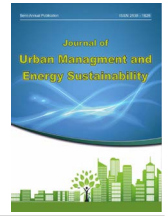


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Explaining the Concept of Physical Complexity in Urban Landscape and Identity

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ABSTRACT

While "identity" in the general sense has a long history and is in line with the history of civilization, its connection with the urban landscape and body, especially with the complexity theory has not been explained. In the process of perception, this concept can present a complex phenomenon that needs to be redefined with the appropriate theory. The connection between identity and urban landscape with the complexity theory has become an influential issue in the sciences related to this field. Hence, the present study aims to address its connection with the theory of physical complexity by explaining the theories of physical identity and urban landscape. The question is how can the physical identity of the city be recognized and defined based on the complexity theory and its consistency with the components of the urban landscape? How can the concept of landscape and physical identity be explained by complexity theory in urban planning? The research method was based on grounded theory, content analysis of texts and theoretical saturation of the experts. First, three concepts were extracted from urban design literature. Then, an attempt was made to find more relevant concepts by coding and comparative comparison and analysis. According to the pairwise comparison and analysis of each of the introduced criteria for all three concepts, it has found that physical complexity is one of the characteristics of physical identity and urban landscape. In addition, similarity- differentiation, unity-plurality and continuity-evolution are common concepts connecting the complexity theory to the urban physical landscape and identity. Thus, in all aspects of the urban landscape and identity, the physical complexity can be explained by three criteria. Successful objective urban landscapes contain a subjective identity that can be redefined based on the complexity theory in urban forms. In other words, with the characteristics of similarity- differentiation, continuity- evolution, unity-plurality of the urban fabric, the concept of physical complexity of a place can be achieved, which reflects the landscape and physical identity of that place.

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1. INTRODUCTION

Although the concepts of complexity science, the thoughts of Leibniz, Jacques Derrida, Gilles Deleuze, Felix Guattari and others are effective in creating form and space, and the theories of folding, fractal, chaos and non-Euclidean system are among the efforts of architects and urban planners to reflect it in the living space, studies have tried to measure the subjective-identity dimensions of the city with objective-physical dimensions through complexity theory (Eisenman, 1993; Hearn, 2003; Jencks, 2002; Rezaei, 2014). The question is how can we analyze the identity and physical concepts of the city with the help of complexity theory? Doing such a work helps to gain higher understanding of the application of complexity theory in urban morphology and leads to a better understanding of dynamic and multifaceted concepts such as the urban identity and landscape during different eras. Furthermore, more clarification of the connection between spatial theories and the complexity theory science can open up new horizons for urban planning, design, planning, and human sciences and man-made environments in general.

“The issue of identity first covered several areas such as logic, philosophy of psychology, but due to scientific developments, its scope has extended to man-made environments in the last few decades, so that, city is a platform for the formation of society and an exhibition for introducing the people’s thoughts of a country, so it plays a major role in the national identity. Urban identity is defined in different ways, reflecting the dynamics of this issue” (Cheshmehzangi, 2015). The identity of each period defines the characteristics and distinctions of each city with other cities and also in different periods. The urban identity characteristics are based on natural, artificial and human components.

A city without a human factor has no identity. Thus, in speaking about the identity of a city, the relationship between humans, the relationship between humans and the environment, and the relationship between humans and the city are addressed. The factors that form the identity of a city include the identity of a person (Nasr and Majedi, 2013). Urban identity is a combination of physical heritage, local culture and geographic

context on which it has been built. Urban identity refers to the local characteristic of a place that differentiates it from other areas. Urban identity is a combination of the experiences of citizens and those who visit that place (Boussaa, 2018). Strengthening an urban identity relies on fully understanding and exploring the meanings and principles of a local identity (Yazdani et al., 2019).

To get rid of the crisis of anonymity and respond to the mental and psychological dimensions of the residents, it is necessary to take advantage of the natural, social, unique physical characteristics and the complexity of the body that has a natural (fractal) origin in the design of the urban landscape (Salingarus, 2014). Moreover, a very essential quality common to all living cities is organized complexity (Batty, 2005; Jacobs, 1961). One of the characteristics of physical complexity is unpredictability. The use of these capabilities can turn the city into a unique event for the residents and make it out of monotony.

