International Journal of Architectural Engineering & Urban Planning

Architectura landscape

Analysis of Persian Gardens using Kaplan's landscape preference theory (Case study: Fin garden, Shazdeh Mahan garden, Eram Garden & El Goli garden)

S. Abbasalizadeh Rezakolai[1], D. Samadi[2], M. Tabatabaian[3,*]

Received: December 2014, Accepted: April 2015

Abstract

A review of findings shows that Persian gardens have attracted a wide area of interests between psychologists and environment designers. The main reasons behind the attraction of Persian gardens are natural content and particular landscape configuration. To study these features, overall organization examination is employed according to psychological pattern. One of the impressive psychological patterns to evaluate the natural landscape is preference matrix which has been developed by Stephen and Rachel Kaplan. In this study, characteristics of Persian gardens are reviewed and they are analyzed according to the Kaplan preference factors (coherence, legibility, mystery and complexity). Hence, four gardens namely, Fin, Shazdeh Mahan, Eram and El Goli, with different topographies are randomly selected and have been analyzed based on the four mentioned factors. Because of the inseparable relationship of human behavior and environment, the research methodology applies psychological approach based on a descriptive – analytical method and to implement this method library documents are used. As the discussion demonstrates, concepts created from the relationship between factors and Persian gardens' characteristics are associated with coherence, legibility, mystery and complexity. It shows that elements shaping the Persian gardens have close relationship with these factors because they are important in perception of the natural environment. Based on analysis, the elements in Persian Gardens are used to provide the best psychological and aesthetic responses for viewers. Also, it can be concluded that, the quality of the material and semantic makes them more attractive.

Keywords: *Persian garden, Kaplan's model, Natural environment, Coherence, Legibility, Mystery, Complexity.*

1. Introduction

The benefit of natural environment to human health and well-being are widely assumed [1, 2, 3]; Restorative environments, primarily natural environments, alleviate directed attention fatigue, assuage psychophysiological stress, and improve emotional state. In addition to nature as an important content of preferred environments, studies show that the arrangement of the contents in a visual landscape significantly affects people's preferences for landscapes [4, 5].

On the other hand, in experiencing natural environment, visual quality of observed landscape plays a key role and the value of this quality lays in interactions between human and natural environment.

One of the best patterns reflecting the interactions between human and the nature is Persian historical gardens. These gardens are studied because they can fulfill human being's physical and mental needs. In Persian culture, garden has a universal picture as it has changed into an internal view through centuries. As well, gardens are considered as a part of Persian culture. In other words, Persian gardens are considered as a symbol of nature and they are a way refer to human internal beliefs.

The environmental psychological field profoundly studies the human psychological relation with natural environments. This research area is based on numerous experimental studies and it is less speculative than the just-mentioned modularity thesis. One of the main topics of environmental psychology is the study of different emotional states in individuals.

Specific aspects of the environment have emerged as the key elements related to individual quality of life, this encompasses many factors including social relationships, education, financial security, health, and environmental quality [6].

One of the most important proposals has been developed by Stephen and Rachel Kaplan considering the specific process based on these emotional states. The study

** Corresponding author: tabatabaian@art.ac.ir*

1 M.A. Architecture, Department of Architecture and Urban Planning, Tehran Art University

2 Ph.D. Student, Urban Design, Department of Architecture and Urban Planning, Tarbiat Modares University (TMU)

3 Ph. D. Art Education, Assistant professor Department of Architecture and Urban Planning, Art university of Tehran

draws a psychological pattern in priorities of natural environment. In the presented preference matrix, the occurrence of such states is significantly the result of cognitively assessing the presence of certain informational features in a setting [5]. The authors studied what people like in natural environment. Their research shows that basic informational needs influence preferences for certain landscapes. This preference framework argues that people perceive scenes or images in two and three dimensions. There are four cognitive aspects of landscape that are essential in the appreciation of a landscape namely 'Coherence', 'legibility', 'complexity' and 'mystery'. Meanwhile, there are questions with respect to the psychological environment, for which this paper tries to find answers:

-What are the connections between the Kaplan's factors in preference theory and Persian garden's characteristics?

-What would be the role of the Persian garden's elements and characteristics in psychological preference of Persian gardens?

2. Research Methodology

This research has been performed based on a descriptive – analytical method using articles, studies, reports and related documents (the library documents). Different elements and characteristics which shape the Persian garden are described. Furthermore, four factors which determine environmental preferences in Kaplan's theory are discussed according to previous researches. Then, four Persian gardens with different topographies are randomly selected. In general, considering the topography features, Persian gardens can be classified as follow: 1- Gardens located on flat levels, 2- Gardens located on steep levels, 3- Aquatic Garden, 4- House Garden and 5- Garden located beside a river [7].

Fin garden is randomly selected from the first classification. As well, ShazdehMahan is the selected Garden in the second classification. El Goli garden is selected from Aquatic Garden classification and Eram garden is selected from house garden classification. Ayine Palace or Saadat Abad Garden was located by the river in Isfahan which was destroyed by a Qajar king. Therefore, the characteristics of Fin, Shazdeh Mahan, El Goli and Eram gardens will be analyzed and evaluated using Kaplan's Landscape Preference Theory.

3. Persian Gardens

The method of relationship between human and nature determines the goal, function and result of architecture. Architecture of the tradition era is not an exemption. Man in the tradition era was seeking a certain level, superior to 'security' and inferior to 'welfare'. Reaching this level is what is called "comfort". In other words fulfilling the comfort needs is the intention of this architecture. This means seeking a heaven on earth. The comfort needs as noted are beyond security need so when one is seeking comfort needs he has attained them [8].

Throughout the Islamic centuries, the Persian gardens have represented images of paradise for the Persians. The gardens were built essentially to create a space for relaxation and leisure. The word paradise comes from pardis (Paridaiza) meaning garden (walled around garden) in Persian [9].

In fact, the plateau of Iran has always been relatively arid and treeless which gave the gardens such a supreme value. Compared to the open and barren wilderness, the garden is enclosed, fertile, and rich in fruit and flowers; in comparison with the drought and heat and unavoidable sun outside, it has water, coolness and shade; compared to the hostile vastness of near- desert, it has arrangement and tranquility, and it is a place where one may sit in the shade, rather than walk in the fierce light of the sun. Habitants of plateau of Iran depicted aspects of their life and beliefs upon the earliest decorated pottery. For instance, some bowls show pools of water, overhung by the tree of life. Others show the world as if it is divided into four quarters, and some of these patterns have a pool at the center. This type of cross plan, in which one axis may be longer than the other, was to become the standard plan of the Persian garden under the name chaharbagh, or four gardens [10].

Since water is the main element in the Persian Gardens. The water effects geometry and axis creation, which are the channels network led to garden geometry formation. The geometry is created by water supplying system and the needs are caused by logic of water matching well with water supplying networks. There are clear relationships between the geometry, layout of gardens and water supplying networks. There is a classification into four parts for the needs of a water supplying network that shows the geometry of gardens is based on the layout of gardens. It is observable in all the farms and gardens created by irrigating base [11].

As well as an important factor in formation of architecture, geometry is considered the base for the shape of Iranian Gardens. The most important feature and indicator of Iranian Garden is its complete geometry and ordered and pre-planned space. This geometrical base has a role in drawing out the concepts, basics and building the material of the garden. As well, it affects the way of composition of these elements which finally determine the general shape of the garden. On the other hand, other orders can be recognized which have effect in shaping the garden [12].

Vegetation (trees and flowers) is another principle element in Persian gardens. In the ancient civilizations of Iran, plants held a special position [13]. The first stage in planting a tree is to determine its distance from all sides. Hence, squares are shaped and it is possible to see the row of trees from all sides. Another important principle in Iranian Garden design is an open rectangular shape landscape in front of the garden. The front side of the building has an open and long space in the main landscape site. To avoid making a barrier on the front side of the garden, short plants are planted [12].

