

# Identifying the Physical- Spatial Factors Affecting Environmental Vitality of Open Spaces within Residential Complexes from the Views of Designers and Residents; Case Study: Residential Complexes of Tehran\*

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## ABSTRACT

Nowadays, the exclusive attention to the quantitative aspect of space design has resulted in reduced quality of most open spaces so that most of them lack of vitality and dynamicity. Thus, the present study aims to determine the physical- spatial dimensions of environmental vitality of open spaces from the viewpoints of designers and residents to compare their viewpoints and find the differences between them. The present study is carried out using triangulation design, in two quantitative and qualitative parts. In the qualitative part, a semi-structured interview is performed with those who expert in residential complex design. This interview is about the physical-spatial factors affecting vitality of open spaces. Then, the factors are extracted through open coding using the context theory approach and applying MAXQDA software. In the quantitative part, according to the existing theoretical literature, the main factors are extracted and a questionnaire is designed based on them. Then, the questionnaires are distributed among 376 residents in all residential complexes studied. The data obtained from the questionnaires are analyzed using Pearson test in SPSS software. Based on the outcomes obtained from the analysis of the interviews with experts, there are 12 main physical-spatial factors affecting the environmental vitality of the open spaces in the residential complex. According to inhabitants, the components of "sense of solidarity" and "memory-making capability of place" are the most effective components. These components, like some others, have been underestimated by the experts. Eventually, by analyzing the responses of residents, the other influential components are extracted. In addition, by analyzing the residents' opinion, residential complexes with dispersed pattern are common in two components of cohesion of situations and spatial diversity, residential complexes with centralized pattern in two components of spatial continuity and openness and residential complexes with linear pattern in four components of form, order and diversity, the sense of recognition and self-respect as well as the creation of public and private arenas.

**Keywords:** Vitality, Spatial, Physical, Open Spaces, Residential Complexes.

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## 1. INTRODUCTION

Since 1960s, Iran has witnessed the construction of apartments in which open spaces for every residential unit are completely ignored so that such spaces do not exist at all, if any, they have been converted into alternative spaces such as balconies, etc.. Moreover, the alternative spaces seem to be constructed instead of private courtyards in horizontal housing and in practice, they do not create the context for their related activities and not have a proper functional quality (Fallah Manshadi, Habibi, & Roohi, 2012, p. 48). This is ever-increasingly intensified due to reasons such as economic benefits, maximum utilization of land and attention to quantity instead of quality. Ultimately, this has made open spaces inefficient and useless, and even in some cases, due to the misuse of open spaces, other problems including the lack of lively urban spaces, would emerge. The vitality of open spaces in residential units, especially residential complexes, improves the performance of residential units (Mohamed, 2008, p. 176), increases the resilience to meet the needs of residents (Ozsoy, Esin Altas, Ok, & Pulat, 1996, p. 318), creates privacy, territory, and identity (Hur & Morrow-Jones, 2008, p. 620), improves urban landscape and enhances the security and viability (Mohamed, 2008, p. 176). With a quick look at the residential complexes of Tehran, boredom and lethargy can be apparently found in residential complexes and in the faces of their residents. Contemporary residential complexes consist of a number of arid, apathetic and repetitive blocks, insecure and unprotected sidewalks for pedestrians, etc., which are not capable of meeting most of the requirements of Iranian lifestyle, and no environmental vitality can be found in them (Einifar & Ghazizadeh, 2011, p. 31).

However, a more precise assessment of the effects of environmental vitality on the sense of security (Thwaites, 2001, p. 245), sustainability and self-sufficiency, physical and mental health (Francis, 2003, p. 30), progress and prosperity (Fallah Manshadi, Habibi, & Roohi, 2012, p. 50), satisfaction (Potter & Perveen, 2006, p. 21), innovation and creativity, adaptability and self-recovery, identity (Pakzad, 2006, p. 98), and sense of solidarity (Eusuf, Mohit Eusuf, & Ibrahim, 2014, p. 642), clearly indicate the importance of the environmental vitality of residential spaces as the first place in which human beings find their identity. Therefore, the current study attempted to promote quality of life in residential complexes by determining the spatial-physical components of vitality of open spaces within residential complexes. Using interviews and questionnaires, this study tried to answer the following questions:

1. Qualitative part: What are the spatial-physical factors affecting the environmental vitality of the open spaces within residential complexes from the view of experts?
2. Quantitative part: Which physical-spatial factors have the greatest impact on the environmental vitality

of the open spaces within residential complexes?

The contribution of this study is its research method (combination of qualitative and quantitative methods). In other words, in most researches, quantitative methods are used to identify the vitality components while in this paper, the effective factors on environmental vitality of open spaces within residential complexes of Tehran have been extracted according to the opinions of experts and inhabitants of residential complexes. Finally, the differences and variances between the views of designers and inhabitants of residential complexes as well as the divergence and convergence of the results of quantitative and qualitative methods were compared, while none of the previous researches on residential complexes in Tehran have been carried out in such a way so far, and in none of them, the difference between the views of residents and designers has been addressed in this way.

## 2. SPATIAL-PHYSICAL ASPECT OF VITALITY

The relationship between the environment and the human is complex and multi-dimensional (Tibbalds, 1992, p. 71). Environment plays a decisive role in human behaviors and moods. In built environments, the relationship between vitality and environment is formed through design, reconstruction, construction and maintenance (Appleyard, 1980, p. 106). Vitality is considered as one of the most important characteristics in successful cities (Cowan, 2005, p. 63). Activity continuity in space can be a sign of the vitality of that space (Abdul latip, Shamudin, & Liew, 2009, p. 149). The environmental vitality is a kind of quality indicating the motion and dynamicity of individuals in their habitat (Khasto & Saeedi Rezvani, 2010, p. 44).

Aristotle was the first thinker who considered vitality as a sense of happiness, human well-being and the experience of enjoying a good life. In the current era, vitality includes the areas of positive psychology in which the theoretical literature emphasizes two areas of well-being and pleasure during the recent years. This approach is merely focuses on the amount of enjoyment in space which eliminates suffering. It not only addresses human habits and perfection, but it is also served as a guide to achieve stable happiness and joy (Fordyce, 1997, p. 21).

Considering spatial criteria in environment design, creating a responsive and people-friendly environment is expected (Sarbandari Farahani, Behzadfar, Abbaszadegan, & Alvandipour, 2012, p. 5). According to the abovementioned definition, the following criteria are considered for the assessment of the spatial vitality of an environment:

1. Permeability
2. Diversity
3. Legibility of activity patterns
4. Flexibility
5. Variety

6. Hierarchy
7. Visual appropriateness
8. Differentiation/ Similarity
9. Continuity/ evolution (Lynch, 1998, pp. 118-119).

A great attention should be paid to physical dimension along with other dimensions of spatial vitality as well (Tzonis, 2006, pp. 1-14). Physical vitality refers to traits and characteristics that distinguish the building body from other buildings and reveal its similarity to its counterparts. These traits must be such that they are evolving and finally resulting in the formation of a whole while maintaining temporal continuity. According to Kevin Lynch, the design of a built environment would be useful if it enhances the quality of life by enhancing the quality of the environment (Zarin, Niroomand, & Heidari, 2015, p. 659). The following criteria are considered for the assessment of the physical aspect of vitality:

1. Physical context
2. Legibility
3. Durability (Pakzad, 2006, p. 108).

According to Fritz and Steele, the most important physical factors making the vitality of the environment are including the restoration of place and sense of place, variety of sensory stimuli, creation of public and private arenas, sense of individuality and belonging, sense of recognition and self-respect, sense of trust and confidence, sense of solidarity, conformity with mental images, identity of place, memory-making capability of the place (Fallah Manshadi, Habibi, & Roohi, 2012, p. 50).