Living in cities perse have a fractal characteristic (Batty and Longley, 1994) and this characteristic is common to all living systems. Expressing the importance of applying fractal dimension and rhythm to improve landscape design patterns are the main concern and problem of this study. The researcher of the current study try to answer to the question of whether analyzing and paying attention to the physical complexities can solve the problem of anonymity. The results of this study were derived from examining the efforts of urban landscape experts and complexity theory in the last two decades. The issue of physical complexity in the urban landscape has not been investigated in detail and simultaneously so far. Thus, we can hope that such efforts will lead to a suitable motivation for deepening new approaches in urban landscape design.

2. RESEARCH BACKGROUND

Spatial theories are divided into three main components: physical (landscape), mental (image) and behavioral, even though landscape theories are mostly physical and identity concepts are related to the mental part and city image theory, but these three components interact and make perceiving the place possible for a person. In addition to the interaction of these three

theories, each of them has been divided and analyzed in different dimensions. The theories of the city landscape have been developed in ecological, spatial, morphological, contextual and visual dimensions with opinions of people such as [Camillo Sitte \(1889\)](#), [Yan Bentley \(1990\)](#), [Peter Calthorpe \(1993\)](#), [Thibalds \(1993\)](#) and [Mazzini \(1996\)](#). Also, identity theories have been developed with the opinions of [Kevin Lynch \(1960\)](#), [Edmund Bacon \(1975\)](#), [Norberg Schulz \(1980\)](#), [Donald Appleyard \(1981\)](#) and others ([Rezaei, 2020](#)). However, the explanation of these theories with complexity theory has been less investigated by urban planners.

Science considers the complexity of the world as dynamic, changing and full of uncertainty. However, the idea of uncertainty is not a new issue in the field of urban planning ([Sengupta et al., 2016](#)). The theory of chaos, resulting from the development of the general theory of systems, states that a complex system is a system that includes a large number of agents that affect each other in different ways. If these agents change their actions due to events in the influencing process, such a system will be called chaotic. A city not only means disordered complexity and simplicity, but it also is a meaning of orderly complexity. A city is essentially a living organism with complex and interconnected behavior. The ideas of complexity science ([Venturi, 2018](#)) were manifested in 1961 by Jacobs in the field of urban planning by rejecting the theory of zoning and functional separation of the city. In other words, Jacobs was the first person who introduced the complexity theory science by writing a book entitled "The death and life of cities" ([Mohajeri, 2008](#)). The traditional urban form changes over time with the gradual addition of elements based on the fractal model ([Batty and Longley, 1994](#)). The reason for the city's change over time is that cities are increasingly built to meet different needs at different scales over time, and the final form of the city is not the product of a single designer's opinion ([Alexander, 2002](#)).

It should be noted that the structure of ideal fractals (such as the Sierpinski triangle and the cantor set) generated by computers cannot be seen in the city, but there is a degree of order and disorder in urban forms that, if they are analyzed,

we will face a range of fractal dimensions, which is caused by the difference in their internal physical complexity ([Haghani, 2009](#)). Fractal patterns correspond exactly to what exists in nature ([Katona, 2021](#)). Geometry as an abstract art and design practice can be used to apply patterns that have various visual forms in the direction of the growth of a spiritual origin to the multiple manifestation of the divine and transform the culture of geometric patterns into a structural system to be used in many today's fields ([Sobh and Sami, 2018](#)). The gradual growth of the body of cities causes the curved and unpredictable pattern of their fractal structure to emerge. The physical complexity resulting from the gradual growth of cities originates from their complexity and intra-organizational-functional changes, emerging from the interactions and performance of diverse sub-systems with diverse but interconnected functions of the complex forms of the city in natural forms (geometric but non-Euclidean) called fractal. In contrast to the one-dimensional and form-oriented view of fractal architecture proposed by people such as [Jencks \(1997\)](#), fractal urbanism separates from formalism and bases the functional efficiency of form at various scales ([Batty and Longley, 1994](#)). Fractal and fractal geometry have desirable characteristics such as scaling, proportional distribution and diversity, which can be applied to the city desirably ([Haghani, 2013](#); [Salingarus, 2013](#)).

