

Original Research Article

An Explanation of Avicenna's Rationalism in the Process of Inventing Geometric Patterns in the Architectural Decoration (Case Study: Five Tombs of the Seljuk)*

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Abstract

Problem statement: Traditional motifs as an integral element of traditional Iranian-Islamic architecture are spiritual, symbols benefiting from the principles of geometry and mathematics. These decorations' pinnacle coincided with the Seljuk's reign over Iran and resulted from their increasing attention to science, philosophy, and art. Undoubtedly, the scientific and philosophical discourse prevalent in each historical period affects other aspects of society, including culture and art such as the Islamic rationalist philosophy that culminated in Avicenna's thought of the subject. He believes that "invention" has come up with "internal senses" or "faculties of the soul", especially the faculty of reason. Therefore, the hidden aspect of rationalism can be deliberated in the process of creating traditional motifs.

Research objectives: The current article aims at analyzing and explaining the hidden aspects of rationalism in the process of creating geometric motifs in Seljuk architectural decorations; which will eventually lead to the explanation of a theory on the rational invention of geometric motifs based on Avicenna's theories. Therefore, the current paper starts with posing the question of how the components of Avicenna's rationalism can be explained in the process of creating geometric motifs in Seljuk tomb architecture.

Research method: This is basic research. Data were collected from library sources and observational documents. This is a descriptive-analytical essay. Thus, geometric motifs and knots have been deliberately selected in the decorations of the five Seljuk tombs.

Conclusion: The design and application of motifs in the architectural decorations of the Seljuk period, based on Avicenna's theories, are an "innovation" type and "rationalistic" process. In other words, the interaction of the faculties of the soul is the guide for designing and creating geometric motifs from the stage of observing objects in nature, analyzing and combining them in the faculty of imagination, and organizing and creating designs and motifs in the faculties of reason. The rational feature of the images contributes to human knowledge and mutual understanding by the audience. Also, the unity and coherence of the components of the building have been maintained through motifs and designs, and the necessary rational planning, coordination, and organization have been done to achieve the desired perfection.

Keywords: *Rationalism; Avicenna; Geometric Motifs; Architectural Decorations; Tomb; Seljuk.*

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Introduction

Iranian architecture is a synthesis of science and art, taste, belief and faith, and technical skills as well as mathematical calculations demonstrating the historical and cultural civilization; while they serve as the language of the time replete with different designs and decorations in accordance with the space and climate. Some of the most widely used decorations include geometric motifs called geometric knots along with various materials embossed on the walls, coated the ceiling, and covered the dome in the exterior or interior space. Meanwhile, post-Islamic Iranian art flourished in the Seljuk era since Iran entered an era of peace and political stability providing artists with more favorable conditions to create many changes in art, especially architecture and related decorations. The Seljuk Turks incorporated many of their traditional customs and rituals into Iranian culture including the construction of tombs and mausoleums in vast plains and far from residential areas (Moradi, Omrani & Mousavi Haji, 2009, 109). The buildings in the Seljuk era have excellent organization and intricate geometric and non-geometric brick and plaster decorations. In Iranian architecture, no work has solely created for the purpose of decoration and beauty, so architects took into account the “under the dome decorations and the use of geometric motifs in the exterior and sometimes interior bricklaying that requires precise calculations, in proportion to its needs, accurate calculation of building weight in proportion to the amount of the foundation depth as well as the thickness and height of the walls, in addition to creating visual pleasure to reduce and distribute the load of the dome on the rafters” (Abolghasemi, 2010, 386).

This period is distinguished by the theoretical and practical sciences including philosophy and logic, influenced by “Peripatetic philosophy”, which was very common in previous decades, and since the art is the fruit of its time, this discourse has been influential on the process of acquisition of arts and related creations. Although the beginning of

Peripatetic philosophy is attributed to Abu Ishaq al-Kindi², Avicenna³ is truly the greatest representative of Islamic Peripatetic philosophy. His philosophical method was discursive and rational (Zabihi, 2019, 10). He does not consider knowledge as innate and internal and states: “Science is not innate that was known to us at one time and we have forgotten it at another time; On the other hand, obtaining knowledge of the principles of argument cannot be through argument itself, because then we ask about the principles of the same argument, therefore, there is no way to solve this problem except there should be a faculty in us whose task is to know things that do not need education, although it is achieved with the help of things that are other than things that help education” (Memarzadeh & Ghavam Safari, 2018, 180). These things are the external and internal senses that can improve the knowledge and understanding of the world and the ability to acquire knowledge; it is specific to humans who can reason. In some of his works, he mentions “innovation” with the help of “internal senses” or “faculties of the soul”. Thus, thinkers including Aquinas, Bacon, and Albertus Magnus have heavily relied on Avicenna’s works. Hence, Aquinas’s psychological theory of art, which emphasizes the special motif of esoteric faculty in artistic creativity and perception of beauty, is closely related to Islamic theories of aesthetics (Najib Aghloo, 2000, 271).

Traditional Iranian-Islamic arts, including architecture, traditional design, etc., are semantic and symbolic. Mathematical and geometric calculations are involved in the design of geometric motifs. The current study aims at analyzing and explaining the hidden aspects of rationalism in the process of creating geometric motifs in Seljuk architecture focusing on Avicenna’s theories about the faculties of the soul, especially the faculty of reason, and finally explaining a theory about the invention of geometric rational motifs based on Avicenna’s theories. Thus, a number of tomb buildings’ geometric motifs have been studied and measured.

Literature review

So far, a lot of research has been done on the Seljuk architecture and the brickwork and bed decorations inside buildings; there has also been much debate about the semantic and symbolic features of traditional motifs, but the rational dimensions involved in inventing geometric motifs, and their adaptation to the theories of Muslim philosophers have received less attention (2000), “Golroo Najib Aghloo “ in the book “Geometry and Decoration in Islamic Architecture” has analyzed the scroll known as Topqapi taking into account the pillars of history, design, calculation, and execution of various geometric motifs used in buildings of Islamic countries (2002). “Mahmoud Maher Al-Naghsh” in the book “Heritage of Iranian Brickwork” has analyzed the use of bricks and brickwork motifs and has stated the method of drawing them (2007). “Hossein Zomarshidi (1986), “ in the book “knotting in Islamic architecture and traditional arts”, has dealt with the principles and foundations of geometric motifs and methods of their drawing.