### 3. OPEN SPACES OF RESIDENTIAL COMPLEXES

Open spaces are often considered as public and semi-public spaces (Amole, 2009, p. 867). The public spaces

are identified with components such as the accessibility of spaces, the efficiency of spaces, facilities, space design, the physical structure of streets and aesthetic considerations (Maruani & Amit-cohen, 2007, p. 8). Open space is usually described as any part of the land on which there is no structure and only balconies and private courtyards are considered private open spaces (Pasaogullari & Doratli, 2004, p. 226). The main function of open spaces is to meet the recreational and social needs of people; Open space in residential complexes is known as the outermost space of houses and act as a joint for communication with urban space. It is the place of common activities. Nowadays, open spaces in residential complexes are limited to the closed and restricted spaces of balconies, although experts emphasize that the open spaces between residential blocks are spaces for holding meetings, events and encounters (Tzonis, 2006, p. 24). Various studies in the West show the impact of open spaces on increasing the utility of space for residents; among them, Cooper Marcus and Sarmes Yandar (1986) emphasized that the success of residential complexes with medium and high densities has a direct relationship with the positive effect of open spaces between blocks. (Beer, 1983, p. 11). For example, although private spaces with short walls traditionally increase communications between neighbors, they can simultaneously induce a sense of insecurity in residents (Thwaites, 2001, p. 15). Due to the role of open spaces of residential complexes, different countries attempt to make open spaces as the most important arena for the formation of social interactions (Alehashemi, 2015, p. 5) by designing different plans at various scales (Mebirouk, 2005, p. 63). In traditional Iranian architecture, open space is used at two scales (Eusuf, Mohit Eusuf, & Ibrahim, 2014, p. 642).

**Table 1. Extracted Variables for the Physical-Spatial Aspect of Vitality**

Physical-spatial Dimensions of Environmental Vitality	The Factors of Each Criterion $X_1 - X_{19}$	
Physical-spatial Dimensions of Environmental Vitality	- Freedom of Choice, Diversity, Openness, Border Clarity, Contradictory Spaces, Pause, Wonder, and Exploration Spaces.	
	- Transparency and Fluidity of Levels, Axial Consistency of the Spaces, Repetition and Rhythm, Unity	
	- Scale, Weight, Rhythm, Composition	
	- Variety of Sensory Stimuli	
	- Creation of Public and Private Arenas	
	- Sense of Individuality and Belonging	
	- Sense of Recognition and Self-respect	
	- Sense of Trust and Confidence	
	- Conformity with Mental Images	
	- Especial Personality and Identity of Place	
	- Memory-Making Capability of Place	
	- Position and Dimensions of Green Space, Position and Dimensions of Play Grounds, Position and Dimensions of Sitting Places, Provision of Portable Benches for Seating, Increasing the Chance of Choice, Position and Dimensions of Footpaths.	

The Factors of Each Criterion  $X_1 - X_{19}$ 

- Safety in the Playground, Safety Against Vehicles, Observance of Space Hierarchy
- Legibility, Signs, Flexibility, Adaptability
- Avoidance of Large scale Landscaping
- Landscape, Penumbra, Color, Visual richness
- Creating a Subtle Balance and Appropriate Composition in Designing, Creativity
- Masses, Materials, Facade, Quality of Building Structures, Complexity and Variety of the Buildings, Attractiveness and Beauty of the Form, The Absence of Physical Exhaustion of the Building, Definition of the Shells and Identity of the Walls.
- Area of Residential Complex, Area of the Residential Unit's Open Space, Number of Floors of Residential Complex, Differentiation in Physical Elements and Structure of Residential Complex, Absence of Great Level Difference in Spaces.

#### 4. RESEARCH BACKGROUND

In these studies, it was tried to investigate vitality of open spaces, especially open spaces within residential complexes, in domestic and foreign studies over the recent years. What matters is that in the studied articles, a limited number of residential complexes had been investigated, and in none of them, vitality had been investigated regarding their open space pattern and the frequency of the residential units. Also in the studied articles, the factors affecting vitality had not been investigated specifically in one or several dimensions, and they just briefly reviewed.

In their paper entitled "Spatial Explicit Assessment of Urban Vitality Using Multi-Source Data: A Case of Shanghai, China", Yue et al. (2019) investigated urban vitality as an environmental capacity in order to strengthen social activities and create a framework for increasing the capacity of the cities using the dimensions of the built environment, human activities, and human-environmental interaction. The results suggest that in Shanghai, there is vitality in the outer layer of the city center, but around the city center and the old cores of the city, vitality decreases. Also, the results show that in this city, vitality should be increased in three clusters: 1. the old core of the city, 2. Lujiazui CBD, and 3. residential complexes. (Yue, Chen, Zhan, & Liu, 2019, p.1).

In their paper entitled "Vitality of Public Open Space (Case Study: Taman Nostalgia Kupang)", Umbu Nday and Manu (2018) investigated vitality in Taman Nostalgia regarding function quality, physical environment, and meaning. The results show that the vitality has decreased in Taman Nostalgia due to several reasons including: division of the environment into parking space, separation of walkways and motorways, unattractive places, lack of connection of walkways to the parks, allocation of a limited space to sport centers, lack of access to supporting facilities, lack of semantic relations (Umbu Nday & Manu, 2018, p.1).

In a paper entitled "A Framework for Exploring Livable Community in Residential Environment. Case Study: Public Housing in Medan, Indonesia", Aulia (2016) investigated the appearance of places in a residential

complex by applying the grounded theory. In this study, low-income housing, development, and management were the goals, and it was suggested to use the strategy of public housing framework for forming this concept in the society. Moreover, housing planning strategy can be used for designing the place (Aulia, 2016, p. 336).

Mahmoudi Khatybiaee (2015), in her master's thesis entitled "Designing a Vital Residential Complex in Tehran with Achievement to Criteria and Solutions for Vitality in Residential Complexes", attempted to design a vital residential complex by identifying its components in Tehran. Finally, by developing hypotheses and analyzing them, the following result was achieved: creating components such as permeability, diversity, legibility and flexibility, increasing the attendance of residents and children, safety of women and safe access to pedestrian design, leads to increased vitality of residents in the residential complex (Mahmoudi Khatybiaee, 2015, p. 5).

Hajipour (2013), in her master's thesis entitled "The Design of Residential Complexes Consistent with Climate for Residential Vitality Enhancement", attempted to create vitality through the architectural design of residential spaces in order to create more vital residential spaces. The results obtained from the analysis indicated that all three physical, spatial and social-functional indicators were effective in increasing the vitality of space (Hajipour, 2013, p. 27).

#### 5. METHODOLOGY

The present study is applied research which was carried out using a mixed method of triangulation. This research method was applied to identify the discrepancies between the views of designers and residents.

**Triangulation Method:** This method aims to obtain different but complementary data on a problem. The purpose of this project is to combine the strengths and weaknesses of the quantitative and qualitative methods (Mohammadpour, 2011, p. 173).

**Triangulation scheme practices:** A one-step plan simultaneously uses quantitative and qualitative methods with the same weights. This method requires



simultaneous implementation; however, qualitative and quantitative data are collected and analyzed separately. To this end, first, the physical-spatial dimensions of environmental vitality of open spaces within residential complexes are explored using data collection method as semi-structured interviews and qualitative approach. Afterwards, in a quantitative study, according to theoretical literature, the existing factors are extracted and turned into questionnaire with a Likert scale, and the residents are asked to fill out them. At the end, the

data from both methods are merged and the distinctions, divergence and convergence of data are determined.

### 5.1. Qualitative Method

Qualitative method is a systematic approach for deeply describing the life experiences and discovering their meaning based on different methods. According to Mason, qualitative research is an interpretation of social content in which information is created or collected (Mason, 2004, p. 4).

