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Investigating the Role of Spatial Diversity in Selecting Behavioral Patterns of Public Territory (A Case Study: Zanjan's Pedestrian Zone)

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ABSTRACT

Public territory in cities has always served as a platform for the embodiment of behavioral patterns and interactive human actions in the environment. The qualitative method used in this study is behavioral observation, a modern approach to environmental design and the analysis of public territory, and a method to understand the mutual relationship between people and spaces. The main goal of this study was to investigate conditions in which spatial diversity could help form specific behavioral patterns inside the public territories. The main study question is: "Which behavioral patterns prevail in the areas under study based on space diversity? And how much do environmental factors contribute to space users' satisfaction? This method was investigated in sample Zanjan's pedestrian zone, the starting point of the city's main historical and commercial routes, subjected to degradation and transformation. The present study was applied and carried out in a survey form. The survey strategy was used to validate the study findings. Views obtained from 50 interviewees led to the extraction of some components constituting the reasons behind visiting a space. Zanjan's pedestrian zone faces a reduced volume of static activity and behavioral patterns in the mid-hours of the day, with the highest volume of traffic taking place from 4 p.m. to 9 p.m. On the other hand, a review of questionnaires on revisiting the space led to the identification of such factors as access to occupations, shopping, spending leisure, and finally, interactions.

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1. Introduction

A public territory refers to data, information, and artificially made knowledge of humans. These three elements are represented by experiential signs (i.e., signs by which the individual can feel via their senses). These signs can take different shapes, including carving signs, painting forms, printed words, digital signs, light rays, waves, voice, etc. Public data, public information, and public knowledge reflect their second cognitive replicas. In the objective domain of data, meaning refers to several signs that represent experiential stimuli and perceptions. Information or data refers to several signs that represent experiential knowledge. Knowledge also refers to a series of signs that represent meaning (or content), or thoughts that the individual justifiably maintains are true. A public territory not only involves social and cultural values but also provides a platform for urban activities and relevant necessities. Public territory indicates the quality of life and lays the ground for the establishment of interactions and the formation of behavioral dimensions in the collective spaces. Over the last few years, research on behavioral patterns in the public territory has increasingly attracted the attention of urban practitioners for new development and intervention measures. One of these methods that can be suggested investigates behavioral patterns and the way people interact with their surrounding environment. This method, which falls under behavioral observation, investigates and records spatial qualities (structural-environmental), activity patterns, and behavioral components to provide a reliable analysis of urban activities in public territories. Much research has been conducted on public territory behavior patterns, an example of which is Jacobs' study in 1960, which critically investigates the type of space structures. Later, other researchers such as John White, Jan Gehl, Altman, Sommer, Audrey, etc., worked in this area.

Conducting a study on Zanjan's zone territory is significant because this space was once a starting point of one of the main routes of the city's historical and cultural fabric; however, considering developments made at the northern angle (which pertains to the Sabze Meidan project) around the pedestrian zone, and the

site's location in the adjacency of one of the communication-commercial routes of the city, i.e., Sa'di Vasat, previous activity patterns have been rapidly transformed despite the not so long age of the pedestrian zone. On the other hand, this space still maintains its walking capacities in different desirable spatial dimensions to improve its environmental qualities, and these capacities increase with the completion of Sabze Meidan Square. For this, the aim of the upcoming research is to investigate the application of the behavioral observation method, simultaneously, on the one hand, to the activity patterns and environmental behaviors that spatial-environmental conditions cause their formation, and also to answer the question that different spaces What are the effects of different spaces on the stability and dynamics of people in the space? And on the other hand, to examine and analyze the environmental qualities and satisfaction of the users of the space, who have a greater contribution in attracting the public.

2. Literature Review

Urban planners have emphasized the necessity of spatial diversity and diversity and have considered spatial diversity as one of the most important components of a good human settlement among the various qualities raised in the urban space. As Montgomery believes, the simple truth that exists in the combination and diversity of space and activities and not separate uses is the key to achieving successful urban spaces. Moreover, Smith basically defines the concept of quality in urban space based on the concept of variety (variety-choice and interest). It should be noted that the concepts and theories that have been proposed due to the existence of spatial diversity can be organized into 4 main categories: place vitality, healthy economy, social equality and sustainability, in other words, diverse spaces are lively spaces with a healthy economy. Social equality and sustainable. Examining each of these concepts can be the subject of future research in this field. But about the second concept, which is the behavioral patterns of public domains. Most studies conducted in this regard pertain to field observations and the recording of human behaviors in the environment. Research

has shown that the need for individual territory is a basic need for the evolution of human thinking, and the need for public spaces is for the completion of this evolution, and the thematic expansion of collective thinking. This discussion is mainly based on Maslow's theories; in other words, Maslow introduces types of needs, which include basics needs, collective communication needs, and individual territories (Sarei and Hajforoush, 2019, p. 11). However, as regards the concept of territory, the following can be suggested (Table 1). Behavioral studies in public realms have been seriously considered since the early 1960s. For the first time, Marta Mucho (1966) used observation-based methodology to study the living space of children in the city of Hamburg,

Germany. In the field of urban design and public realms, researchers such as Jane Jacobs (1962), Kevin Lynch (1960-1984), William White (1980), Claire and Francis Markus (1998) and Jan Goll (1996-2000) believed that urban design should be based on "the study of what people actually experience and use the urban environment". This type of view needed a tool to be implemented. Therefore, observation, as a method that with limited time allocation, had the possibility of achieving desirable results in showing the actual use of public territories, was noticed. A number of other researches have sought to improve the conditions of territories and public spaces by using behavioral patterns. In this research, behavioral patterns have been considered as the

Table 1: Theories on spatial diversity and its relation with the formation of behavioral patterns in the public territories (Mohammadi et al., 2018; Uskouei et al., 2017).

