was a part of all numbers or a hidden part of all numbers. The implicit meaning of one shows uniqueness and loneliness. This meaning is considered as a general notion in all important human cultures, and thus one and its equivalents (such as unique, single, and peerless) have been normally used to refer to the unique God. Moreover, it is also used to denote various peerless and unique phenomena.

The Ikhvan al-Safa believed one was the basis of numbers and stated that no number has ever lacked number one as no line lacks dots (Ikhwan al-Safa, 1992, p. 51).

Concerning the typical architectural and urban spaces, it could be stated that existence of an urban complex or a building can be a manifestation of emphasis on unity of the buildings. Existence of the Naqsh-e Jahan square in Isfahan or any other special complex in Iran or the world shows uniqueness of those structures.



Two

Two can be considered as one of the most important numbers in human life of the past from many aspects. This is because human was aware that the life of animals and some plants was based on the parity principle, and thus parity played the major role in a large fraction of human worldview in most of the past civilizations. In many cases, other phenomena were also divided to male and female categories based on the parity principle. Hence, “two” was known as the number of nature, the first large number, and sometimes the symbol of the female gender based on some beliefs.

This is because symmetry would add to stagnation of the building and more importantly the best and most beautiful form of order was considered to be an order based on symmetry, which matched the order of many animal beings. Therefore, this can explain the formation of many paired architectural, urban, and artistic compositions, and the paired minarets used in Iranian and Islamic architecture are examples of this composition.

Three

In some ancient texts number 3 was considered the first whole number, because they believed that 3 was the first number with a beginning, middle, and an end (1-2-3). It was considered the symbol of maleness. In some lands, many mathematicians of the past believed number 3 was special and important because it was the first number that forms a geometrical shape (triangle).

Number three is commonly used in ancient Iranian religions and Zoroastrianism. The ancient Iranian society was divided into three classes (Soltanzadeh, 2011) and three fires were dedicated in three sacred fire temples to each class. The Azarfaranaq (Fars), Azargoshnasb (Azerbaijan), and Azarborzinmehr (Khorasan) fire temples were dedicated to Zoroastrian priests, army forces, and farmers, respectively (Faranbaghdadegi, 2001, pp. 90, 112).

Number three was also highly important in urban and architectural design in Iran. First, according to an ancient myth (Vare Jamkard), the Iranian utopia was formed of three parts (Soltanzadeh, 2011, p. 20). This phenomenon was not solely limited to Iranian utopia, but it continued through the Iranian urban design tradition during the Islamic period.

However, construction of three domes in a building known as the Ardeshir Palace in Fars cannot be explained by functional purposes, as it was probably a symbolic action. Not many three-dome buildings have remained

from the ancient Iran, but the prevalent construction of three domes in a form of Indian mosque during the Mughal era (which is considered a characteristic of Islamic religious architecture in India) was symbolic because functional and environmental reasons could have not led to formation of this composition.

Four

As stated, number four is important because humans and many animals have four feet and hands, directions known by humans are four (front, back, right, left), and it is the most static number in architecture and some visual arts which is widely used with square structures. Number four can be perhaps considered as the most common, applicable, and symbolic number in many arenas, especially in architecture. Four directions, four seasons, and four elements of the world were most probably discovered later. In this regard Plato puts: “All of the four elements are used fully in construction of the world. The creator has combined fire, water, air, and soil, and has not excluded a part or fraction of these elements from this world” (Plato, 1972, p. 38). There are also references to this point in most of the Islamic textbooks. For instance, in his consider Mersad al-Ibad, Najm Razi writes: “Be aware that human body is formed of four elements namely water, fire, wind, and soil, which are based on singular attributes.” (Najm Razi, 1973, p. 65)

The human world is also based on four natures and there are four types of winds (West, East, North and South winds). The world has also four directions namely the east, west, north and south directions. There are also four wedges known as the dawn wedge, the sunset wedge, heavens’ heart, and earth’s wedge. There are also four seasons namely the spring, summer, autumn, and winter. Human’s life is divided into four periods: childhood, youth, senility (between youth and senescence), and senescence (Hamedani, 1997, p. 42).

