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Analyzing the Effective Environmental Factors in the Sense of Open Spaces of Residential Complexes in Tehran

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Research Article

Abstract

Open spaces in residential complexes have diameters that encourage people to attend these places to pass their times. This research by using a complex method, extracts effective environmental factors in the sense of place in open spaces of residential complexes to develop them by means of developing stimulus projects. In the first stage, the extraction and verifying them with a theoretical basis, a questionnaire is developed by interviewing the effective variables. This is available for space users and they are asked to answer the semi-open questions and for verifying them, they should refer to university experts. 52 residential complexes were studied in Tehran. 384 residents are randomly sampled. For the qualitative part, open and axial coding techniques are used in ATLASTI software. In quantitative section the inferential tests in SPSS were used. It can be concluded the dimensions of sense of place in residential complexes are intertwined and each of these dimensions includes the other, in a way that in the components or the first dimension of spatial-social components, they are merged and they have correlation. In the second factor physical-social and in the third factor socio-spatial and in the fourth factor spatial factors exist. Overall, when the selected components have two aspects of the environment, the correlation between them is much higher than the components to create more coverage to induct a sense of place in the residential complexes. It should be in a way that cover two or more dimensions to achieve more success than sense of place.

Keywords: Open Space; Residential Complex; Environmental Factors; Spatial-Social Components

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1. Introduction

By developing communicating ways in the modern word, the social relationships are decreased. In the residential complexes, the relationship with environment and its perception by various senses has been shaken and it has created places without necessary performance, without application and identity. Development in modern cities has made man, city and architecture unfamiliar with meaning and feeling, and has created a myriad of unknown and meaningless spaces. Overall, loosing the idea of living space can be one of the prevailing crises in the present age and change the perception of memories in the residential complexes in the modern world and turn them into a place without spirit and feeling, only a place for Life. In reality, these modern complexes seem to have insufficient sense of place. The effect of architecture on the human spirit in short and long time is undeniable, space can be a dry, spiritless and cold body to a body with sense and spirit of place, currently in the modern cities the place of spaces full of rich sense of place are empty. As an excellent space have positive effect on human's spirit, it can create the issue of identity crisis and unfamiliar signs in the super scale cities (Norberg-Schulz, 1989: 48). The interest in the sense of place has grown rapidly in recent years, and the concept of leisure has expanded to entertainment and a wide range of programs (Madanipoor, 2000: 68). The concept of sense of place is Interdisciplinary concepts that are studied in sciences such as psychology, sociology, architecture, and geography. However, considering place dependencies have historical records (Norberg-Schulz, 1989: 52). This research has answered this question by the purpose of extraction and categorizing environmental components in sense of place in Tehran residential complexes. What are the environmental components in sense of place in residential complexes in Tehran?

2. Research Background

Saeid Norouzian-Maleki and Neda Omidi in 2020 in an article entitled "Evaluation of the impact of physical-social factors on the sense of place in residential open public spaces" of residential complexes with Delphi technique showed that factors such as low density of units, height reduction in the side with better perspective, the view of the units to the green space, lighting and illumination at night is effective in promoting the sense of place in a residential complex (Nowruzian et al., 2020: 87).

Montazerolhodjah et al. in 2016 in an article entitled "Assessment of factors affecting the sense of place in urban neighborhood centers case study: sheikhdad neighborhood and shahrak daneshgah neighborhood, city of yazd" by the purpose of investigating the concept of sense of place in historical and contemporary centers, identified the factors affecting its creation and promotion in the environment. For this purpose, two samples from the center of Yazd neighborhoods, one in the historical context and the other in the new context of city were selected and studied. Correlation research method and Kolmogorov–Smirnov statistical test, multiple regression and Pearson correlation test were used to determine the relationship and intensity and direction of the relationship between independent and dependent variables. Based on this, ten hypotheses were developed and tested in study samples. According to the obtained results, the identity variables in the historical neighborhood and the spatial quality in the new neighborhood have the highest correlation with the sense of place in the center of neighborhoods (Montazerolhodjah and Namavar, 2015: 43). Shibani et al. in 2017 in an article entitled "The role of natural environment in creating sense of place in the urban resident" had aimed finding the lost connection between humans and the environment replacing traditional yards with a proper functional and behavioral option in contemporary housing. The theory of research based on the discuss between indoor and outdoor

spaces in the traditional yards, states that creating a good sense of place leads to residents' satisfaction and it is a qualitative factor in the future planning of housing (Shibani et al., 2017: 41). Mohammad Sadegh Falahat and Samira Noohi, in 2012, in an article entitled "The nature of signs and their role in enhancement of sense of place in architectural spaces" assessed that since excessive attention to performance in the modern perspective have faded many perceptual aspects of architectural spaces in relation with audiences, the meaning gap becomes more apparent in today's societies more than before. Thus, modernity, which was emerged after the solving of this deficiency in the modern view, could not provide a comprehensive view in the place of architectural spaces due to the excessive attention to the physical aspect of meanings. The study of meaningful factors is an effective way to induce a sense of familiarity in the architectural space, and the use of semiotic principles is one of the best solutions in analyzing the method of giving meaning to space.

The principles of semiotics, with roots in many perceptual sciences, relying on the concept of signification, cause the audience to connect better with the architectural space as much as possible. Therefore, the study of semiotics factors that consider different functional, structural and semantic aspects simultaneously in forming the architectural space, can be a step towards giving meaning to the space and creating a sense of space in the audience. This study investigates the role of signs in the perception of meaning concepts and its role in promoting sense of place. From this point of view, the study of different features of signs with a structuralism perspective has surveyed the identity of signs as one of the most important criteria in sense of place in architecture and semiotic concepts. Since the semantic quality of architectural space is essential, the effect of symbolic meanings on the sense of place has been studied from a phenomenological perspective (Falahat et al., 2012: 17). Costlow et al., in 2020, in an article entitled "When Less is More Sense of Place and Welfare in the end of life, did quantity research to show that mastery of the environment, purpose in life, and self-acceptance are important than anything else. The results showed that older people with high spiritual stress cannot understand and communicate with crowded environments (Costlow, 2020: 21).

3. Theoretical Framework

3.1. Place

The place is the main element of the identity of its inhabitants. By knowing the place, man can achieve his knowledge. Man has different images in his mind from different places. His emotions can affect his perceptions of the environment and the formation of a mental image of the place. It is this mental image of human beings that gives place to identity. In addition to the physical structure of the place, people's memories are effective in identifying the place (Najafian Sharif, 2011: 1054). The crisis of place in the sense of the crisis of social meaning is one of the most obvious problems of contemporary urban planning. A crisis that has been manifested in the creation of urban spaces without identity, without history and communication. From a phenomenological point of view, the place is more than just an abstract place. (Mojtahedzadeh, 2016: 71). A place is a whole that is made of real objects and has materials, shapes, textures, and colors (Tuan, 2001: 421). The combination of these elements together defines the environmental character of the place, which is the context for the activities. (Shamai, 1992: 72). Place, in general, has an identity that includes various social factors and has a history that connects the past, present, and future. (Mahmoudinejad et al., 2008: 48).