Theorist	Year	Study basics
De long	1973	Territoriality in the public territories in social relations
Irwin	1975	Primary territory (individual, semi-individual), secondary territory (friendly and familial), public territory
Altman	1975	Personal territory and the effects of mental comfort on individual territories, and meeting this thinking in collective spaces
Roger	1975	Delimiting boundaries based on the context and the environment (e.g., prison, training-administrative centers, recreational ceres, etc.)
Douglas Porteous	1977	Personal territories (relying on house and accessible by house)
Oldenburg	1980	Primary and secondary territories (a space for identification and a space for mental satisfaction in social interactions)
Groepat	1985	The hierarchy of desirable territories and its significance in urban space designs
Lang	1987	Personal territories and mechanisms to serve people and to meet a mental space, and the formation of personal identity, introspection, and behavioral patterns
Oldenburg	1989	Emphasis on public areas as the third realm of people
Sommer	1990	Personal space and mental comfort in individual territories
Tavassoli	1990	The concept of territory in residential units in the form of single- and multi-units, a neighborhood, and an alley
Bahraini, Taj Bakhsh	1998	Qualitative indicators affecting public territories in urban spaces
Eini Fur	2000	The conceptualization of internal and external links in the structural system of territory for each person
Mortazavi	2001	Territoriality behaviors, social order stability, and the avoidance of aggression and oppression
Mike Biddulph	2007	Determining territory based on the type of spatial organization, and the number of people in urban spaces
Ricky Burdette, Diane Sudjek	2008	Emphasis on the study of behavior in public spaces
Hossein Al-Sharkawi	2013	Categorizing territories in peripheral, protective, central, and continuous frameworks
Richard Sennet	2020	The formation of the concept of spatial openness in different dimensions, and the creation of specifical kinetic behaviors in space

main factor in the formation and improvement of the state of urban spaces. In the studies he conducted in 1962, Thiel invented a method called “space measurement and counting”. In this method, he organized the body shapes that a person perceives while moving by changing his speed and direction. Thiel method, which is considered to be one of the most complete and complex methods, is used to record and analyze the characteristics of pedestrian spaces and low speed, the most important advantage of this method is its analytical nature. His main goal of these studies was to find conventional signs that can be used to identify and show all the characteristics of the space, such as crowdedness or solitude and other things. In other words, he sought to create a common language for designers. Although Thiel is considered one of the pioneers of behaviorism, “Donald Appleyard” is known as the founder of behavioral visual studies, who in 1964, in collaboration with Kevin Lynch and John Meyer, conducted the first visual-visual research at the city scale. The result of their studies was published in the book “View of the Road”. In Table 1, a number of ideas raised in previous researches that are related to the concepts expressed in our research are mentioned.

According to the literature review, both individual and public territories affect the formation of optimal behavior. In line with its subject, this study aims to investigate most public territories, along with relevant behavioral patterns. Here, theories by scholars such as Oldenburg, De Long, Jon Gehl, etc., about the subject in question are studied.

3. Conceptual Framework of the Research

This section concerns the keywords of the study and relevant components for evaluation. Thus, it describes basic concepts to provide an appropriate understanding of the main frameworks of the study.

3.1. Spatial Diversity

The term diversity includes various senses in urban literature. This concept, for urban planners, refers to a mixture of apartments with a variety of land uses. For planners, it suggests a variety of land uses and the heterogeneity of ethnic-

racial groups. The latter is more acceptable to sociologists and cultural analysts. Some authors concentrate on one of these interpretations; however, many people consider each of these senses as related to the other, though there is no agreement over their cause-and-effect relations (Acerro, 2015, p. 25).

In his 1961 book, Jacobs addresses the issue of land use diversity in the urban space. In this book, he introduces the success of urban neighborhood units to be dependent on providing a variety of urban land uses, arguing that urban security, stability, public interaction, etc., depend on the complete desirability of diverse land uses (Jacobs, 2017, p. 21). By diversity, he means activity dimensions and uses functions, as he concluded that diversity is a factor that affects behavioral patterns under social environments.

In another study by Jabbareenn, diversity is defined to be a multi-dimensional and general phenomenon. Here, he presents an optimal and more desirable composition of the city that includes types of housing (single-, and multi-household, apartment, etc.), apartment density, household dimension, age and income, and a mix of land uses. In other words, diversity is a general principle that represents social-cultural, and structural composition (Jabareen, 2022, p. 3).

It is concluded that diversity refers to a type of environmental structures that can leave a direct impact on the landscape, behavior, environment, structure, etc. This study deals with special behavioral patterns under the diversity prevailing over the studies space. These patterns tend to be dependent on the conditions governing the space structure.

3.2. Behavioral Patterns

Behavior refers to a conduct done by an individual, or to words uttered by him. Behavior originates from an individual's interpretations and perspectives about an artificially social environment (Altman, 2013, p. 24). Behavioral patterns arise from the culture, beliefs, habits, living environment, rules governing over society, and individual characteristics, with each alone, or in combination with others, justify peoples' different behaviors. However, different behavioral patterns require specific environments

(Abbaszadegan, 2015, p. 23). Scholars divide behavioral patterns into various categories as follows:

3.2.1. Living Behavioral Patterns

These patterns leave significant impacts on peoples' behaviors. These patterns effectively work to transfer self-control criteria under obsessive conditions, and together with transferring desirable behaviors, they can transfer criminal conducts, also.

3.2.2. Oral Behavioral Patterns

Oral behaviors such as vilification, lying, and scurrility are oral behaviors (Bierhof, 2018a, 2018b).

3.2.3. External Behavioral Patterns

These patterns are characterized by being observable, abundant, shared by many people, involving social content, etc. These behaviors are divided into customary and formal forms (Shami, 2018, p. 20).

3.2.4. Internal Behavioral Patterns

They do not only refer to appearance or forms; rather they are also used as lessons. People do not just act similarly; rather they think similarly, also. Hence, similar manners of thinking, believing, and feeling, although uniform and repetitive, are not directly observed, while inferred from peoples' behaviors and individual inference (Shami, 2018, p. 23).

3.2.5. Behaviors in urban space

In different urban environments, people and homogeneous groups of citizens show different behaviors according to their goals. According to Chapin and Brill, each person's activity in space is subject to the spatial pattern of his activity system. The activity system is actually the flow of activity during a specific time to achieve a specific goal. In the activity system, a person shows a unit of behavior which is known as an episode in a specific place. Based on this, David Havilaneh proposes and Roger Barker, the creator of "activity space", the term of ecological psychology, introduces the term "behavioral settlement"

(Kamor Shlamani and Hanachi, 2014: 52). Barker explains behavioral patterns in a way related to the physical location of the same behavior. By observing the behavior of people outside the laboratory and in the real environment of the city, Barker found various behavioral camps of the artificial environment, from a building to a city, in addition to aesthetic purposes, in order to provide the behavioral environment of interested people in the environment (activity space or behavioral camp)) he pays attention. According to Barker's theory, behavioral accommodation refers to a space that is related to two sets of elements: psychological elements and non-psychological elements. According to Barker, the psychological element refers to a specific form of behavior and the non-psychological element includes material things that facilitate the occurrence of certain behaviors. It has been observed that the probability of occurrence of a certain behavior in a specific behavior camp is higher than the probability of occurrence of another behavior. Such a possibility of behavior is directly related to our understanding of the identity of the place (Khatibi, 2012,p.67).