Some chemists discovered such a strong relationship between number four and a sphere that they believed a sphere body can break copper down to four elements (Zahedi, 1998, p. 213). The Pythagoreans highly valued number four and called it the number of balance (Plotinus, 1987, p. 956).

Existence of a relationship between some musical chords and modes and the number of four elements and four seasons, can be recognized among the facts that had been considered before (Ermavy, 1967, p. 20).

The crux was present in almost all of the visual arts of Iranians and one of the most interesting forms of its manifestation was seen in calligraphy, where a special



composition of number four (as itself) and a factor of number four (as itself or a factor of four) was known as “crux alphabet”. This art involved italic letters written in Nastaliq, and thus some thinkers believe that the name crux was given to this style due to its use of italic letters (Ahsant, 1997, p. 10). However, a foursome combination of verses has definitely contributed to this naming.

Concerning Afrasiab’s legendary mansion it was believed that it embraced four rivers, and although it was an underground structure, it was extremely light at night. In this regard, Bundahish states: “About Afrasiab’s mansion, it is said that it is built by the aid of magic under the ground. It was as light as daytime at nights, and it embraced four rivers. One contained water, the second contained wine, the third contained milk, and the fourth contained yogurt. Its roof sometimes was decorated by the sun and sometimes by the bright moon” (Faranbaghdadegi, 2001, p. 138).

“In the Chinese system of thought, each season of the year, each color, each element, and each animal or human organ, corresponds to one of the main spatial directions. Hence, the diversity of the nature is formed based on these four main spatial directions” (Cassirer, 1999, p. 236). In Iranian architecture, number 4 plays the most important role in compare to other sacred numbers, and the most important Iranian architectural designs are linked to number four. Examples include the four arcs, four porches, four galleries, four gardens, four directions, and the eight gardens (Soltanzadeh, 2008, p. 61).

The religious use of number four is seen in the design of very few historical cities such as the Goor City which was divided into four sections (Brosious, 2006, p. 168).

Different foursome designs and compositions are also used in Taj Mahal, which accurately reflect the symbolic use of number four and related designs (Soltanzadeh, 2009, p. 105). The emphasis on four-part designs is also seen in Shalimar gardens.

Five

Importance of number five seems to have originated from the five fingers of hands which were used in simple calculations. Concerning the mathematical composition of this number it is said that it is the first number to be the result of combining an even and an odd number. In many ancient civilizations, number five was known to be important. It is also considered a lucky number in China (Schimmel, 2013, p. 124).

One of the best reflections of number five in important religious spatial plans in the Iranian architecture was a square grid divided into nine parts. It is the same

structure based on which the Apadan Palace in Persepolis was designed and built. Another form of this five-part structure, which is fully distinguished from four-part structures, is a space formed of five similar elements. A suitable example of such a space, which has remained from the past, is the Amir Ismail Samani’s cemetery in Bokhara. This building consists of one main dome and four small domes on the sides. There is also a fire temple in Baku with almost the same structure. Arjmand Banou Beygom’s cemetery in Taj Mahal is also a very good example of these five-part spaces, where a central main dome is surrounded by four secondary domes or a huge umbrella on the sides (Soltanzadeh, 2011).

Six

It seems number six is sometimes used as a symbol in construction of some architectural elements. For instance, a total of 12 (6×2) are used in all of the three porches of the Apadana palace in Persepolis. In the Islamic era, a few number of important mosques had six minarets, which can be ascribed to the symbolic aspect of number six.

Number six is also used in non-architectural arts. For instance, at the center of the Pazyryk carpet, which seemingly belongs to the Achaemenid era and contains symbolic figures, such as a cross (chalipa), twenty four (6×4) squares are used.

