Generalization Rate of Christopher Alexander's Living Structure Theory Case Study: Chaharbagh and Isfahan Gardens

Somayeh Hatefi Shogae*

Abstract

Based on the idea of order nature, Alexander[1] regards all the phenomena of universe in living structures and nonliving structures and takes the patterns of living structures in terms of total whole and strong centers. This theory is formed as 15 interrelated characters of strong centers[2].

Regarding the opinions of Persian garden researchers, Persian garden is a cultural phenomenon interwoven with different natural elements and artifacts based on geometrical sets. The attention to the recognition of total whole and explanation of strong centers can bring about a new look at Persian garden.

The question of the research is extent of generality of Alexander`s theory in Chaharbagh and selected gardens in Isfahan studied in analytic method with quality approach.

The results of the research show that the features of living structures such as level of scale, strong centers , boundaries, alternating repetition, and etc. are adaptable with selected gardens of Isfahan relatively but their roles are not the same while Level of scale, strong centers, positive space, alternating repetition, echoes, boundaries and good shape play greater role in creating life. Chaharbagh is of greater life as a public space and the role of strong centers, contrast, not - seperation and roughness is seen to be greater.

Keywords

Garden, Chaharbagh, Isfahan Gardens, Pattern, Living Structures, Strong centers.

*. M.A in Architecture, Department of Architecture, Science and Research Branch, Islamic Azad University, Tehran, Iran.
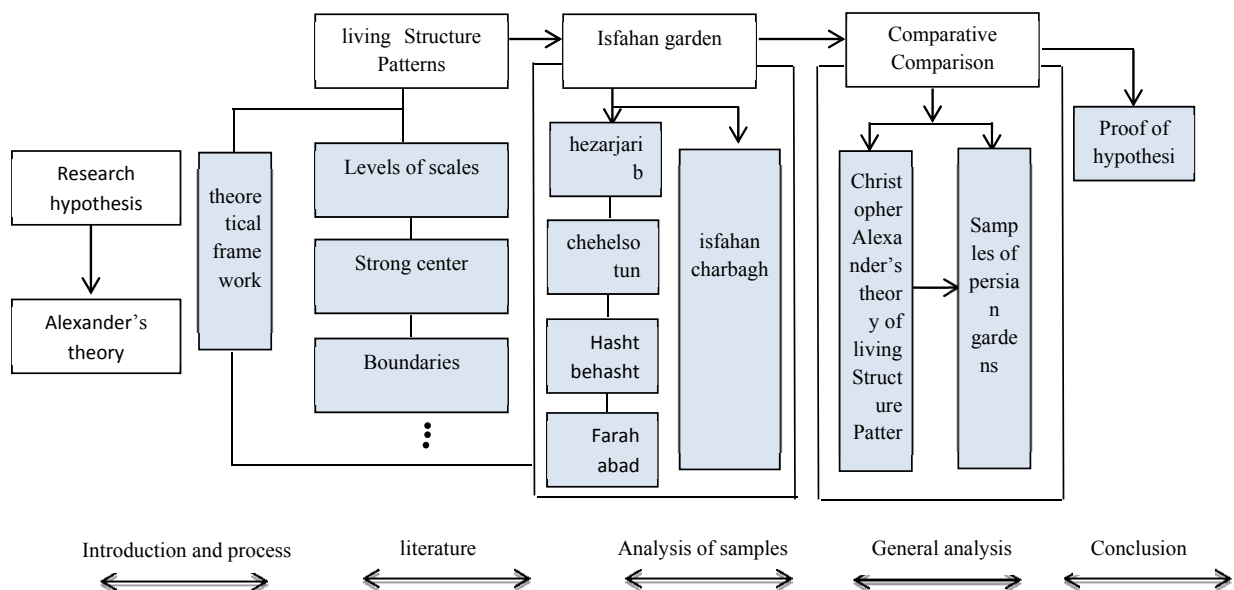somayeh.hatefishogae@srbiau.ac.ir

Introduction

Alexander believes that the entire surrounding environment including sky, nature, sea and buildings is not randomly arranged but there is an order governing them. Patterns help us to know the complexity of environment and expand the description language of the environment .All the patterns are produced by humans .Each human has patterns in his mind through which he can embody the objective patterns of the world. Subjective patterns are forms of world patterns appearing in the mind, meaning they form abstract images objectifying objective rules of the world. Objective and subjective patterns are completely different but their representations are dynamic, have power and are generators (Honardoost, 2010: 57). Persian garden is a cultural, historical and physical phenomenon emerged in an enclosed area in which plant, water and buildings are combined in a definite architectural system and it provides a favorable environment for human (Shahcheraghi, 2009). This paper aims to analyze and compare the quality approach of generalization of alexander`s theory, living structures, to Isfahan gardens assuming that alexander`s theory features do not adapt the Isfahan garden equally .the selected samples are in two forms of private use (king) and public use (Table1).

Literature review

Mohajeri reviews the design theories of alexander from his book notes on composition of form to order nature (new concepts from complexity theory) believing that alexander`s theories were not able to relate different elements in design and planning but there is seen to be a growth of success in his latest works (Mohajeri & Ghomi, 2008 : 55). Sabri and Akbari believe alexander started his tenet criticizing the modern world and rational world view while knowing architecture closely related to humane world view. He requested the termination of earth destruction from modern urbanization and architecture .Besides; he wanted the meaning and sacredness to return to nature as the sustainable development. Alexander introduced the premodern world as the proper inspiration source in making eternally and tries to generalize it to architecture (SirousSabri & Akbari, 2013: 42). Tahouri compares Heideger and Alexander`s ideas with phenomenology approach necessitating the meaning and pluralism in architecture to create and make living environments for dwelling and evasion from modernism (Tahouri, 2002: 70). Akbari focuses the change of Alexander`s ideas based on post-structuralism epistemology believing that Alexander has developed the principles of architecture and urbanization in traditional societies along with the current rules in the process of creation and making (Akbari, 2013:108). Reviewing the physical and spatial aspects of Ghoretan castle Hedayatnia introduces the 15-fold features of Alexander`s theory in nature of order as the suitable criteria for traditional architecture. The most important result was adaptation of these criteria with the architecture of Iran Kavir (Hedayatnia, 2013). Eghbali Zarech reviews the nature of order and its foundation from the totality to center and

Table 1. The process of the research,Source: author.

explains the fifteen features with their related patterns referring the transcendental feelings from human innate while looking at center concept in Alexander`s idea (Eghbali Zarech, 2011). Noorani Yazdi says alexander interprets the good architecture as a living phenomenon and presents objective and practical structures to achieve a living architecture. He introduces some geometrical structure in nature system as living factors which are generalized to architecture realms and other artifacts (Noorani Yazdi, 2013).