Ralph believes that (Relph, 1976; Tuan, 2001): "A place is a space beyond a space that has three physical properties, activity and meaning, and in the meantime, considers meaning as the main component of this group. Canter (1977) also presents the theory of "place face", classifies a place into four components: functional differences, spatial goals, scale to environmental size, and design parts, and refers to the physical elements and components in the place. He considers place from the approach of environmental psychology, a specialized term that includes activity, physical location, and other components (Canter, 1977: 121). Gustafson (2001) describes the interactive three-polar approach of the individual, others, and the environment as a theoretical framework model in the formation of meaning, based on a comparative analogy of Canter theory, and a clear model of meaning and its formation in constructed environments. According to this model, meaning is the result of the interaction of the three poles of the individual, others, and the environment (Gustafson, 2001: 157).

3.2. The Difference between the Concepts of Place and Space

The first distinction that emerges during the symmetry of space and space is the level of abstraction of the two concepts. Almost every human being perceives and experiences place more easily than space, and in comparison, with space, the necessity of place for individual and social life is simply felt. People even perceive space through place and consider a space separate from a place unimaginable (Cross, 2001:29). This difference in perception of place and space stems from the fact that space is more abstract than the place. In other respects, the more abstract the space than the place is debatable (Motalebi and Forouzandeh, 2011:18). Space is everywhere but the place is definite. Undoubtedly, imagining everywhere must be more difficult than imagining a certain place. The place has content, but space is a kind of vacuum. The place is much easier to delimit and threaten than space, while space is decentralized and tends to be finite (Bonaiuto et al., 2003: 43).

3.3. Sense of Place

The most important term used here in relation with place is the sense of place. The concept of sense of place has become very popular in the last 40 years and it has covered a wide range of research. Now, after defining the subject of place, we will study and define the sense of place and the formable sense of place. After the concept of place was introduced, the term sense of place was mentioned. "The sense of place has been defined and analyzed from the perspective of various experts." At first, the term seems to express human feelings about the environment; in the finding of the feeling that each of us has from a space can be different over time and for each person. Various experts have expressed their views in this regard. "The concept covers a wide range from human fun and enjoyment to more serious applications in human life."

This concept includes a vast range of connection between place and human, which is includes the concept of place and dependence to place (Borer, 2016: 112). One of the effective factors in the semantic quality of architectural space is the sense of place. He considers the sense of place as a factor that connects human and place and brings unity. Sense of place is generally associated in the connection of people group who experience a place, or the feelings that people have about a particular place. Sense of place is an intellectual matter, and based on different culture and experience, changes. The sense of place means people's mental perception of the environment and their more or less conscious feelings of their environment, which puts the person in an internal relationship with the environment so that the individual's understanding and feelings are linked to the semantic context of the environment and becomes integrated. This sense is the factor that

changes a space into a place with special sensing and behavioral characteristics for special people. The sense of place, in addition to make people feel comfortable in an environment, supports the desired cultural concepts of people, the social and cultural relations of society in a particular place, and reminds the past experiences and achieves identity for individuals (Falahat, 2006: 56). Sense of place is a mixture of self-conscious and unconscious emotions, perceptions and understandings; It is a rich concept that includes how people perceive, experience, and individual express, and gives meaning to a place, and a person's sense of place influences his or her attitudes and behavior in that place. The environment in addition to physical elements includes messages, meanings, and codes that people understand and judge based on their roles, expectations, motivations, and other factors. This general feeling that arises from the perception and judgment of a particular environment in a person, is called the sense of place. The received sense of place is descriptive and symbolic of the concept of place. According to Lynch, the sense of place is a factor that connects human and place and creates unity. He believes that space must have a perceptible identity and be recognizable, memorable and visible in order to create a sense of place. This kind of sense of place can also bring a sense of belonging. Tuan has a different perception; He believes that "the sense of place is in fact a distance; an abstract distance between oneself and place that creates the possibility of understanding a place" (Tuan, 1980: 3-4). It seems that this term of distance that Tuan has used, implies the implicitly of the passage of time.

The sense of place has proved in many ways that it was strong enough to tolerate any political, social, or cultural change. For example, this is true for cities such as Rome, Istanbul, Paris, Prague and Moscow. For example, the metropolis has a special sense of place. This sense is a factor that turns a space into a place with special sensory and behavioral characteristics for special people (Mahmoudinejad, 2008: 59). Finally, about the sense of place we can assert: "The sense of place includes a point where the physical element, activity and meaning from people's experience of place are mixed. The sense of place, in addition to make people feel comfortable in an environment, supports the cultural concepts that people desire, the social and cultural relations of society in a particular place, and reminds people the past experiences and achieves identity (Falahat, 2006: 57). The sense of place can be changed by external changes, with the economy, social and political changes of modernity had a great impact on the loss of sense of place. "Weakness of the sense of place is facilitated through economic globalization and standard products." Integrative concepts in programing and development of urban spaces have sometimes led to the loss of local identity. As a result, currently urban development tends to decrease the dependency on place and depth of meaning, and weakens the diversity of place experience. “The sense of place is a dynamic bond that a person develops as a result of attachment to place, awareness of place, belonging to place, satisfaction of place, and commitment to place” (Shamai, 1991: 72).

The specific experience of individuals in a particular environment (sense of stimulation, stimulation, happiness, developmental and etc.) is relative and everyone has a specific experience, but at the same time collective, local and with personal meanings that connect the person to the world that changes the space into a place, the sense of place is created over time in the long-term use of space.