Many books and articles have been written on the basics of traditional arts. Mehran Hoshyar (2011), has written a book titled “Introduction to the basics of traditional and visual arts. The book entitled “Philosophy of Avicenna’s Art” authored by Hadi Rabiee (2011) addresses Avicenna’s views on the theological and mystical foundations of art and beauty. Great scholars such as “Dr. Hassan Malekshahi”, “Mohammad Hossein Naeji”, “Dr. Yahya Yathribi” have translated and described the works of Avicenna. Also, the researchers have compiled and reviewed a big number of master theses on traditional art.

Theoretical foundations

The religion of Islam places great emphasis on reasoning and thinking. There are several verses of the Holy Qur’an referring to reasoning and thinking. Among them, the third verse of Surah Ankabut reads: “ These are the examples we set for people, and only the wise understand them.” This verse refers to the Qur’anic parables which, although all people hear

them, the truth of these parables is understood only by the wise.

The discussion of reason and reasoning has always been the concern of philosophers. In Islamic philosophy, the theory of reason has a special place, “The purpose of Islamic philosophy is to understand the universe and to guide and manage human life based on this understanding. Sense and reason are the only means that are available to man. Thus, if we must adhere to the originality and credibility of man, we must consider their reason and senses as the only means of understanding and managing their life “(Yathribi, 2018, 45). Abu Ishaq al-Kindi, Abu Nasr al-Farabi, Avicenna, etc., were thinkers who formalized their theories under the name of “Peripatetic philosophy” which emphasized reasoning and argument. The main axis of Peripatetic philosophy is the reliance on rationality and rationalism. Undoubtedly, Avicenna was the most influential representative of Peripatetic philosophy among other philosophers of this school.

• Avicenna’s theory of faculties of the soul and rationalism

One of the most important topics in Avicenna’s philosophy is his “psychology⁴”. After proving the soul and its abstraction, Avicenna has discussed the facilities of the soul. According to him, the human soul has facilities, the most important of which is the facility of reason, specific to human beings who can think and reason. The soul has outward and inward faculties⁵. He believes that knowledge begins with the senses; the soul, with the help of the external and internal senses, enters imaginary forms and partial meanings into the reservoir of illustrated faculty. “The faculty of sense perception is to unite the illustrated forms and separate them”(Avicenna, 2004 a, 97). Perception is the perceptual facility that does two things, combining meanings and forms or separating them. When the perception takes its material from the reason, it is called the “thinker,” and when it takes them from the illusion, it is called the “imaginative.” The human soul is a substance with faculties and perfections that can reason and think. Perhaps it can

be said that Avicenna's most important innovation in psychology is that he passed the perceptual forms through the channel of reason so that they could be perceived. In the sixth chapter of "The Book of Healing", he classifies perception into four types including feeling, perception, illusion, and reason, and in the third chapter of the book "Remarks and Admonitions", he classifies the faculties of the soul into three types, including:

- **Feeling:** It is the perception of something present in the recipient in a certain article with a special body and tangible effects of place, time, situation, quality, and other things. Therefore, the tangible that is perceived by feeling has these three conditions: 1) the presence of matter (establishing a direct connection with a perceptible object, by one of the senses), 2) the perception of a strange body (the image of a material object and all its properties) and 3) Partiality (this feature has been added by Khajeh Nasir, in other words, it is only related to a tangible form).
- **Perception:** In the perception, the presence of matter in the eyes of the receiver is not valid out of the above three conditions, Therefore, two

conditions are valid in the perception: 1) to include distant features (features that can be degraded and separable), and 2) Partiality, in other words, receiving partial forms is tangible, whether present or absent for the receiver.

- **Reasoning:** It is the perception of universal and immaterial concepts. Therefore, the three conditions that existed in the feeling are not valid. Reason is, in fact, relative to the general and abstract concepts of matter. The reason has the ability to remove a part from all distant complications and to realize its general nature as it is. Reasoning is of two types: perception of the rational and the sensible quality (Malekshahi, 2017,175). Perception takes place through the senses; the reason then influences these perceptions, thus recognizing and subsequently embodying the meanings received. There is a difference between the perception of an image and its meaning. An image is perceived through the internal and the external senses, meaning that it is first perceived through external senses and then gives its perceived power to the internal sense, while a meaning is something that the soul perceives it from the sensible things, without being perceived at