Buildings are constructed in different parts of the garden. For example, sometimes the main building is in

the middle of the garden with an open view and secondary building and portal are located around it. Sometimes the main building is in one side and other buildings are around it with two crossing ways. The main landscape is located at longitudinal axis of the garden. In some gardens the palace is in the longitudinal axis of the main space with one third ratio and internal buildings are positioned in solitude part of the garden and the main landscape is in the opposite direction of internal buildings. Other buildings include summer, winter, water storage and bathroom. Other required buildings are constructed in suitable places regarding their function. Totally, two criteria are important in Iranian Garden geometry: trees expanding beside each other and dividing the garden into squares. As well as rectangular and square shapes, there are octagonal, palace and solitaire shapes like the pool in the garden. Around the secondary streets which cut each other in an orderly and square shape, white-berry is planted. This plant is beautiful and remains short by regular pruning. As well, it does not occupy any space in the middle of the street. Willows are usually planted in watery areas but not beside pools because they damage the structure of the pool. Pussy is a decorative tree and its flowers are used to make distil [12].

In general, the study shows the characteristics of Persian gardens as follow: Geometry and Proportions in plan (chaharbagh), Symmetry, Centralization (main pool, main building), Rhythm (in rows of trees and in rows of fountain), Hierarchy, Being enclosed, Existence of longitudinal axis in the plan (longitudinal paths and longitudinal pool), Diversity of trees and flowers.

These orders include a collection of norms, ideological bases and living customs of people which shape the methods of giving orders to the spaces. Some of these orders have an effect on shaping the garden as well as determining the whole shape of habitats and human environments such as land ownership, economical and living and social orders. Some of them are mainly dedicated to architecturally shaping spaces and something which is of more importance to us, i.e. the garden [12].

Persian garden is a place surrounded by mystery and restricted by codes and secrets. It is a place of memory and fantasy which does not remain within its boundaries. Its scope expands beyond its walls and limitations, including the natural and cultural basis and the potentials of the environment around it. It means more than its tangible and objective characteristics and also associates and recalls its relations with universal order. The Garden enjoys the aesthetic, high transcendent and utility values all at the same time [14].

Results of analysis of the Fin and Shazdeh Mahan Gardens are included in the text and because of lexical constraints; conclusions of the other gardens analysis are given in the final section.

4. Kaplan's Landscape Preference Theory

Preference has been a popular approach in assessing perception of a certain setting, achieving a human response where it provides valuable information regarding the public's attitude towards a particular environment, which includes the reaction to the content and spatial configuration. It has been stated that preference studies is a practical and a systematic approach that can be used in measuring people's preference for gathering data, categorizing landscape measurements such as; level of human effects and as well as the elements and features in landscaping as preferred or disliked by people. In general, the concept of preference is known as the simple perceptual response regarding a particular setting preferred by individual [15].

The Kaplan's landscape preference theory proposes coherence, legibility, mystery and complexity as being the four factors that determine environmental preferences. Of these four informational factors, coherence and complexity are based on the two-dimensional plane. They involve the direct perception of the elements in the scene in terms of their number, grouping and placement. Legibility and mystery, by contrast, require the inference of third dimension (Table 1). When viewing scenes, people not only infer a third dimension, but also imagine themselves in the scene. These two factors involve the inference of what being in the pictured space would entail [4].

Table 1 Kaplan's preference matrix [4]

	Understanding	Comolexity
2-D	Coherence	Complexity
3-D	Legibility	Mystery

As the table further indicates, coherence and legibility provide information that can help to make sense of the environment. An environment that is well organized and distinctive is easier to understand. Complexity and mystery, by contrast, concern information that suggests the potential for exploration, either because of the variety of the elements or because of the cues that imply there may be more to be seen. Although in the context of a scene or environment the four informational factors operate jointly, for purposes of explanation, it is useful to consider them one at a time [4].

4.1. Coherence

Coherence as recently mentioned is defined; 'The structure, inherent order or patterning of that information, as perceived in a 2-dimensional array. It includes factors that make the picture plane easier to organize, to comprehend, and to structure [16]. Coherence is enhanced by anything that helps the organization of patterns of the brightness, size, and texture in the scene into a few major units. Features as repeated elements and uniformity of texture are examples of redundancy. They help to delineate a region or area of picture plane [5].

This principle of grouping is reinforced by repetition, similarity, proximity, common enclosure, symmetry and orientation of the parts. In this area, Gestalt psychologists have also paid attention to how sensory intakes are organized, or how a whole is formed and pulled together out of the parts. Gestalt psychologists believe that if various stimulants are designed so that they are perceived as a whole unit, tension will decrease. It implies that the design

is coherent. The greater the complexity of a scene, the more structure is required to organize it to be coherent [17].

4.1.1. Repetition and similarity

The eyes tend to group things of the same type together. Even when the elements taken in pairs are somewhat different, we find that the structural resemblance dominates these differences. Repetition in the form of rhythm, as in music and architecture, is an extremely simple principle of composition which tends to give a sense of coherence. Unity of materials and texture is another example of partial characteristics which reinforce the tendency towards coherence in spite of the individuality of each building. Common scale, despite the comparative size of elements, is an effective factor in grouping by similarity. It must be emphasized that this would not be sufficient if it were the only common characteristic. When the objects differ in other ways, such as materials, texture, openings or roofs, the unity is destroyed in spite of the similarity of scale [18].

Rhythm is the repetition of an element in a regular sequence. It directs the eye and helps it to move about a space. Rhythm is essentially a disciplined movement and can be either passive or dynamic. There are essentially four types of rhythm:

Regular rhythm: Rhythm created by repetition is the most common and can be seen everywhere. Repetitive rhythm is achieved by repeating a color or pattern on a wall, on curtains or even in a painting. This type of rhythm is passive and must be handled sensitively, otherwise it becomes boring.

Progressive rhythm: It is an ordered, gradual change in the size, direction, or color of an object or space. It is more subtle, dynamic, and inventive than simple repetition and can be achieved by succession in size from large to small (or vice versa) or in color by succession from dark to light (and vice versa).

Alternation rhythm: Rhythm by alternation or rhythm by line is the regular, undulating, and continuous flow of line or space.

Radiation rhythm: Rhythm by radiation is created when object lines or motifs extend outwards from central axis, in a light fixture [19].

Texture: Texture is the relative smoothness or roughness of a surface as it appears to the eye and to touch. Texture is a unique characteristic of a material or a pattern. The appearance of texture is a direct result of the reflection of light of the materials.

Smooth surfaces appear shiny and have a high degree of reflectivity and potential for glare. They also can be slippery and hasten the movement of elements such as water and debris across the surface.

Rougher surfaces recede in the landscapes, absorbing light, increasing surface resistance, and slowing movement of elements across the surface [20].

4.1.2. Proximity

The eye tends to group elements which are close together and to distinguish them from those which are further apart. This grouping principle is very powerful. It makes it possible to join together which is different using small gaps to create an articulation between elements. There is no established size for these gaps, because the cohesion depends on the relative size of the elements and on the context.

4.1.3. Common enclosure and common group

An enclosure, a ground, even a carpet, defines a field. What is included within the field is distinguished from what is outside it, even if the elements within are heterogeneous. This is a very effective method of unification which is frequently used. Moreover, the elements which define the enclosure form a separate subgroup.

4.1.4. Orientation of elements, parallelism or convergence towards a void or a solid

The eye also tends to group elements which have the same position: vertical, horizontal, parallel elements.

Symmetry is a particular example of this principle. It can even contribute to the unification of such fundamentally different elements such as building and nature. These acquire a common belonging by their relation to an axis which may be either real or virtual.