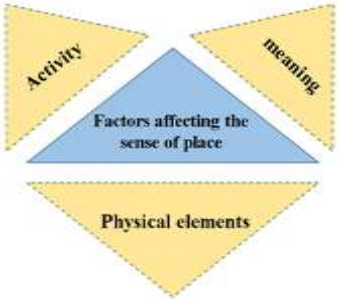

Fig 1 The effective dimensions in the sense of place (Carmona, 2013: 45)

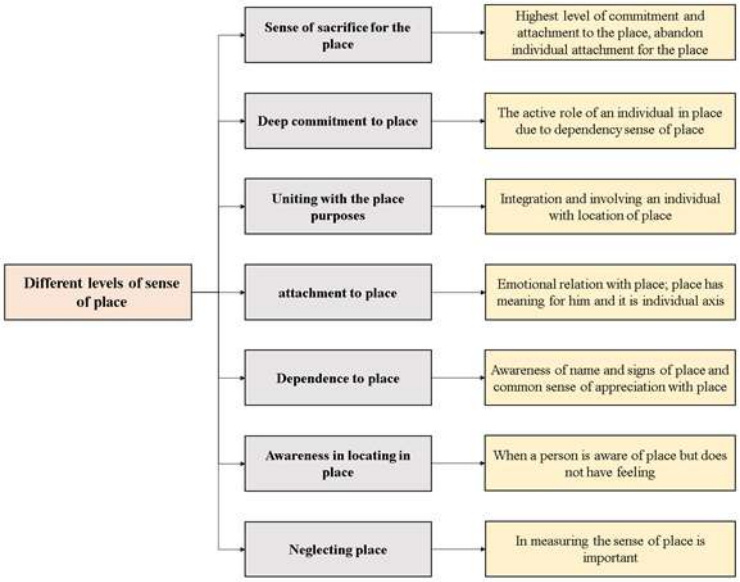

Fig 2 Different levels of sense of place (Carmona, 2013: 45).

The sense of place is an experience created by the environment with what one brings. Two main branches of sense of place includes the sense of place as the dependent axis and place as an attachment axis. The first is related to a geographical place as an operational structure. Researchers do not consider this definition very comprehensive (Carmona, 2013: 45).

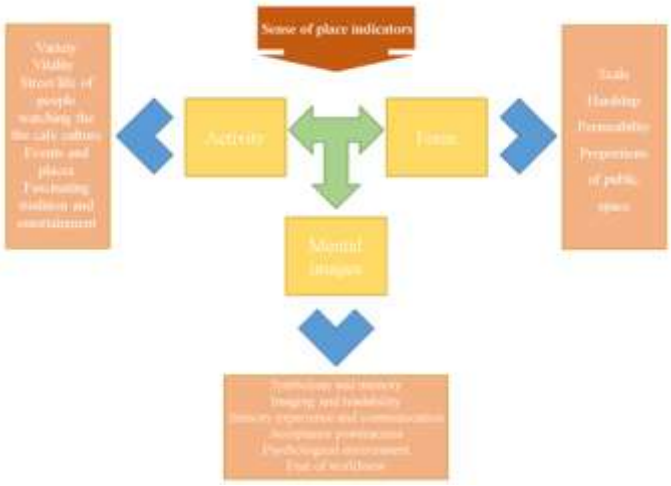

Fig 3 The index of sense of place in the environments from (Carmona, 2013: 45)

3.4. Cognitive Approaches to the Sense of Place

A Sense of Place from an Epistemological Approach

In the epistemological approach, numerous studies have been conducted on the knowledge of the sense of place and its relationship with various human aspects by different sciences, and different thinkers in various fields have explained and recognized this sense and its role in human life. In general, this group of thinkers can be divided into two categories: (Barker, 1968: 127-132).

- The first group: phenomenologists
- The second group: environmental psychologists.

***Phenomenologists*:** According to the phenomenologists of human geography, the sense of place means a strong connection and an influential factor between people and place with its constituent parts (Tuan, 1974). From the point of view of this approach, experience is the main element of perceiving the concepts and meaning of a place, and therefore the meaning in a place is directly related to the way of human perception and related categories (Pretty et al., 2003: 284). Explaining the connection between perception and experience of place, Ralph believes that in the sense of place, human beings understand a concept beyond physical characteristics and physical elements in a place, and somehow feel a continuous connection with the spirit of the place (Varady and Carrozza, 2000: 798). By stating this, he points to the fundamental and inseparable connection of the concept of sense of place with human aspects and declares what elevates a space to a place (Tuan, 1974).

In addition to him, others such as Twigger-Ross and Uzzell emphasized and expanded Ralph's theory by emphasizing spatial distinction as one of the characteristics of spatial identity in the formation of individual identity. A concept that is mainly known as territory and is related to the physical dimensions and psychological logic of location knowledge (Carmona, 2006). Nuremberg Schultz is a well-known phenomenological architect who, based on the theories of the phenomenologists Husserl (1970) and Heidegger (1962), expresses several theories about architecture, and in particular place and space (Heidegger, 1962).

Based on the nature and structure of the place, he refers to the description and analysis of place and space as the space of existence and refers to the spirit of place, which means the essence of the relationship between place and man (Nurberg Schultz, 1980) In defining the "nature of place", he names it as a whole consisting of objects, physical elements, and what is the nature or spirit of

place, and considers the structure of place to include landscape, habitation, space, and personality (Motalebi and Forouzandeh, 2011: 19). In the physical environment, meaning is expressed as an identifying factor and the space of existence as a factor of individuals belonging to the environment. The characteristics of this place are announced in three factors: typology, topography, and morphology (Mahmoudinejad et al., 2008: 49).

Environmental Psychologists: Environmental psychologists have been studying human relationships with the environment and its various meanings for nearly forty years. These psychologists have developed theoretical foundations by the spaces and environment by studying the human living environment and examining everyday behaviors (Motalebi and Forouzandeh, 2011: 18).

The term behavior setting in this science is a description of a place of behavior that is a small social unit and is obtained by combining activity and a place in a way that in a regular process can meet the necessary functions of that behavioral environment. A place of behavior includes activity and territory, time, schedule, and controlling factors (Barker, 1968). Three important human factors are important in the realm of this knowledge: perception, cognition, and feeling. Numerous terms such as attachment to place, place dependence, place priority, place identity, etc. describe the sense of place. In general, the types of semantic attitudes of the human relationship with place in environmental psychology can be divided into several approaches: (Gifford et al., 2002: 132-134).

Cognitive approach

This approach emphasizes the role of human knowledge of the environment as they need to create a sense of belonging. Accordingly, environments with more awareness and cognition are less semantic for individuals than similar environments with less individual perception and cognition.

Social approach

From the perspective of this approach, the sense of place to the environment is the result of factors of social interactions that take place in the environment. According to this approach, the environment contains information and common social cues that humans interact with their environment by understanding and deciphering them.

Emotional approach

This approach refers to the emotional dimension of communication and place and declares interaction in this degree as a result of a deep connection between man and place and considers the formation of meaning in this approach about human emotions. Many environmental design theories refer to a sense of belonging in this approach as a sense of place and refer to a reflection of the combination of human perception, cognition, and feelings about the environment (Eusuf et al., 2014: 641-644).

Proshansky considers individual identity to arise from spatial identity and it originates from perception, cognition, and finally feelings about a place (Proshansky et al., 1983).

Taylor (2011) along with another group in his study of public spaces in neighborhood units, refers to physical elements, refers to it as physical interaction, which is equivalent to physical belonging to a place (Mebirouk, 2005: 61-66).