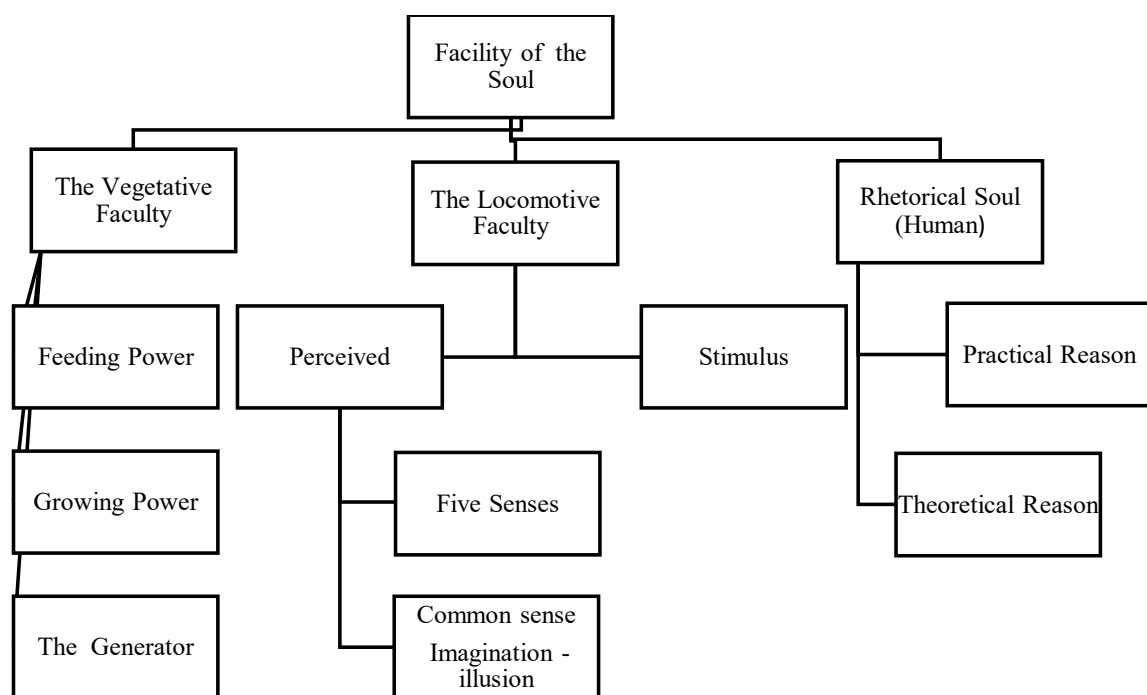


Fig. 1. Avicenna's theory of faculties of the soul and rationalism. Source: Authors.

the beginning by the external sense. “(Naiji , 2008, 143); (Fig. 1).

• Types of reason on Avicenna view

Avicenna has classified the faculty of reason into two parts: theoretical reason in the field of ontology and practical reason in recognizing values. In the sixth chapter of The Book of Healing, he deals with the stages and actions of the reason. According to him: “The faculty of the reason is classified into the faculty of ‘agent’ and the faculty of ‘knowledge’, and each of these two faculties is called verbal and nominal commonality, or is permissible and is likened to the analogy of reason” (ibid., 154). The agent faculty is called “practical reason” and good and bad morals come from it and the inference of creations (Avicenna, 2004 b, 24). The other faculties of the soul, “theoretical reason”, is a group that a person uses in completing his essence and with the help of which he achieves a much higher reasonable and cognitive level (Avicenna, 1996, 251). Obviously, it is important to note that Avicenna considers the source of rational perceptions to be the connection to the Wahhab al-Sawr or the first reason, and in this regard, he states that: “The educated rhetorical soul, whenever it wants, it refers to the agent reason, which is a lover of forms, and because learning has given it a talent, it is connected to this reason, and from this connection, general abstract forms are imparted to him by the agent reason “(ibid., 208). Therefore, like the Active Intellect, man can use the ability of his perception to make forms in the world and add an ontological form to the world. The reason is a faculty in man that can transform the form of partial sensory perception into general rational perception and vice versa. At the level of theoretical wisdom, man achieves the perception of the rational; “Practical wisdom is the opposite of theoretical wisdom, that is, practical wisdom begins with the rational and leads to the addition of the perceptible form to the sensible world.” The cognition that one adds to the world is the result of his perceptions perceived from the level of knowledge. Therefore, sensible forms being originated by human rational

perception which emanates from the Active Intellect, essentially, is reason type. In creating this new thing, the human will is along the will of the Active Intellect, and human action is explained in the rational path of the universe.-

In Avicenna’s view, reason is reflected in the form of scientific principles; the construction of the work is the result of observing scientific standards and shows itself in creating moderation and proportion among the components of the work and its all-encompassing unity. The work of art is based on perception. That is why perception must provide man with a form that derives from the perception of the rational quality. It is also a work of art born out of reason, which is added to the set of beings in the universe by accepting various limitations by man as a mediator in the exercise of the divine will. This new being (the work of art), because it is inherently of the type of reason, preserves the rational totality of the universe and does not disturb the rational order of the universe (Jafarian, 2009, 114 & 115).

• The concept of innovation in Avicenna’s view

Another point is the definition of “innovation” on Avicenna’s view, who stated: “Every creation and innovation means creation, with the difference that when the creation of something is independent of time, it means “creation” and if its creation should not be preceded by time, such a thing is called invention, so in the first place, it is creation and in the second place, it is invention and in the third place, it is construction” (Malekshahi, 2017, 281). In the stage of creation, man can receive the meanings of the holy world by imitating God and by abstaining from images. Receiving meanings and their reflection is in his reason, so reason becomes pregnant with meanings; so the creation is realized. These meanings flow in his soul and cause the invention of the face in human perception. The meanings of reason are extended to the perception and then to the senses, and the person finds the ability to construct the object. It is done from the reason only in the case that the rational form is given

from the gift of images to the reason of the artist and from there to the material accepting the form through the perception and physical forces" (Dadashi, 2009, 67).

The Seljuk tombs' architectural decorative geometric motifs

• **Geometry:** It is the common basis of all techniques and no technique can reach its full perfection without relying on the science of proportions (Najib Aghloo, 2000, 256). The use of geometric drawings in Iranian art and architecture has a long history. The design of geometric motifs, especially after Islam, was used to determine the size of the building and to obtain the desired proportions; position enjoyed by the science of geometry was so elevated that "Abulvafa Buzjani ⁵", organized drawings in certain chapters in his treatise "Practical Geometry" by presenting geometric methods for use in the works of craftsmen. The general structure of the treatise chapters is based on providing a solution to the problems of industrialists and its dominant focus is on drawing regular shapes and methods of proliferation (Beheshtinejad, Samanian & Maziar, 2017, 140). The art of geometry was the most important tool for making the connection between architecture and the designs that the builder had in mind; therefore, not only in construction but also in related decorations, such as plastering and bricklaying, artists have created valuable works by using the knowledge of geometry and geometric shapes.

An examination of the architectural works of the Seljuk era reveals that most of these decorations, with their variety and complexity of appearance, are inspired by nature and have been used simply and abstractly. Iranian architects were aware of the concept of geometry derived from natural shapes. These motifs are based on precise mathematical equations, drawing circles, and regular shapes such as squares, pentagons, and hexagons, with a symmetrical arrangement and sometimes on a spiral motion, and more complex designs are created with the evolution and repetition of micro-

motifs. Architects, in addition to paying attention to mathematical and geometric proportions, have also considered the symbolic themes of the designs; "Each of the three shapes, namely square, triangle and circle, has its qualities and functions; but all of them, in their regular form, are subject to their circumferential circle. The circle is superior to all other motifs, because the circle is the secret of the unity of the world, and its hidden center or "anima" is necessary for the temporal changes as the dimensionless point of the place of the environment "(Critchlow, 2005, 375).