In a number of historical and mystical textbooks there are references to the six directions which are the north, south, east, west, up and down. Human is also considered to be limited to these six directions (Sohrevardy, 2008, p. 8). Therefore, some people believe a cube is the geometrical symbol of six directions as it has six sides.

“All of the three monotheistic religions agreed that the creation took place in six days. The whole number that is related to creation and the relatively honored quality of the sum of 1, 2, and 3 (divisors of 6) is 6”. (Critchlow, 2011, p. 68)

Seven

Seven is one of the most important special numbers which is almost globally significant and has been valued in many important cultures. Some ancient civilizations used number 28 to round the number of days of a lunar month, and therefore, one of the reasons for the importance of this reason is the method of dividing time based on the movements of the moon. Half of 28 is 14 and half of it equals seven.

The full moon is also derived from this classification, and each month was divided into 4 weeks on the same basis. Six days were defined as working days and the



seventh day was defined for relaxation and religious practices. Arthur Pope correctly explained this process in his work (Pope, 1986, p. 34).

In “Bondahesh”, it is assumed that the Gang Fortress have had seven walls made of gold, silver, steel, brass, iron, crystal and azure (Faranbaghdadegi, 2001, p. 138).

Number seven has been highly valued in ancient and historic texts. An example is a very ancient myth called Gilgamesh. In this myth, Gilgamesh tells someone called Orshanbi that seven wise masters prepared the plan of important buildings of the Oroc City (Gilgamesh, 1999, p. 95). In addition, some knowledge and sciences are divided into seven types, for example in Ihsa al-Uloom, Al-Farabi divided the science of math into seven parts (Farabi, 1985, p. 75).

Moreover, seven attributes of people who are fond of the world and are detached from the good are mentioned in religious books (Kolayni, 1989).

Number seven was highly important in Mithraism in Iran and levels of spiritual growth and ritual hierarchies were divided into seven. To be converted into the religion, people would first enter a stage called the “crow” stage and other stages were called the hidden and the soldier stages. Only a few numbers of people were able to reach the fourth phase which was the lion stage, and only very few of them were able to reach higher stages which were the Parsi and Sun’s messenger phase. The last stage, which was the father phase, only belonged to very special, wise and esteemed religious people (Vermazeren, 2011, p. 167).

Number seven was less prevalent in architectural plans, because it lacked stagnation and symmetry. However, it was used in design of facades, voluminous bodies, and such. One of the ancient documents related to this application describes the façade of a fortress on a plate kept in the Hermitage Museum of Leningrad. On the epigraph below the shelter of the upper floor of the fortress there are seven arc-shaped vaults, the number of which was most probably based on the sacred number seven. Some of the decorations of this fortress are clearly similar to Takht-e Soleiman decorations and elements, which indicates that the image was based on ancient samples and rooted in reality. In the Islamic era, examples of usage of number seven in facades and voluminous bodies are available. An example is the number of small decorative domes on top of the main entrance of Taj Mahal which is equal to seven (Lahori, 1867). The existing documents suggest that some ancient and historic cities of the past had seven gates, and it could be attributed to the symbolic significance of number seven in some cases. An example

is the sacred part of the area surrounding Choqazanbil (of the Elamite era), which was separated from other parts of the city with a fence and had seven gates (Prada, 1978, p. 68). Bokhara City in the fourth century A.H. also had seven gates (Narshakhi, 1984, p. 73).

Eight

Number eight was linked to cube in the early ages and it was found that the square of an odd number, larger than one, is equal to a number that is a multiple of eight plus one. It was also found that the result of subtracting the bases of odd numbers larger than one was a multiple of eight. In ancient Babylon eight was considered the number of gods and it was also considered the number of bliss in some other civilizations (Schimmel, 2013, p. 172).