4.1.5. Interaction of factors

In most organizations several factors come into play simultaneously. Reality is complex and pure situations are rare. Sometimes one factor dominates the others [18].

The quality of rhythm, a clear expression of fundamental rules of design and thematic consistency in the plan imply the quality of coherence in a plan [21, 22]. Also, the concepts of readability, organizing, predictability, signs, directions signs, and space differentiations are all associated with the concept of coherence in a plan [23]. Table 2 shows the relationships between the elements used in Persian garden's design and coherence.

Table 2 The relationships between coherence and characteristics of Persian gardens [Authors]

Characteristics of Persian gardens		Coherence (principle of grouping)											
		Repetition and Similarity						Proximity	Common enclosure and common group	Orientation of elements, parallelism or convergence towards a void or a solid		Interaction of factors
		Rhythm				Uniformity of texture						
		Regular rhythm	Progressive rhythm	Alternation rhythm	Radiation rhythm	Smooth surfaces	Rougher surfaces					
geometry	Geometry in plan	*										*
	Proportions in plan	*										
Centralization	Symmetry									*		
	Main pool					*				*		
	Main building						*					
rhythm	Rows of trees	*				*		*	*	*		
	Rows of fountain	*										
Hierarchy			*									
Being enclosed									*			*
Existence of longitudinal axis in plan	Longitudinal paths						*			*		
	Longitudinal pool					*				*		
Diversity of trees and flowers						*			*			*

4.2. Legibility

As Kaplans defines, a legible space is one that is easy to understand and to remember. It is a well-structured space with distinctive elements, so that it is easy to find one's way within the scene and to find one's way back to the starting point. It is also important that the objects be identifiable and the scene be experienced as interpretable. Legibility thus entails a promise or prediction of the capacity both to comprehend and to function effectively [5].

Legibility is one of the most important concepts associated with coherence. Legibility is enhanced by distinctive elements such as landmarks, smooth textures and the ease of compartment the scene into parts. While coherence focuses on the conditions for perceiving the scene, legibility is concerned with movement within it. Vividness and simplicity of the form, so that the form is as close as possible to geometric forms, reinforce the legibility of the form [21, 24]. Also, appropriate signs are of the most crucial factors in improving the legibility [25]. When a plan is legible, it has been organized well and enough attention has been paid to the orientation of the components [21, 22]. Legibility also can be enhanced by integrating signalizations and distinctive markings, by offering views on the outside and making the shape of the building more regular [23].

4.2.1. Geometry

As Robin Evans illustrates in his essential book, namely, the Projective Cast [26] the meaning of geometry in architecture has changed markedly over time. Evans identifies three types of geometry that have been implicit in the architecture at different times: metrical, projective and symbolic. Each of these reflects the conception of space prevalent at the time. Architectural design expresses this conception and is conditioned by it.

Metrical geometry is concerned with the absolute measure of objects and therefore operates in a static, universal Euclidean space. Euclidean geometry allows the transposition of spatial ideas into visible and measurable form. It establishes a clear relationship between architectural drawings and construction, avoiding the necessity of specifying the location of each point individually. Euclidean theorems can be seen everywhere, ensuring the construction of equal angles, parallel lines, equal lengths and definite proportions.

Projective geometry: addresses the appearance of objects which depends on the position from which they are seen. Its central operation is transformation, specially the transformation of one view of an object into another [27].

Symbolic geometry: Our world is expressed in terms of defined dimensions. Therefore, as single and heavenly truths come into the world, they change into dimensions and geometry forms. For example, Circle represents perfection and it is divine. So in illustrating the symbolic heaven and earth orientation, the sky is always non-finite expressed by the circle. Also, the earth which is surrounded and protected with sky is drawn by square. According to the Pythagorean, squares represent the unity of species and the equivalence of one thing to itself. Then, it can be considered a symbol of justice and law into one's eye.

4.2.2. Proportion in geometry

is a harmonious relationship between the elements and between each component and the entire system.

On the other hand, studies show important critical factors in the 'legibility' of public space; the biggest open spaces should be related to the most important public facilities. Actually, people are able to form clear and accurate image of a legible layout.

4.2.3. Lynch's theory

Lynch, who was pioneered in the topic of image maps (1960s), suggests that there are overlapping features among images that people perceive from a place, namely **paths, edges, districts, nodes and landmarks**. It would be wrong to assume that every area should contain all these features [21].

4.2.3.1. Paths

Lynch describes paths as channels for potential movement, 'Paths are the channels along which the observer customarily, occasionally, or potentially moves. They may be streets, sidewalks, transit lines, channels and railroads'.

4.2.3.2. Edge

The definition of an 'Edge' according to Lynch is linear elements not considered as paths by the observer. They are boundaries between two phases or linear breaks in continuity of shores, railroad cuts, edges of development and walls. They are lateral references rather than coordinate axis. Such edges may be barriers which are more or less penetrable and separate one region from another. They may be seam as lines along which two regions are related and joined together.

4.2.3.3. Districts

like nodes, lack the overt identification with the axial map. Axial maps inherently do not provide any sense of a hierarchical structure in their mapping of the cities or buildings. The use of developing hierarchical structures in residential plans as a means to characterize their genotypes has been discussed in space syntax literature, but the issue has been significantly little discussed with respect to urban structure. No techniques exist at the moment for capturing the natural emergence of distinct districts within a city, a phenomenon that Lynch [21] points out as being both ubiquitous and highly relevant to the image of the city [28].

4.2.3.4. Nodes

Lynch distinguishes two types of nodes. Nodes located at the major intersections, and nodes which are characterized by concentration with a thematic activity. Lynch's distinction between the two types of nodes is actually not so informative. It does not help understanding the characteristic features of nodes. On the one hand, nodes are key points used in way finding tasks, or points at which crucial route choices are offered to the subject. This type of node does not need to have any distinctive physical or visual characteristic. Obviously, such a node would be able to be identified through axial analysis [28].

4.2.3.5. Landmarks

Landmarks, the point references considered to be external to the observer, are simple physical elements which may vary widely in scale. Since the use of landmarks involves the singling out of one element from a host of possibilities, the key physical characteristic of this class is singularity, some aspect that is unique or memorable in the context [21].

Studies show architecture's role in facilitating way findings by creating legible spaces(spaces are classified and defined partial units), creating a key destination, creating an opportunity for members to review the whole space, decreasing the complexity in the overall arrangement and composition of spaces, emphasizing the use of architectural components to routing purposes, attention to the geometry of the space, applying the symptoms of stress and isolation zones and creating legible circulation system [29]. Table 3 shows the relationships between the elements used in Persian garden's design and legibility.

4.3. Mystery

Mystery means the amount of hidden information within the environment that one can discover [30]. Thus, there must be a promise of further information if one could walk deeper into the scene. This necessarily implies that it would be possible to enter the scene, that there would be somewhere to go [5]. There are several ways for scenes or settings to suggest that there is more information available. Some classic examples include the bend in the path and a brightly lit area that is partially obscured by foreground vegetation. Partial obstruction, often from foliage and even modest land-form changes can enhance this sense of mystery [5]. Some claim that this property can also be conveyed by specific design elements: 'when appearing around corners attached to walls and hung from ceilings, interesting objects, architectural details or motifs, graphics, video displays and artifacts can create a little mystery and surprise in the workplace' [31].

However, the most straightforward way to apply mystery to an architectural setting is '**deflected data**'. This can be realized by letting the architectural trail (e. g. corridor) to bend away, which can lead to curiosity of what might lie beyond the bend that result in encouraging explorative behavior. Another mode of mystery is called '**enticement**'. Essentially, this notion refers to the situation in which a person is in the darks, where it can see a partially visible and enlightened area or setting. Such enlightened regions draw attention and trigger explorative behavior. Although, mysterious settings can be aesthetically appealing and too much irregularity or surprise can lead to confusion and nontransparent building layout. This ultimately results in orientation and way-finding problems [32]. Also, various studies of people's preferences for different environments show that mystery is a particularly effective factor in making a scene highly favored [4].