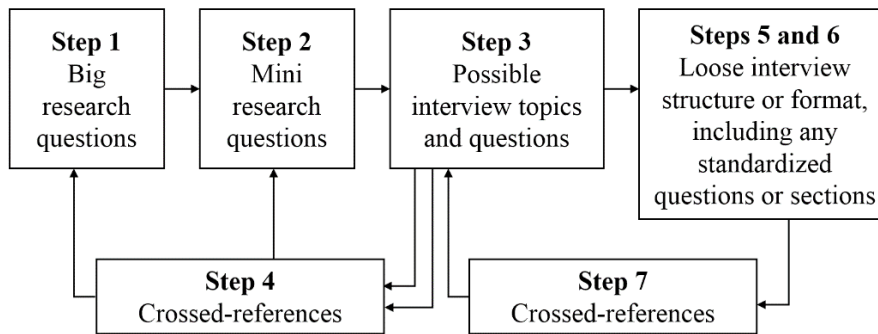


Fig. 1. Planning and Preparing Qualitative Interviews  
(Mason, 2004, p. 72)

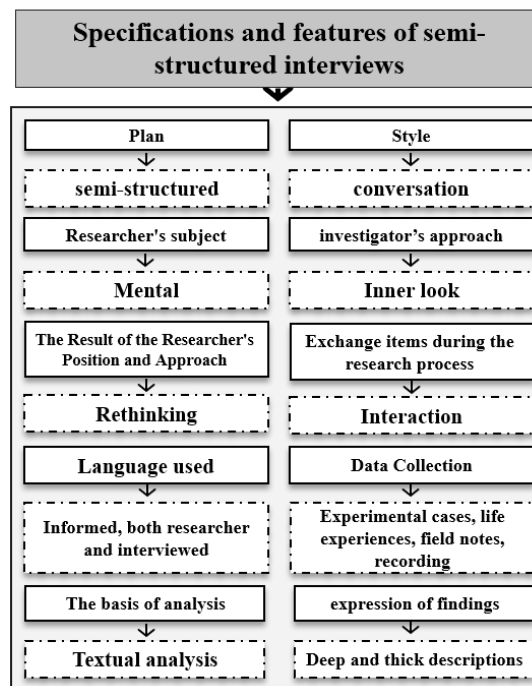


Fig. 2. Characteristics and Properties of Semi-structured Interviews  
(Mohammadpour, 2011, p.173)

In the “qualitative section”, using the grounded theory as well as open and axial coding method, data were obtained from interviews and entered into MAXQDA software. The accuracy and intelligibility of the interview questions were assessed using the pre-test method.

#### 5.1.1. Open Coding

This phase of the grounded theory is done immediately

after the first interview. The stages of open coding include:

- Descriptive coding
- Interpretative coding (Kanji & Asher, 1996, p. 65).

#### A. Descriptive Coding

In this stage, the goal is to identify the parts of the written data that can be useful in investigating the

research question. In descriptive coding, trying to “describe” the important points of the participants’ statements is important, not to “interpret” their meanings. The first step of descriptive coding is to fully read the written text that is to be analyzed. The next step is to specify any useful point in the text that can help us to understand the participants’ viewpoints, experiences, and perceptions of the “research topic”. In the last step, the primary explanations are used to define descriptive codes. These codes should remain close to the data and it should be avoided to think about the probable underlying meanings of the participants’ expressions or to interpret them based on a specific theory. In the present research, after performing the interview, the text of the interviews was fully entered into MAXQDA software.

## B. Interpretive Coding

In this stage, no special theoretical concept should be used in coding, because it will limit our analysis and also, lead to the selection of the only aspects of the data included in our theoretical framework. In the present research, in interpretive coding phase, the descriptive codes generated in the previous stage are integrated by interpreting the meanings of the descriptive codes or by continuously comparing them with each other for several times. So, the clustered descriptive codes are the clusters used for answering the research question. In interpretive coding, more than one interpretative concept may be assigned to a descriptive concept. At the end of the interpretative coding of an interview, the process is applied for the subsequent interviews and the interpretative codes are added or redefined.

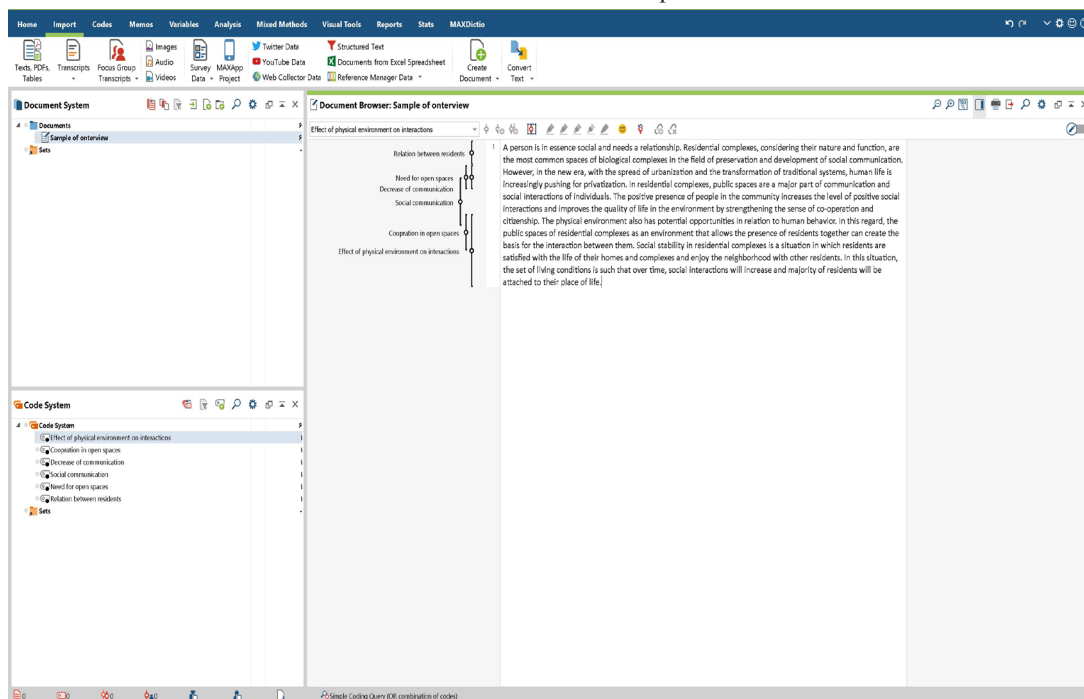


Fig. 3. Interpretive and Descriptive Codes in the Code System (MAXQDA)

Table 2. Interview Questions

Row	Questions
1	In your opinion, which strengths of physical-spatial dimensions of open spaces within residential complexes can contribute to the environmental vitality?
Interview with Experts and Managers of Residential Complexes	Creation of calm□
	Creation of identity and self-scrutiny □
	Provision of security□
	Making of recreation and wellness□
2	Others.....
	In your opinion, which of the following options is the most important problems in the open spaces of these residential complexes which leads to their lack of environmental vitality?
	Pollution□
	Low area of residential complexes□
3	Lack of attractiveness and beauty of form and texture□
	Others .....
	Do you think that creating green spaces could prolong the inhabitants’ lives in the open spaces of the residential complex?
	Yes□
	No□

Row	Questions
4	What do you think of the features of a vital residential complex?
5	In your opinion, how can environmental vitality of the open spaces within the residential complex be achieved at night by providing physical facilities?
6	In your opinion, what physical-spatial factors increase the level of residents' satisfaction with their environment?
7	In your opinion, how can form and architecture of spaces inside and outside the area increase the vitality of open spaces within residential complexes?
8	Which of the following factors, in your opinion, has a more impact on the environmental vitality of the open spaces within residential complexes?  Parks <input type="checkbox"/> Places and sports halls <input type="checkbox"/> Cultural Centers and Libraries <input type="checkbox"/> Cinema <input type="checkbox"/> Cafes and restaurants <input type="checkbox"/> Shopping centers <input type="checkbox"/> Walkway <input type="checkbox"/> Others .....
9	In your opinion, which of ritual/public ceremony in the residential complex could be a source of vitality of open spaces within residential complexes?  National and religious ceremonies <input type="checkbox"/> National and religious celebrations <input type="checkbox"/> Others .....
10	In your opinion, how can we restore the place and strengthen the inhabitants' sense of place and attachment to their habitat?
11	How can we increase the time of walking at night and the security of women in open spaces of residential complex? (explain)
12	In your opinion, is there an adaptation between the experts' design and the inhabitants' mental images?
13	In your opinion, what is the average time spent in open spaces of residential complex?  0-15 <input type="checkbox"/> 15-30 <input type="checkbox"/> 30-45 <input type="checkbox"/> 45-60 <input type="checkbox"/> More than 60 minutes <input type="checkbox"/>
14	What are your solutions for increasing the environmental vitality of open spaces in residential complexes?