In traditional Iranian architecture, motifs have an intrinsic connection with the content and are never separated from it; in the meantime, Avicenna has also interpreted and defined two aspects of geometry. In his view, geometry, in addition to being part of mathematics, which consists of shapes and quantities, has a symbolic meaning and refers to supernatural concepts and subjects; "The first element of this world was originally a point that came under the action of nature and became a line and a surface and finally a body. The body, in turn, was stimulated by nature and the management of the soul, and came into complete geometric shapes such as circles, triangles, etc., and found purity and refinement, and then reason and action were added to it, and ... "(Sharifi Nia, Neyestani & Mousavi Koohpar, 2013, 72). He classified geometry into two categories, "tangible geometry" and "rational geometry", tangible geometry is used in practical creations and rational geometry is used in the creation of science, while both are used to understand the essence of the soul.

• **Geometric motifs:** In traditional design, motifs were classified into two categories of broken and rotating including various designs of human, animal and plants. The motifs are derived from natural phenomena such as: star, sun, moon, sea wave, or objects. Broken motifs are derived from natural phenomena and objects known as "geometric motifs or knots"; they are abstract forms that are intertwined and drawn in a regular way based on

certain geometric rules. These motifs or knots are classified into “simple knots” and “composite knots” according to the drawing method. Composite knots have sun-like motifs and can be drawn in all backgrounds (polygon, square, rectangle, and circle), so the “knots box” is composed of some knot backgrounds that are repeated inside the box. Each knot background contains a set of geometric shapes, each of which is called an instrument (Zumrashidi, 1986, 55). The decorations are formed according to regular rules, straight lines, and geometric shapes, and from their juxtaposition, a motif or knot is formed. “Geometric motifs have been used for centuries as decorative motifs on walls, ceilings, openings, domes and minarets” (Embi, 2012, 27).

The geometric motifs’ distinctive features are the dynamism and the reproducibility and expansion from any side of the knot. Fertility is the other attribute of knots; meaning that each knot is capable of generating other knots. Hence, “if the motif of the knot within itself is sharpened and then slowed down in such a way that it produces all its decorations, the knot is created in the knot, and whenever the knot decorations break within themselves; in such a way that the internal knots together form a complete knot, the big knot is formed” (Shafizadeh, 2018, 56). Symmetry is another characteristic of geometric shapes. “In Islamic geometric motifs, symmetry emerges as the most basic set of numbers according to which a certain motif can be layered and fragmented. In the same analogy, symmetry can be considered a manifestation of unity” (Critchlow, 2005, 382). Therefore, it can be said that the observance of the principles of reproducibility and symmetry along with creating rhythm, movement, and harmony in geometric motifs has led to the creation of complex and diverse designs.

• **Architectural decorations:** In the early Islamic centuries, Iranian architecture and related decorations were influenced by Sassanid art but political-religious developments and the emergence

of Islamic philosophy, as the most important factor in the evolution of designs, affected the content and form of works of art. “This evolution includes the emergence of abstract forms, the elimination of human and animal motifs, the emergence of calligraphy, the widespread use of geometric motifs, and the emergence of monotheistic and cryptic content” (Alipour, 2016, 117).

Meanwhile, the Seljuk’s architecture resembles the most unique forms of decorative designs on the exterior and interior surfaces of the building in terms of technique and variety of patterns. The Seljuks took great steps in changing the decorative motifs from flowers and plants and figurative shapes to geometric motifs. “Examining the decorative motifs of this period, from the earliest stages to the time of construction, shows an artistic movement that brought about fundamental changes in the use of conventional geometric motifs” (Embi, 2012, 32). These decorations induce a sense of grandeur and beauty in the viewer. The decorations on the exterior of the building are made of cut bricks, which is in line with the traditional Iranian architectural space and local materials. Brick is a dry and rough material and form, but, “decoration adorns the roughness of materials such as brick and makes them beautiful, light and pleasing” (Petersen, 2002, 37).

Review of case studies

• **The Forty Girls Tower⁷:** The Forty Girls Tomb Tower is located in Damghan, and this work dates back to 1054 A.D. The exterior is covered with bricks with various geometric motifs and the interior walls are whitewashed with plaster. Below the dome, there are brick decorations in the form of a wide strip, including a row of Kufic inscriptions, four rows of geometric motifs, and a row of honeycomb moccasins. The geometric motifs used in the building are: Row (1) is a simple combination of eight Shamseh (solar) knots and a cross (armband). Rows (4) and 6) are two different combinations of the motif of a broken cross or solar

wheel, which is called “Pili” in the geometry of the motifs. The eight solar knots and the cross are the most widely used types of geometric knots. The solar motifs, as its name implies, are inspired by the solar and are created by dividing the circle into equal and different arcs. The motif Pili is the same as the solar wheel or Chalipa, which is also inspired by the sun (Fig. 2).

• **Kharqan Twin Towers:** Two brick towers, the eastern tower was built in (1067 A.D) and the western tower was built in (1093 AD). The plan of both buildings is octagonal and each side, consisting of brick knots, includes about 25 types of decorative designs with different geometric motifs. In this building, in addition to the different brick vein motifs, the geometric motifs of Sormedan and cross, hexagonal knot, hexagram, the motif of the top, which is obtained from the hexagonal division, Sormedan knot of rhombus “Loz” vertically and horizontally, the twelve solar motifs and so on. Among these motifs, the solar motif with different radii can be seen, which creates various decorations (Fig. 3)

• **The dome of the Alawites:** The tomb of the Alawites dome in the city of Hamedan is a remnant



Fig. 2. Forty Girls Tower. Source: Bozorgmehri & Khodadadi, 2013.