The key point in this study does not concern the psychology of the environment; but rather behavioral patterns whose formation is emphasized by spatial diversity. According to a theory by Richard Sennet, some environmental components help form specific behavioral patterns. According to his theory, patterns that are imposed on the individual(s) in the public territories can affect the formation of movement paths, static and dynamic spaces, or spaces that are aimed at social interactions, with each falling under behavioral patterns (Sennett, 2020, p. 45). Thus, considering the environmental structure of the area under study and diversity prevailing over it, this study concerns external behavioral patterns that can be, based on the Sennet's theory, divided into movement spaces or paths, static and dynamic places, pause places, shading, etc., with each component falling under components affecting presence in space. Based on what was discussed about behavioral patterns, the diagram1 is presented as a conceptual model of this section.

3.3. Public Patterns

Territory refers to an enclosed space that is used and defended by individual(s) as a special boundary. Territory has a psychological identity when combined with a place, and is symbolically represented by the sense of ownership and structural composition (Pastalan, 2007). The concept of territory is not just a spatial one; rather it is a social phenomenon. Territory can be considered the location and place of a community in the space (Lawson, 2012, p. 31). It should be stated that many special behaviors also involve various territorial aspects that should be spatially defined and changed based on places. Territory serves as a key instrument for a transition from a simple space that can be recognized as a supportive mechanism for the main life needs like identity, motivation, and security. According to theories by Aurdrey, the territory is an element of the main needs of most creatures (Lawson, 2012, p. 39). Therefore, one would claim that territory plays a key role in human life, which helps organize the surrounding space and give it individual or collective identity (Roberts, 2020, p. 4).

Public areas are urban social spaces that can be used and accessed by all people. These spaces provide the basis for the formation of cultural, religious, political, commercial interactions and gatherings or even personal activities. The public

domain represents the quality of life, urban culture and daily interactions of people. Cremona considers the public realm an optional environment: "All people need to use public realms." But they are free to choose which part of the space they use the most."

Ma intrinsically determines various spatial territories in his life environment. These territories principally vary by time and space. A territory can be owned by an individual or a group of people for a short or long period. Meanwhile, according to Altman's theory, the territory is divided into three primary, secondary, and public categories, when owned by an individual or a group of individuals (Altman, 2013, p. 27). A more developed theory comes from Shahcheraghi who stated that territory could be divided into nine categories, three of which fall under full ownership, and the remaining under relative and sensory ownership. Figure 1 gives a summary of spatial territories.

In the Figure 1, territories intended by the study are described as the public territories; public territories such as walkways (pedestrian zones), parks, collective spaces, etc., are called temporary territories, and anyone has the right to use them. These types of territories are also known as free, public and temporary, or voluntary territories. It is the typology of group possession of places and free possession of places that distinguishes these two public territories. In the free possession of

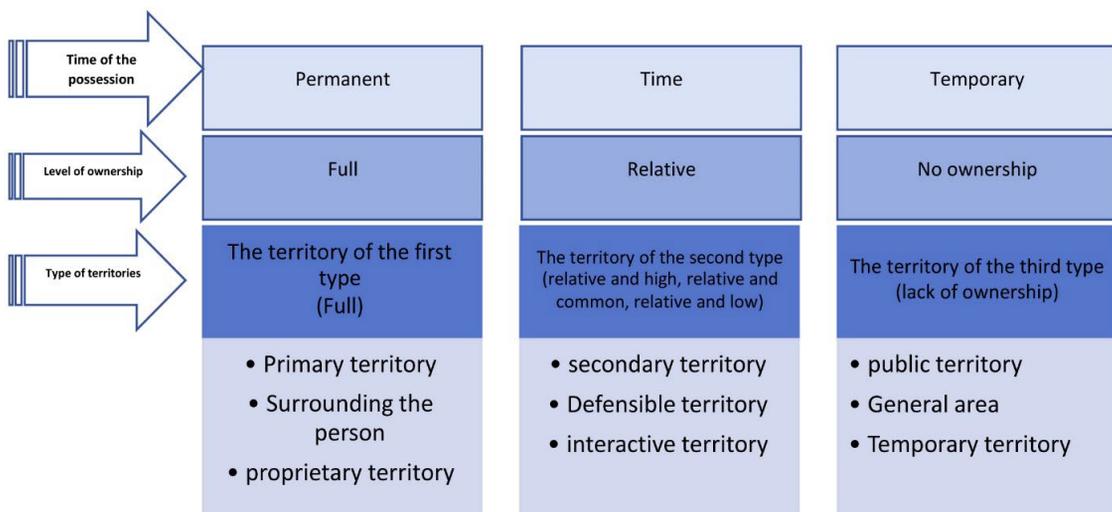


Fig. 1: Types of spatial territories (Source: Bandarabad and Shahcheraghi, 2015)