Altman considers the sense of belonging in the environment to be more than cognitive experience and believes that this sense includes the cultural beliefs that connect individuals with the environment. He describes the characteristics of this environment based on three factors: scale, specificity, and availability (Thwaites, 2001: 247-249).

Rappaport, emphasizing the role of socio-cultural components in the formation of the physical environment, by presenting the theory of non-verbal communication, divides the environment into a set of fixed, semi-fixed, and moving physical elements (Rappaport, 2005). According to Lefebvre,

the combination of mental and real space takes place in the social context. For Hegel, perception and experience are influenced by the social dimension (Babaei, 2014: 695). Theorists such as Edmund Bacon, Christopher Alexander, and Lynch point to the importance of open spaces as a place to strengthen people's social relationships (Thwaites, 2001: 247-249).

Emphasizing the dependence of environmental meaning on the cognitive process, Kevin Lynch uses cognitive maps to study the meanings desired by users of space (Lynch, 1998). Bentley and his colleagues, by studying and examining buildings and residential houses in England, point to a tendency to create the color of belonging and environmental differentiation in buildings and interpret it as environmental readability and classify it into two categories: consensual belonging and healing belonging. In his research on the sense of belonging, Robert Ryan points to the classification of active, semi-active, and passive environmental interactions and states the need for active environmental interaction as one of the important and influential factors in the formation of a sense of belonging and the use of natural elements. Introduces the environment as one of the factors creating a kind of interaction (Ryan, 1998).

A Sense of Place from an Ontological Approach

In examining the dimensions and nature of the sense of place from the ontology approach, it is necessary to pay attention to human needs. Today, various models of human needs have been proposed in the field of architecture-related sciences. Among these models, the model of the pyramid of human needs proposed by Maslow has been considered and important by several environmental designers in the development of theoretical foundations of design (Royuela, 2005).

While emphasizing human motivations and needs, Maslow has accompanied human beings from birth and believes that human beings seek to satisfy these needs at different levels by interacting with the environment and changing their capabilities (Babaei, 2014: 695). In describing this feeling, Lawson points to the existence of unwritten rules in human societies. Schultz's cosmic space, which is described in various dimensions of the orientation and topology of human space, is Lynch's well-considered urban form, which expresses the mental dimensions of the people who use the city (Nurberg Schultz, 1980).

3.5. Different Dimensions of Sense of Place

Some scholars, such as Altman and Lou, have emphasized the social role of place, referring to socio-cultural interactions and relationships in place, and have interpreted belonging in terms of social belonging (i.e., a kind of belonging for the sake of the people who use it) (Voordt and Wegen, 2005). However, other researchers have emphasized the role of physical elements as another important factor in the formation of a sense of belonging and consider it necessary to pay attention to the physical dimensions in the process of creating a sense of belonging (Muruani and Amite-Cohen, 2007).

***Social Belonging*:** This type of belonging, which is mainly based on social interactions and actions in the environment, is based on the theory of social environment, and from this perspective, the environment has a type of belonging, a combination of social elements in which one seeks belonging (Muruani and Amite-Cohen, 2007).

***Physical Belonging to a Place*:** This type of belonging is derived from the physical elements and components of place as part of the process of human cognition and identity (Muruani and Amite-Cohen, 2007).

Table 1 Classification of factors affecting the creation of a sense of place (Source: Author)

Theorist	Concept	Definitions
Merleau-Ponty 1962	Meaning and concept	Merleau-Ponty bases his phenomenological concepts on the explanation of the body (based on the body) and considers it a better approach to the nature of the mind, and the subject matter is important to him. According to this view, the intimacy of an architectural experience depends on the architectural ability to pay attention to the mind and body at the same time, and discovering the characteristics of a space based on sensory implications will enable one to have a more satisfying experience.
Arkitas 1969	Dependent on the person	Arkitas claims that every person occupies certain places and if those places do not exist, he or she will not exist. That is, the place where everything happens is the first thing to pay attention to.
Heidegger 1976	Communication with places	By questioning Kant's duality between man and the world, and defining man as Dasein, Heidegger defines human identity in relation to place and emphasizes place as the first manifestation of the realization of humanity and human being and life. Place puts man on a path that reveals the external relations and connections of his existence and at the same time the depth of his freedom and originality of existence. This is a profound and complex dimension of human experience in the universe.
Relph 1976	History and Geography	Sense of place A common sense of local history and geography that manifests itself in a combination of pride and commitment to improving the place.
Steele 1981	excitement	He considers the sense of place as experiences such as excitement and inference in a particular behavioral setting, and believes that it is the spirit or character of the space that evokes these particular emotions
Lynch 1998	Unforgettable place	The sense of place is related to identity and requires nodes that are distinct and unforgettable places.
Shamai 1991	Experience space	He considers the sense of place as the experience of space by man; In other words, place is a combination of man and a special design of his physical environment of life that is perceived and experienced through feeling. The desire to visit or not to visit, the continuity of the presence, the enjoyment of the place and participation in its activities stem from this feeling.
Panter 1991	Activity	and use, amount of pedestrian traffic, amount of vehicle traffic, behavioral patterns of artificial environment and readability
	semantic	Cultural relations, perceptual functions and qualitative evaluation
Zou, 1995	Unique place	A sense of place is a combination of features that make a place special and unique and protect the cultural heritage of the areas, promote cultural awareness and kinship relations.
Rudolph 1997	the memories	A person is born in the village that precedes him. Gradually, this village becomes his homeland with all its memories. Paths and places become memories and time and space become the history of his life.
Norberg-Schulz 1998	Path and meaning	How we get from one place to another is the main form of existence in the human world.
	Distinctive character	A sense of place is found in places that have a distinct personality. They have a place identity, and this distinctive character is made up of tangible things with materials, shapes, textures, and colors.
Montgomery 1998	liveliness	He believes that the sense of place is the distinguishing feature of the success of regions and makes them feel alive and happy and cheerful in creating a place

Cross 2001	Mental experience	The sense of place is a matter of the mind and varies according to different cultures and experiences.
Bonaiuto 2003	Background and location and equipment	Background and context, existence of services and facilities, location in the urban context, how the place relates to its surroundings
Kyle et al 2004	Emotional belonging	Emotional attachment to place can take place in relation to the physical environment as well as the social environment.
Salvesen 2004	Landscape-position	A sense of place arises from the interaction of the three elements of individual position, perspective, and entanglement. Physical personality, ownership, originality, residents, amenities, private and collective spaces are effective in creating a sense of place.
Carmona 2007	Time	The way places are controlled and managed over time affects the sense of place.
Devine Wright 2009	Variable based on outside	The sense of place can be changed by external changes, by the economy, by social and political changes.
Steadman 2016	Descriptive, symbolic	The sense of place received is descriptive, symbolic and symbolic of the concept of place.
Raymond 2016	Human	The concept covers a wide range from fun and enjoyment to more serious applications in human life. This concept encompasses a wide range of relationships between man and place.