2.1. The nature of urban identity

From lexicological viewpoint, identity is identification, and the same meaning is known among sages and theologians, which is a partial truth ([Dehkhoda, 2010](#)). "Identity is also defined as a sense of belonging with the environment and criteria such as a sense of security, memorability, sense of attachment. Physical identity is conceptually synonymous with the term of 'personality' and 'sense of place'" ([Mir Moghtadaei, 2004](#)). One of the needs of human community is a sense of security and a sense of belonging. In this regard, identity and elements of identity in human life bring peace and create self-confidence and willingness to have a continuous effort with a sense of security. Giddens writes in

the book of sociology: identity is what a person is aware of. The constituent elements of human identity can be divided into three categories: 1- Natural characteristics and elements (natural environment) 2- Individual characteristics and elements that include gender, age, and occupation; 3- Human characteristics and elements (human environment) which include race, family, language, history, civilization, culture, tradition, and religion (Noghrekar, 2002). Identity is a set of signs, material, biological, cultural and psychological signs resulting in identification of a person from another person, a group from another group, a nationality from another nationality, or a culture from another culture. It expresses a kind of unity, homogeneity, continuity and integrity (Mohrjami, 2004).

While Mazini (1998) emphasizes cohesion and focus regarding the city's identity indicators, other theorists such as Mir Moghtadaei (2004) and Eghbali (1993) point to differentiation and continuity, so that differentiation is considered to be the characteristics of the city body. It

distinguishes the self from the other and reveals its similarity with the self, and continuity also refers to the sense of disconnection from the past. Halbuash (1983) also considers memory as one of the indicators of the recognition of urban indicators, so that the memory in its broad sense is the reconstruction of the past. Naghizadeh (2008) also refers to religion, which can be a major factor in preserving the Iranian-Islamic identity, and the urban environment is a major factor in manifesting the cultural identity, using native and national arts in the architecture and special spaces of a city, which represents the identity of the society. According to localism, for example, in the theories of the Iranian or Islamic city, the concepts of differentiation-similarity (contrast, inside-outside, shadow-light), continuity-evolution (sequence of order, spontaneous growth, gradual, consistency), and the course from unity to plurality (unity in diversity) can be clearly restored. These concepts are known as an important factor in the Iranian-Islamic city and in manifesting the cultural

Table 1. Summary of the identity indicators from the theorists' point of view (source: authors).

Cohesion and focus	Focus creates identity and this is one of the characteristics of ancient cities. A city without identity has no history, since the identity factors are limiting and resistant to change and belong to the past. However, it does not negate the reverse course of the city (Mazini, 1998).
Differentiation	Physical identity means traits and characteristics that differentiate the body of the city from others and reveal its similarity with the self. These characteristics should be such that the body of the city should undergo evolution and eventually leads to the emergence of a whole, while continuing in time (Mir Moghtadaei, 2014).
Continuity	The sense of disconnection from the past and following other people's models for housing, which has led to the discontinuity of architects' experiences, had the signs of modernity and was available as a ready and easy solution (Eghbali, 1993).
Memory	Gooderzi (2012) (quoted by Halbush, 1982) states that the memory is the reconstruction of the past. Every social person has two memories; one is internal and the other is external. Memory, both individual and collective, means the past in the present or the preservation of the present in the past (Gooderzi Soroush and Gooderzi Soroush, 2013).
Religion	Ashura has been very important factor in preserving Iranian Islamic identity. The urban environment is a major factor in manifesting the cultural identity, the use of local and national arts in the architecture and special spaces of a city, which represents the identity of the society. Respecting the ancestors, prevents the destruction of the old traditional fabric (Naghizadeh, 1999).

Table 2. The concept of physical identity from the urban thinkers' viewpoint (source: Authors)

Theorist	The concept and definition of (physical) identity	The underlying factors of identity (physical)	Conclusion
Rapaport	The urban landscape and its symbols are the expression of people's culture, which finds meaning in this way and differentiates urban elements.	Historical, social and psychological characteristics	Differentiating urban elements that transform space into place.
Lynch	The identity of the place means the individuality of each object, its continuous connection with the environment and the meaning it creates in the mind in the form of mental image.	Mental image	Recognizing a place from other places by the special characteristics of each object meaning its unity, its connection with other elements and its meaning.
Alexander	Identity is the repetition of certain patterns in places.	Objective landscape	The special quality of each environment that provides the basis for the aliveness of that place and reveals the identity through physical embodiment.
Ralph	The identity of the place in the new urban development is the mutual relationship between the person and the environment.	Objectivity and subjectivity	The adaptation of the physical environment is the activities of people in certain places.
Cullen	Identity is the prevention of uniformity in urban spaces due to the specific characteristics of each place.	Objective landscape	Attention to the body, details, and the place where the buildings are placed. Urban identity is an identity that is formed independently of people's identity.
Jacobs	The identity of an urban scene depends on the prominence of its physical elements.	Physical elements	It is the differentiability of a space.