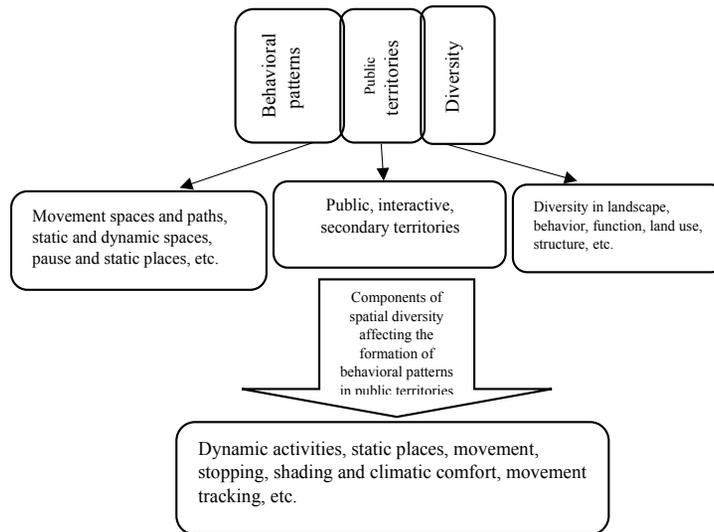


Fig. 2: Conceptual framework of the study

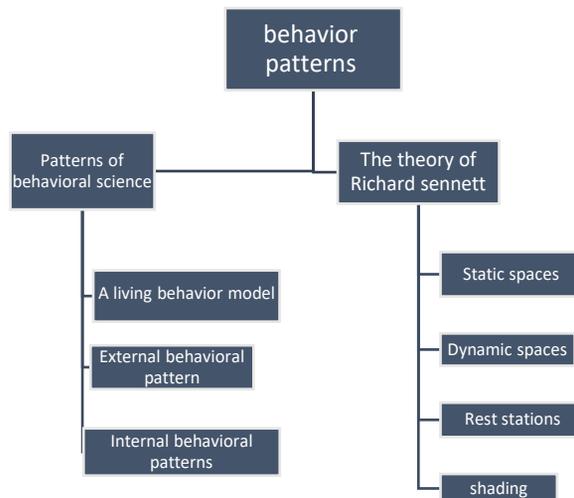


Diagram 1: Conceptual model of behavioral patterns

places, such as streets and parks, there is no restriction unless laws are complied with (Baver, 1965).

In these spaces, territory takes on a new meaning under the influence of such components as perception and a combination of values and attitudes, subjective perceptions, and the dominating culture (Ziari et al., 2017). Thus, in general, territories can be divided into several

categories based on conditions, and according to the present study, public territories refer to spaces that are subjectively owned by individuals for not so long, and these conditions depend on delimiting territories based on the type of social-environmental factors. Below, two more components affecting public territories are addressed. In the end, these components in the area under study are measured. Designers of the

public areas are responsible for meeting the needs of people using the space. If the preference, desire and perception of the users are not taken into account in the design and organization of urban spaces, then there is a possibility of failure of the plan or reduction of the environmental quality of the space (Sholeh, 2017, p46).

Activity patterns and environmental behaviors affected by spatial-environmental conditions, the environment and behavior and their constitutive relationship as the most important component of the behavioral camp and consequently the most important component of the built environment is very important in examining built environments from a behavioral perspective and designing the environment with a behavioral approach. By examining several sources that examine built environments with different approaches, from anthropological to cultural and indigenous, it is clear that paying attention to structures and other components of the behavioral camp is very important in designing with any approach. This is why Barker expresses that despite the difference in satisfactions, a behavioral position enables a person to reach satisfaction (Latifi and Sajjadzadeh, 2013: 10).

Every human show behavior in different times in different environments, depending on the type of environment capabilities and dominant behavior, his behavior can be different in various places and in effective environments that he is placed in based on his own choice. The relationship states that the capabilities of the effective environment may be different for different people. The result of the differences is that the design can facilitate some behaviors and hinder some other behaviors, the design is based on the daily needs of people and not the beautiful wishes of the designers. This design not only causes face-to-face interactions, but its positive dimension, which facilitates and enables healthy citizenship behaviors, is superior to its negative dimension, and people's voluntary behaviors are formed in the best way based on the capabilities of the environment, and a two-way relationship includes the relationship between behavior and the physical environment, and this relationship can form the behavioral positions that are the basis and unit for defining the environment.

As a person grows and has a personality, the environment affects him and he affects the environment. Environmental psychologists and especially ecological psychologists in the relationship between the environment and everyday behavior have been able to create a combination of behavior and the key to a suitable answer to the wishes and needs of people in life and maintain the importance of urban spaces and their prosperity (Khormian Ghafarakhi, 2022, p 13).

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4. Materials and Methods

This study falls under applied research and analyzes and evaluates the components. Using the observational method, data in this study analyze the environment; the observational method is a subset of qualitative methods which, to Barker, is a special activity that is not naturally provided to many people. Observation differs from the evaluation suggesting what is good or bad, why something has happened, and a report summary. Therefore, observational methods require training for environmental interpretations (Barker et al., 2019, p. 31). As stated, one of the major points to be considered in the observational method is the description of something as it is, in a way to make someone, who has not seen a specific space, almost get to know how it looks like and what structure it has. This method involves no bias. Here, using the observational and experiential method of space, maps and outputs of behavioral patterns in the environment are first analyzed. In this connection, effective environmental factors such as shading, the static and pause places of space, land uses, and the spatial diversity of the areas are taken into account; in the next stage, information layers of environmental-structural components, activity, and behavioral patterns, as well as parts of space that are most used by users and involve activities at various time intervals, are compared. Similarly, other parts of space that receive less attention are determined. In the quantitative section that pertains to the subjective dimension of the visitors of space, the collaborative method is used to randomly interview 50 people in the space about the reasons why they have (or have not) selected the space, and about the quality of the pedestrian zone, with the views recorded. As

a result, considering the subjective goal of the visitors, and the reason behind selecting a special part of space for an intended activity, design and planning principles and guidelines were introduced. Meanwhile, the current conditions of the area under study were evaluated.

5. Results and Discussion

5.1. Area under Study and Analysis of Behavioral Patterns in Public and Collective Territories of the Area under Study

Zanjan is the provincial capital of Zanjan Province and a city of this name, which is located in northwestern of Iran. According to statistics, this city had a population of 430,871 people in 2016 (Iran's Statistics Center, 2016). It is also the twentieth city in the country in terms of population. The area under study is a commercial-historical area of the city, which has been transforming into a walkway in the last two decades. This issue was a key issue in the Sabze Meidan projects. Over the last several years, it has become a pedestrian zone. As seen from the following map, the location of the area under study in the city is as Fig. 3.

According to the 2016 Census, some 4689 people used this pedestrian zone daily, with the average number of women, men, children, and the elderly visiting it amounting to 1924, 2012,

538, and 215 people, respectively. As clear from the figures obtained from the area, young women and men were the highest users of the space; however, all groups did use this space for various affairs throughout the day.

As explained above, the type of environment structure that determines behavioral patterns in space is studied. Reviews conducted pertain to the dynamic activities of the area, the number of static and sitting activities, the climatic comfort of the space, and in the end, the effect of the above factors on the volume of traffic.

5.2. Behavioral Interpretations of Static Activities

Static activities in the studied area are divided into two general categories of standing and sitting activities. Activity interpretation in this section aims to answer the question: "Why and where has a presence in the space been provided for the user? The latter (where) refers to the location of the activity, while the former (why) relates to the distinction of the goals of presence in the space for a special activity, which is answered due to sitting or pausing in the space. The relevant map serves as an aerial image of the area under study wherein the time of pause is pinpointed. Thus, static activities in this area at the time intervals of the morning, noon, and afternoon are as Fig. 6.