The originality of this issue can be considered in the theory of life phenomenon from alexander`s view which introduced the difference of living and non-living structures and from analysis of Persian garden which is an adaptable phenomenon with native architecture and people`s spirit.

Explanation of alexander`s theory (theoretical foundations of research)

Alexander stresses the philosophy of nature and life in architecture believing that the link between nature and human mind is deeper than what science and architecture claim to present. Based on behavior patterns, alexander introduces order and geometrical relations in nature with theory of life phenomenon and living structures. He believes that setting strong centers and integrated totality and Living the beings, it is possible to realize the internal energy of creatures. The idea of order nature shows that all phenomena are classified into living and nonliving structures (Alexander, 2013:7-8). Alexander knows the world as a whole and ordered containing living and nonliving beings (Ibid:13).the most important element playing role in formation of alexander are life, integrated whole, strong centers and pattern of living structures which are briefly discussed.

- Life is a quality of existing nature of space and everything such as functional spaces of living system. Life is a general concept existing in every area of contiguous space whether geometric, structural, social or formal (Ibid).

- Integrated totality As a subtle structure contains different parts the life of spaces coming from this totality in a way that supporting the life comes from this reality where thing acts as an integrated totality which means that we see it as a part of interconnected chain (Ibid).

- Center is a structured field through the space which includes a separated set of points in space which represents a kind of centralization due to its structure caused by inside coherence and its connections to the context it is present at (Ibid).Integrated totality contains powerful centers and life and makes patterns of living structures. In the Islamic Encyclopedia, the description of Garden word is as follows: fully enclosed area, made

man enjoying the plants and trees and water, especially based on the geometric rules and beliefs (Islamic encyclopedia, 2002: 206),(Shahcherghi, 2009). Garden is one of the most important architectural spaces in the history of Ancient Iran. In the history, design and implementation of the architectural space and natural artifact was considered by the kings and the people of this land. Diversity in the reconstruction plans by archeologists such as "Massoudi" in the reconstruction plans of Egyptian, Babylonian, Assyrian and Achaemenid's gardens (2009: 107,109,116,170), and also retaining some elements in certain periods, especially the three pillars of water, plants and buildings which are three fixed components paid attention to the culture; show the emergence of myth and religious ideas in Iranian gardens (Labibzadeh, et al., 2012: 4). One of the interesting phenomena is the pillars of Garden city of Isfahan which shah abbas erected in 1589.The method of garden making reach the peak so that the European tourists knew it superior than that of Constantinople and Rome (Naima, 2006: 60).Therefore, chaharbagh-e hezar Jarib, Bolbol, Hashtbehesht, Fathabad and chehlsotoun are discussed in this writing. Alexander`s theory is represented by 15 interrelated features in nature objectively which are embodied in Iranian garden (Fig.1).

• Level of scale
Places where levels of scales big, small and very small are shaped in a beautiful spectrum with bounded levels make a deeper sense of levels while centers are created according to them (Ibid: 145-150). Regarding the site analysis, the proportions of elements in most Persian garden is so arranged that the width of main axis is half of that of patches, side axis is equal to that of fountain axis and the width of pause space and ponds is the same as that of the patches. In the totality system ,these strong centers are in proportion with each other in dimension .The life of each center is associated with that of its adjacent center .Based on the analysis of fig, level of scale are represented well in Site dimension, Patches, Ponds, Width of movement path, main and side (Fig.2).

• Strong centers
The most important feature of a living creature based on which totalities are shaped is the existence of strong centers presented as totality's pillars. Centers can be various and symmetric since each center is represented as a square which is beyond a local symmetry. By strong centers, we do not necessarily mean geometric centers because if a center is single dimensional which only appears as geometric shape not a strong center,

it makes a poor power (Alexander, 2013: 151-157). All elements in Iranian garden are considered as centers, divided into two the following groups constituted from other strong centers. Water path and its elements such as ponds, streams, The elements in patches such as trees and plants, Building elements such as portal and kiosk, Motion axes such as main and side axes (Fig.3).

• **Boundaries**

Living centers are shaped by boundaries. The aim of creating a round boundary is dual. Boundaries act for separating and linking , boundaries make attention for the center and on the other hand the limited center is integrated by linking to the beyond world (Ibid, 158-164). borders in Iranian garden are formed by natural and artifact elements which are of importance in terms of dimensions. Natural elements consisting of water in different forms of pond and pool, Artifact elements such as wall, portal, yard (Fig.4).
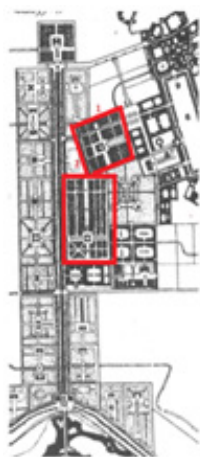

Fig.1. The location of Esfahan's gardens in Chaharbagh street. Source: Naima, 2007. Analysis: author.

• **Alternating repetition**

One way for center to support its life is alternating repetition by which we mean a kind of repeated tone parallel and alternating which are intensified through primary centers' rhythm (Ibid, 165-172) .Alternative repetition be seen in Patches, Staircase surfaces in sloped garden, Polygon ponds in every other step in Hezar Jarib garden (Fig.5).