identity, the use of local and national arts in the architecture and special spaces of a city which is also a representation of the community's identity and culture (Naghizadeh, 1999; Noghrekar, 2002, Rezaei, 2013). Nowadays, there are many cities that are considered beautiful in appearance, but they lack identity elements" (Behzadfar, 2011). The identity of a city is a concept that is easy and impossible in the perception process. Everyone thinks that he or she perceives both the identity and the city. However, in a professional and specialized position, it is very difficult to understand identity and city. It is not far from

the mind that the common people have easily understood the identity of the city. Especially, from the environmental psychology point of view, understanding the characteristics of a city is what is associated in the mind of the observer and citizen, so whatever he or she understands about the identity of the city is correct. However, the understanding of experts, planners and officials is to be precise and standardized (Behzadfar, 2011). The identity and personality of the city becomes meaningful when the specific indicators of the city are manifested.

The identity of a city is the physical

manifestation of that city's culture, which will be represented through the type and nature of construction technology, functions, signs, urban forms and symbols, and generally visual and physical characteristics (Mousavi and Shakur, 2018). The social life of a city also depends on the physical characteristics of a city, and the connection between citizens and the city is established through its body (Shakibaei Bidarooni and Tabibian, 2018). With regard to the physical identity of the city, different theorists have proposed different views. For example, Cullen presents objective landscape techniques, or according to Kevin Lynch, subjective landscape analysis is important in the book entitled "urban landscape" and Carl Kroff proposes the morphology of the city in his article on urban texture and city characteristics. From his viewpoint, morphology is the factor that distinguishes one city from another, and this factor reflects the identity of a city (Marzi, 2016). Table 2 presents the theories proposed with regard to physical identity from the urban thinkers' viewpoint.

Based on what was stated above, we understand that physical identity means the attributes and characteristics that differentiate the body of the city from others and reveal its similarity with the self. These characteristics should be such that the body of the city undergoes evolution and ultimately leads to the emergence of a whole, while maintaining the continuity of time. Therefore, the identity of city reflects the distinct image of one place from another place, which is manifested in different people and in different cultures in a special way. It has objective or physical and subjective or spiritual dimensions. The mentality that is created over time towards a place evolves and eventually becomes history.

2.2. Urban landscape

The term "landscape" with its complex objective and subjective concepts and broad physical and non-physical concepts from various aspects has always been of special interest to theorists. Thus, sometimes its concept is considered as an objective reality that is separate from man and his or her mind, and sometimes it will be considered a subjective reality (Mahan

and Mansouri, 2017). The urban landscape is the citizens' perception of the city, which is obtained through its signs and symbols. The dependence of the understanding of the landscape on the history of presence in the city makes different layers of the landscape to be recognized. "For tourists, who have no experience of its symbols, the city is nothing but a body, but the existence of signs and symbols, which represent the events and memories of the citizens from the space, indicates the history and important points of the city for its residents. The interpretation of the city landscape decodes the historical developments of the city and the mentality of citizens throughout history, provided that the traces of history remain on the face of the city" (Mansouri, 2010).

Cullen (1998) defines urban landscape as the art of providing visual and structural integration to the set of buildings, streets and places that make up the urban environment. After providing a detailed description of a landscape of Scart Nick in Yorkshire, England, Bell (2003) writes "These are all part of the landscape that my family and I have contributed in forming it. For this reason, this place is important to me and how I feel about it is influenced by my cultural background, extensive experiences, knowledge and my attachment to my home". Speiregen, the speaker of the alphabet of his own literature, investigates the components of urban landscape elements and evaluates them and identifies the weak and strong points from an urban observer's viewpoint. He considers the landscape of a city as full of meanings, experiences, memories, buildings, crowds and scenes of life and death (Mahmoudi, 2006). Accordingly, he examines the visual manifestations of the city first when entering the city and then when moving inside it, and argues that all urban elements are based on the shape of the land and then the prominent characteristics of the land such as the shape of mountains, plains and hills, plateaus, rivers or lakes affect its landscape. This framework is completed by vegetation depending on the congestion, location, size, current changes and as a natural bed; it includes the city as a turning point within itself (Mahmoudi, 2006).