As shown in Fig. 6. image, most of the static

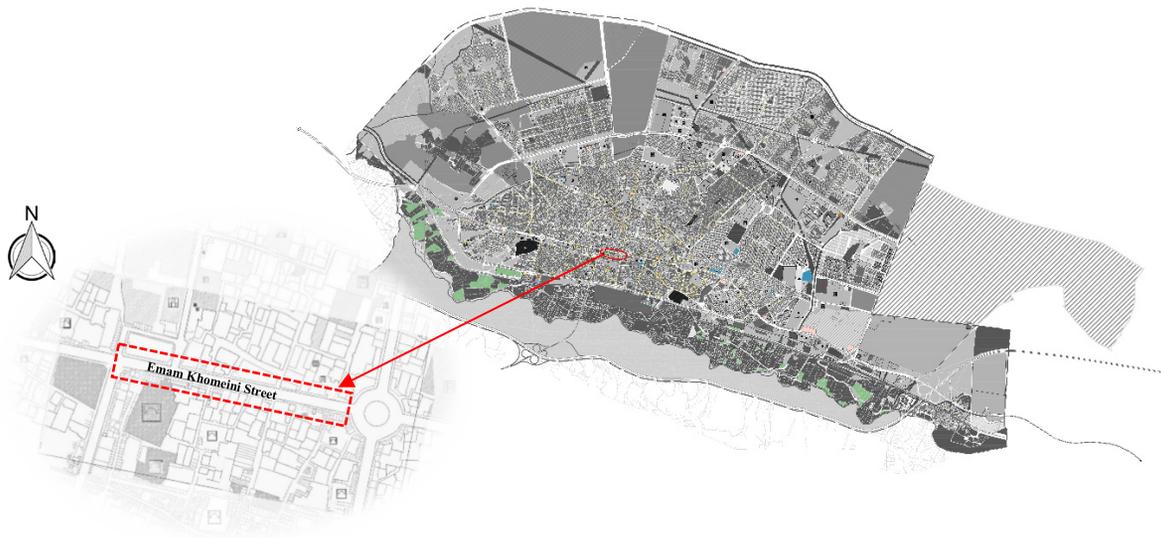


Fig. 3: Location of the area under study in the region and the city of Zanjan

activities and behavioral patterns occurred at the time interval of afternoon to night, with the predominating behaviors at this time being stopping for shopping, sitting for watching, and taking rest. The closer we get to the Sabze Meidan, the more the behavioral patterns, i.e., sitting for watching and waiting increase. Hence, activity in the mornings is mostly in the form of standing for conversation, and in the form of sitting for taking rest. In the end, the noon activities, assigned the lowest level of activity in the space, involve sitting eating something, and waiting. Images 5 and 6 illustrate the percentage of each static space under study.

In Figure 7, the static activity of standing in two points is more than that of sitting, while the space of pause and sitting is available for space users across the path. In Figure 8, sitting in the path is mostly aimed at taking rest, and also at

waiting. In sum, users make pauses and sit in this space for eating and drinking (several shops with food service uses). Thus, it is concluded that the majority of behavioral activities and patterns in this path are in a standing form, while sitting patterns, which rank second, are mostly aimed at taking rest. Another major factor that affects the formation of behavioral patterns in public territories in the area under study pertains to climatic comfort and shading in collective spaces, which are as Fig. 9.

As for the climatic comfort and shading in the area under study, three-time intervals were considered; thus, considering the sunlight orientation in the morning, the northern angle is covered by tree shades and buildings, which continues up to the middle hours of noon. Meanwhile, in the afternoon, this shading is seen on the southern angle of the area and up until the