Mysterious scenes are characterized by continuity. There is a connection between what is seen and what is

anticipated. While there is indeed the suggestion of new information, the character of that new information is implied by the information that is available. Not only is the degree of novelty limited in this way, there is also a sense of control, the sense that the rate of exposure to novelty is at the discretion of the viewer. In a highly mysterious scene one could learn more if proceed further into the scene. Thus, one's rate and direction of travel limit the rate at which new information must be dealt with [17]. Another mode of mystery in architectural setting is mystery in the **'concept'** of architecture design, which helps the spaces to be more attractive. Table 4 shows the relationships between the elements used in Persian garden's design and mystery.

Table 3 The relationships between Legibility and characteristics of Persian gardens [Authors]

Characteristics of Persian gardens		legibility																	
		Vividness and simplicity of the form			Important critical factors in the "legibility" of public space (Lynch's studies)					factors in facilitate way findings									
		Geometry																	
		metrical	projective	symbolic	Proportion in geometry	Paths	Nodes	Districts	Edge	Landmarks	Legible spaces(spaces are classified and defined spatial units)	a key destination	review the whole space	the lack of complexity in the overall arrangement and composition of spaces	emphasizing the use of architectural components to routing purposes	applying the symptoms of stress and isolation zones	Legible circulation system
Geometry	Geometry in plan	*	*	*				*			*		*		*			*
	Proportions in plan				*						*							
Centralization	Symmetry	*						*						*				
	Main pool						*			*		*		*		*		
	Main building						*	*		*		*		*		*		
Rhythm	Rows of trees								*					*				
	Rows of fountain								*					*				
Hierarchy																		*
Being enclosed									*									
Existence of longitudinal axis in plan	longitudinal paths					*								*				*
	longitudinal pool					*												
Diversity of trees and flowers								*										

Table 4 The relationships between Mystery and characteristics of Persian gardens [Authors]

Characteristics of Persian gardens		Mystery		
		Deflected data	Enticement	Concept
Geometry	Geometry in plan			*
	Proportions in plan			*
	Symmetry			
Centralization	Main pool			
	Main building			
Rhythm	Rows of trees			
	Rows of fountain			
Hierarchy		*	*	
Being enclosed			*	
Existence of longitudinal axis in plan	Longitudinal paths			
	Longitudinal pool			
Diversity of trees and flowers		*		

4.4. Complexity

Complexity is defined in terms of the number of different visual elements in a scene. It is concerned with scene interaction and richness. It thus reflects how much is going on in a particular scene, how much there is to look at- issues that call upon the picture plane, as opposed to depth cues. As a matter of fact, there are more different things available. It could be argued that complexity provides content or things to think about [5].

Complexity is the involvement component a scene's capacity to keep an individual busy without being bored or over stimulated. Often referred to as diversity, variety or richness, it used to be regarded as the single most important factor. Kaplan describes it as how much is 'going on' in the scene-a single field of corn stretching to the horizon will not have the same level of complex it has many fields of many crops on undulating land with hedgerows and cottages. The more complex scene will tend to be preferred to be simpler. Complexity and novelty of space bring about the stimulation as well. Research shows that people require such extent of complexity and novelty that provides them with challenging opportunities. Extreme complexity or novelty of space makes the interior confusing and impossible to analyze. However, a low level of complexity creates a sense of worthlessness and typicality [22].

The low-coherence scene could be used as an example of high complexity. One can readily tell that there is a richness of elements in the setting. It appears intricate and has many different visual components to consider. By contrast, large and open expanses are low in complexity [4].

Most people understand complexity as a disorganized variety. In fact, there are two distinct types of complexity: '**organized**' versus '**disorganized**'. Biological forms are highly complex, and at the same time marvelously organized, thus establishing the relationship between life and organized complexity [33]. Table 5 shows the relationships between the elements used in Persian garden's design and complexity.

Table 5 The relationships between Complexity and characteristics of Persian gardens [Authors]

Characteristics of Persian gardens		Complexity	
		Organized	Disorganized
Geometry	Geometry in plan	*	
	Proportions in plan	*	
	Symmetry		
Centralization	Main pool		
	Main building	*	
rhythm	Rows of trees		
	Rows of fountain		
Hierarchy			
Being enclosed			
Existence of longitudinal axis in plan	Longitudinal paths		
	Longitudinal pool		
Diversity of trees and flowers			*

5. Case Study

5.1. Garden located on flat levels: Fin Garden in Kashan

Designed for Shah Abbas I. There are four different gardens inside the garden which are separated by principal and secondary axis. These axis are made as channels with turquoise tiles [34]. The garden is organized as a chaharbagh with a pavilion at the intersection of the principal axis. This pavilion faces the main house in one direction and in the other a smaller pavilion with a talar porch. It faces a large pool on its south side. The pavilion overlooks a broad channel that runs to various subsidiary buildings along the north wall which is slightly elevated. Accentuated by the luminous blue faience tile lining the channels, water can be found everywhere in the garden. It defines the principal axis of the plan, encircles the garden and runs through the central pavilion. It runs down small cascades (chadars) and jets upward in fountains. A secondary water axis runs along the south-west side leading to another nineteenth-century pavilion and basin (called the HowzJushan) that marks the water's point of entry into the garden. The waterworks and dense shady plantings of fruit, willow, and ancient cypress trees are a dramatic contrast to the desert setting of the Bagh- I Fin estate [35]. Bathhouse (hammam) is located on one side of the garden that is well-known as the place where Iranian nationalist hero, Amir Kabir, was murdered. On the opposite side of the garden Kashani National Museum is placed. Textiles, ceramics and calligraphy are exhibited in the museum.

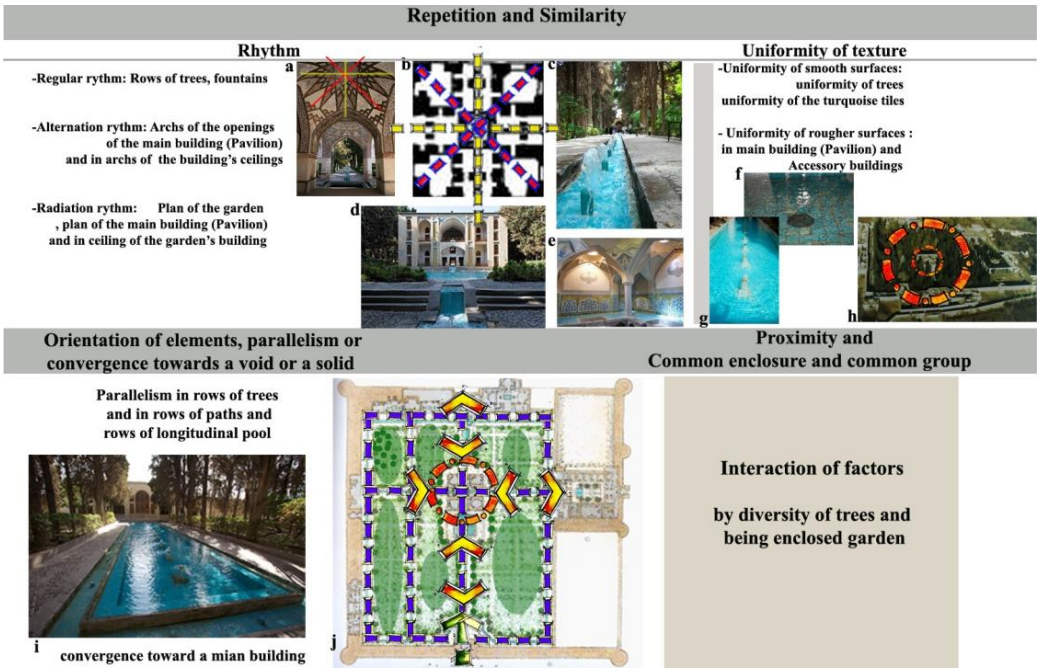

Fig. 1. Analysis of Coherence in Fin garden [Authors]