The urban landscape is a nature that emerges through human activities and its association with

the body throughout history and is interpreted in the minds of citizens, and these subjective dimensions may be individual or collective. Urban landscape is an objective thing at the beginning, which is realized due to the quality of appearance and physical factors of the city, and due to the passage of time and repetition, it becomes a common element that connects people in society. Urban landscape of the body and urban quality are initially perceived through the body and emotions, but what gives meaning to it is the citizen's mentality. The urban landscape is not just memories (tangible-objective), but a phenomenon that results from the interaction (objective-subjective) in the city.

3. MATERIALS AND METHODS

Due to the novelty of the research topic, the method of this study is grounded theory. Data was collected and analyzed by content analysis of qualitative-quantitative texts and three-layer coding (open, axial and selective coding). First, open coding related to theories and concepts of urban landscape, complexity and physical identity were done separately from different sources in three areas (identity, urban landscape and physical complexity). In selecting the texts, we tried to select key sources in all three theories. Thirty sources were reviewed in the area of identity, 30 sources in the area of urban landscape, and 20 sources in the area of physical complexity. Then, the related codes were compared, summarized and corresponded based on the overlap, and the open codes were

equated with the help of axial codes. In the next step, the selected codes of the concept of identity, connecting the other two concepts, were highlighted.

4. RESULTS AND DISCUSSION

By analyzing the texts related to urban landscape theory, physical identity and complexity theory in open-source urban development were extracted and summarized according to the examples of Table 3.

Given what was stated above, in all three components of physical identity, urban landscape and complexity, it was found that they have subjective-objective dimensions. The identity of every city is formed over time and is related to the landscape of the city, which creates history through humans and over time. On the other hand, the complex urban body is also a phenomenon that emerges over time and with human existence. Comparing these three concepts and the matching of their extracted codes will lead to a better understanding of identity in the urban landscape due to the overlap. The increase in physical complexity in the city that takes place on the urban landscape creates its special identity. Identity indicators are qualitative and complexity and fractal indicators are quantitative and measurable. Therefore, by referring it to the city landscape, quantitative and qualitative indicators can be observed in the cities.

On the other hand, the coding performed in the concept of physical identity of the city led to the following three selected codes.

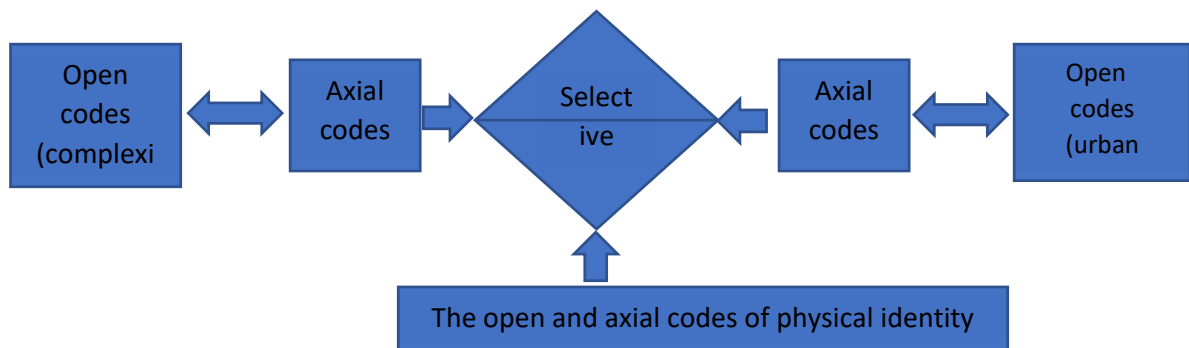


Fig. 1. Analysis the process based on three-layer coding (source: authors).

Table 3. Examples of extracted open codes in the content analysis of texts related to the concepts of landscape, complexity and urban identity (authors' source).