Interview with Experts and Managers of Residential Complexes

### 5.1.2. Axial Coding

In this research, axial coding is done using the paradigm pattern. So, the main categories are related to sub-categories according to the paradigm pattern. The main objective of this process is to enable the researcher to systematically analyze the data and correlations. The basis of this process is to connect categories to expand the themes. It should be noted that in the approach used in this study, data were categorized by spatial-physical dimensions. As a result, 12 themes were obtained.

### 5.2. Quantitative Method

In the "quantitative section", the factors and variables in the theoretical literature were extracted and then a questionnaire was developed with Likert scale respecting these variables and distributed among the residents of the residential complexes studied in Tehran. The validity of the questionnaire was estimated 0.71 using the CVI formula for 20 experts. The normal distribution of data was investigated by Kolmogorov-Smirnov test and it was revealed that the data had the normal distribution. Ultimately, the results were

imported into SPSS software, and analyzed. Data dependency was assessed by Pearson correlation test.

### 5.3. Sampling

Due to the use of a mixed research method in the present study, various sampling techniques were used.

#### 5.3.1. Qualitative Sampling

In the qualitative sampling, 9 residential complexes were selected among the 14 most suitable residential complexes, using the Delphi method. To this end, initially, 20 experts, who were totally acquainted with the subject and residential complexes and selected through Snowball method, were asked to score 14 residential complexes, from 1 to 10, in terms of enjoyment of the physical-spatial factors. The complexes with average score of over 5 were selected and again referred to experts to confirm them.

In the next step, 46 experts were interviewed and repeated information was observed in interview No.37 onwards. According to grounded theory, after performing the first interview, the data are collected and analyzed (Rose, 2007, p. 184).

Table 3. Frequency Distribution of Interviewee's Specialty

Interviewees	Frequency (N)	Frequency (%)	Cumulative Percentage
Architectural Professors	16	34.8	34.8
Landscape Architecture Professors	9	19.5	54.3
Professors of Urban Design	12	26.2	80.5
Professors of Urban Planning	9	19.5	100
Total	46	100	-

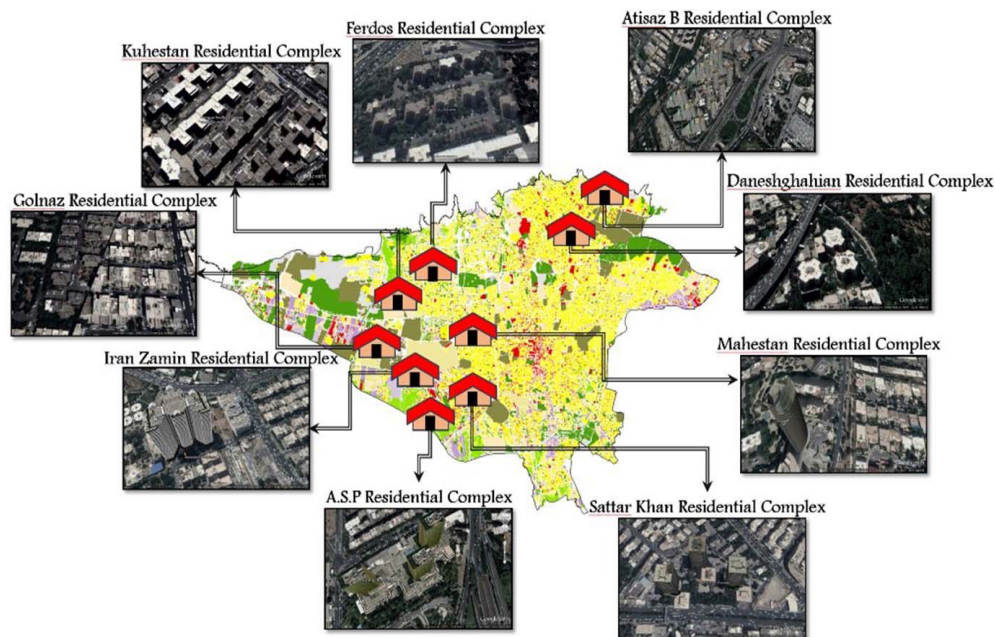


Fig. 4. Desirable Sample of the Population Studied

### 5.3.2. Quantitative Sampling

In the next step, based on the experts and residential managers' opinions and the extracted variables, a closed questionnaire was designed with a five point Likert scale. The questionnaire had questions related to the main research question, i.e. the effect of each of the spatial-physical factors on the environmental vitality of open spaces within residential complexes in Tehran. In order to calculate the scores, the score 5 was attributed to "very high effect" and score 1 was attributed to "very low effect". The questionnaires were randomly

distributed between 376 residents of 14 residential complexes considering men-to-women ratio. This sample size was estimated according to Morgan table. Generally, the residential complexes in Tehran are divided into three groups based on the frequency of the residential units: small scale (less than 216 units), middle scale (217-504 units) and large scale (more than 505 units). Open spaces in residential complexes in Tehran are divided into three main groups, dispersed, linear, and centralized (Einifar & Ghazizadeh, 2010, p. 37).

Table 4. Residential Complexes Interviewed

Open Space Pattern		Number of Units		
		-216	216-504	+505
Height	-6 Linear	Golnaz	Kuhestan	
	7-12 Dispersed	Ferdos	Arghavan	Sadra
	Linear	Nevisandegan	Besat	
	Centralized		Daneshgahian	
	+13 Dispersed		Sattarkhan	AtiSazB
	Centralized	Mahestan	IranZamin	Hafez
				ASP