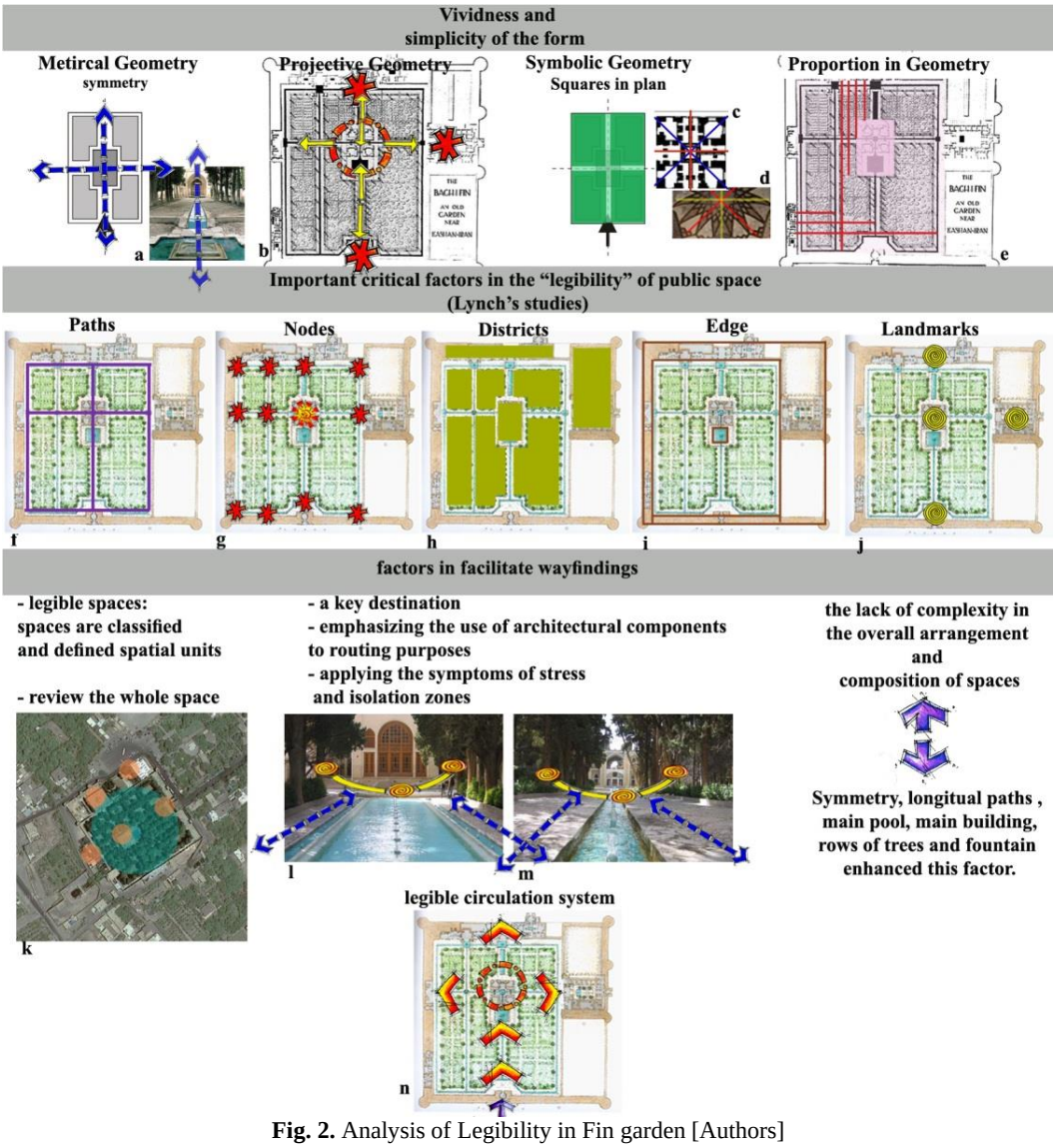

Fig. 2. Analysis of Legibility in Fin garden [Authors]

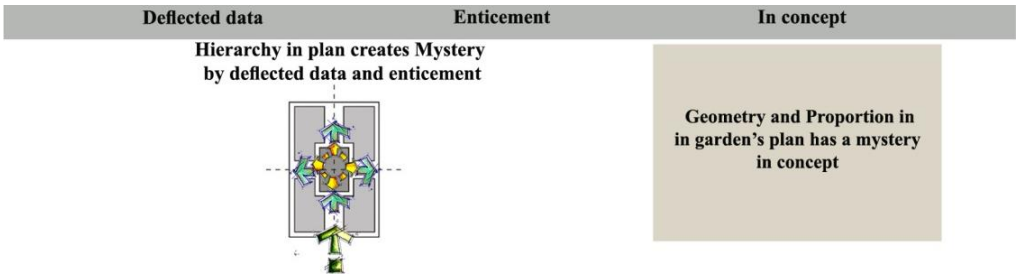

Fig. 3. Analysis of Mystery in Fin garden [Authors]

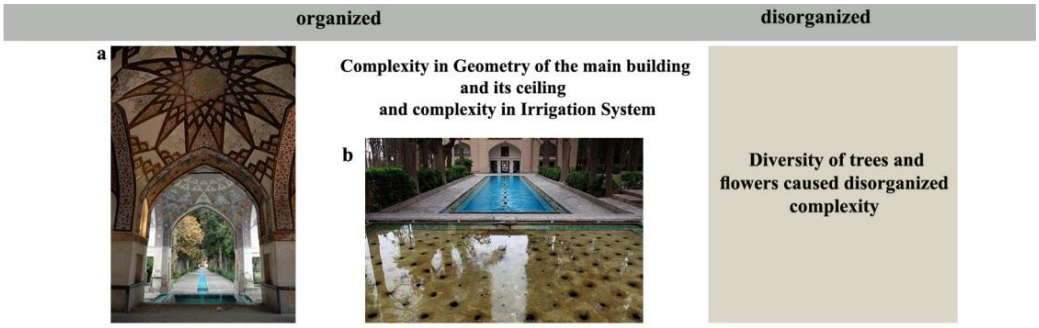

Fig. 4. Analysis of Complexity in Fin garden [Authors]

5.2. Garden located on steep levels: Shazadeh Mahan Garden in Kerman

Shahzadeh Garden is located in 35 km from the south-east of Kerman, and at 6 km from Mahan, on the Kerman-Bam Road near the altitudes of Joupar. It is an Iranian garden benefiting from the best natural situation. Shahzadeh Mahan Garden was constructed in Qajar Era, at sovereignty of Abdol hamid Mirza Naseroldoleh. This garden is located near the tomb of Shah NematollahVali on the hill sides of Joupar altitudes. This garden is constructed over an arid and barren land because of its fertile soil, sufficient sunshine, mild wind, and access to Tigaran water. Owing to the 6.4% slope along the garden, a height difference of about 20 meters occurs in the 407 meters length. This natural slope has led to divisions in the garden defining the nature of the garden. In the garden, along the main axis landscapes of Joupar altitudes are seen. This long landscape is hidden by the huge size of the main structure and it is reinforced by the trees at both sides having different colors at different seasons. The water's streams along the garden's main axis and the waterfalls with nice sounds have contributed to a high quality for this axis. Tree reflections, the facade structure and the gazebo have contributed to a pleasant feeling, peace and solitude in the garden. Light and shade play a significant role in this landscaping [36].