• **Positive space**

The simplest and necessary feature through living structures is certain space which is prominence of each particle to the outside. If he center is certain and well formed the certain space helps it be more powerful (Ibid, 173-178).geometry of Persian garden can be observed in fourgons in definite spaces of strong center in: Patches, streams a kiosks (Fig.6).

• **Good shape**

The feature of good shape is dependent on centers each part of which has a certain and defined form. In order to have a good form, all forms have to be definite after analysis and characterization (Ibid: 179-185). centers of Persian garden can be seen in definite space and good form in: Façade forms, Kiosk decorations (Fig.7).

Local symmetries

There is a bilateral relationship between local symmetry and living center. Local and general symmetry supplements for sustaining a totality. In one hand, the most interconnected and coherent patterns have the most local symmetry and on the other hand symmetric parts are necessary in order to change a plan to a totality. Generally, it is concluded that local symmetry should rule on total structure in order to create strong centers; however, in formation of a coherent space, general symmetry helps all parts' understanding of the space (Ibid: 186-194).

Fig. 2 .A view of analysis of level of scales in samples of Isfahan gardens. Source: Naima, 2007. analysis: author.

Charbagh	Hezarjarib	Farah abad	Chehelsotun	Hasht behesht

Fig. 3.A view of analysis of strong centers in samples of Isfahan gardens. Source: Naima, 2007.analysis : author
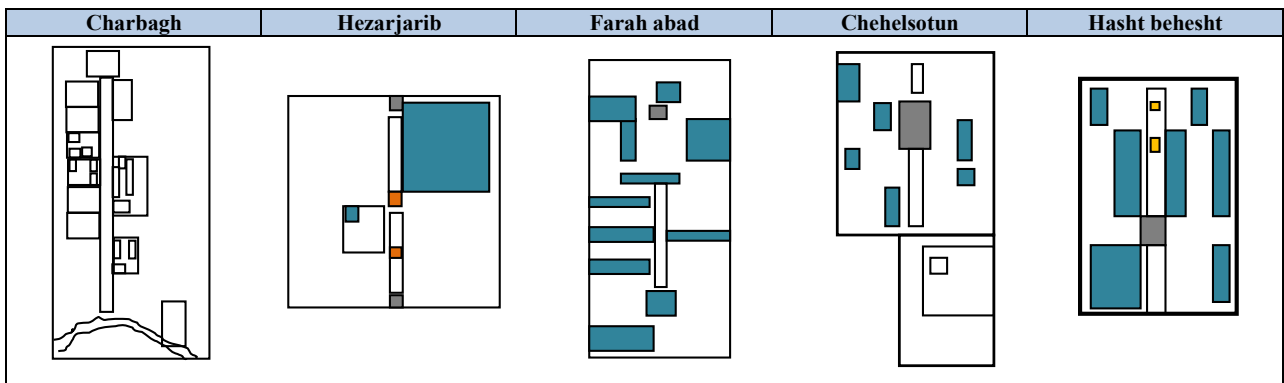

Fig. 4.A view of analysis of boundaries in samples ofIsfahan gardens.Source:Naima, 2007. Analysis: author.
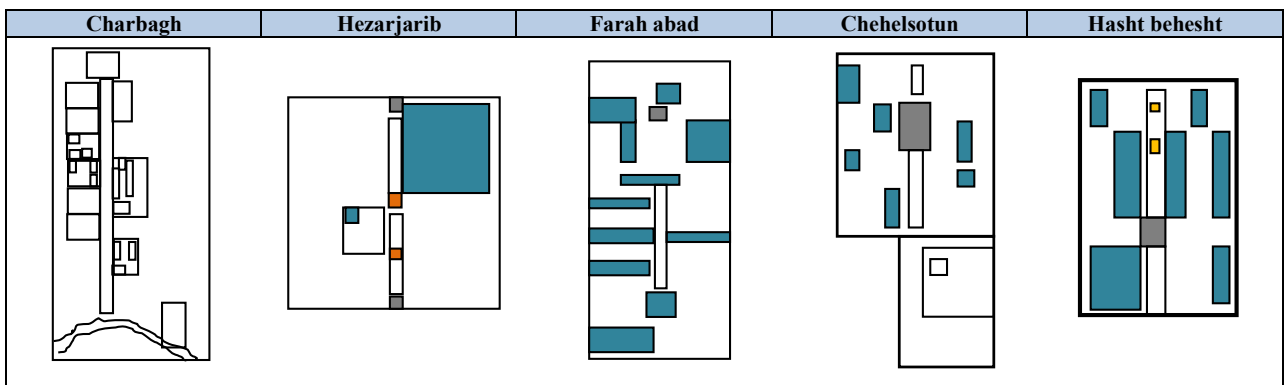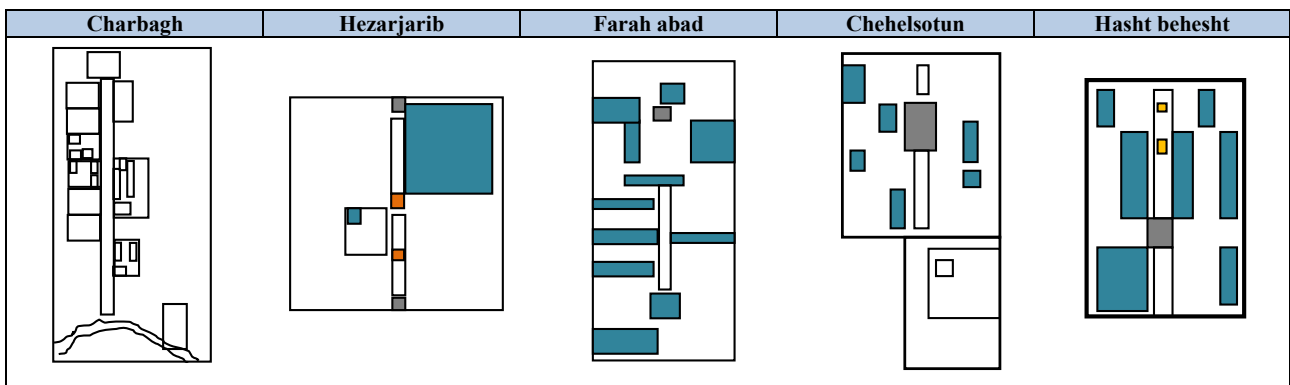

Fig. 5. A view of analysis of alternating repetition in samples of Esfahan gardens. Source:Naima, 2007. Analysis: author.

investigation of Persian garden site and its plans shows that the general structure is based on local symmetry but the part of the space located in the observer`s view has the overall symmetry is one principle of classic aesthetics and in Persian garden it is seen in patches, buildings and paths (Fig.8).