The octagon has had a significant role in design of architectural spaces and structures. Concerning architectural structures, octagon was mostly used in construction of many Iranian domes, which were built on a square background. In such domes, to transform the square area into a circle suitable for construction of a dome, the square was normally transformed into an octagon. Sometimes the dome was built on a circle on an octagon and sometimes an octagon was divided into a hexadecagon which formed the base for the circle. Such applications of number eight was not for symbolism purposes, as it was meant for functional and structural purposes. Therefore, the statement by Rene Guenon and his followers, who believed the octagon was a symbol, can be easily accepted.

Nine

Number nine is a number of which there are different interpretations and definitions in different lands. It seemingly had a negative meaning in Christianity as they believed that Jesus Christ passed away at nine o’clock. However, in some other cultures such as in ancient Chinese culture and parts of southeast Asia it is considered an ominous number as they believed that the whole universe is formed of nine-part groups: the sky is composed of nine parts, the earth is composed of nine countries, each country has nine mountains, each mountain has nine valleys, and each ocean has nine islands (Schimmel, 2013, p. 183).

In the Islamic and Iranian cultures, the world is formed of nine heavens and thus number nine was highly valued. In this regard, Danisari writes: “Planet earth and what is within this planet float between skies similar to the yolk. The surrounding sky is an environment and is



round. The water around the earth forms an environment, while it is surrounded by wind, which is surrounded by fire... Human natures are known as elements and empirical sciences state that the sky is the fifth nature and there are nine skies. Each sky is wrapped in another sky. The first sky contains the planets and is considered as the greatest sky, which is the wisest of skies. The second sky is the Zodiac, and the third is Saturn" (Danisari, 1971, p. 49). Other planets include Jupiter (4), Mars (5), Sun (6), Mercury (7), Venus (8), and Moon (9).

The following is also written about comets: "If a comet is seen in the Aries it is a sign of death of kings, public distress, famine, and death. If a comet seen in Taurus is the sign of drought, robbery, destruction, and bloodshed. In Gemini it is a sign of destruction of parts of cities, change of governments, bad luck for villages, death, and tyranny. In Cancer it is a sign of death of the king with poison, bloodshed, invasion by enemies, and natural disasters. In Leo it is a sign of diseases, wreckage, cholera, etc." (Shikh Bahae, 1991, p. 514)

One of the most important applications of number nine in architecture is in plans of nine-part buildings which date back to at least the Achaemenid era in Iran. Apadana Palace in Susa and Apadana Palace in Persepolis (which as an identical plan) are formed of nine-part plans, which could be considered the basis of quadratic architectural designs in Iran. The same structure led to the formation of the eight-garden designs during the Timurid era. The nine-part structure did not solely belong to Iran as it was used in many other lands. However, it manifested in special forms by Iranian architecture.

Ten

Formation of this number is rooted in the number of fingers, which were used to count by primitive humans and even children still use their fingers to count. In the numeral system, this number is so important that it is currently considered as an important base. The prevalent use of this number and its relationship with human body led to the special value of this number. Pythagoras believed there was a relationship between numbers 4 and 10. He stated that number ten is equal to the sum of number 4 and the other three previous numbers (i.e. $1+2+3+4=10$). He showed his hypothesis using the following triangle which was known as the Tetraktys (number four) (Plato, 1972, p. 42):

Number ten was not commonly used in architecture, but very few single tombs were in the form of decagon such as the Dome of Qabus in Kavous Dome and Momeneh Khatoon Dome in Nakhchivan (Godard, 1979,

p. 427). However, the number was used in geometrical plans.

Twelve

The most important basis for formation of number 12 as an important and sometimes sacred number was the movement of the moon in relation to the earth, which was also the basis for dividing a year into 12 months. This number was almost universal and was valued in all of the important civilizations. Therefore, it was the basis for counting time. Today, each day is divided into 24 hours or two 12 hours, and one hour is divided into 60 minutes ($12 \div 2 = 6 \times 10 = 60$) and one minute is divided into 60 seconds.