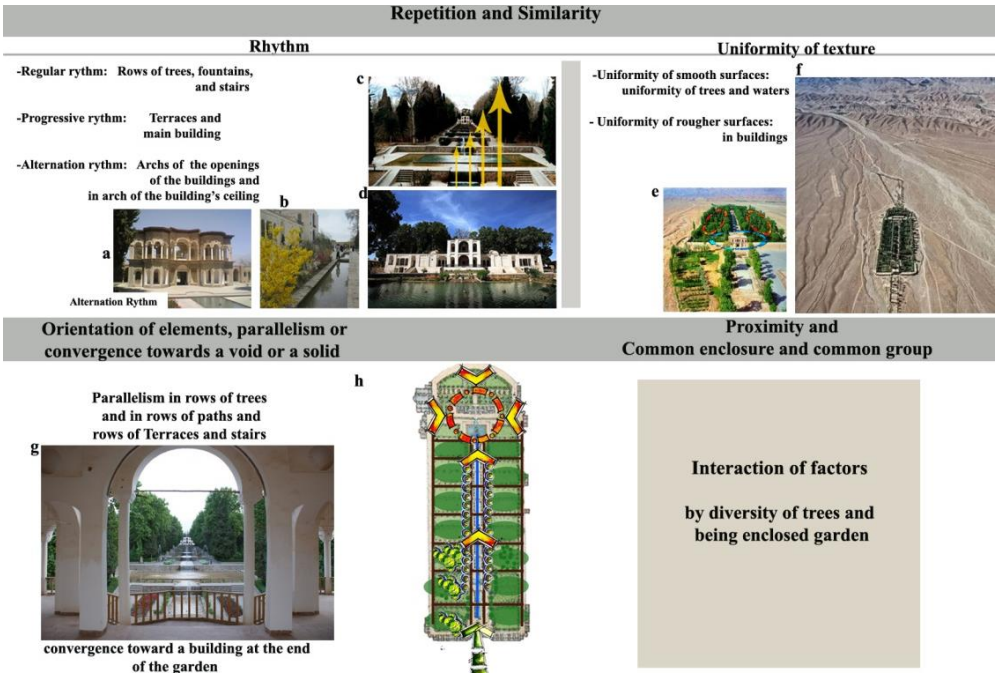

Fig. 5. Analysis of Coherence in Shazdeh Mahan garden [Authors]

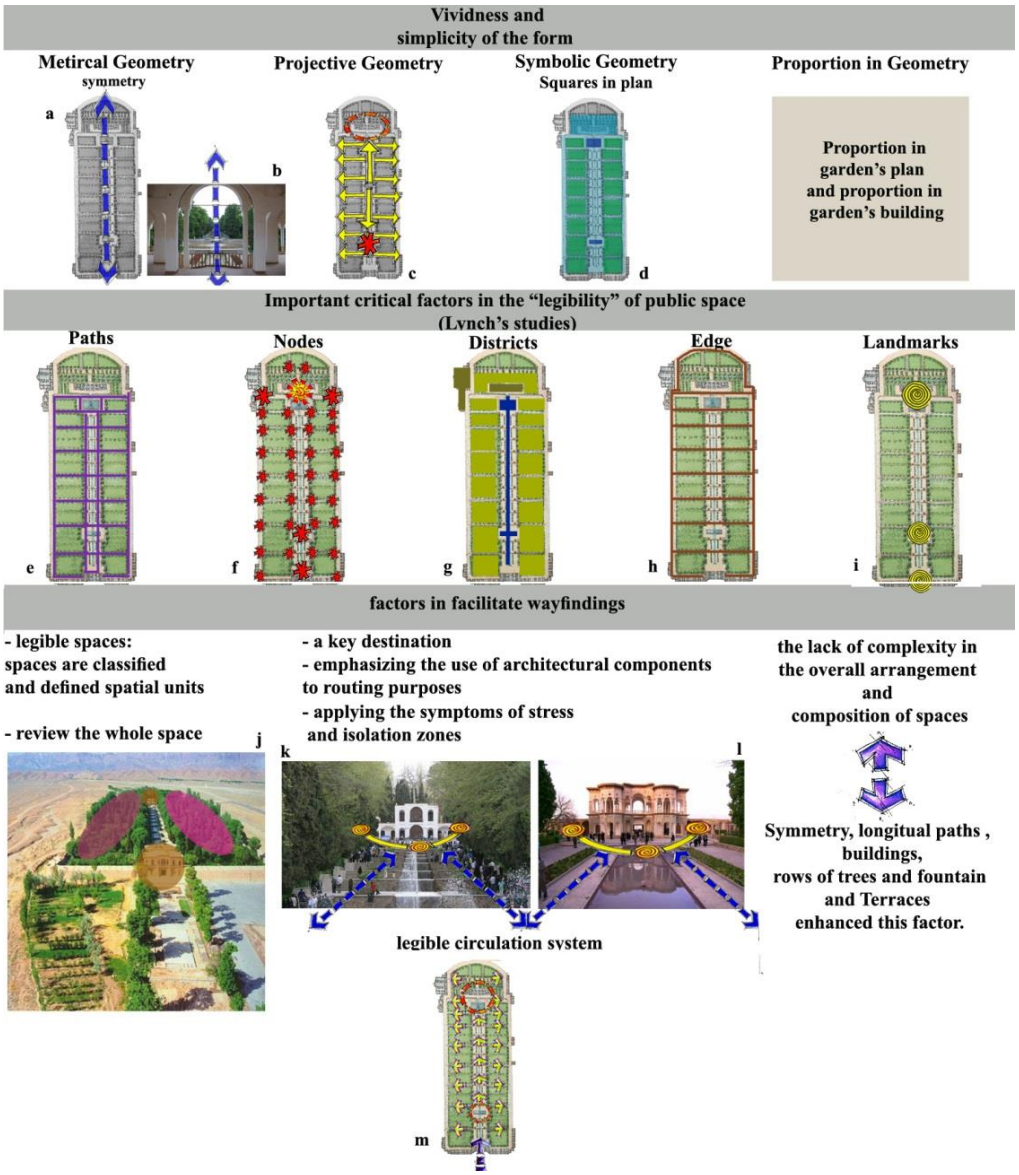

Fig. 6. Analysis of Legibility in Shazdeh Mahan garden [Authors]

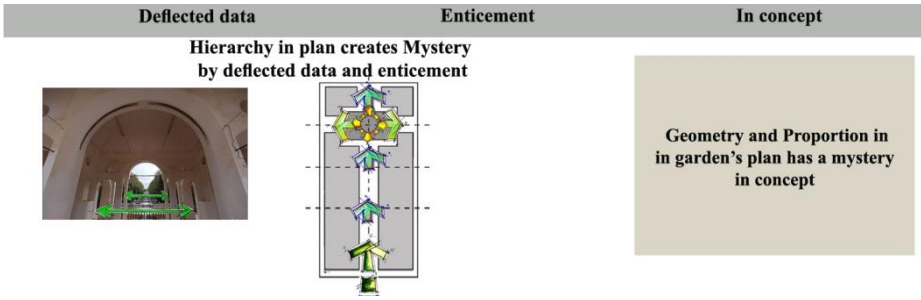

Fig. 7. Analysis of Mystery in Shazdeh Mahan garden [Authors]

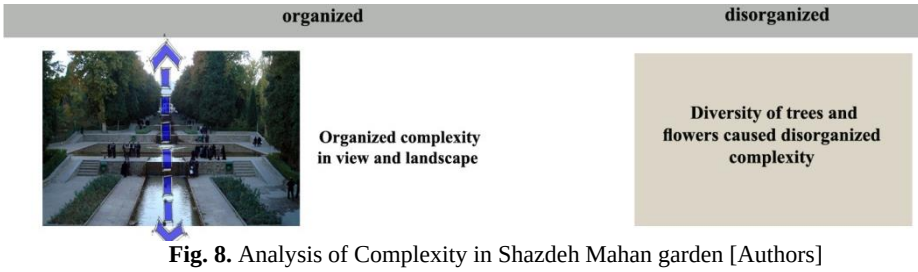

Fig. 8. Analysis of Complexity in Shazdeh Mahan garden [Authors]

6. Results and Discussion

The extracted results of the paper indicate that studying the overall organization of the gardens is an effective method to understand the superiority of Persian gardens landscape to separate physical elements. The overall organization makes a relation between the physical characteristics of the raw garden and aesthetic responses of a viewer. As mentioned above, this paper applies an effective psychological pattern in preference of natural landscapes based on framework provided by Stephen and Rachel Kaplan, Obtained results are according to Kaplan's preference theory based researches to determine the reaction of a person to the environments including four factors: Coherence, Legibility, Mystery and Complexity. As mentioned above, four gardens of fin, shazdehmahan, Eram and El Goli are randomly selected and analyzed according to preference factors. Results of this discussion are given in Table 6. As it can be observed, in the analyzed gardens, factors of Coherence, Legibility, Mystery and Complexity can be considered in different parts of the Persian gardens.