Open codes of physical identity	Open codes of the concept of complexity	Open codes of urban landscape concept
The formation of the city, the history of settlement, the origin of the city, the evolution of the city, the physical structure of the city, the arrangement system, the size, density and spatial dispersion of urban phenomena, ancient and old places, accessibility characteristics, functional characteristics of the elements and components that make up the physical fabric of the city, old neighborhoods, tourism axes, open and public spaces, architecture, urban view, construction methods, materials, architectural style, scale, mobility characteristics of the city, the effect of time on the visual manifestations and landscape of the city, sound and smell	Continuity of functional efficiency, not limiting efficiency to one scale Scaling, appropriate distribution, diversity, connectivity, self-organization, consistency, interconnectedness, self-similarity and fractal pattern (image of complexity), hierarchy, naturalness, time	Being perceptible, paying attention to color, style, personality and texture characteristics, significant relationship between form, function, proper combination of elements and creating a coherent whole, applying great powerful complexity, creating surprise and applying visual mystery, interpreting appropriate mental ideas in the space, diversity and flexibility, paying attention to symbolization in the place and conceptual dimension of architecture, attention to the three dimensions of activity, meaning and body, paying attention to cultural and social factors, repetition of events (celebrations, ceremonies, etc.), the presence of factors evoking memories and inspiration, paying attention to the system of signs and symbols, paying attention to plants and weather, consistency among place, function, economy, society, nature

Table 4. Examples of open and selective physical identity codes (source: authors).

Unity/plurality	Continuity/ evolution	Differentiation /similarity
Creating a coherent whole from multiple components	Evolution over time	Specific characteristics of each environment

4.1. Differentiation/similarity

Cullen defines identity as paying attention to the individual character of each environment and avoiding uniformity and similarity in urban environments by highlighting the special characteristics of each environment. There will be no connection and feeling of belonging between a person and his or her living environment, unless he or she is able to deeply understand the environment and recognize it, and has the ability to understand its distinction from other environments, and knows when and how to respond appropriately to actions performed in that environment (Alexander, 1981; Cullen, 1977).

4.2. Continuity/evolution

The concept of continuity can be well observed in the findings of Christian Norberg Schulz. He states that it is important that any place maintains its identity while undergoing any changes. Continuity and evolution mean that despite all the changes and evolutions, something remains constant. Every place should maintain its identity through internal change and evolution. What Schulz puts forward is exactly the same interpretation of the need to preserve characteristics and traits while moving in line with evolution. Furthermore, he adopted a dynamic point of view towards the identity of

the place and suggested the necessity of being affected by the time (Norberg Schulz, 2002).

4.3. Unity/plurality

The interpretation of unity in plurality has been stated in many specialized texts, which emphasize the necessity of forming a whole from the unity of multiple parts. Alexander (1979) puts an emphasis on building a whole. The whole that is created as a result of a million construction actions and its physical crystallization is unanimous quality. Ardalan and Bakhtiar (2012) consider this concept as one of the principles of organizing the Iranian city (with an emphasis on the shape of the city of Isfahan). He analyzes the structure of the Isfahan during the Safavid era and finally concludes that it can be seen that the production of major urban systems in Isfahan is in the hands of the rulers, while the center of the city remained in the hands of the people.

The mentioned codes of each concept have been adapted based on the reviewed texts in Table 5.

Table 6 also shows the link between the coding of concepts and major texts (theorists). In this table, selected codes indicate more dependence of concepts.

4.4. Similarity-differentiation

Consistency, integrity, connectivity and things

like these are expressions of similarity between phenomena. Even disordered systems act like living organisms in relation to their environment, and there is a kind of consistency between them and their surroundings. Waldrop named this system as adaptive complex systems. These systems have been very successful and maintain their survival over time through dynamic consistency. Besides, these systems have the characteristics of self-organization and learning (Khosravi Pour and Sawari Mombeini, 2019). In a complex system, if any of the components of the three dimensions of activity, meaning and body are inconsistent, due to the property of complex systems, they will include self-organization and a dynamic consistency will be created in the landscape. Even social life and connection between societies are of this kind. The city is one of the clear manifestations of human need for social life. The set of people's relationships with each other and with their surroundings and presence in it causes social life and integrity. This integrity between people and the environment is due to the mental characteristics that their existential properties were mentioned before. According to Salingarus, it connects both the body of the city and the people through the creation of new communication routes. In contrast, differentiation indicates the emergence of a

Table 5. Open, central and selected codes (source: authors).