This number was also used to measure length. For instance, ancient Egyptians had a measurement tool which was based on number twelve and a chord with twelve nodes on equal segments has been found in Egypt. A pulley with a node-filled chord was also found on the body of Sashta the goddess of building or the goddess of measurement. She was seemingly called "Safkht" which means seven and had seven weathers on her head (Al-Saeed, Parman, 1985, p. 129). Ace was the Roman metric and one twelfth an ace is an ounce (Taton, 1985, p. 83).

According to some references, the ancient Iranian music of some eras was composed of 6 songs, 12 modes, 24 branches, and 48 angles. However, there was a lack of consensus on the sequence and names of songs among a group of musicians (Vejdani, 2002, p. 120). An ancient example of usage of number 12 in architectural spaces is the number of columns of porches of Apadana Palace in Susa and also the one in Persepolis. Both of these two buildings have three porches, and each porch has 12 columns. It could be stated that the number of columns was selected due to the religious importance of number 12 because in addition to this number, number 72 and a number of animal symbols were also used in these buildings. The twelve-foolium flower, painted on several parts of Persepolis, is another proof of importance of this number.



RESULTS

Research results revealed that numbers and mathematics were the most important phenomena that enabled humans to discover some of the orders and rules governing the universe and allowed calculation of phenomena. Hence, mathematics and geometry were considered supreme sciences which not only enabled human discover the world but were also used for business, military purposes, production, and other purposes in practice, and were therefore, highly important.

In addition to these dimensions, some phenomena such as the number of human organs, order of movement of some planets such as the moon and sun, some innate mathematical and arithmetic rules and orders, some social phenomena and human worldview, led to assignment of special properties and meanings to some numbers which were used in many areas. An example of application of these numbers to arts was numeric symbolism, the reflection of which can be seen in some visual arts and daily objects.

Not all of the numeral symbols and signs have the same value, significance, and social/cultural importance. Some numbers such as 4, 5 and 12 were somewhat universal and were valued in all of the important civilizations, whereas some other numbers were valued by followers of a certain religion or residents of a specific region and land.

There has been more reflection of some numbers in architectural spaces, as for instance number four had an important explicit role in Iranian architecture.