Fig. 3. Kharqan Twin Towers. Source: Pirmia & Memarian, 2004.

of the Fourteenth century AD and the Seljuk period. The entrance has intricate bed decorations with various geometric, plant designs and brick knots. Inside the building, there is an altar with Quranic inscriptions along with plant and geometric decorative motifs. The most prominent motif at the top of the entrance (No. 1) is the ten-pointed solar knot. Motif No. 2 is the eight-pointed solar knot. Motif No. 3 is three hexagons and a wave, Motif No. 4 shows six knots in a hexagram, and Motif No. 5 is a simple hexagonal knot (Fig. 4).

• **Blue Dome:** The Blue Dome is one of the five tombs of Maragheh from the Seljuk period, which dates back to 1186 and 1258 AD. The tower is in the form of a ten-sided prism with a conical dome that has been destroyed over time. It is noteworthy that the knot motifs in this building are not made of brick veneer, but were made of molded bricks and designed pottery (Fig. 5). Geometric motifs used in this building: 1) six solar and rhombus. 2) Cross. 3) Drums and Sormedan. 4) The eight-pointed solar. 5) Pili .

• **Red Dome:** The red dome of Maragheh ¹⁰, was made in 1147 AD. The plan of this building is quadrangular and similar to Sassanid fire temples. The exterior and interior are decorated with geometric motifs and brick porcelain knots, which are: motif 1) Above the entrance of the geometric motif is a hexagram and a drum. 2) Three-leaf hexagram and wave. 3) Cross and Sormedan. 4)

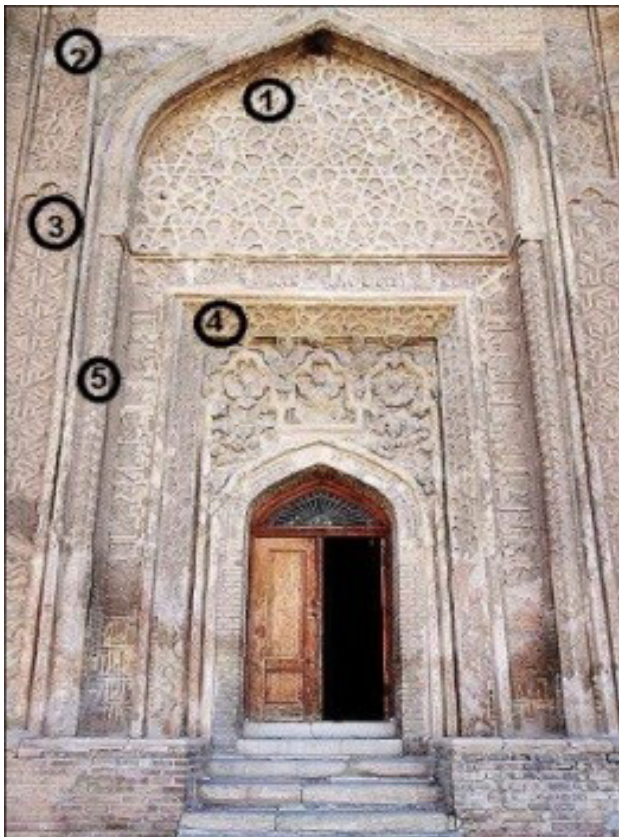


Fig. 4. Alawites Dome. Source: Bozorgmehri & Khodadadi, 2013.

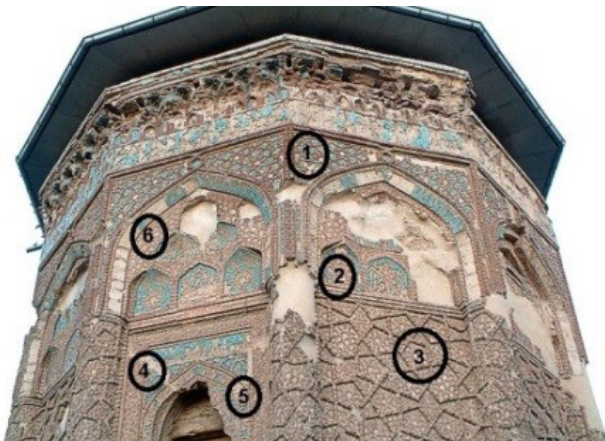


Fig. 5. Blue Dome. Source: Bozorgmehri & Khodadadi, 2013.

The other arrangement is different from the motif of the cross (Fig. 6); (Table 1).

Analysis of geometric motifs

From all the knotting and geometric motifs that are engraved on the facades of the mentioned buildings by bricks, some of the most widely used motifs have been purposefully selected to be analyzed and then adapted to Avicenna's theory



Fig.6. Red Dome. Source: Bozorgmehri & Khodadadi, 2013.

of faculties of the soul in the process of inventing motifs. The wide and undeniable application of mathematics and geometry in the motifs and execution of building decorations has already been analyzed and validated by researchers. The roots of geometric motifs go back to ancient art; however, the coherence of the motifs, the observance of proportions, and the creation of a logical connection between form and space and the context of performance have taken on a principled and calculated process during the Islamic period due to their wide application in various arts. The treatise "Practical Geometry of Buzjani" stated that by making a method of designing and executing geometric motifs and knots by calculation and compass, a big step has been taken to promote the use of these motifs in architecture. The geometric motifs used in the decorations of the building, as can be seen in Tables 2 & 3, are composed of micro- motifs (decorations) each are perceived and abstracted separated from the surrounding environment with the help of precise calculations and the capability to repeat and adapt to a variety of contexts. The decorations work together to

Table 1. Some geometric and bricklaying motifs used in selected buildings. Source: Authors.

Red Dome motifs	Blue Dome motifs	The dome of Alawides motifs	Kharqan Twin Towers motifs	The Forty Girls Tower motifs
				
				
				
				
				

create the main (mother) motifs or knots. The main (mother) knots are contagious, and they multiply to develop the final motifs.