3.6. Factors that Create a Sense of Place

***Perceptual-Cognitive and Individual Factors (Meanings)*:** A sense of belonging is a complex combination of meanings, symbols, and environmental qualities that a person or group consciously or unconsciously perceives from a particular place. This meaning, which is mainly based on the emotional connection of the person with the environment, manifests itself in the design in the form of physical manifestation (Lang, 2002). Knowing one's perception of a place is one of the basic conditions for creating a sense of belonging to a place. For this purpose, desirable environments have a better perception and knowledge by people (Mebirouk, 2005: 61-66).

***Social Factors (Activities)*:** The role of social variables such as culture, symbols, and social symbols is of great importance. All human beings have social needs and in the pyramid of human needs, they seek to belong to relatives and friends. At this stage of the sense of belonging, the environment is the context of social and cultural activities in which individuals discover, interpret and interpret physical elements based on their perception of their cognitive structural system (Lang, 2002). In this category of factors, physical elements such as forms, shapes, textures, and colors arising from the social layers of the environment play a communicative role with users, and each is based on cultural data obtained throughout the history of environmental architecture and contains its meaning (Amole, 2009).

***Environmental-Physical Factors (Physical Elements)*:** Based on the theory of place-behavior in environmental psychology, these factors categorize the two important factors of activity and body, define the activities in an environment based on social factors, actions, and general human interactions, and define the body along with form variables (Mebirouk, 2005: 61-66). And the organization of components is evaluated as the most important factor in the formation of a sense of belonging to the environment (Ewing et al., 2006: 223-224). Physical elements create a sense of belonging by creating environmental differentiation, internal and external communication in spaces. Shape, size, color, texture, and scale as characteristics of form each play an effective role in the formation of the right and the type of organization and arrangement of physical components is another effective factor (Pasaogullari and Doratli, 2004: 225-227). On the other hand, physical elements are effective in creating a sense of belonging through harmonization and the ability to

meet human needs in space. In design, each of the variables of color, shape, texture, scale, and type of organization based on human needs and providing the desired type of activity in the spaces are of special importance, which indicates the ability of the environment that flourishes the form of performance (Mebirouk, 2005: 61-66).

3.7. Space of Open Residential Areas

The open space is generally considered as public and semi-public spaces (Amole, 2009: 867). The open access is divided into three categories: public, private and semi-private. Public spaces with definitions and applications of criteria and components such as accessibility of spaces, profiting from spaces, designing method, facilities, physical structure of streets, aesthetic considerations are on the agenda (Cybriwsky, 1999: 231). There are other definitions of this space, but in this context, the aim is familiarity with one of the types of public spaces. Public space is divided into three categories: open space, semi-open space, closed space.

The "open space" term was first used in "London follow" committee (Muruani and Amit-cohen, 2007: 5). The open space is generally described as a land without building and it is only a balcony and private yard in private open space (Pasaogullari and Doratli, 2004: 226). The main performance of open space is to meet peoples' needs (Ewing et al., 2006, 224). Open space in residential complexes is the outermost space of houses and it is the joint with the urban space and is considered as an exterior in terms of application and it is a circle for the formation of more open and common activities (Wilkinson, 1983). Today, the open places in residential places are limited to the closed spaces, balconies and or small private courtyards on the ground floor, parking lots, or unplanned common areas, although experts emphasize that the spaces between residential blocks are not unused and redundant spaces that are spaces for meeting, events, and so on (Tzonis, 2006: 24). Various researches in the West show the effect of open spaces in increasing the desirability of space for residents; for example, Cooper Marcus and Sarmes Yander (1986) emphasize in their research that the success of medium- and high-density residential complexes has a direct relation with the degree of positive impact of open spaces between blocks (Beer, 1983: 11). It should be noted that a successful neighborhood design makes a proper balance between neighborhood collision opportunities and seclusion opportunities. For example, if private spaces with short walls have traditionally increased neighborhood encounters, but they can simultaneously induce a sense of insecurity and visibility in residents (Thwaites, 2001: 15). In different countries due to the role of open spaces, the residential complexes with planning and various strategies at different scales try to evoke a sense of belonging in the residents and in addition the benefits of outdoor capabilities for a common and ecological place in the city is achieved.

In neighborhoods and residential complexes, limiting buildings in open spaces are the same as the residential buildings (Mebirouk, 2005). Open space is the most important arena for the formation of social interactions. Open space in traditional Iranian architecture is described in two scales (Eusuf et al., 2014: 642). The first is the large open spaces, which meets the needs for large gatherings, religious and military ceremonies, etc., and the second is small open spaces in relation to everyday uses in small and often residential buildings. Residential open space refers to a single space or a collection of organized, decorated and orderly spaces that are located between the constructed surfaces and are a platform for human activities and behaviors. Open space is used as a balancing and generalizing space in urban space, which is a complement for green space. At the same time, open space is considered as a modulator of building and human density. The common denominator of open space as a connecting space between different activities, which appears as a special skeleton within the city, defines a part of the urban structure or a form.

Open space residential areas are a kind of the nature of social life, this means a place where citizens are present. Intrinsic human behavior has a close relationship with the environment, therefore, organizing human behavior and applying it in time and space is the most important factor in outdoor design. Human is the main component of this space that gives meaning to this space by his values and norms. Outdoor design is the art of arranging the external physical environment to support human behavior, and the outdoor designer applies activities in three-dimensional space in a desired time. A successful design is in harmony with the people who use it, and on the other hand, it shows a connection with the environment (Voordt and Wegen, 2005: 32). Paths, public communication spaces, sidewalks and passages, local squares and squares, neighborhood parks and green spaces, bridges and connecting spaces between sidewalks are a section of open space residential areas. Open residential spaces provide opportunities for the growth of creativity, socialization, social interaction and applications such as communication, tranquility, entertainment and they are a place to walk to reduce pollution and improve the living environment.

Open space residential area is a new concept that is a result of modern social life and communal living as an alternative of private yards. Although there are many differences in the nature and form between these two, but based on functionality it is expected that they have similar uses. However, these natural differences have overshadowed in its performance, and as a result, in many existing residential complexes it has been reduced to a passing area or stop area for cars. Today, the positive effect of outdoor quality on the physical and mental health of people is accepted, and it is expected that open spaces in residential complexes fill the gaps due to the lack of yards in the lives of residents, an absence which is sensed more than before with a per capita shortage of green space in cities and congestion of modern cities (Francis, 2003: 30-33).