Row	Selective codes	Axial codes	Open codes
1	Similarities and differentiations	Consistency The emergence of an unexpected phenomenon Diversity and irreducibility Fractal pattern Hierarchy and time scale	Self-similarity, integrity, connectivity, three dimensions of activity, meaning and body Body, society, economy, nature social life Meaningful relationship between form, function, proper combination between elements and creating a coherent whole The system of signs and symbols new events, creating surprises and applying visual mysteries, Repetition of events, diversity and flexibility Continuity of functional efficiency Style, space personality and texture features Symbolization in the place and conceptual dimension of architecture Interpreting appropriate mental images in space, not limiting efficiency to one time, plants and weather, natural

Table 6. Correlation of urban landscape dependence, complexity and physical identity (dark cells were more frequent) (source: authors).

Theorist (landscape)	Codes of successful urban landscape	Selected codes (Urban identity)			Complexity codes	Theorist (Complexity)
		differentiation/similarity (Alexander and Cullen)	Unity and Plurality (Norberg Schulz and Alexander)	Continuity/evolution (Alexander and John Ruskin)		
Bentley, Behzadfar	Three dimensions of activity, meaning and body	✓	✓	✓	Consistency	Haghani, Betty
Pakzad	New events	✓	✓	✓	The emergence of an unexpected phenomenon irreducibility	Haghani, Alexander, Betty
Bentley	Style, personality and texture features	✓	✓	✓	Diversity	Haghani, Jacobs
Kellen	Diversity and flexibility Creating surprise and applying visual mystery, repetition of events	✓	✓	✓	Self-similarity and fractal pattern	Betty, Langley
Jacobs, Mansouri	Symbolization in the place and conceptual dimension of architecture	✓	✓	✓	Hierarchy and scale levels	Salingarus, Alexander
Bacon, Jacobs	Meaningful relationship between form, function, proper combination between elements and creating a coherent whole	✓	✓	✓	Not limiting efficiency to one scale	Salingarus, Jacobs
Lynch	Interpreting appropriate mental images in space	✓	✓	✓	Time	
Lynch, Cullen	The system of signs and symbols	✓	✓	✓	Connectivity	
Jacobs, Reagan	Plants and weather	✓	✓	✓	Normal	Salingarus, Alexander
Jacobs, Bacon	Body, society, economy, nature	✓	✓	✓	Continuity of functional efficiency	
Jacobs	Social life	✓	✓	✓	integrity	

new phenomenon. Unpredictability is due to the changing needs of people in different periods of time. Uncertainty can exist both in the body and in the behavior of society. Different people show different behaviors towards different structures (Ashrafi, 2015). Unpredictability and new events arise based on personal needs and freedoms, causing the body to be different and complex. Finally, the changes created over time and the plurality of phenomena and at the same time its unity due to a whole complex system create an identity in the urban landscape.

4.5. Unity-plurality

The personality of the space and its irreducibility indicate the unity at the same time and the plurality in the urban landscape. Complexity means going beyond the approach of reductionism (homogenization and reduction), which is the traditional approach of scientific research. The complexity is in something that is discrete, separated and differentiated (Haghani and Gooderzi, 2015). The urban landscape takes on a style and personality and is created from the combination of elements and their sum is more than its individual parts based on Gestalt. For this reason, it cannot be reduced to a single element, and its existence differentiates it from another space, which includes these elements. Furthermore, it multiplies the diversity and flexibility of the unit. A city is a complex system in which the complexity and plurality of factors and connections make the system stable against changes (Farah and Shokoohi, 2009). In case of removing and adding urban landscape components, no general changes will be made in the complex and the totality of the space will not be lost. Moreover, by adding or reducing its components over time, the identity of a set as well as its physical complexity will increase. Repetition of events and self-similarity and fractal pattern are combined with creating surprise and applying visual mystery. Nowadays, fractal geometric patterns can be used as a new tool and a new approach in examining the role of internal sources and explorations, and its symbols can be used to understand the artist's goal, which is discovery and intuition and achieving hidden beauties (Makbarian, 2015). By passing through the

modern world, complexity and diversity enter the architectural space and enlivens the space, since the removal of complexity and space of discovery from spaces have caused space uniformity and spatial boredom (Ashrafi, 2014) and the fractal pattern and complexity in the urban landscape creates a visual mystery due to the natural and internal characteristics of humans and it will create the desire to explore the landscape of city. The system of signs and symbols increases connectivity and as a result increases unity. In a general, there are natural, artificial and human components that form physical identity (Nasr, 2016). Different units are related to each other, connect to each other and have the ability to form a whole unit. Appropriate placement of elements will create connections over time and by people, and due to the formation by people and by the components, it becomes a special identity of that landscape.