- **Solar motifs:** The solar motif with different radii is the most frequent geometric motifs used in the architectural decorations of tombs of the Seljuk. The solar motif include eight radii-solar, ten radii-solar or two radii-solar, five radii-solar and twelve radii-solar. The extension of the radii of these solar around the motifs or decoration has created an attribute known as the reproductive feature of geometric motifs; these decorations, as seen

in [Tables 2 & 3](#), are called motifs of headbands, armbands, bergamot, etc. The solar is drawn inside the circle and has axial and central symmetry. It can multiply and adapt to different types of frames, flat and circular surfaces, including the surface of the dome. The decorations obtained from the solar have the same number of different angles, but as the number of angles increases, the angles of the decorations become sharper and the motifs more elongated. This change, based on principles and geometric calculations has led to a variety of designs and adaptations to different frames. In addition to

Table 2. Analysis of composite motifs into constituent decorations. Source: Authors.

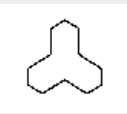
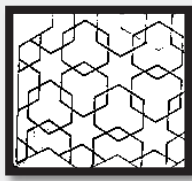
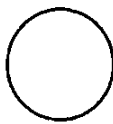
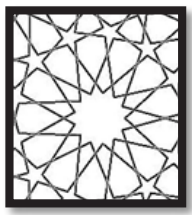
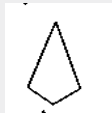
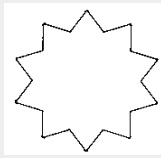
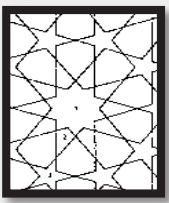
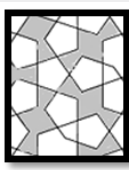
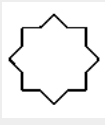
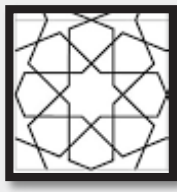
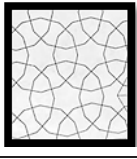
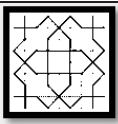
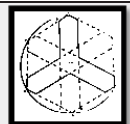
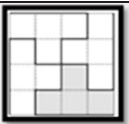
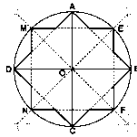
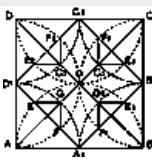
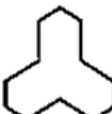
Constituent decorations				Type	Motif
   				Composite	
Genaqi	Selli	Rhombus	Hexagon	Hexagram	
   				Composite	
pentagon	sharp-torance	six-knot	Twelve-solar		
   				Composite	
six-knots	sharp-torang	pentagram	Ten-knot solar		
   				Composite	
Givch	sormedan	slow-torang	Sharp		
   				Composite	
six-knots	sharp-torang	pentagram	Eight- solar		
  				Composite	
Slow-six knots	Drum	Hexagram			

Table 3. Analysis of simple geometric motifs . Source: authors.

	Motif ١	Motif ٢	Motif ٣	Motif ٤		
Simple motifs						
Decorations						
	Armbands	Eight- Solar	Armbands Square Sormedan	Selli	Solar Wheel	

benefiting from geometric principles, motifs have symbolic meanings. The motif of the solar is the environment in the circle of the solar and light, which has a special and ritual place in Iran before and after Islam. The solar is a symbol of unity and integrity among Islamic geometric motifs that are engraved on most buildings.

- **Hexagonal solar:** Hexagonal solar is drawn on a rhombus background. In addition to this motif, fewer decorations are created, which is the result of regular hexagonal division. This motif also has axial and central symmetry, balance and static, and it fits to the frame with reproducibility. This motif is also composed of two equilateral triangles in opposite directions. The vertex has one triangle facing the sky and the other facing the ground.

Cross: The motif of the cross consists of two arms perpendicular to each other, which are drawn in a square surrounded by a circle, which is called the solar wheel (representing the rotation of the solar). Some architects consider it as the division of space into four elements. In the above buildings, three different motifs of crosses can be seen. The motif, called the pili, is essentially the same as the solar wheel, whose arms rotate 90 degrees around. In these buildings, the cross is placed in combination with eight-solar or next to Sormedan and is created as a single wheel

- **Pentagon and five-pointed star:** The pentagonal motif seems to be inspired by the connection of the plantain leaf tip, and the star motif seems to be from the internal connection of regular pentagonal vertices or is inspired by a starfish. This motif arose from the birth and extension of the central solar lines.

- **Torange:** The original design is adapted from bergamot fruit (lemon). In both sharp and slow states, it occurs in all types of mother knots due to the multiplicity of divisions in the circumference of the circle (central solar).

- **Selli motif:** a three-pronged and directional

motif that is created by the division of a circle into three parts; Its original design can be taken from clover leaves. In the mentioned buildings, a dual combination of this motif has been used, one facing the sky and the other facing the ground.

- **The motif of the drum:** It is created on a rhombus background and its design is taken from a musical instrument of the same name.

- **The motif of Sormedan:** This motif is also drawn in rhombus, and the reason behind called Sormedan is probably goes for its middle protrusion shape.

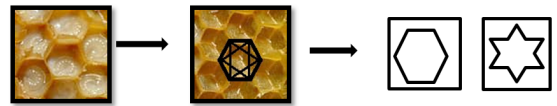
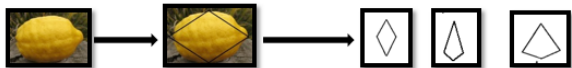
- **The motif of Giva:** It is a simplified design of giva or a kind of shoe that is created on a square and rhombus background.

- **Genaqi motif:** It is one of the common motifs in Iranian design that is drawn on a square background. It is taken from the shape of the sternum of the chest (Table 4).

Structural analysis of motifs, based on the process of rational creation and conformity with Avicenna's theory of faculties of the soul

According to the aforementioned information, the work of art is essentially reason type, as long as it does not disturb the rational order of the universe; and the reason is manifested in the form of scientific principles. In the Avicennan view, the soul, with the help of external and internal senses percepts and then captures forms and partial meanings through the reservoir of "retentive faculty", and uses imagination to manipulate forms and provides the ground for the acquisition of meaningful forms by abstracting and organizing them by "reason". Because according to Avicenna, the condition for receiving meaning and creating an image is passing through the channel of reason. The work of art is caused by imagination focused on reason. That is, the perception must provide man with a form arising from a rational affair. The work of art is the fruit of reason that by accepting various limitations by man as a mediator between the expanses of the reason of *universal intellect* and the universe, new forms that are of

Table 4. Various geometric motifs used in the architectural decorations of Seljuk tombs.