• **Deep interlock and ambiguity**
Connection of centers and difficulty of separating them from the adjunct centers make a deep solidarity between them. Ambiguity and solidarity appear as interconnectedness and being bound with the near centers and also as creating an important point which belongs to its own center and also to around centers (Ibid, 195-199) .the basic and general principle in Persian garden is to establish a longitude movement axis in the middle of the garden .on both sides of the axis, the shadowing trees are planted. This is a

one-point perspective with great deep. The space which forces human to view inside to get intuitive insight (Mansouri, 2005). Ambiguity and coherence in Iranian garden are formed in Semi-open spaces in hall, ivan and porch, Stream, pond and water path (Fig.9).

• **Contrast**

Conflict in living creature causes its stability and it can be created as different shapes of full and empty, white and black, etc. The important point of creating such centers is integration and cohesion of the spaces which should be protected (Alexander, 2013: 200-204). In Persian garden, contrast and opposition are paid attention to in different forms such as objective, semantic and symbolic representation. The merging of garden elements while making some limitations bring about extent, yet it is a space for society with borders, continuity and definiteness into borderless ness (Shahcheraghi, 2009: 4). Shade with trees, Pause spaces and pause axes, Empty and full spaces in planting, Symbolic aspects are sky representation through ponds as a contrast in garden (Fig.10).

• **Gradients**

Moving through the space and hierarchy with gradual

change of distance, size, intensity and features make a proper ground for creation of strong centers. Hierarchy makes variety of centers and reveals its internal totality (Alexander, 2013: 205-209). Design of Persian garden represents the hierarchy in the following forms:
1-10 Functional hierarchy: Such as portals or squares and fountain in the exterior of garden passing through court and main axis. Diba has mentioned it as ambiguity of complex combination (Diba, 1994:103). Spatial hierarchy such as public, semi-public and private spaces is formed (Fig.11).

• **Roughness**

Roughness is fulfilled when uniform designs are not located in same place. The important point of creating a heterogenic space is the designer to be unconscious and unintended to create powerful centers (Alexander, 2013: 210-217). Roughness in form composition of Chaharbagh site and patch decorations are of interest (Figs.12 &13).

• **Echoes**

Echo appears when smaller elements and centers which make bigger centers are formally members of a family and this causes their coherence and unity (Alexander, 2013: 218-221). Persian garden architect

Fig. 6.A view of analysis of positive space in samples ofIsfahan gardens.Source: Naima, 2007. Analysis: Author.
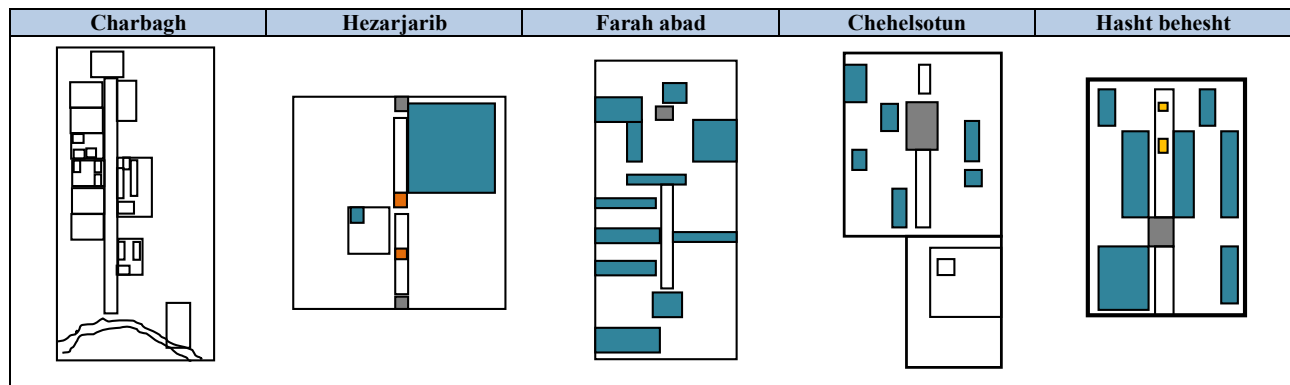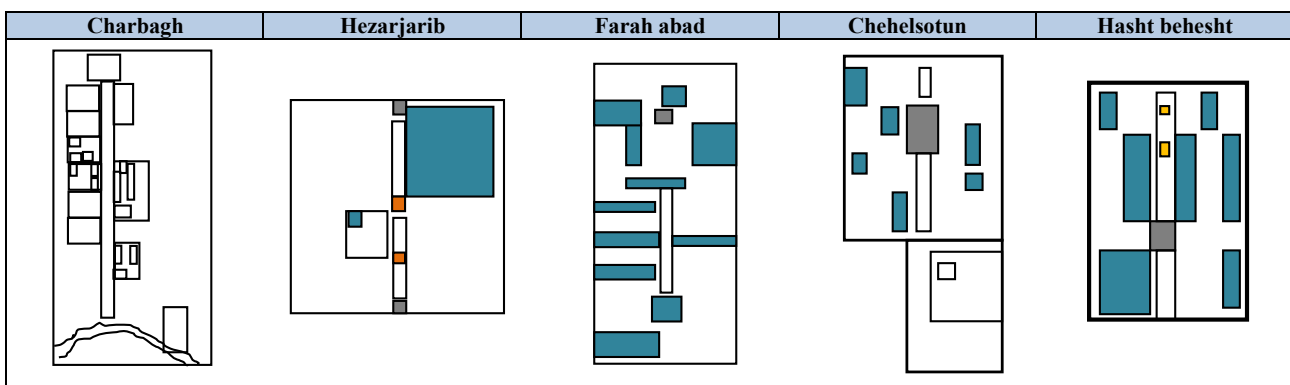

Charbagh	Hezarjarib	Farah abad	Chehelsotun	Hasht behesht

Fig. 7.A view ofanalysis of good shape in samples ofIsfahan gardens. Source: Naima, 2007.Analysis :Author.