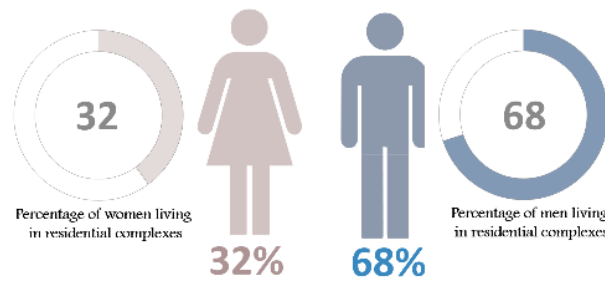


Fig. 5. The Percentage of Women and Men Interviewed

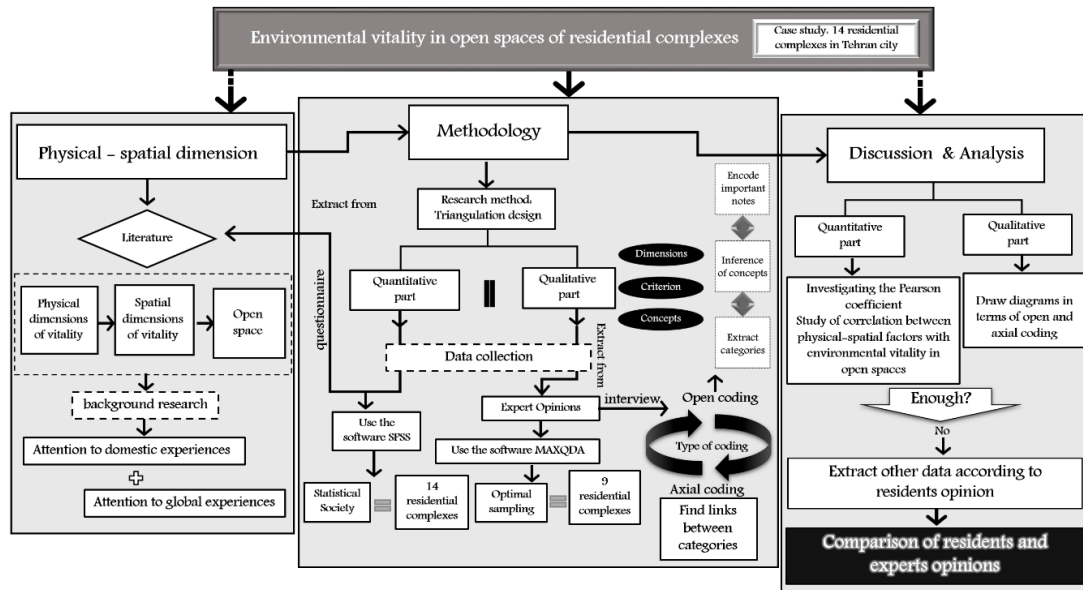


Fig. 6. The Process of Research Method

## 6. FINDINGS

In this section, first, using qualitative methods, the factors affecting vitality are examined and analyzed from the perspective of experts, and then through the questionnaire, the factors affecting vitality from the perspective of residents who have lived experience are discussed with quantitative methods. And finally they are compared to each other.

### 6.1. Qualitative Findings

At this point, the collected data has been reviewed over and over from various perspectives. At this stage, the researcher tries to recognize the latent themes by continuously reviewing the collected data. Finally, after collecting the data from interviews with experts, 38 themes were extracted (Fig. 7). This experience structure is based on the type of meanings derived from positive experience and interconnections of the spatial-physical dimension that shape the essence of environmental vitality.

#### 6.1.1. Physical Dimension of Vitality of Open Spaces within Residential Complexes

During semi-structured interviews with experts,

conceptual codes were extracted. With in-depth examination of them, the main theme of the physical dimension was identified as one of the main fields of environmental vitality. It seems that in open spaces, a residential complex can be formed based on physical characteristics, dynamics of physical environment and the building texture. Therefore, to confirm those theorists who know the environmental vitality due to physical factors, the physical dimension can be considered as one of the main fields strengthening environmental vitality of open spaces within the residential complexes. Also, finding analysis demonstrated the fact that the main theme is influenced by other sub-themes, as listed in figure 7. Some evidence in this regard can be made from the following statements:

“Nowadays, residents and owners are not looking to sell the building, without paying attention to the final operation such as demolition, or the building will be abandoned with the lowest cost, without the design of facade, the volume and the structure,” (Code: Lack of attention to the texture and form of the building).

“One of the problems of residential complexes is that they are very small courtyard, for example Kouhestan Residential Complex” (Code: the area of open spaces in residential complex).

“Despite of informing people on earthquake and education of it in schools, earthquake-resistance standards are not observed in the design of open spaces within residential complexes. Today, those spaces with no exhaustion are considered resistant to earthquake but most of the residential complexes have old texture” (Code: lack of physical exhaustion).

### 6.1.2. The Spatial Dimension of Environmental Vitality of Open Spaces within Residential Complexes

The results of the current study indicated that the spatial dimension can create the environmental vitality through the improvement of legibility, the maintenance and continuity of spatial concepts, the creation of public and private arenas, the sense of individuality and belonging, the sense of recognition and self-respect, sense of trust and confidence, sense of solidarity, conformity with mental images, especial personality and identity of the place, memory-making capability of the place, cohesion of situations. In other words, spatial properties, tranquility, identity and self-scrutiny, security, recreation and well-being should be considered as the main environmental factors in the open spaces of the residential complexes so that there were numerous statements about spatial-physical

dimensions within semi-structured interviews.

“I stepped into one of the complexes, I saw that there were a lot of delusional places and no diversity was observed, and they were all the same” (code: variety, wonder and exploration).

“If some shops are established in the open spaces of residential complexes, residents can meet their various needs and also strangers will be attracted to the complexes to provide their requirements and this increases the vitality in the residential complexes” (code: freedom of choice, diversity and composition).

“To create vitality, a space should be designed as a part of the city and it should be free of pollution and bustle. It should be a calm place with green spaces and also be designed for both residents and strangers...” (Code: complexity and diversity, scale).

From the interviews, 103 first-level codes were extracted without their overlapping. Considering their overlapping for more precise coding and facilitating the research process, 82 first-level codes remained. Subsequently, these codes were compared and categorized based on their similarities and differences. The result of this classification was 67 concepts. Subsequently, these concepts were grouped according to their similarities and differences. The result of this grouping was the production of 38 primary classes in the open coding process.

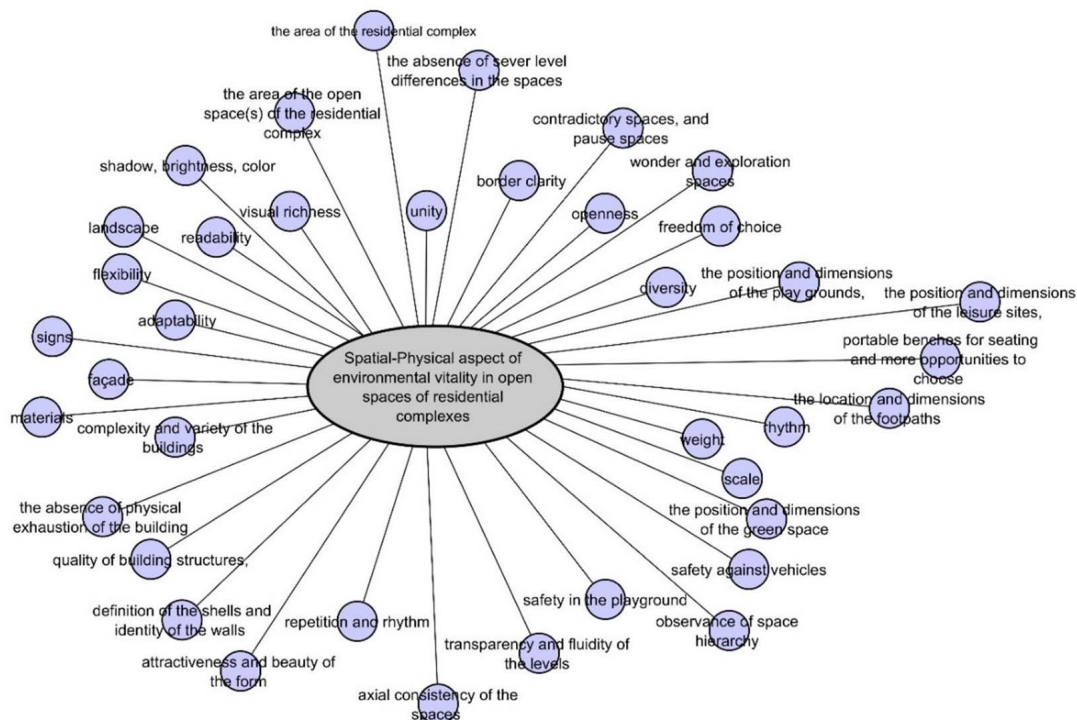


Fig. 7. Conceptual Codes Extracted from Interviews in Open Coding

### 6.2. Axial Coding

In the axial coding, the categories formed in open coding were compared with each other and the relationship with their subcategories was investigated. The same categories were merged. The data became

more abstract. In axial coding, the data cracked in open coding are linked. At this stage of classification, the codes, according to their common features and dimensions, were placed around the main axis to provide the basis for the emergence of the process latent in the

data. In axial coding, categories are systematically developed and connected with their subcategories. For this purpose, all codes were re-examined and those codes with common features were re-categorized. The

main categories were named according to the concepts within it. During this process, 38 concepts in open coding were reduced to 12 axial concepts.