No	Geometric motifs	Image
1	Hexagonal solar	
2	Cross	
3	Pentagon and five-pointed star	
4	Torange	
5	Selli motif	
6	Motif of the drum	
7	Motif of Sormedan	
8	Motif of Giva	
9	Genaqi motif	

the type of reason and do not preserve the rational whole of the universe and do not disturb the rational order of the universe and thus it adds to the world; this creation is of the “invention” kind; because creation from nothing is specific to the essence of transcendence, and the traditional artist creates work by observing and inspiring those around him. In this process, the motif of wisdom must be far beyond sense. Although the last two components are the core of the design concept, and the initial similarities of the motifs with the tangible objects, and then beyond the motifs of the sensory forms and the parsing and composition of the forms, are somewhat imaginative. It has been planned so that the design is acceptable in terms of principles and foundations. Therefore, after creating the themes in the perception and extending it to the reason, their composition and coherence with the help of practical reason and creating connected plans in a specific space by observing the principles of proportionality and balance, reproducibility, and compatibility with materials, the executive materials show the colorful motif of wisdom.

In traditional design, each design is a combination of a set of motifs by the artist, often modeled on nature. The process of creating motifs, from observing natural elements to creating the final design, based on Avicenna's faculties of the soul, that is, “sense, perception and reason”, is as follows: the artist looks around through the five senses; for example, when they see a “sycamore tree leaf”, they record its image in their memory, then, with the help of their perception, they visualize the leaf image by specifying the main points and angles of the motif in mind, and then they analyze and simplify them and create the motif of a “pentagon” in their perception; after passing these stages, it is the turn of the “faculty of reason” to organize, arrange and combine the obtained forms and present them in a meaningful form that is out of the physical and tangible state and has found a reasonable form; this is done first by “theoretical wisdom” and then by “practical wisdom”; each object is controlled by the soul and is transformed into complete geometric shapes such

as circles, triangles, etc., the images abstracted in the perception, by the theoretical reason, create the meaningful form of “pentagon” and “pentagram”. Then these meanings are again extended to the perception and then to the five senses under the supervision of practical reason to create a tangible form in accordance with the same meaningful form. The process of observing natural forms to create an abstract and meaningful form is common to all motifs. This consistency of procedure is another reason for the dominance of reason in the process of creating designs. Whereas the greatest common denominator between human beings is reason and the faculty of reason; while these concepts and combinations will never be expressive and comprehensible to the viewers who have not experienced the artist's senses and perception if they are not created in a meaningful way by reason. In other words, at the level of sense and perception, faces are unique to each individual, but faces are meaningful and shared at the level of reason.

Accordingly, Avicenna believes that wisdom is two kinds: practical and theoretical. Practical wisdom is the opposite of theoretical wisdom. Theoretical wisdom begins with the tangible stuff and is understood by the rational, while practical wisdom begins with the rational and leads to the transmission of the imaginary form to the tangible world. Therefore, human as an agent with reasoning power is possibly incapable of imagining their perception in a practical way in the world and add an ontological form to the world. This last case is the same conditions that the traditional artist has gone through in the process of designing motifs from tangible forms to inventing geometric motifs and then implementing them in building decorations; under the ability of the perception in the practical apparatus of his reason, man has reached the forms that show the ontological form in the face of the tomb building with special nature. In addition to using geometric motifs and knots in architectural decorations, the architect has used a regular and different arrangement of bricks together to create harmonious motifs. The

arrangement of bricks is based on mathematical equations and regular geometric shapes such as hexagons, rhombuses, squares, etc. Their movement is progressive and often based on the rotational spiral movement in a centrifugal manner, while they have unity, integrity, and multiplicity throughout the frame. So in creating these images of regular geometric shapes with unifying themes, the architect uses the faculty of reason. Islamic art is displayed in the form of a brick arrangement. The widespread use of geometric motifs by brick (which fits very well with the form, shape, and nature of the material) in the exterior of Seljuk period buildings, indicates a significant formal invention that due to the composition, space, rhythm, and coordination of motifs in all designs from the solar to similar knots have been done to create meaning, and the practical reason has purposefully and consciously presented an ontological form.

In traditional Iranian architecture, motifs have an inherent connection with the content. These motifs have also retained their symbolic aspect in Islamic art; because geometry, in addition to being composed of mathematical shapes and committees, has a symbolic meaning and refers to supernatural concepts and subjects. The solar knot, at the height of its multiplicity, is unifying. The full hexagram, with its two-sided motif, looks both at the sky and the earth. The cross also symbolizes the rotation and solar light and induces both the concept of the four elements and has been used in almost all buildings in different ways in both knotting and brick veneering. Interestingly, the brick, like the cross design, is made of a quartet of soil, water, fire, and wind. In the process of constructing and decorating the building, the architect's reason conceived meanings and matched the abstract forms with the perceived meanings with a mind focused on the reason. It has been able to alleviate the dryness and inflexibility of bricks with the help of these meaningful forms.

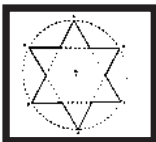
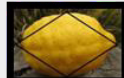
Conclusion

The examination and analysis of the *geometric*

patterns in the architectural decoration motifs of the tombs of the Seljuk showed that the components of Avicenna rationalism can be justified and applied from the stage of observation to the creation of a meaningful form through the process of creating these motifs. In this process, the artist has designed and applied the geometric patterns in the architectural decoration motifs of the tombs of the Seljuk in accordance with an “innovative” and “rationalistic” process. In other words, in accordance with Avicenna's rationalist theories, the interaction of faculties of the soul with each other has been the guide for designing and creating these geometric motifs, because the geometric motifs and knots in question exist in the following three stages: first, the stage of observing objects in nature, the second is their decomposition and composition in the mind and the third is the organization and creation of design and motif (Table 5). These motifs are created by the designer or the architect through the elements of balance and proportion, order and coordination, rhythm and reproducibility, dynamism and the birth of designs, and the need for creative spaces by observing stylistic motifs, based on regular motifs and in accordance with the nature of the building. Also, the intended space has done the initial design and execution of the designs and then the implementation in the decoration design of the building. Since only God can create from scratch, this process of creation has occurred as the outcome of the unity and coherence of these decorations and motifs based on regular motifs and forms derived from the perception of the rational, which are received through reasoning and by connecting to the first reason, so the existing rational order and meaningful forms are inherent of the reason. Having perceived the rational, the received forms re-enter the perception and through them express as tangible. And this is where the “invention” takes place, and because a rational journey has been made to achieve these forms, they cause human knowledge.