3.8. Environmental Factors in Residential Complexes

For understanding the relation between building and environment, firstly we should consider the human view about environment or in general the nature (Grooter, 1996: 163). Earth and climate geographers, people and personality psychologists, sociologists of social organizations and processes, and architects of buildings and open spaces define the environment. Each of these classifications is related to the purposes that are expected from the environment. Some analysis between physical, social, psychological and behavioral environments have distinguished (Lang, 2002: 163). If we assume the environment as a living creature, it needs vitality to continue living. It is clear that the need for vitality of spaces is the presence of people. In architecture and urban design, considering the citizens' opinions is one of the most important factors for design, that means the space and the surrounding environment have features that attract people.

Most of the researchers concentrated on several physical dimensions of the environment but we cannot consider these dimensions as definite because there are different disagreements, but it can be summarized in three dimensions.

a. Environmental situations: that simulates five senses (temperature, light, noise, music and perfume)
b. Special design and ability: respond to the needs in the extent of shape and machine settings, facilities and furniture or ability.
c. Signs and artifacts: the tools show the kind of service in the space (Royuela, 2005).

The physical environment includes terrestrial and geographical locations. The social environment includes the institutions of group members. The psychological environment includes the intellectual images of people. Behavioral environment is a set of factors to which a person reacts. What is important is that the physical environment must be fitted to the earth's environment.

The physical environment is a set of adaptations that human creates with geographical and cultural environments. Environmental organization affects the interaction of people and the geographical environment. Banat and others consider environmental factors as communication with nature through natural materials or presence in nature (Bennet, 2012: 41). According to Winer and Carmalit environmental factors are climate, neighborhood, services and facilities and even technology. Attention in the opinion of some people is a functional distance in functional centrality and functional proximity (Shamsuddin, 2011). This has led people to gather and led social interaction between the residents of the residential complex. On the other hand, adaptability and flexibility cause human interaction with the environment and create meaningful experiences (Huisman and Deeg, 2010).

Some people consider the geographical space as housing and ownership type, space performance, and height code as the most important physical factors affecting the outdoor space in a residential complex. While for others, visual attractiveness and readability are the most important physical variables of the environment. On the other hand, effect of factors such as shape diversity, material and building diversity, active frontiers in residential complexes, natural and artificial bed, number of blocks, the level of occupation, facades and furniture, the quality of the building structure, the quality of the residential unit and finally the population density on the surrounding environment of the residential complex are undeniable. In this regard, other people have studied the transportation access network, outdoor and indoor access network, pedestrian access network, permeability, monitoring by residents in a residential complex, space for ceremonies and celebrations, as environmental variables (Montazer Al-Hajjah et al., 2015).

4. Research Method

This research is a combination of nest to nest that firstly the documentary studies are conducted in this field. The existing variables in the sense of place are extracted and in the next stage, environmental components are extracted. In order to investigate and make relationship between research variables (environmental components and sense of place) Delphi model is used, then for variables that have not existed in the theoretical literature or compared to previous case studies, semi-structured interviews with open and axial coding techniques are used. In the end, the aggregation of variables and their use in a Likert questionnaire determine their contribution. Each of the steps are described as follows.

4.1. Qualitative Part:

Delphi Futurology

- **Intellectual storm:** the research questions related to the subject are asserted in two stages that take place in a question, at first the qualitative question in relation to factors are considered as the main purpose of the Delphi question and for complete understanding it becomes simple by converting into three questions along with the main question. The results of identifying the factors were evaluated by experts and repetitive responses were eliminated and the names of each member in a team were defined and easily sent to them. This step involves extracting and validating the list of factors.
- **Limitation of factors:** At this stage, the understanding of ranking was the importance of factors based on different perspectives of different groups. Hence, the strategy was to have groups that think similarly about the importance of factors. Attempts to fit the factors

extracted by the researcher experts was done. This stage has a multiplication of adornments and includes a questionnaire of the most important factors.

- **Ranking of the relevant factors of the purpose in this stage:** the purpose is to reach an agreement in the ranking of relevant factors in each board. Research shows that reaching an agreement in Delphi groups is much more difficult than reaching an agreement in groups where there is direct interaction between members. This step includes ranking of the selected factors (Powell, 2003: 382).

Semi-Structured Interview

Based on studies in the field of sense of place and open space residential areas, the questions of semi-structured interview are written and became available for experts. The results of this stage were analyzed with ATLASTI software and with techniques as follow:

Open Coding: Open coding process is an analysis through which the concepts are identified and their properties and dimensions are achieved. In this stage the theory of data foundation forms the primary categories of information about the under-study phenomenon by segmenting the information. The researcher founded the categories based on collected data, such as interviews, observations, and events or his notes (Creswell, 2005: 397).

Axial Coding: This process is linking categories to subcategories, and linking categories at the level of features and dimensions. This coding is called axial because coding is done around an axis of a research category (Lee et al., 2004: 249). Strauss in the axial coding stage discusses several basic actions shown in the table below (Lee et al., 2004: 50).

Table 2 The stages of applying axial coding (Lee et al, 2004)

1	Expressing the properties of a research category and its dimensions is an action starts during open coding
2	Identifying various cases, various action or feedback and its outcomes related to a phenomenon
3	Relating a category to its sub-categories through options which indicates its relation
4	Search for clues in the data that indicate how the main categories may be related to each other.

This section includes two different sampling in quantitative and qualitative area.

4.2. Qualitative Sampling

Firstly, the qualitative sampling was asked from 20 experts who were fully acquainted with the sense of place and open spaces of residential complexes and they were selected in the form of snowballs, they were asked to give 1 to 10 score to the valuable residential complexes for examining in the field of sense of place. Complexes with an average score above 5 were selected and they were referred back to experts for approval. In the next step, for interviewing with experts in this study, 46 experts were interviewed and from the 37th interview repeat was seen. Based on Grand theory principals, after the first interview they started to collect and analyze the information.

Table 3 Dispersion of interviewed professors

Cumulative percentage	Abundance	Number	Interviewers
34.8	34.8	16	Architect professors
54.3	19.5	9	Professors of landscape architecture
80.5	26.2	12	urban designing professors
100	19.5	9	urban designing professors
-	100	46	Total

4.3. Quantitative Part

In the next step, according to the views of the experts and managers in residential complexes and the extracted variables, a questionnaire was developed as a closed questionnaire with five-degree Likert-scale answers. The structure of the questionnaire included questions related to the main research question; for the calculations, a score of 5 for "very impressive" and a score of 1 for "low impress" was considered by each expert and to minimize cost and time, a questionnaire was distributed among a random sample of 38,500 people (the desired residents in the complexes). The sample size was selected using Morgan table which includes 384 people and it was distributed randomly between residents of residential complexes. According to the population and the separation of men and women. The volume of distributions in the dispersion of age groups was based on age groups and was clustered. The reliability of the questionnaire was calculated based on Cronbach's alpha, with the value of 0.72 and the justification was calculated with the CVR formula, which is 0.78. In general, the diagram of the research method is as below:

Fig 4 The research process diagram (Source: Authors, 2021)

5. Findings

5.1. Qualitative Findings

In the Delphi stage, the executive phases are as follow:

- First Phase, Brain Storm:

The first questionnaire was sent to Delphi commission via electronic post and they were asked to relate these variables with flash in the answer of this question “which of the sense of place variables can include some of the environmental variables?”.