Fig. 4: Most users of the space

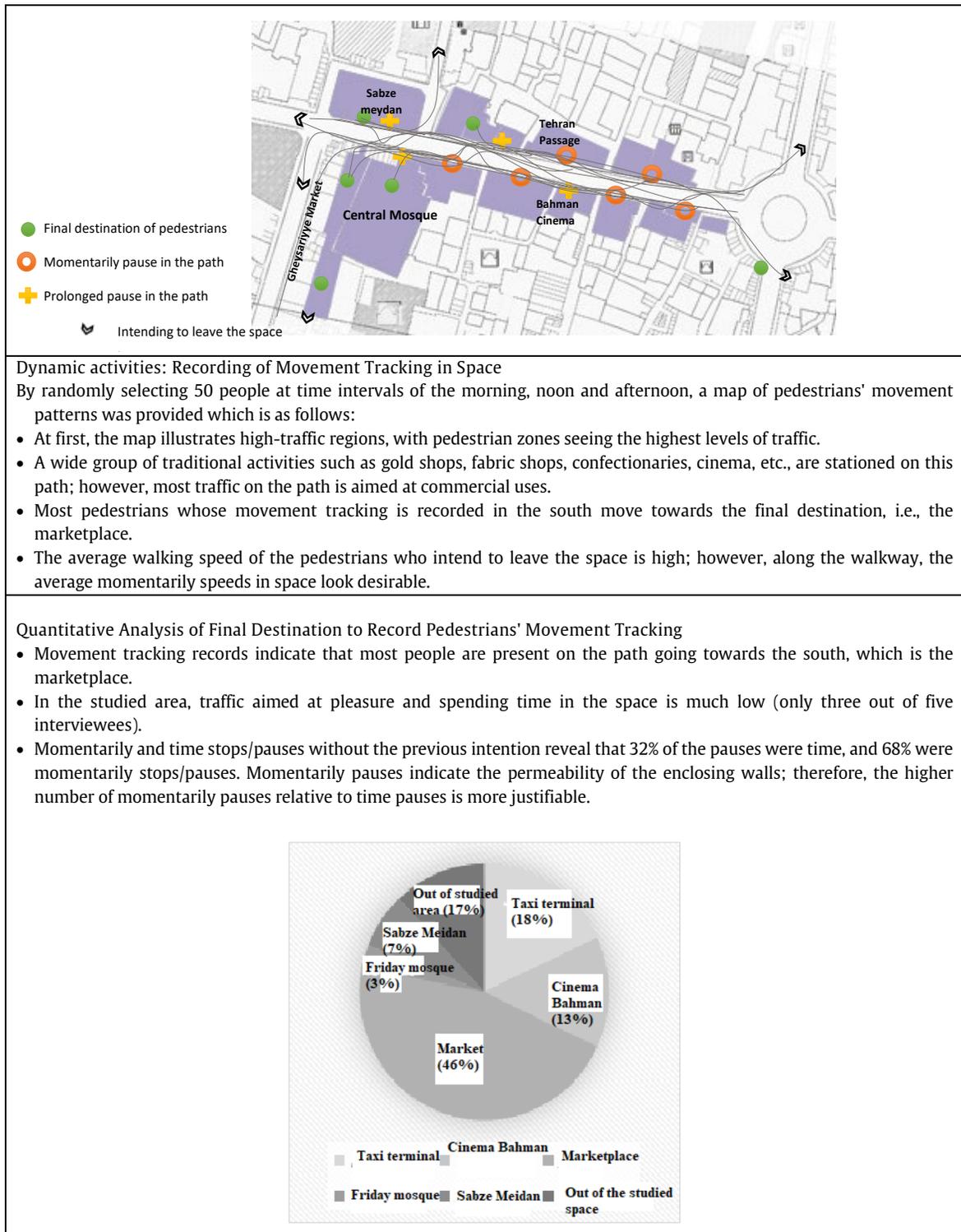


Fig. 5: Dynamic activity, pursuit, and outlining of the movement tracking of pedestrians visiting the studied area.



Static activities	Sitting	Sitting for watching	○	Standing	Crier	□	Standing for conversation	■
		Sitting for eating something	○		Stopping for quenching thirst (eating, drinking, eating ice cream, etc.)	○	Standing for doing something necessary (for tying shoes, direction, etc.)	■
		Sitting for taking rest	○		Stopping for shopping	□		
		Sitting for waiting	○		Stopping for watching the store's showcase	□		

Fig. 6: Recorded static activities in the area under study by activity goals.

middle of the pedestrian zone due to the height of the buildings. Considering the type of pedestrian zone structure at most hours of the day, the mid-path of the zone lacks good shading and climatic comfort, as it is highly frequented in the late hours of the day.

Later, as for the effects of shading on traffic,

examined in the previous stage, a review of the above map suggests that the highest volume of traffic occurred from 5 p.m. to 10 p.m., which involves all age ranges. Meanwhile, the reason for this high rate at these hours may be the closure of the occupations, spending leisure, good shading, space for collective paths, etc. The second rank

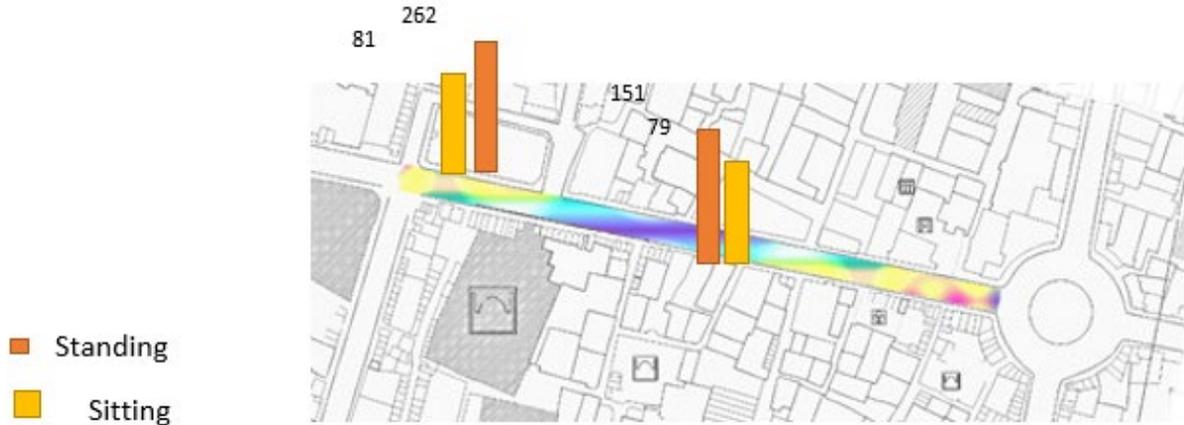
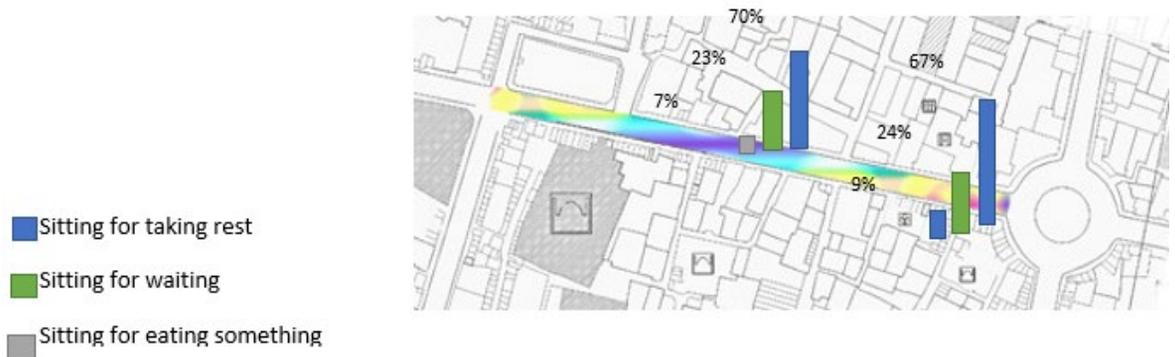


Fig. 7: Number of recorded static activities in the area under study.



Findings

- Static activities that are performed in a standing form in the area under study account for a significant contribution in all paths.
- Static activities analysis in the area under study indicates that the activity patterns of sitting on the two sides of the space (pedestrian zones) are almost identical.
- By afternoon, a more vital and vibrant space is observed due to the balanced distribution of static activities across the area under study.
- Static activities with little urgency significantly affect the space vitality; thus, these activities should be strengthened.

Fig. 8: Investigating the activity of sitting in the area under study by goals.



Findings

- Two more effective factors in the shading of the area under study are the tree vegetation seen on two rows along the pedestrian zone and the presence of two-story buildings enclosing the space.
- As for the spatial orientation and sunlight, the northerly and the southerly of the area capture the sun in the morning, and the afternoon, respectively.
- In the middle of the path, there is almost no vegetation, and because of the path's width, it faces direct sunlight almost throughout the day, with the shading and climatic comfort being practically low in this section.