Charbagh	Hezarjarib	Farah abad	Chehelsotun	Hasht behesht

considers the proportions of different elements in the garden as: Echo in elements of kiosk, Elements of garden (Fig.14).

• The Void

Another element effective in formation of living centers is the empty space between them. Accordingly, in addition to peace and silence made by empty space, it attracts more energy of center and empowers it and forms a geometric and regular space (Ibid: 222-225). In Persian garden, empty space in main axis is concomitant with pause space and Planting system:

plants bring about peace, hierarchy and continuity and frequent repetition, in pavilion Ivans, empty space empowers the surrounding and makes continuity (Fig.15).

• Simplicity and inner calm

Totality of a living structure is simple so that in most times it can be created through simple and geometric forms. However, internal simplicity and relax is not only made apparent rather it is reached by protecting necessary elements and omitting the others (Alexander, 2013: 226-229). Persian garden is not a

Fig. 8. A view of analysis of local symmetry in samples of Isfahan gardens. Source: Naima, 2007. Analysis: Author.
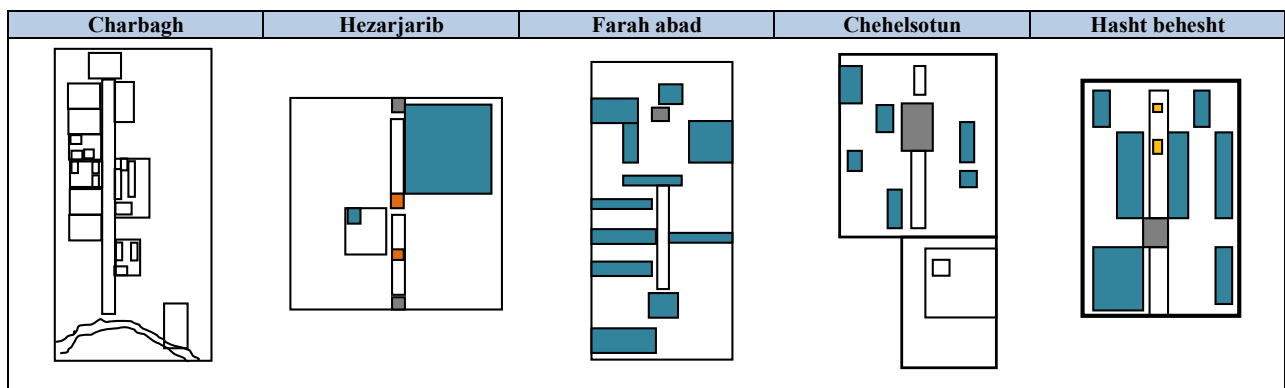

Fig. 9.A view of analysis of Deep Interlock and Ambiguity in samples ofIsfahan gardens.Source: Naima, 2007. Analysis: Author.
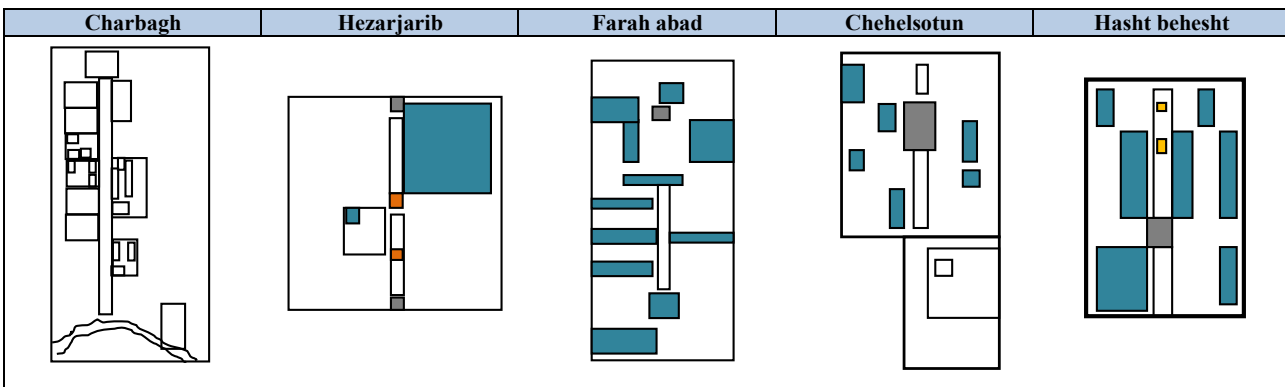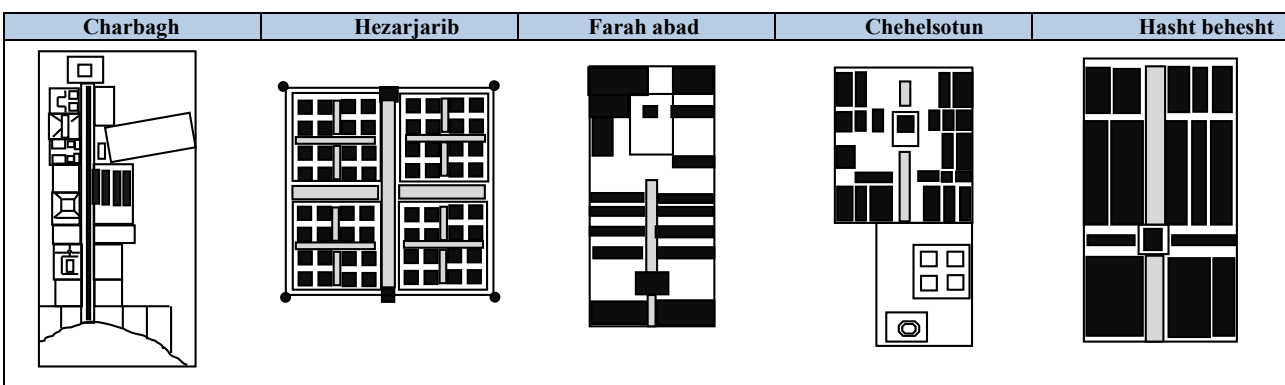

Fig. 10.A view of analysis of contrast in samples ofIsfahan gardens.Source:Naima, 2007. Analysis: Author

one-dimensional space but it brings peace, physical comfort and mental peace with low contrast colors and pleasant sounds of balance. (Ghafouri, 2010: 79). Naghizadeh considers other factors. The peace in Persian garden is due to relation of human with nature in which the humane intervention is little while the most security and safety are provided (Naghizadeh, 2013:7); (Fig.16).