Second Phase, Limitation:

In the next stage, the experts as a separate board were asked to rank the selected factors by each board. Each expert was asked to select 10 factors. For each board, the selected factors were accepted by 50% of the experts.

Third Phase, Ranking:

Experts are asked to rate the available factors in their revision lists; the average rank is calculated for each item. Each list is evaluated using Kendall W, and this action continues until an agreement is achieved and some of the first-round variables are removed. The extracted variable from the sense of place and the adapted environmental variables are displayed below.

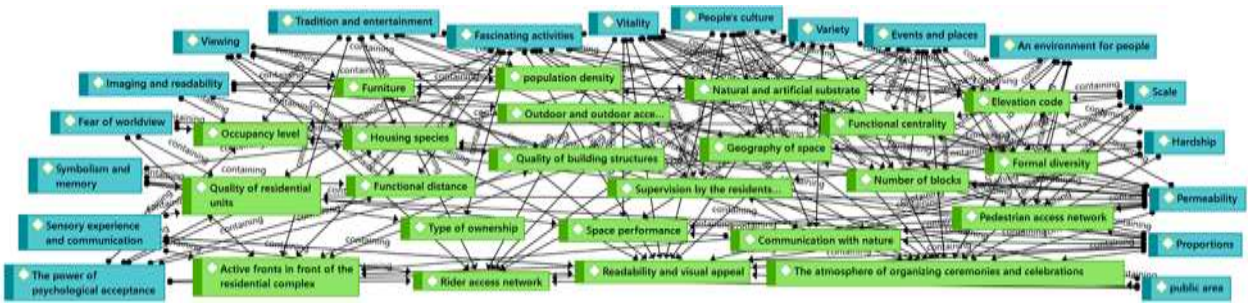

Fig 5 Results of connection between sense of place variables and the environmental variables

It was defined that nearly all of the environmental variables are representative of sense of place variables. Hence for analyzing sense of place in open space residential areas we can profit from environmental variables. It should be mentioned that the culture of the cafe, the power of psychological acceptance, fear of worldwide view and fear and panic have no variables and researchers have not considered any variables for them.

In the next stage, based on the existing definitions and spatial variables and environmental factors extracted in the Delphi stage, the questions are provided to experts and semi-open questions are asked to extract the maximum variables and the results are entered into ATLASTI software. 45 codes are extracted and based on these codes a questionnaire with Likert scale is designed;

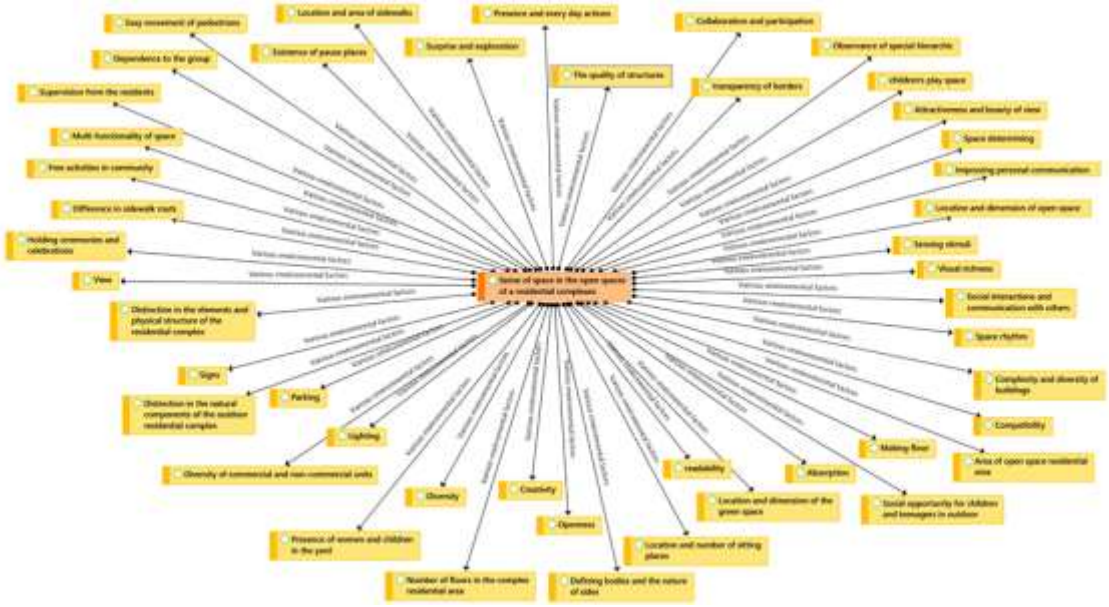

Fig 6 Results of open coding from researchers interview with live, descriptive and interpretive coding techniques.

5.2. Quantitative Findings

In order to perform factorial analysis, first the information matrix should be formed. Here its columns include indexes and its rows include complex residential areas. Due to select 9 residential

complexes for investigation and 45 environmental arguments, the M×N matrix is 45×9. In order to investigate the sufficiency of data and their suitability in determining the phenomenon, the KMO analysis and Bartlett were used. In order to confirm this and the component test, the trial-and-error method and indicator removal with values less than 0.4 were used. Hence, the coordination index with the local climate was removed and factor analysis was performed for the remaining components. Thus, KMO test and Bartlett is shown in the below table:

Table 4 The results of KMO and Bartlett

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.564
Bartlett's Test of Sphericity	Approx. Chi-Square	341.016
	df	73
	Sig.	0.000

As it is seen in the below table, there are common values. None of the components have not correlation below 0.4. In this stage, it is determined that how much of the number of selected factors can cover the project purpose. Hence, in the first stage the values more than 1 and include the 60% of the total and every one includes 10%, can cover the data.