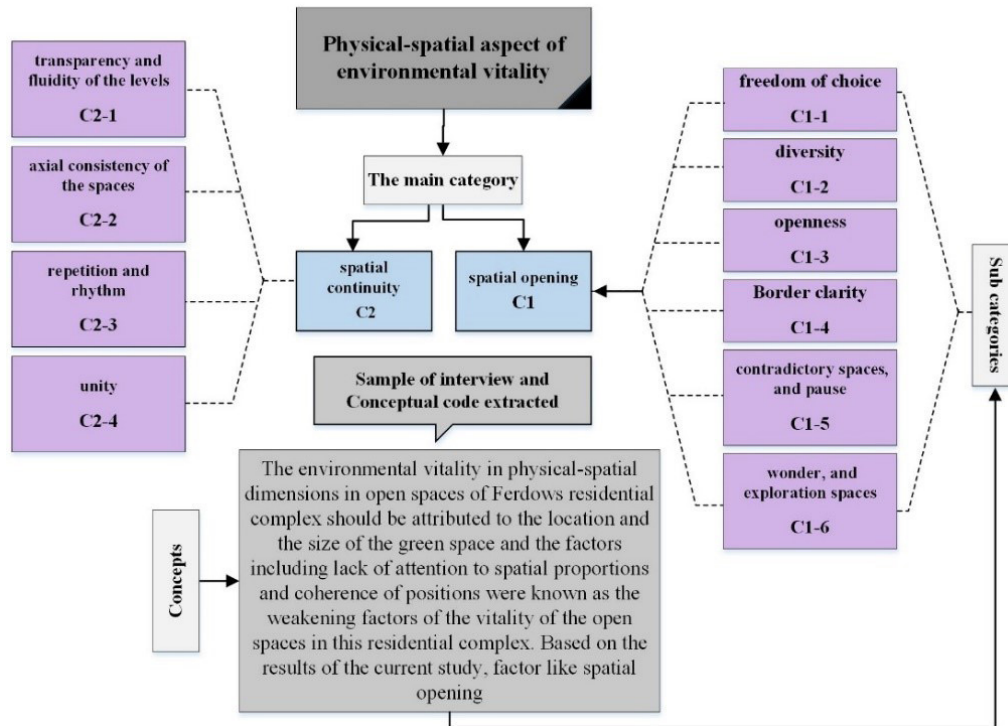


Fig. 8. The Process of Converting Subcategories into Main Categories

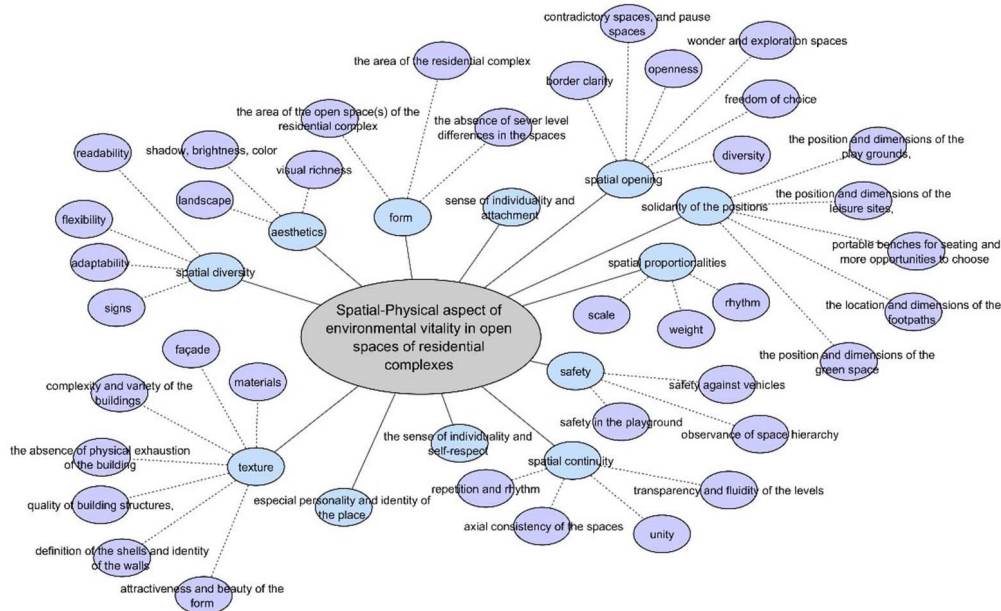


Fig. 9. Physical-spatial Dimensions of Environmental Vitality Using MAXQDA Software

### 6.3. Quantitative Findings

In the next step, using the information extracted from questionnaires filled by the residents of the complexes, the Pearson correlation coefficient was utilized in order to investigate the relationship between

physical-spatial components. Table (5) represents the correlations between physical- spatial components of environmental vitality of open spaces within residential complexes in Tehran. According to Table 5, it is observed that there was a positive relationship between the sense of solidarity and memory-making capability

of place with other components and these variables only had a negative relationship with lack of people-friendliness. This means that as the components of the sense of solidarity and memory-making capability of place are enhanced, other components, except for “the lack of people-friendliness” are enhanced. From

the results of the table, it can be concluded that the greatest correlation was observed between the sense of solidarity and memory-making capability of place with other components, followed by the correlation between sense of individuality and sense of belonging with other components.

**Table 5. The Correlations between Physical and Spatial Dimensions of Environmental Vitality of Open Spaces within Residential Complexes**

	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10	X11	X12	X13	X14	X15	X16	X17	X18	X19
Y1	1																		
Y2	.625	1																	
Y3	.621	.626	1																
Y4	.117	.656	.421	1															
Y5	.224	.487	.214	.356	1														
Y6	.112	.565	.895	-.325	.589**	1													
Y7	.306	.215	.210	.112	.545	.056	1												
Y8	.307	.112	.214	.245	.116	.215	.369*	1											
Y9	.605*	.118	.245	.895**	.215	.026	.352	.568*	1										
Y10	.257*	-.214	.857	.278	.235	.540*	.341	.114	.385	1									
Y11	.730**	.223	.651	.366*	.440	.203	.125	.126	.015	-.321	1								
Y12	.114*	.328	.256	.241	.321	.023	.135	.661	.321	.242	.895	1							
Y13	.225	.754**	.135	.246	.668	.156	.368	.625	.568	.625	.324	.218	1						
Y14	.311	.685*	.331	.397*	.830*	.689**	.654	.840**	-.211	.874	.328	.746	.418	1					
Y15	.456	-.545	.265	.412	.124	.212	.259	.215	.256	.215	.219	.624	.362	.852*	1				
Y16	-.115	.119	.215	.240*	.379	.125*	.203	.368	.329	-.365	.842**	.685*	.214	.326	.688**	1			
Y17	.560**	.325	.119	.366*	.374	.652	.625	.215	.218	.025	.651	.324*	.328	.215	.288	.067	1		
Y18	.040	.021	.698	.018	.731	.365*	.156	.328	.321**	.112	.213	.201	.686	.321	.841	.406	.865	1	
Y19	.116	.045	-.421	.420*	.197*	.456	.365	.302	.316	.369	.201*	.203	.840**	.216	.213	.411	-.321	.344**	1

\*P<0.05 , \*\*P<0.01

After conducting the correlation analysis for the vitality of open spaces in the residential complexes, the results obtained from questionnaires about components and physical and spatial aspects of environmental vitality in the residential complexes, distributed among residents, were analyzed. It should be noted that, the sampling

process was conducted based on the population density of the complexes and the questionnaires were distributed randomly. Table 6 represents the influence of each variable on the open spaces of the complexes and based on the Five-point Likert scale, five most influential variables were emphasized.