• **Not - Separateness**

The last and also the most important feature is integrality which is fulfilled as appearance of a living generic as part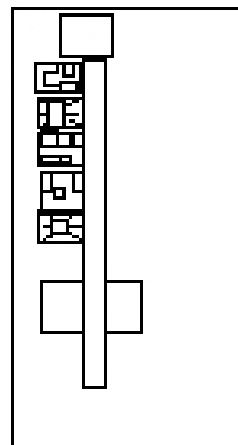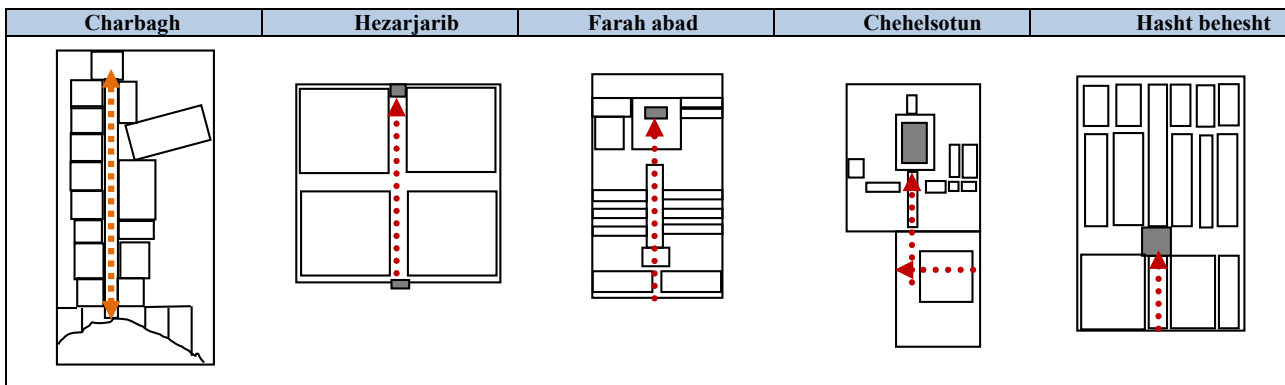 in the world and inseparable from it so that it is melted around context (Alexander, 2013: 230-235). Not - Separateness in Persian garden is formed in three ways. Motadyaen believes that pavilion and great portal are located in urban scales to combine the borderless space of Persian garden through visual relationship in physical aspects of the garden.in this case, border spaces of garden and city are the place of social interaction and continuity of government to society (Motadyaen, 2010: 50); (Fig.17).

Conclusion

Evaluating the spatial and physical characteristics of Ghoretan castle with 15 features of Alexander`s theory has shown that this theory is applicable to the traditional architecture of the Iranian desert. Isfahan gardens study with the patterns of Alexander`s theory confirmed that this set gives adaptation of 15 characters partially applicable to theory but heterogeneity is not seen in the private gardens. In Table 2, the role of each character is given. The results show that of the 15 characters of the theory of Alexander the role of level of scale, strong centers, boundaries, positive space, alternating repetition, echoes and good shape are too much. Chaharbagh as an urban space with public functions (people) have more life and the role of strong centers, contrast, not- separateness, roughness, is substantial. chaharbagh has many elements, including royal kings, Caravansara, school, public cafes, and the path as strong centers which assist the life, Chaharbagh relationship with the neighboring urban areas including the Naghsh-e Jahan, thirty-three bridges, bridge Khaju, palaces, royal gardens and other royal gardens is in coherence and ,not- separateness impact . Roughness can be seen as a character in the decoration of palaces. Gardens located on the Western Front Chaharbagh are effective collection and full spaces and empty spaces, pause and navigate routes, contrast in different functions such as education, entertainment, business help life more complexly (Table2).

Fig. 11.A view of analysis of gradients in samples of Isfahan gardens.Source:Naima, 2007.   Analysis: Author.

Charbagh	Hezarjarib	Farah abad	Chehelsotun	Hasht behesht

Figs. 12&13.A view roughness in chaharbaghandchehelsotun garden.Source: author/ http://up2www.com/ uploads/8ad0Chehel-Sotoun-Inside-Isfahan-Edit1.jpg

Fig.14. A view of analysis of Echoes in samples of Isfahan gardens. Source: Naima, 2007.Analysis: Author.

Charbagh	Hezarjarib	Farah abad	Chehelsotun	Hasht behesht

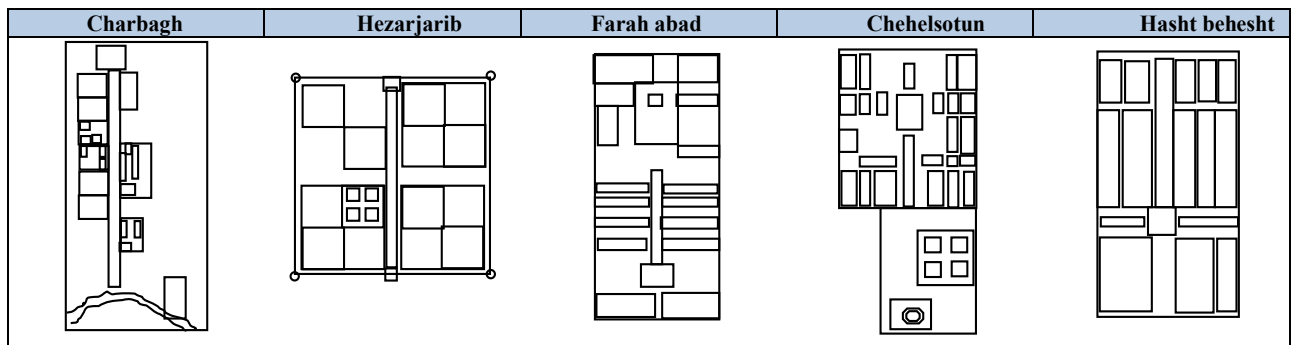Fig.15. A view of analysis of the void in samples of Isfahan gardens. Source: Naima, 2007. Analysis: Author.