Table 6 Case studies analysis, the relationships between garden's elements and Kaplan's preference factors [Authors]

Kaplans Preference Factors				Fin Garden	Shazadeh Mahan Garden	Eram Garden	El Goli Garden
Coherence (principle of grouping)	Repetition and Similarity	Rhythm	Regular rhythm	+	+	+	+
			Progressive rhythm	-	+	+	+
			Alternation rhythm	+	+	+	+
			Radiation rhythm	+	-	-	+
		Uniformity of Texture	Smooth surfaces	+	+	+	+
			Rougher surfaces	+	+	+	+
		Proximity		+	+	+	+
	Common enclosure and common group			+	+	+	+
	Orientation of elements, parallelism or convergence towards a void or a solid			+	+	+	+
	Interaction of factors			+	+	+	+
	Vividness and simplicity of the form	Geometry	metrical	+	+	+	+
			projective	+	+	+	+
			symbolic	+	+	+	+
		Proportion in geometry		+	+	+	+
legibility	Important critical factors in the "legibility" of public space (Lynch's studies)	Paths		+	+	+	+
		Nodes		+	+	+	+
		Districts		+	+	+	+
		Edge		+	+	+	+
		Landmarks		+	+	+	+
	factors in facilitate way findings	legible spaces(spaces are classified and defined spatial units)		+	+	+	+
		a key destination		+	+	+	+
		review the whole space		+	+	+	+
		the lack of complexity in the overall arrangement and composition of spaces		+	+	+	+
		emphasizing the use of architectural components to routing purposes		+	+	+	+
		applying the symptoms of stress and isolation zones		+	+	+	+
		Legible circulation system		+	+	+	+
Mystery		deflected vista		+	+	+	+
		enticement		+	+	+	+
		concept		+	+	+	+
Complexity		organized		+	+	+	+
		disorganized		+	+	+	+

7. Conclusion

In the context of this study, the characteristics of the Persian garden and the role of its elements in preferring the landscape have been discussed. Also, studies shows that elements shaping the gardens have close relationship with Coherence, Legibility, Mystery and Complexity which are important factors in perception of the natural environment. Features utilized for designing these Gardens are in a close association with the four factors mentioned above. Table 7 displays the relationships between the elements used in Persian garden's design and the four factors developed by Kaplans.

Table 7 the relationships between Persian garden's elements and the Kaplan's preference factors [Authors]

Kaplans Preference Factors				Persian garden's elements
Coherence (principle of grouping)	Repetition and Similarity	Rhythm	Regular rhythm	rows of trees, fountain & rows stairs and terraces in Gardens located on steep levels
			Progressive rhythm	terraces in Gardens located on steep levels& in the main building of some gardens
			Alternation rhythm	Arch of the openings of the main building & Arch of the building's ceilings & In the longitudinal pool of some gardens
			Radiation rhythm	Plan of some gardens & Main building with central plan and in Ceiling of them
		Uniformity of Texture	Smooth surfaces	Uniformity of the trees texture and water texture & Uniformity of the turquoise tiles texture in some gardens
			Rougher surfaces	Uniformity of texture of the Main building and accessory buildings & Paths in gardens
	Proximity			Most elements of the garden which are close together and to distinguish them from others are perceived as a whole unit
	Common enclosure and common group			What is included within the garden like trees is distinguished from what is outside it & what is included within the main building or with in the main pool is distinguished from what is outside them
	Orientation of elements, parallelism or convergence towards a void or a solid			Parallelism in rows of the trees, rows of the paths, rows of the longitudinal pool & Parallelism in rows of the terraces and stairs in some Gardens located on steep levels Convergence toward a main building or main pool
	Interaction of factors			By diversity of elements such as different vegetation and different buildings which located in enclosed garden
	Vividness and simplicity of the form	Geometry	Metrical	Symmetry, equal angles, parallel lines, equal lengths and definite proportions in Persian gardens
			Projective	Addresses toward the main building and main pool & Addresses toward the accessory buildings
			Symbolic	Squares in plans of the gardens & circular and central design in plan of the buildings in most of the gardens have a symbolic Geometry
		Proportion in geometry		There are Proportions in all of the parts in Persian gardens, such as location of the main building & dimensions of the buildings and in geometry of the its plan & location and dimensions of the pools
legibility	Important critical factors in the "legibility" of public space (Lynch's studies)	Paths		Longitudinal, latitudinal paths & paths on the terraces and stairs toward the main building on the highest level in Gardens located on steep levels& paths around the garden
		Nodes		Nodes created by Collision of two longitudinal and transverse paths & Collision of longitudinal and terraces in Gardens located on steep levels
		Districts		Districts created by segmentation of the gardens to four parts (chaharbagh) in most of the Persian gardens & segmentation of the gardens to planting the vegetation in each part & by building's special location in gardens in
		Edge		The walls around the garden & The edges of the pools & the edges of stairs and terraces in Gardens located on steep levels
		Landmarks		Main building (pavilion) & the pool in front of it
	Factors in facilitate way findings (legible spaces, a key destination, review the whole space,…)			All of the elements in designing Persian gardens facilitate wayfindings as discussed above the table
Mystery	Deflected data			Enclosed and Hierarchy in Persian gardens caused enticement and added deflected data to viewers of the garden
	Enticement			
Complexity	Concept			Geometry and Proportions in gardens design
	Organized			Geometry of the garden and the buildings of them & in ceiling's structure & structure of the arches in openings and ceilings
	Disorganized			Diversity of the vegetation such as trees, flowers,…

According to above analysis, some conclusive statements can be made:

7.1. Coherence

in Persian gardens is considered as an important factor based on Repetition and Similarity (by Rhythm and Uniformity of Texture), Proximity, Common enclosure and common group, Orientation of elements (parallelism or convergence towards a void or a solid) and Interaction of factors. As mentioned in Table 7, Rhythm in Persian gardens is indicated in different ways. **Rows of trees and fountains**, **longitudinal paths** and **channels of water** are repeated in all parts of the Persian gardens. Also, uniformity of texture developed by **proximity of trees** in a considerable range of the gardens and **proximity of rougher surfaces such as buildings and paths** are important factors for determining the rhythm. To sum up, all the analysis indicates that elements in Persian gardens create a whole unit in spite of the diversity in all aspects.