**Table 6. Classification of Residential Complexes by the Components Extracted from Research Literature for Each of the Physical-Spatial Dimensions of Environmental Vitality**

The Residential Complex name	Form	Texture	Beauty	Order and Diversity	Avoidance of Decoration	Spatial Diversity	Safety	Cohesion of Situations	Memory-Making Capability of Place	Espeal Personality and Identity of Place	Spatial Openness	Sense of Trust and Confidence	Sense of Recognition and Self-Respect	Sense of Individuality and Belonging	Creation of Public and Private Arenas	Revival of Place Sense of Place	Spatial Proportionalities	spatial Continuity	Sense of Solidarity, Conformity with Mental Images
Ferdos	0.41	0.29	0.28	0.24	0.21	0.53	0.26	0.47	0.31	0.28	0.29	0.26	0.34	0.24	0.31	0.24	0.35	0.37	0.47
Kuhestan	0.51	0.27	0.49	0.22	0.25	0.23	0.47	0.27	0.28	0.31	0.22	0.32	0.34	0.28	0.37	0.21	0.32	0.34	0.23
Daneshgahian	0.31	0.44	0.39	0.28	0.21	0.35	0.53	0.46	0.27	0.54	0.31	0.47	0.37	0.39	0.26	0.32	0.35	0.48	0.49
Satarkhan	0.34	0.37	0.29	0.37	0.31	0.38	0.41	0.38	0.31	0.34	0.29	0.37	0.34	0.23	0.42	0.28	0.39	0.26	0.34
Mahestan	0.29	0.41	0.34	0.26	0.32	0.21	0.53	0.36	0.48	0.28	0.61	0.48	0.51	0.35	0.57	0.23	0.35	0.71	0.62
Iran Zamin	0.37	0.41	0.54	0.59	0.64	0.51	0.46	0.43	0.34	0.48	0.38	0.57	0.46	0.42	0.29	0.26	0.58	0.62	0.72



The Residential Complex name	Form	Texture	Beauty	Order and Diversity	Avoidance of Decoration	Spatial Diversity	Safety	Cohesion of Situations	Memory-Making Capability of Place	Special Personality and Identity of Place	Spatial Openness	Sense of Trust and Confidence	Sense of Recognition and Self-Respect	Sense of Individuality and Belonging	Creation of Public and Private Arenas	Revival of Place Sense of Place	Spatial Proportionalities	Spatial Continuity	Sense of Solidarity, Conformity with Mental Images
Golnaz	0.59	0.46	0.34	0.52	0.38	0.33	0.38	0.36	0.29	0.49	0.27	0.36	0.52	0.46	0.53	0.57	0.36	0.29	0.44
Ati Saz B	0.65	0.59	0.42	0.51	0.39	0.69	0.42	0.73	0.68	0.69	0.53	0.71	0.57	0.62	0.61	0.22	0.38	0.41	0.64
A.S.P	0.41	0.41	0.68	0.43	0.36	0.72	0.34	0.34	0.31	0.41	0.44	0.38	0.39	0.63	0.43	0.46	0.31	0.57	0.55
Besat	0.61	0.47	0.59	0.24	0.27	0.45	0.52	0.27	0.29	0.33	0.39	0.42	0.49	0.35	0.51	0.45	0.41	0.39	0.48
Arghavan	0.45	0.42	0.37	0.37	0.34	0.56	0.36	0.52	0.49	0.47	0.39	0.46	0.18	0.27	0.37	0.28	0.31	0.37	0.34
Sadra	0.57	0.59	0.53	0.55	0.49	0.75	0.57	0.71	0.69	0.62	0.51	0.65	0.48	0.52	0.54	0.60	0.58	0.59	0.53
Nevisandeghan	0.31	0.24	0.34	0.22	0.19	0.17	0.28	0.21	0.18	0.16	0.16	0.13	0.29	0.17	0.25	0.22	0.24	0.16	0.14
Hafez	0.64	0.61	0.68	0.61	0.59	0.73	0.58	0.54	0.51	0.59	0.54	0.53	0.61	0.65	0.57	0.59	0.53	0.62	0.64

Based on the results of the above table, from the perspective of Ferdows residential complex residents, the most effective component was spatial diversity. The reason is that four completely similar complexes in texture and form were constructed besides each other. The linear form of Kuhestan residential complex has led to the decrease of surveillance and security in it and due to the low area of the open spaces, there was no place for sitting and attendance in public space. In Kuhestan residential complex, the most influential factor is the physical factors and texture, followed by other factors of beauty, safety, the creation of public and private arenas, the sense of individuality and the

sense of recognition and self-respect.

Daneshgahian residential complex has a very rich form and texture because of the special personality and identity of place. So, security and sense of trust and confidence are the factors with the greatest effect on the vitality of the open spaces within this residential complex from the residents' perspective.

Sattar Khan residential complex is extremely poor in terms of security because of the robberies and committed crimes. Therefore, from the resident's viewpoint, this residential complex requires to increase the public areas and create spatial diversity (due to the old texture on this complex).



**Fig. 10. SattarKhan Residential Complex, Creating Security in Open Spaces by Increasing the Number of Cameras**

Mahestan residential complex, located in the northernmost and highest point of Qods (Qarb) Town, is one of the complexes made based on the principals of modern urbanism in Iran. Therefore, from the perspective of the residents of this residential complex, the existence of openness and spatial continuity should be considered as the most effective determinants of vitality in this residential complex.

In Iran Zamin residential complex, numerous public amenities, including parks and permanent green spaces, sports complexes, shopping centers, in its open

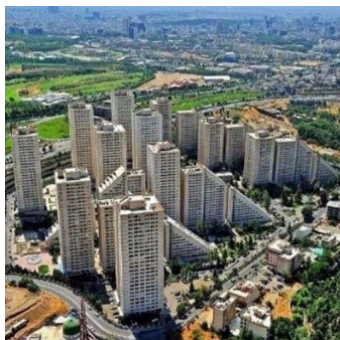
spaces have increased the quality of the complex for its inhabitants.

Golnaz residential complex has a linear form. The facade of this residential complex requires to be reconstructed and renovated so that it can recreate order and diversity. Due to the small area of the residential complexes and their open spaces, the residents demanded the construction of public and private arenas in order to increase the sense of self-respect.

In Atisaz B residential complex, according to its residents, due to the presence of business, educational,

healthcare, cultural centers, factors including cohesion of positions, sense of confidence and trust, especial identity and personality of the place, spatial diversity,

and memory-making capability of the place should be regarded as factors influencing the vitality of this residential complex.



**Fig. 11. Atisaz B Residential Complex, Special Group Design of Building Masses and Personal Balconies for the Residents Due To the Lack of Open Spaces**  
(<https://www.google.com/maps>)

In Atisaz B residential complex, the special group design of building masses and personal balconies for the residents makes it possible to meet families' need to open spaces. Moreover, the dispersed pattern of this complex leads to spatial diversity and various range of public and private territories in open spaces of this

complex.

In A.S.P residential complex, due to the access to amenities and facilities like swimming pools, gyms for men and women, skating fields, young residents prefer to spend their time in the indoor of the residential complex.



**Fig. 12. A.S.P Residential Complex Amenities and Facilities in Open Spaces**  
([www.kikojas.com](http://www.kikojas.com))

Arghavan Residential Complex, due to having facilities such as a swimming pool, has spatial diversity and cohesion of positions. However, in spite of all these facilities, the residents demanded for public spaces in the open space of this complex.