Fig. 9: Investigating shading and climatic comfort in the area under study at the three-time intervals of morning, noon and afternoon.

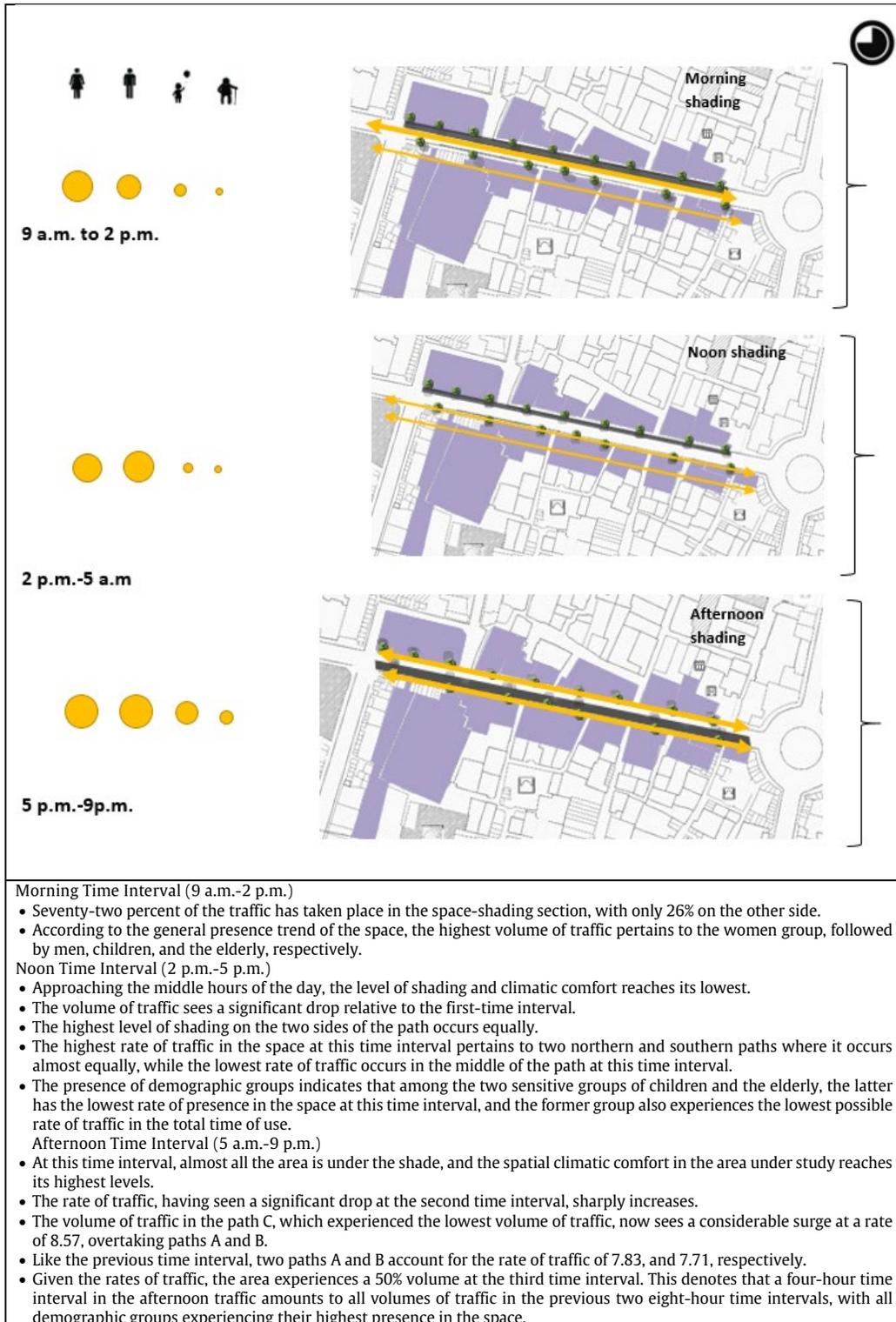


Fig. 10: Investigating the effects of shading on the volume of walking in the area under study.



Fig. 11: Investigating the effects of shading and climatic comfort on the location of static activities.

is the morning traffic, as people mostly travel for necessary activities. However, traffic in the afternoons is mostly aimed at selective and social activities.

As suggested, in previous stages, shading has had a considerable impact on the presence of people in the space, and the formation of behavioral territories. One of these territories involves static activities; the more shading and climatic comfort increase, the more space static activities in the space. The highest static activities pertain to the afternoons (as observed, the volume of traffic in the afternoons and the formation of

static activities sometimes reduce space security and increase traffic disruption).

5.3. Questionnaire Analysis of the Reasons for the Selection and Level of Satisfaction with the Environmental Qualities Mentioned

As for the area under study, at the three-time intervals, fifty people were randomly interviewed about their selection of the space and about their level of satisfaction with the environmental quality of the area based on the components studied above. Most interviewees were aged 15-45 years, and they responded to the scale at the

three-time intervals. Most of them described their reasons for the selection of the area as passageways to access occupations (necessary activities), social interactions, shopping (selective and recreational activities), visiting the area, and spending their leisure while a few people cited other reasons.

As shown by the Table 2, the age density in the area at various hours of the day was first 15-30 years, which is then followed by 30-45 years; this indicates that demographic density in the afternoons is greater than that at other times, as women and men's visits of the area under study at this time interval were greater than at other times. According to the respondents, three principal components were required for presence in the space: access to occupations, interaction and shopping, and finally, visit of the area for spending leisure, while a few cited other reasons. The percentage frequency of the received responses is given in Table 3.

Results revealed that the fifty respondents referred to the three main reasons for visiting

the space, with the evaluations suggesting the number of times as very high, high, moderate, low, and very low. Out of all three main components, the option of very high accounts for the most selected options. Only fewer than ten people cited other reasons. Later, the respondents were required to describe their satisfaction with their presence in the space in the form of climatic comfort frameworks, shading, static and dynamic spaces in the area, pause spaces for communication, eating and drinking, and movement paths. According to the evaluations, the respondents' satisfaction showed an average quality of 3.57, which is greater than the statistical average of 3. This difference was also significant at 1%. Therefore, with a 97% confidence level, it is concluded that satisfaction with the factors in the area concerning the formation of behavioral patterns was higher than the average rate, as the Friedman test results of the evaluation of these components are as follows:

Friedman Test results in Table 4 indicated that the category of interactions and shopping held the

Table 2: Responses to the questionnaire at time intervals by age groups and male and female respondents.