REFERENCES

- Ahsant, G. (1997). *Tarkib Chalipa*, Tehran: Yasavoli.
- Alneski, S. (1985). In the way of Pythagoras, (P. Shahriari, Trans), Tehran: Amir Kabir Alkashani, G. (1987). Tagh va Azaj, (A. jazbi, Trans.), Tehran: Soroush.
- Alsaeed, E. Parma, A. (1984). *Geometric Pattern in Islamic Art*, (M. Rajabnia, Trans.), Tehran: Soroush.
- Ikhwan Alsafa. (1992). *Mojmalalhekmata*, in "Three Persian Treatises on Music" (T. Binesh). Tehran: University Publication Center.
- Ikhwan Alsafa. (2008). *Mojmalalhekmata*, (M.T. Danesh Pajoh, I. Afshar, Edited.), Tehran: Institute of Humanities and Cultural Studies.
- Brosious, M. (2006). *The Persians*. London: Routledge.
- Bunce, Fredrick, W. (2002). *Numbers*. New York: D.K. Print World Ltd.
- Burckhardt, T. (1990). *Principels et Methodes de Lart Sacre* (J. Sattari, Trans.), Tehran: Soroush Press.
- Burckhardt, T. (2010). *Traditional Cosmology and New Science* (H. Azarkar, Trans.), Tehran: Hekmat.
- Cassirer, E. (1999). *The Philosophy of Symbolic Forms* (Y. Motghan, Trans.), Tehran: Hermes.
- Critchlow, K. (2011). *Islamic Patterns (An Analytical Cosmological Approach)* (H. Azarkar, Trans), Tehran: Hekmat.
- Faranbagh Dadeqi. (2001). *Bundahishn* (M.Bahar, Edited), Tehran: Toos.
- Danisari, S. (1971). *Navader Altabador Letohfatoalbahador* (M.T. Danesh Pajoh, I. Afshar, Edited). Tehran: Bonyad Farhang Iran.
- Ermavy, A. A. (1967). *Music Paper Behjat Alrouh*, Tehran: Iran Culture Fondation.
- Farabi, A. (1985). *Ehsaeolome*. (H. Khadivi Jam, Trans.). Tehran: Elmi Farhangi Publishing Co.
- Ghiyath- al- Din, J. A. (1987). Tagh va Azaj, (A. Jazbi, Trans.). Tehran: Soroush.
- Gilgamesh. (1999). *Translations of Texts by George Smith* (D. Monshizadeh, Trans.) Tehran: Jajarmi.
- Godard, A. (1979). *Iranian Art* (B. Habibi, Trans.), Tehran: National University of Iran.
- Grutter, J. (1996). *Aesthetic in Architecture* (J. Pakzad, Trans.), Tehran: University of Shahid Beheshti.
- Hamedani, A. (1997). *Alnoghteh Secrets* (M. Khajavi, Trans.), Tehran: Mola.
- Hami, A. (1976). *Bagh Mehr*, Tehran: Davarpanah.
- Ibn Khaldon, A. (1968). *Muqaddameh* (M.P. Gonabadi, Trans.), Tehran: Bongahe Tarjomeh va Nashre Ketab.
- Kolayni, R. (1989). *Osol Al-kafi* (J. Mostafavi, Trans.), Qom, Ahlal-Bayt Press.
- Lahori, M. (1867). *Padeshahnameh* (A. Maulavi, A. Abdulrahim, Edited). Kalkateh.
- Lings, M. (2002). *Mystery High Kind* (F. Sanaee, Trans.), Tehran: Hekmat.
- Najm Razi. (1973). *Mersad-Alebad* (M.A. Riahi, Edited.), Tehran: Bongah Tarjomeh va Nashre Ketab.
- Narshakhi, A.B.M. (1984). *The History of Bokhara* (Alghabavi. & M. Razavi, Trans.), Tehran: Toos.
- Plato, (1972). *Timaeus* (M.L. Lotfi. Trans.), Tehran: Kharazmi.
- Plotinus. (1987). *The Works of Plotinus* (M.H. Lotfi, Trans.), Tehran: Kharazmi.
- Pope, A.U. (1986). *Iranian Architecture* (K. Afsar, Trans.), Tehran: Yasavoli.
- Prada, E. Dayson, R. (1978). *Iranian Ancient Art* (Y. Magidzadeh, Trans.), Tehran: Tehran University Press.
- Rahol, V. (1975). *Buddism* (G.Khatami, Trans.), Tehran: Tahori.
- Schimmel, A. (2007). *Decryption of Divine Revelations* (A.Govahi. Trans.). Tehran: Islamic Culture Press.
- Schimmel, A. (2013). *Secret Numbers*. Tehran: Islamic Culture Press.
- Sheikh Bahae, B.M.A. (1991). *Kashkol* (B.Razavi, Trans.), Tehran: Zarrin
- Shirazi, Qutb Al-Din. (1990). *Doratto-altaj*, Tehran: Hekmat.
- Soltanzadeh, H. (2011). *Taj Mahal*. Tehran: Cultural Research Bureau.
- Soltanzadeh, H. (2011). *Brief History of the City and Urbanization in Iran*. Tehran: Chahartagh.
- Soltanzadeh, H. (2011). The Symbolism of Taj Mahal. *Hoviatshahr Journal*, No. 9
- Sohrevardy, Y. (2008). *In The Fact of Love*, Tehran: Mola.
- Taton, R. (1985). *Account History* (P. Shahriari, Trans.), Tehran: Amir Kabir.
- Vejdani, B. (2002). *Symbolic Numbers 7 and 12 in Iranian Music*, Book of Month, No. 51.
- Vermazeren, M. (2011). *Mithra, ce Dieu Mystereux* (B.Naderzad, Trans.), Tehran: Cheshmeh.
- Zahedi, T. (1998). *Spiritual Philosophy of Music*. Tehran: Ferdows.