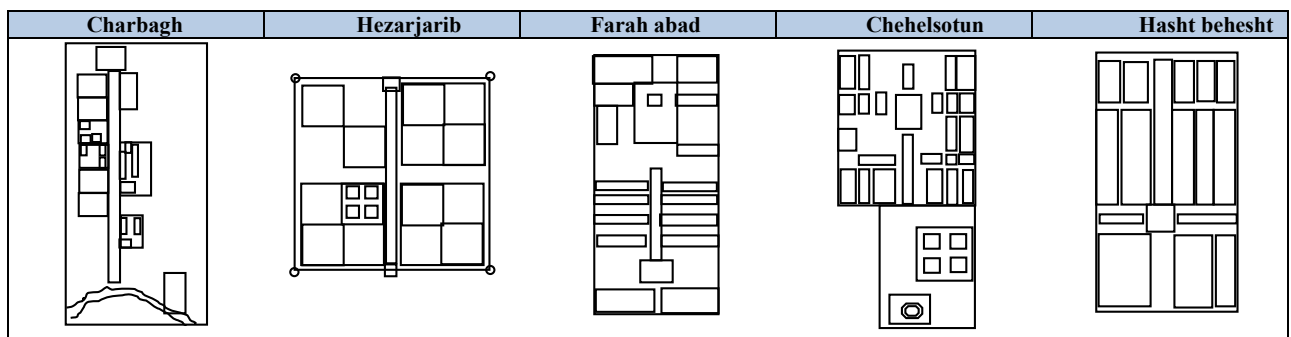| Charbagh	Hezarjarib	Farah abad	Chehelsotun	Hasht behesht

Fig.16. A view of analysis of simplicity and Inner calm in samples of Isfahan gardens. Source:Naima, 2007. Analysis: Author.

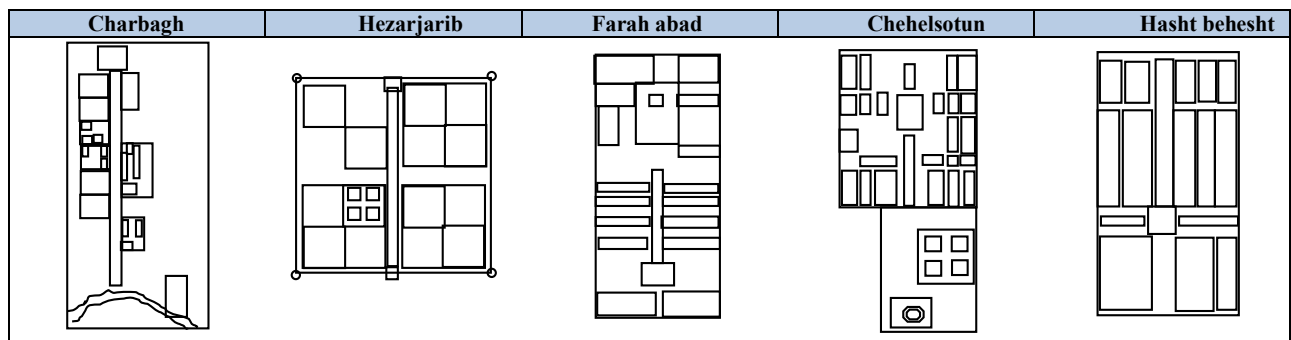| Charbagh	Hezarjarib	Farah abad	Chehelsotun	Hasht behesht

Fig. 17. A view of analysis of Not- separateness in samples of Esfahan gardens.Source: Naima, 2007.Analysis: Author.

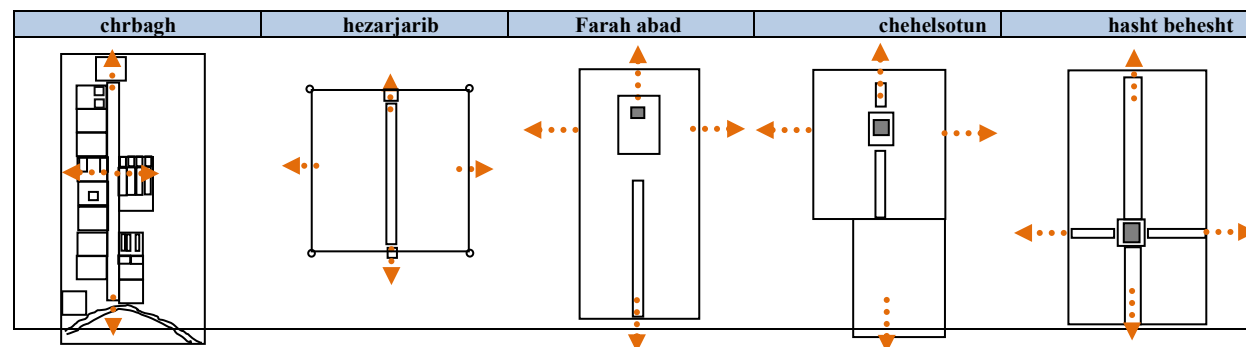| chrbagh	hezarjarib	Farah abad	chehelsotun	hasht behesht

Table 2. comparative Investigation of characteristic Alexander's theory and samples of Isfahan gardens, source: author.