Time of presence in space	Morning	Noon	Afternoon	Morning	Noon	Afternoon	Morning	Noon	Afternoon	Morning	Noon	Afternoon	Morning	Noon	Afternoon
Age range	0-15 years			15-30 years			30-45 years			45-60 years			Over 60 years		
Woman	2	1	2	3	1	4	1	1	3	1	2	2	1	2	1
Man	1	1	2	2	1	3	1	1	3	1	1	2	2	1	2
Average (%)	19%			28%			20%			18%			18%		

Table 3: Indicators mentioned in the interview and quality investigation in the study components.

Density of indicators mentioned	Very low		Low		Moderate		High		Very high	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Indicators										
Access to occupation	2	4%	2	4%	5	10%	14	28%	27	54%
Interaction and shopping	3	6%	3	6%	6	12%	17	34%	21	42%
Visit and spending leisure time	2	4%	3	6%	4	8%	17	34%	24	48%
Other factors	1	2%	1	2%	3	6%	1	2%	1	2%
Average factors in the space		4%		4.5%		36%		40%		36.5%
	T statistic=23.94 Sig.= 0.000 Freedom degree=97									

Table 4: The prioritization of environmental quality indicators in the formation of behavioral patterns in Zanjan's Imam Street using the Friedman Test.

Variables	Average ranking	Priority	Chi-square statistic	Freedom degree	Sig.
Access to occupations	2.71	3			
Interaction and shopping	3.05	1	44.12	3	0.000
Visit and leisure	2.79	2			

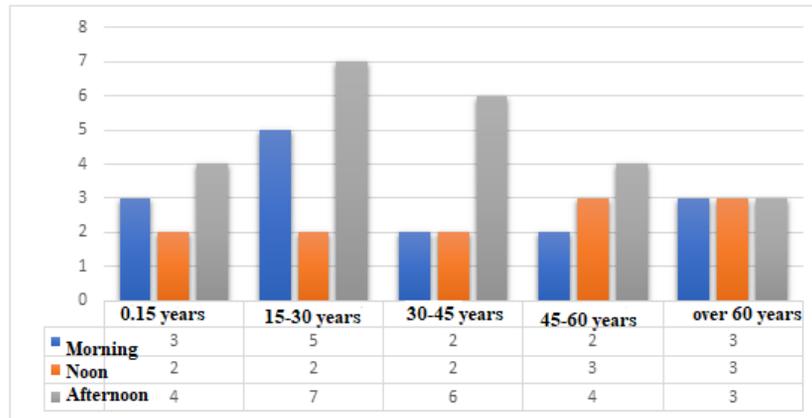


Table 5: Proposals to improve the existing situation in Zanjan pedestrian area

highest scores with a rate of 3.05, as subcategories of climatic comfort, static and dynamic spaces, movement paths, etc., accounted for the highest scores; this category was followed by visits and leisure time, and access to occupations, ranking second to third, respectively. This suggests that based on the environmental components behind the formation of behavioral patterns, the space under study was mostly used for shopping and interactions. Thus, it is concluded that such indicators as shading, pause spaces, movement paths, etc., had a direct impact on interactions and shopping activities in this area.

6. Conclusions

As stated, the main goal of the study was to evaluate and analyze behavioral patterns in the pedestrian zone located on Imam Street in the city of Zanjan, Iran, using the behavioral observational method, and the evaluation of public environmental and behavioral components in this space. The key issue in this study for the selection of this path was the diversity of this space, which is embodied in structural,

functional, environmental, etc., dimensions. These dimensions were found to help form a special type of behavioral pattern. For this, the following measures were taken in the study:

After stating the problem and the theoretical and conceptual frameworks of the study, the area under study and its historical and commercial land use were investigated. This area had turned into a pedestrian zone over the last several years and had formed behavioral patterns in collective spaces. These patterns, somehow related to the space structure, were examined in the present study. In addition, environmental components, such as subjective and objective components were examined. In the meantime, static and dynamic activities, shading, and climatic comfort components were observed and surveyed, which suggested that in the afternoons, the area experienced the highest number of users with static activities along the path including such activities as pause, sitting, standing, and eating. Later, the study investigated the reasons behind the selection of the area in a questionnaire that was distributed to 50 people with different age

Fig. 12: Age and time intervals of the respondents.

Increasing the volume of traffic in the middle route by improving climatic comfort and creating the ground for the occurrence of all kinds of activities	Suggestions in the form of strategies and solutions
Creating places for young people to hang out	
Consider bicycle and skate paths for children and teenagers	
Strengthening the visual attractions of the route	
Emphasis on the index element of Jame Mosque and bazaar along the route	
Leveling shops and sidewalks	
Improving the quality of the environment for the disabled (blind, deaf and physically challenged)	
Increasing environmental quality through increasing urban furniture	
Creating service infrastructure along the way	
Creating activity areas to increase attendance during low traffic hours	
Setting the stage for the formation of various activities such as conferences, open-air cinemas and street theaters	
Creating pleasant walls that attract the crowd	
Uniformity of shop signs to reduce visual disturbance	

ranges. The following gives the time and age intervals of the respondents.

Considering the age ranges and the hours of visit, it is determined that most of the respondents had visited the space in the afternoons, and the space had mostly been used by the age range of 15-30. Responses also suggested that the area had been mostly used for interactions and shopping (the presence of the marketplace and commercial areas), visits and leisure, and finally as passageways for access to occupations. Other marginal factors were less mentioned by the respondents. At last, satisfaction with the components in the area under study was asked from respondents, who mostly referred to the conducive environment in terms of climatic comfort, shading, pause, dynamic spaces, etc. The only complaint of people may have been the presence of vehicles on some passageways (considering the pedestrian zone of the area under study, people could not see vehicles pass by), or a lack of natural shading in the middle of the path. In general, according to the frameworks studied, space has a good quality to form diverse behavioral patterns for all groups, and the only problem with this can be the lack of tree vegetation for the creation of shading; however, space has a good potential of forming new behavioral patterns and

attracting frequenting people.

According to the analysis and evaluations carried out through the information of the study questionnaire, the analysis of the map of traditional behavioral patterns and the information obtained from Friedman's test, the research proposals can be expressed in order to achieve the desired goals. These suggestions are in the form of strategies and solutions.

Conflict of Interest

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

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