7.2. Legibility

as an important factor in the priority of landscape exists in Persian gardens. As it can be observed, metrical, projective and symbolic geometry are indicated in all elements of the garden which is an important factor to the legibility of the space. Furthermore, results of study show the Lynch's factors in legibility of space and its relationship to Persian gardens. Paths, Nodes, Districts, Edge and landmarks are seen in all of the Persian gardens. Design features such as **longitudinal and latitudinal axes** are demonstrated as paths. **Segmentation of the gardens into four parts** is considered as districts. **Designing the walls around the garden** emphasizes the edges. Furthermore, **locating the building in central position** and **locating the pool in collision of axes** are observed as nodes and landmarks. Generally, all elements in Persian gardens facilitate way findings by creating legible spaces and key destination, applying the symptoms of stress and isolation zones, reviewing the whole space, decreasing complexity, emphasizing the use of architectural components to routing purposes and creating legible circulation system.

7.3. Mystery

in Persian gardens can be seen in the garden's structure in addition to its concept**. Being enclosed** and **Hierarchy** in Persian gardens cause enticement and add deflected data to viewers of the garden. Viewers enter the garden step by step and they can see a partially visible and enlightened area or setting.

7.4. Complexity

Disorganized complexity has been established in all gardens through **a wide variety of trees and plants.** Organized complexity can be seen in the **geometry of the garden and buildings** (such as geometry and proportions in garden's plan and its building, the location of the main building and its elevation, ceiling's structure and openings' arches structure), **water supplying system** and so on.

Finally, it can be realized that features such as geometry and proportions, symmetry, centralization, rhythm, hierarchy, being enclosed, existence of longitudinal axis in plans, trees and flowers diversity and so on are principal patterns shaping the Persian gardens. They are based on the cultural, social, economical and religious beliefs of Iranians and have a close relationship with psychological and aesthetical perception of the landscapes and environments.

References

[1] Ulrich RS. Aesthetic and affective response to natural environment, In I Altman, JF Wohlwill (Eds), Behavior and the Natural Environment, New York, Plenum Press, 1983, pp. 85-125.

[2] Knopf RC. Human behavior, cognition, and affect in the natural environment, In D Stokols, I Altman (Eds), Hand Book of Environmental Psychology, New York, John Wiley, 1987, Vol. 1, pp. 783-825.

[3] Hartig TR. Nature experience in transactional perspective, Journal of Landscape and Urban Planning, 1993, Vol. 25, pp. 17-36.

[4] Kaplan R, Kaplan S, Ryan RL. With People in Mind. Design and Management of Everyday Nature, Washington DC, Island Press, 1998.

[5] Kaplan R, Kaplan S. The Experience of Nature: A Psychological Perspective, New York, Cambridge University Press, 1989.

[6] Shieh E, Sharifi A, Rafieian M. Identification of factors that assure quality of residential environments, using environmental assessment indices: a comparative study of Two of Tehran's neighborhoods (Zafaranieh &Khaniabad), International Journal of Architectural Engineering & Urban Planning, 2011, No. 2, Vol. 21, pp. 119-132.

[7] Naema Gh. Bagh- I Irani, Tehran, Payam publishing, 2011.

[8] Moradi Asghar M, Kooshesh-Garan SAA, Akhtarkavan M. An introduction to the way of regarding the earth (site) in traditional architecture Recognition of the architect's attitude toward earth in the traditional era, International Journal of Architectural Engineering & Urban Planning, 2011, No. 1, Vol. 21, pp. 27-34.

[9] Zandian N. Bridging the Worlds Through Art and Culture: An Iranian Cultural Center in Washington, Cambridge, Part 3 ProQuest, 2007.

[10] Wilber DN. Persian Gardens and Garden Pavilions, Tokyo, C. E. Tuttle Co, 1962.

[11] Haghshenas A. The importance of water bodies and structures in the persian garden architecture, Journal of Vestnik MGSU, 2014, Vol. 4, pp. 29-36.

[12] Nassehzadeh Sh, A'zami A. Analyses of Iranian Garden Design Art from Landscape Architecture and Urbanism View, Journal of Energy and Environment, 2010, No. 1, Vol. 4, pp. 311-316.

[13] Haghighat bin M, Ansari M, Steenbergen C, A. Taghvaee A. Innovations in the charbagh axis of the safavid period, International Journal of Architectural Engineering & Urban Planning, 2012, No. 2, Vol. 22, pp. 79-90.

[14] Rahim Rahnama M, Pouremad M. Indicators of Iranian-islamic gardens on reclamation of timeworn structures, International Journal of Advanced Studies in Humanities and Social Science, 2013, No. 8, Vol. 1, pp. 1151-1160.
[15] Hami A, M. Suhardi B, Manohar M, Malekizadeh M. Natural elements spatial configuration and content usage in urban park, International Journal of Architectural Engineering & Urban Planning, 2014, No. 1, Vol. 24, pp. 15-23.
[16] Kaplan S. Perceptions and landscape: conceptions and misconceptions, In Proceedings of Our National Landscape Conference, USDA Forest Service General Technical Report PSW.35, 1979, pp. 243-244.
[17] Dondis Donis A. A Primer of Visual Literacy, Cambridge, MIT Press, 1973.
[18] Meiss Pierre Von. Elements of Architecture: From Form to Place, New York, Routledge, 2013.
[19] Kubba Sam. Space Planning for Commercial and Residential Interiors, New York, McGraw Hill Professional, 2003.
[20] Hopper Leonard J. Landscape Architectural Graphic Standards, Volume 27 of Ramsey/Sleeper Architectural Graphic Standards Series, New York, John Wiley & Sons, 2012.
[21] Lynch K. The Image of the city, Cambridge, MA, M.I.T. Press, 1960.
[22] Kaplan S, Kaplan R. Cognition and environment: Functioning in an uncertain world, New York, Praeger, 1982.
[23] Evans GW, McCoy JM. When buildings don't work: The role of architecture in human health, Journal of Environmental Psychology, 1998, Vol. 18, pp. 85-94.
[24] Weisman J. Evaluating architectural legibility: way finding in the built environment, Journal of Environment and Behavior, 1981, No. 2, Vol. 13, pp. 189-203.
[25] Zimring C, Gross M. Searching for the environment in environmental cognition research, In T Garling, GW Evans (Eds), Environment Cognition, and Action, New York, Oxford University Press, 1991.
[26] Evans R. The Projective Cast: Architecture and Its Three Geometries, Cambridge, MIT Press, 2000.
[27] Scheer David Ross. The Death of Drawing: Architecture in the Age of Simulation, New York, Routledge, 2014.
[28] Conroy-Dalton R, Bafna S. The syntactical image of the city: a reciprocal definition of spatial elements and spatial syntaxes, London, In (Proceedings) 4th International Space Syntax Symposium, 2003.
[29] Mardomi K, Hashemnejad H, Hassanpour Rahimabad K, Bagheri M. The architecture of way-finding, wayfinding process design in healthcare architecture, Journal of Fine Arts, Architecture and Urban Planning, 2011, Vol. 48, pp. 51-53.
[30] Bell A. Paul, Greene C. Thomas, Fisher D. Jeffery, Baum Andrew. Environmental Psychology, London, Lawrence Erlbaum Associates Publishers, 2001.
[31] Hase Betty, Heerwagen Judith H. Phylogenetic design: A new approach for workplace environments, Journal for Quality & Participation, 2000, No. 5, Vol. 23, pp. 27-31.
[32] Joye Yannick. Architectural lessons from environmental psychology: The case of biophilic architecture, Review of General Psychology, 2007, No. 4, Vol. 11, pp.305-328.
[33] Salingaros Nikos A, Mehaffy Michael W. A Theory of Architecture, Solingen, Umbau-Verlag HaraldPüschel, 2006.
[34] Khansari M, Moghtader MR, Yavari M. The Persian Garden: Echoes of Paradise, Washington DC, Mage Publishers, 1998.
[35] Ruggles D. Fairchild, Islamic Gardens and Landscapes, Pennsylvania, University of Pennsylvania Press, 2011.
[36] Tajaddini L. Review of the characteristics of Mahan garden: one type of Persian gardens, Journal of Engineering and Technology, 2011, Vol. 5, pp. 1363- 1366.