In Sadra Residential Complex, residents mentioned the following reasons for the vitality:

1. Attention to the issues, influenced by the public culture in the design of the residential complex,

2. Creation of gathering places and playground for Children by observing the appropriate distance from residential blocks and riding routes, and the possibility for parent supervision.

3. Creation of green spaces, fountains, bicycle routes, outdoor playground for children and sitting area

Nevisandeghan residential complex is a small, old one full of trees. Most often, some people are chatting under the shade of trees.




**Fig. 13. View of the Open Space in Nevisandeghan Residential Complex**

Besat Residential Complex is comprised of 7 blocks. Despite the high population density, it doesn't have adequate facilities and amenities in its open spaces. Hafez Residential Complex is composed of residential blocks centralized in a part of the land and the

remaining part of it was assigned to open spaces. This complex has a swimming pool, sauna and spa, cinema hall, games room, gym and an auditorium. The residential units are located in two blocks connected by a beautiful corridor.

**Table 7. The Variables Were Studied in Three Steps (Quantitative, Qualitative and Residents of Residential Complex)**

Parts		Variables			
Qualitative Part	Use of Textual Themes	+	Use of Conceptual Labels	+	Narrative Qualitative Data
	Form	Spatial Diversity Safety Cohesion of Situations	Especial Personality and Identity of Place	Sense of Recognition and Self-Respect	Sense of Individuality and Belonging
	Texture				
	Beauty				
		Spatial Proportionalities Spatial Continuity Spatial Openness			
Parts		Variables			
Quantitative Part	Collection of Data From the Statistical Population	+	Control of Case Study Context	+	Standardization of Measurements on a Regular Basis Prior to Data Collection
	Form	Spatial Diversity Safety Cohesion of Situations Memory-making Capability of Place Especial Personality and Identity of Place Sense of Solidarity, Conformity with Mental Images Sense of Trust and Confidence Sense of Recognition and Self-respect Sense of Individuality and Belonging Creation of Public and Private Arenas Revival of Place Sense of Place Spatial Proportionality Spatial Continuity Spatial Openness	→ Data From Residents' Views ←	Sense of Individuality and Belonging Creation of Public and Private Arenas Revival of Place Sense of Place Spatial Proportionality Spatial Continuity Spatial Openness	
	Texture				
Beauty					
Indicators Added by Residents	Spaces with Sports Equipment	Environmental Monitoring  Eventfulness The Spacing of Building Blocks From Each Other The Degree of Environmental Mastery Dynamics in Space Stability and Self-sufficiency Urban Development			
	Sense of Navigation				
	Gathering				

## 7. CONCLUSION

The open coding of interviews resulted in 38 components of environmental vitality of open spaces in residential complexes. After comparing categories formed in open coding and investigating the relationship between them and their sub-categories, 38 components were reduced to 12 axial components. The indicators enhancing vitality in open spaces of residential complexes, from experts' point of view, were examined by open and axial coding. In fact, according to their experts, these 12 components are of great importance for spatially and physically enhancing the dimensions of vitality of open spaces in residential complexes. But, they did not have comprehensive view on how the variables are related,

the intensity and type of relationship, and the impact of variables on each other. This is while experts need to have a good understanding of this area to design a suitable space for fulfilling the vitality of the inhabitants because the accurate design will provide health to the inhabitants in the living space automatically.

However, in order to achieve reliable results that are the basis for planning and decision-making on physical and environmental interventions in residential environments, it is required to use those environmental quality assessment approaches that are based on assessing the inhabitants' views on the different aspects of their residential environment, because paying attention to factors affecting environmental vitality of

open spaces from the inhabitants' views, can be helpful to analyze the existing residential situation, make future decisions to improve the quality of residential areas and to avoid repeating the failures in other places. Therefore, the variables extracted from the theoretical foundations were put in the form of a questionnaire. These variables included 19 concepts, some of which were similar to experts' opinions. The questionnaires were distributed randomly among residents.

The results of the correlation analysis indicated that the most important factor affecting the vitality of open spaces within residential complexes are the "sense of solidarity" and "memory-making capability of place" factors which were the only factors mentioned as influential factors on vitality for some complexes. These factors are of the concepts that have been neglected by experts.

According to the results from table 5, it was found that the greatest correlation was observed between the sense of solidarity and memory-making capability of place with other components, followed by the correlation between sense of individuality and sense of belonging with other components. Although the component of "sense of individuality and belonging" was of factors mentioned by experts, the most influential components, i.e. the sense of solidarity and memory-making capability of place, were ignored by them, which results in social isolation among the residential and urban complexes in terms of social cohesion.

The lack of attention to the inhabitants' views causes a lack of attention to the concept of residential units as the center of human solidarity, with the social and biological structure, worldview, social and psychological needs, the requirements of individuals and groups, the combination of environment and climate, materials and technology, and leads to dogmatic attitudes in formulating the form and physic. The inhabitants' view is more precise due to

their biological experience and comprehensive picture of what is happening in their open spaces. Moreover, the reflections received from the open space of their residential complex helps the accumulation of mental experience resulting in a specific cognition of their habitat and, consequently, finding it as an epistemic basis for shaping urban behavior.

At the last step, according to an open question at the end of the questionnaire, the researchers concluded that there were other variables affecting the environmental vitality from the inhabitants' view, such as:

Stability and self-sufficiency, dynamics in space, the degree of environmental mastery, the spacing of building blocks from each other, eventfulness, environmental monitoring, gathering, sense of navigation, spaces with sports equipment.

Overall, benefitting from the components in urban planning and interventions, the vitality of open spaces in residential complexes in Tehran can be enhanced by considering open space as a gathering place as well as a place to meet individuals' needs in today's urban spaces. The other concepts obtained in the present study were the components residential complexes with various open space patterns were common in them. According to the research findings, residential complexes with dispersed pattern (i.e. Ferdows, Atisaz B, Arghavan, Sattar Khan and Sadra residential complexes) were common in two components of cohesion of situations and spatial diversity, residential complexes with centralized pattern (i.e. Daneshgahian, Mahestan, Iran Zamin, ASP and Hafez residential complexes) in two components of spatial continuity and openness and residential complexes with linear pattern (i.e. Kouhestan, Golnaz, Nevisandegan and Besat) in four components of form, order and diversity, the sense of recognition and self-respect as well as the creation of public and private arenas.

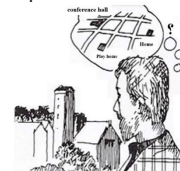
**Table 8. Suggested Solutions for Creating Vitality in the Physical-Spatial Dimension in Open Spaces of Residential Complex**

The spaces should be designed in a hierarchy



Physical characteristics for citizens' perception of environment:

1. Has the necessary clarity and legibility
2. Provide a good perception of the environment beauty



The tactile and visual clues can be used to find the path in open spaces.



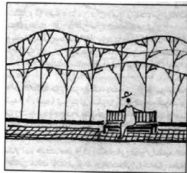
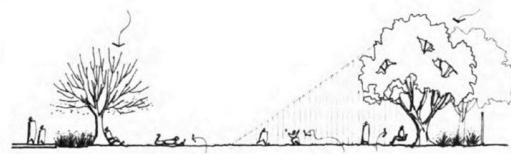
Creating indoor spaces with sitting places in open spaces provides more space for use.



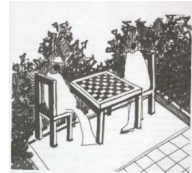
Those plants planted in a kindergarten area should make shade in summer, but allow the light to pass through the winter.

Winter

Summer

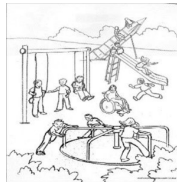


The walkways provide a good place to sit, with spectacular views and possibility of seeing active areas.



In the green areas of the residential complexes, some spaces should be considered for exercising and walking.

Some spaces should be considered for children to play and also their parents.



Some provisions should be considered for low-ability people



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