characteristic Alexander's theory and samples of Isfahan gardens					
Alexander's Theory	**Samples of Esfahan gardens**				
	Bolbol Garden	Chehelsotun garden	Farah abad Garden	Hezarjarib Garden	Esfahan Caharbagh
Levels of scales	✳✳	✳✳	✳✳	✳	✳✳✳
Strong centers	✳✳	✳✳	✳✳	✳✳	✳✳✳✳
Boundaries	✳✳	✳✳	✳✳✳	✳✳✳	✳✳✳✳
Alternating repetition	✳	✳	✳✳	✳✳	✳✳✳
Positive space	✳✳	✳✳	✳✳	✳✳✳	✳✳✳
Good shape	✳✳	✳✳	✳✳	✳✳✳	✳✳✳
Local symmetry	✳	✳	✳	—	✳✳
Deep Interlock and Ambiguity	✳✳	✳✳	✳✳	✳✳	✳✳✳
contrast	✳	✳	✳✳	✳✳	✳✳✳✳
Gradients	✳	✳	✳	✳	✳✳
Roughness	—	—	—	—	✳✳
Echoes	✳	✳✳	✳	✳	✳✳
The void	✳✳	✳✳	✳	✳	✳✳
Simplicity and Inner calm	✳✳	✳✳	✳✳	✳✳	✳✳
Not-separateness	✳	✳	✳	✳	✳✳✳

Endnote

1. Christopher Alexander was born in 1936 in Vienna, Austria and grew up in Great Britain. He holds a bachelor's degree in architecture and a master's in mathematics from the University of Cambridge. Alexander, in 1963, took his architecture PhD from Harvard University and since 1963 has been professor at the University of California, Berkeley in America. Christopher Alexander is father of pattern language movement in computer science and is the author of a pattern language published in 1977.

2. A singular set of point in the space which shows a type of centrality due to its structure stemming from internal continuity and the relation with the ground where it presents .Whenever I use center, it refers to a physical set occupying a certain volume of space showing an outstanding continuity (Alexander, 2013: 69).

Reference list

• Alexander, C. (2013). *The Nature of Order: An Essay on the Art of Building and the Nature of the Universe*, translated by: cyrus reza sabri, ali akbari, Tehran: Parham naghsh.
• Akbari, A. (2013). *Az zaban-e riyazi ta sakhtargarayi dar memari: baresi-ye tahavolat dar ara-ye se dahe Alexander ba morori bar asar-e vey* [From mathematics to structuralism in architecture/the transformations in ideas of Alexander in three decades reviewing his works], *Journal of Ketabmah-e Honar*, (180): 22-28.
• Diba, D. (1994). Mafahim va osoole bonyadi-ye Iran [concepts and Iran origin principle], *Journal of architecture & culture*, (15): 102-107.
• Eghbali Zarech, F. (2011). *Tarahi-ye eghamatghah-e kaviri dar hamsayegi-ye roosta-ye mesr ba negareshi be mafhoom-e markaz dar andisheh-ye Christopher alexander* [design of desert settlement in Mesr village adjacency with a view to center in Christopher alexander`s idea], master`s thesis, yazd university.
• Ghafouri, A. (2010). Fazahaee ke zaman dar anha motevaghef mishavad [There are spaces where the time is stopped in them], *Journal of MANZAR*, 2 (6): 78-79.
• Hedayatnia, M. (2013). *Barresi va arzyabi-ye vizhegihay-e kalbadi, fazayee-ye Ghaleh Ghortan bar mabna-ye andishe-ye Christopher Alexander* [assessment of physical and spatial features of Ghaleh Ghortan based on Christopher Alexander`s ideas], master`s thesis, Isfahan: art university.
• Honardoost, H. (2010). *Tarahi-ye mojtame-ye eghamati-ye dareh moradbeyg-e Hamedan (tarahi bar mabnaye olgoo)* [Designing residential complex of Hamedan moradbeyg valley (pattern- based designing)], Bachelor's thesis. Hamedan: Art and architecture college of Bouali sina.
• Labibzadeh, R. et al. (2012). Influence of ideas and ideals on Persian garden structures Case study: "Pasargad Garden" from Achaemenid period and "Fin Garden" from Islamic period. *Journal of Bagh-e Nazar*, (19): 3-16.
• Mansouri, A. (2005). An introduction to the aesthetics of Iranian Garden. *Journal of Bagh-e Nazar*, 2 (3): 58-63.
• Motedayen, H. (2010). Baresi-ye naghsh-e onsor-e rabeteh-ye baaghha-ye shahri dar iran [Examines the role of interface element in urban gardens of Iran], *Journal of MANZAR*, 2 (9): 48-51.
• Mohajeri & Ghomi, N. Sh. (2008). Rooykardi tahlili bar nazariyeh hay tarahi christopher alexander [An analytical approach to design theories of christopher alexander], *Journal of Hoviatshahr*, (2): 45-56.
• Noorani Yazdi, M. (2013). *Tarahi-ye dabestan-e pesareneh dar yazd ba taammoli bar rabeteh-ye tagharon va hayat dar meaamari* [designing boys` school in Yazd with a view to relationship of symmetry and life in architecture], masters` thesis. Yazd: Yazd university.
• Naghizadeh, M. (2013). Representations of beauty in iranian gardens, *Journal of MANZAR*, 5 (22): 6-9.
• Naima, GR. (2006). *Baghha-ye iran* [Iran gardens]. Tehran: Payam.
• Siroussabri, R. & Akbari, A. (2013). The concept of order, Christopher alexander and new science. *Journal of Sofeh*, (61): 33-42.
• Shahcheraghi A. (2009). Tahlil-e farayand-e edrak-e mohit-e bagh-e irani bar asas-e nazari-ye ravanshenasi-ye boomshenasi [Analyzing the perception process of Persian garden environment, According to the Ecological psychological theory], *Journal of Hoviatshahr*, (5):71-84.
• Tahouri, N. (2002). Sokoot-e shaeraneh va saakhtane javedaneh, barasi-ye vojoh-e tashaboh dar ara-ye Heideger and Alexander`s [poetic silence and eternally making of similarities in Heideger and alexander`s idea], *Journal of Khiyal*, (3): 70-113.