Therefore, the designer of these geometric decorations has experienced creation in the first place,

Table 4. The process of creating geometric motifs from observation to creating a meaningful form. Source: authors.

Rational form (rational)	Perception faculty	Natural form		Rational form (rational)	Perception faculty	Natural form
			٦			
			٧			
			٨			
			٩			
			١٠			

innovation in the second place, and construction in the third place. In the stage of creation, in the likeness of God and by abstracting forms, they have been able to receive the meanings of the holy world, and the intuition of meanings and their reflection in their reason has conceived the meanings, and then creation has been realized and these meanings have flowed in their soul. The form was invented in their perception, and then the meanings of the reason were extended to the perception and then to the senses, which led to the ability to construct an object or these geometric decorations. Those mediating in the craft for transmission have certainly prepared and fulfilled the condition of the following reason. As the rational form has been bestowed upon the artistic reason, and then upon the material accepting the form to the imaginary and through the physical faculties. On the other hand, Avicenna's theories state that the effect of perception is on reason; in

fact, the effect of perception is to represent reason. Therefore, in the face of the audience and perception can be made reasonable, especially since the greatest human being's common feature is having reason and the faculty of reason. Therefore, if these concepts and combinations are not created in a meaningful way by reason, they will never be expressive and comprehensible to the viewers who have not experienced the artist's sense and perception. In other words, at the level of sense and perception, the forms are unique to each individual, but it is at the level of reason that the forms are meaningful and shared; therefore, the encounter with the designs by the artist and the audience must be based on rational knowledge to contribute to mutual understanding and pleasure.

In these buildings, the architect changes the decorative motifs of flowers and plants and figurative shapes to create geometric motifs by understanding

abstract shapes and he analyzes them in the perception corresponding to the use of the building, the initial plan and the bed on which the designs are based, as well as the materials. In addition, the scientific principles of mathematics and geometry are applied to maintain unity and coherence of the components of the building with motifs and designs, and necessary rational tactics of coordination and organization are applied to achieve the desired perfection. This means that the choice of geometric motifs to decorate the body of the tombs has gone through a rational process. The architect, having observed the nature creates abstract and meaningful designs that are centralist, pluralistic and at the same time show unity and cohesion, reproducibility and ascend and are compatible with the nature of the tomb, such as the cross and hexagram that face the sky as well as the earth and the like. This selection and coordination of the elements and components of the building have another reason for the rationalism of the process of inventing geometric motifs on the body of the tomb, which can be justified by Avicenna's theory of faculties of the soul and the important motif of reason. Therefore, in the case of the geometric motifs of the decorations related to the architecture in question, the explanation of the theory of rationalist invention, in Avicenna view, that the reason manifests itself in the form of scientific principles; the construction of the work is based on the observance of scientific standards and manifests itself in creating moderation and proportion among the components of the work and its all-encompassing unity.

Endnotes

1. The word Masha means walking or very walking. It is a school of philosophy inspired by the teachings of Aristotle.
2. Abu Yusuf Ya'qub ibn Ishaq al-Kandi, known as Abu al-Hakma (801–873 AD, 185–256 AH), was an Arab mathematician, astronomer, and the first Muslim sage and philosopher who had access to the works of Greek sages and translated, interpreted, and expressed the works of Aristotle.
3. Abu Ali Hussein ibn Abdullah ibn Ali ibn Sina, known as Bu'ali, was born in 370 AH and died in 428 AH. He was a physician, philosopher, mathematician, physicist, geographer, poet, logician, musician, and one of the most influential scientists in Iran and the world because of his works in the field of philosophy and medicine.
4. The complete definition of the soul is as follows: The soul of the first perfection has potential life for the higher natural body. This definition

implies the soul in its material meaning. The material soul is a complex of several plant species of human and constellation animals, each of which has different types (Davoodi, 2008, 285).

5. The outer faculties are the same as the five senses, but the inner faculties are of three categories; plant soul: feeding soul, productive soul, non-existent soul, animal soul: stimulus and perceiving that includes: common sense, memory, fear, and the third category, which is specific to human beings, is called reason soul and includes practical reason and theoretical reason. (Refer to the book of the treatise of the soul, chapter two)

6. Abu al-Wafa Muhammad ibn Yahya ibn Ismail ibn Abbas (939-998 AD) is a great Iranian mathematician and astronomer.

7. The cross (solar wheel or swastika) is a shape with 90-degree branches to the right or left. It is an ancient symbol that according to some scientists was originally representative of the solar (Hall, 2001, 5).

8. Probably the tower was originally built of raw clay and was restored between the 4th and 5th centuries AH by a person named "Abu Shuja". The plan is circular with a cylindrical body and an onion-shaped dome of an all-brick shell sitting on top of this cylinder.

9. Two brick towers belonging to the Seljuk period, which are 29 meters apart and are located around Kharqan in Qazvin province. The eastern tower was built in 1067 AD by "Mohammad Ibn Maki Zanjani" and the western tower was built in 1093 AD.

10. The Red Dome is another tomb of the Seljuk period in Maragheh. The name of the founder and the date of its construction are written in the inscription of the northern front and the name of its builder is written in the western inscription.

11. The four elements refer to water, wind or air, earth, and fire, which is the custodian of the existence and creation of the world and human beings (Bakhtortash, 2000, 56).

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