4.6. Continuity and evolution

The continuity of functional efficiency, which is one of the fractal indicators, results in creating positive effects in the landscape of city. In the social dimension, it will create meaning and identity. In the economic dimension, it will increase the capacity of tourism, and in the physical and environmental dimension, it will create complexity, order in disorder, diversity, dynamism and vitality. Nature includes a major part of our surroundings, where all the factors present in it provide us with the knowledge of fractal systems, and the urban landscape is also one of the components of this nature. Green space homogeneous and consistent with nature causes ecological dynamics and can help to increase the fractality of the urban landscape. Symbolization in the place and conceptual dimension of architecture, which is linked with hierarchy and levels of scale, placement of symbols in the appropriate hierarchy and accordingly in the appropriate scale, is effective in creating a conceptual dimension in the landscape of the city, and the created concepts cause identity. This set, each of its symbols has been placed in its appropriate place in terms of scale and spatial hierarchy, is a member of a complex system. Creating continuity between all the components

of a system and following the appearance of the function lead to spatial integration and a coherent whole. In complex and integrated sets, its elements must be related to each other with a regular hierarchy in all scales from small to large. The integrity and coherence of the components is a sign of the rich identity of a landscape. Coherence is one of the basic characteristics of a single whole. Generalities are not easily recognizable, so the theory of complex systems shows how complex the wholes are (Bahreini and Foroughifar, 2016). In other words, the memory structure is fractal. The “sailboat” set does not refer to an abstract image of a boat and a sail, but refers to a complex set of inner connections of the mind that are difficult to limit. My fractal set for this word is different than someone else's, since the fractal sets in which the words appear in their memory are slightly different (Boyle, 2013). The behavior of complex systems and thus fractal will change over time in response to environmental conditions or external forces (Hosseini, 2017). The ideas created in the complex minds of people over time result in the emergence of identity, which distinguishes that landscape from other similar landscapes.

5. CONCLUSION

The theories of urban landscape and urban identity based on the complexity theory in urban forms have the most intrinsic commonality with the three concepts of differentiation-similarity, continuity- evolution, and unity-plurality in the urban forms, so they can be redefined. In other words, with this indicator and characteristics, the concept of physical complexity of a place can be achieved, which reflects both the objective landscape and the subjective identity of that place. Review of the studies suggests that the urban landscape as a concept has a dynamic, living and evolving nature. Identity is also a factor that emerges due to human presence over time. Furthermore, the complexity theory and fractal geometry seek to change the view of humans in relation to space over time. In other words, a large part of the identity of every urban landscape is known by its self-organization and consistency with other elements of the city. The landscape of the city as a living phenomenon

undergoes evolution, which is brought about by the people. Besides, its identification according to the principles of complexity and fractal geometry cause the continuity of the identity and differentiation of the landscape of each city from another city, and creation of memories. Thanks to their visual richness and their lifespan, urban spaces visually change over time and their texture becomes more complex. This complexity of the space usually has a direct relationship with the details of the space. It means that with increasing the physical complexity a space, the production, stabilization and continuity of identity will be more stable in it. As it is more visible in examples of architecture and old urban space, the factors of time play a key role in creating physical diversity and this is the same characteristic that can be seen in fractal urban patterns. In other words, spatial fragmentations can produce a self-similar whole by repeating its pattern, so that the same order is used in each component as seen in the whole and vice versa. It usually has more visual richness in urban spaces where elements are added and removed by different people over time. In short, urban landscapes with identity and visual richness are physically more complex. Thus, urban identity can be evaluated and redefined through recognizing the presence or absence of the criteria of complex organizations. However, spaces that have organic growth have more spatial fractality and physical complexity than spaces with Euclidean and predetermined plans. However, places with linear geometry can turn into fractal geometry over time.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Abbreviations

Not applicable.

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