Table 5 Common factors matrix

Component	Special amount	Component	Special amount
Holding ceremonies and celebrations	0.774	Parking	0.841
Social opportunity for children and teenagers in outdoor	0.754	Supervision from the residents	0.813
Social interactions and communication with others	0.699	Presence and every day actions	0.862
Free activities in community	0.833	Improving personal communication	0.751
Diversity of commercial and non-commercial units	0.892	Difference in sidewalk routs	0.924
Multi-functionality of space	0.871	Collaboration and participation	0.695
Distinction in the elements and physical structure of the residential complex	0.658	Dependence to the group	0.822
Number of floors in the complex residential area	0.617	Presence of women and children in the yard	0.906
View	0.906	Complexity and diversity of buildings	0.914
Attractiveness and beauty of view	0.965	Area of open space residential area	0.901
The quality of structures	0.632	Defining bodies and the nature of sides	0.736
Space determining	0.626	Surprise and exploration	0.779
Openness	0.721	transparency of borders	0.954
Existence of pause places	0.745	Space rhythm	0.913
Sensing stimuli	0.652	Diversity	0.947
Location and dimension of the green space	0.932	Location and dimension of open space	0.919
Location and number of sitting places	0.894	Location and area of sidewalks	0.952
Readability	0.830	Observance of special	0.921

		hierarchic	
Visual richness	0.832	Signs	0.954
Creativity	0.639	Compatibility	0.711
Lighting	0.854	Making floor	0.721
children's play space	0.741	Distinction in the natural components of the outdoor residential complex	0.768
Absorption	0.609	Easy movement of pedestrians	0.742

In order to determine that all these components can be classified into several factors, the percentage of variance of the special amounts of different factors is used. The result of the analysis showed that a total of four factors cover 76.41%, the first factor covers 26%, the second factor 20%, the third factor and the fourth factor 14% and 12% of the data. Therefore, by selecting 4 factors and performing Varimax rotation, the relationship between indicators and factors is achieved. In the table, the correlation between variables and factors for every factor that has more dependence are selected.

Table 6 Determining the number of factors

Variance percentage and the special number of various factors									
Variables	Primarily special amount			Explained variance of factors with special values greater than one.			Collection number of the extracted factors after rotation		
	Total	Variance percentage	Cumulative percentage	Total	Variance percentage	Cumulative percentage	Total	Variance percentage	Cumulative percentage
1	3.927	30.301	30.301	3.927	30.301	30.301	3.326	25.583	۲۵/۵۸۳
2	2.746	21.126	51.33	2.746	21.126	51.33	2.713	20.867	46.45
3	1.95	15.000	66.33	1.95	15.000	66.33	1.897	14.59	61.041
4	1.442	11.059	77.442	1.442	11.059	77.442	1.848	14.218	76.412
5	1.087	8.363	85.758						
6	6e5-6.513	-5e4/241	100.000						

Based on the below table, the relationship of components with factors are as below:

Factor 1: It is related to the components of supervision in footpaths, surprises and exploration, observance of spatial hierarchy, holding ceremonies and celebrations, free association activities, attraction and beauty of form, sensing stimuli, readability, children's play space.

Factor 2: It is related to parking components, presence of women and children in the yard, open area of the residential unit, location and dimensions of the open space, signs, ease of walking, opportunity for socialization for children and teenagers in outdoor, multifunctional space, quality of the structures, existence of pause spaces, location and dimensions of green space, creativity and permeability.

Factor 3: it is related to supervision from the residents in the complex, presence and daily activities of the place, improving personal communication, cooperation and participation, transparency of borders, location and area of sidewalks, social interactions and communication with others, diversity of commercial and non-commercial units, number of residential complex floors, spatial determination, openness, location and number of sitting spaces, visual richness, lighting.

Factor 4: It is related to the dependency to the group, Complexity and diversity of buildings, The rhythm of spaces, diversity, flooring, distinguishing in the natural elements of the open space in the residential complex, differentiation in the elements and the physical structure of the residential complex and façade.

Table 7 Correlation table between variables and factors

Rotated matrix of factors				
	Factors			
	1	2	3	4
Parking		0.873		
Supervision from the residents			0.684	
Presence and daily activity			0.730	
Improving individual connection			0.586	
Supervision in sidewalks	0.931			
Collaboration and participation			0.654	
Sense of dependence to the group				0.781
Presence of women and children in space		0.832		
Complexity and diversity in buildings				0.921
Open space area of residential areas		0.984		
Defining bodies and the nature of sides				
Surprise and exploration	0.862			
transparency of borders			0.773	
Space rhythm				0.752
Diversity				0.884
Location and dimension of space		0.901		
Location and area of sidewalks			0.302	
Observance the spatial hierarchy	0.581			
Signs		0.402		
Adaptability				
Flooring				0.365
Distinction in the natural elements of the outdoor residential complex				0.733
Easy walking		0.895		
Holding ceremonies and celebrations	0.947			
Opportunity for outdoors socializing for kids		0.349		
Social interactions and relationships with others			0.314	
Activity of free associations	0.695			
diversity of commercial and non-commercial units			0.504	
Multi-functional space		0.768		
Distinction in the elements and physical structure of the residential complex				0.562
Number of floors of residential complex			0.743	
View				0.702
Attractiveness and beauty of view	0.528			
The quality of materials		0.319		
Special determining			0.544	
Openness			0.893	
Existence of pause spaces		0.787		
Sensing stimuli	0.519			
Location and dimension of green spaces		0.625		
Location and number of sitting places			0.574	
Readability	0.684			
Visual richness			0.725	
Creativity		0.565		
Lighting			0.655	
children's play space	0.542			
Absorption		0.380		

Considering the obtained results from questionnaires we can conclude that the dimensions of sense of place in residential areas are complex and each of these dimensions (factors) include the other. Hence, in the first factor or dimension spatial-social factors are mixed with each other and they have correlation. In the second, physical-social factor and in the third, social-spatial factor and in the fourth, spatial factors exist. In general, when the selected factors have two aspects of environment, their correlation increases. In order to create more coverage for inducing sense of place in residential areas, it should include two or more dimensions to achieve higher success than sense of place.

6. Conclusion

Sense of place is an internal connection that is created between a person and his environment through the perception of the individual. This intellectual perception arises from various environmental components that have many multiplicities. These components are in different categories including spatial, social, and physical, most of which are spatial. It is important that the physical and social, social and spatial and spatial physical components are correlated with each other and in general each of the components affects the other aspects and when the components are single the other Components do not affect or follow one dimension. The amount of their contribution factor and their correlation coefficients are greatly reduced. The purpose of this study is to explore and analyze the components of sense of place in the open spaces in residential complexes, and the following solutions are proposed to improve the case and the situation in the sense of place in residential complexes:

- Designing cultural spaces by having the highest diversity, harmony, beauty and visual continuity of landscapes
- Designing safe spaces for different age and sex groups and individual and social activities
- Prioritizing to pedestrian movements in service centers for ensuring free movement of pedestrians
- Encourage residents and staff to use opportunities and outdoor training facilities.
- Ensuring that long-term maintenance and care of gardens and green spaces becomes an essential and permanent activity.
- Improving the personality and design of spaces to change the behavior of residents and increasing personal security.
- Encouraging residents to be more active and more present in open spaces by providing attractive and well-maintained open spaces
- Providing the maximum security for residents against climate change
- Creating proportion and coordination with land effects
- Sufficient size and extent in play spaces than population

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