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Original Research Article

Enhancing Presence with a Multisensory Design Approach in Urban Public Spaces

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Abstract | Public spaces are an essential part of urban life, and their presence depends on human interaction. Research shows that environments with perceptual complexity stimulate the mind and increase the desire to be present. Multisensory design can enhance the quality of perception and sense of belonging to the space by simultaneously engaging the senses. Previous studies have focused more on specific spaces or historical environments and have mainly addressed only one or two senses. Therefore, other senses in urban spaces have received less attention. Understanding the landscape in an integrated way through all five senses can be more comprehensive. This research aims to investigate the multisensory components that shape the presence of urban spaces, their interrelationships, and their mutual effects. The main question of the study is how multisensory design can help enhance the presence of urban public spaces and which senses play the most significant role in this regard. The research hypothesis is that multisensory design increases presence by simultaneously stimulating multiple sensory modalities. The research strategy was to evaluate the relationship between the components of presence and the five senses across three urban spaces: Chitgar Lake, Baghrah, and Keshavarz Boulevard, using open-ended interviews with users. This research evaluated the relationship between the components of presence and the five senses through open interviews with users of three urban spaces: Chitgar Lake, Baghrah, and Keshavarz Boulevard, and showed that multisensory design plays a significant role in enhancing presence. The senses of sight and touch play the most critical roles; sight promotes vitality and physical quality, and touch promotes presence through its impact on thermal comfort. The equal and simultaneous understanding of these two senses increases the level of presence, and its effect is crystallized in the physical quality index. The sense of touch is more influential due to the nature of activities, including sports, and although vision is perceived more consciously, touch plays a more permanent role in the presence of space. The sense of taste has the smallest share of perception.

Keywords| *Sensory Landscape, Urban Landscape, Five Senses, Environmental Perception, Sensory Perception.*

Introduction| Successful public spaces are a vital component of the city, contributing to the sustainability and quality of urban life by fostering social interaction (Shaftoe, 2008). These spaces meet users' needs and strengthen a sense of belonging and participation. Their success depends on being present, functional diversity, appropriate placement of elements, social interactions (Amirfakhrian et al., 2024), accessibility, continuity, mental image, and sociability (Esmaieli Berneti et al., 2024). Jacobs (1961) considers the presence of people to be the primary factor shaping the life of public space. Interaction between city managers and citizens creates the basis for the presence and participation of people (Mehri Gharabolia et al., 2023). However, the urban landscape projects of the Tehran Beautification Organization have failed to attract audiences and require practical examination. The primary function of public space is to provide favorable conditions for human presence in the city (Shojaee & Partovi, 2015), including individuals' perceptual and cognitive responses to surrounding phenomena (Ijsselsteijn, 2002). The parameters that affect the formation of accessible spaces fall into three categories: human, environmental, and semantic-perceptual (Naghiloo & Falahat, 2016). In the environmental dimension,

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pedestrianization, furniture quality, flooring, accessibility, and functional diversity are among the most important criteria for accessibility (Amirfakhrian et al., 2024). In the semantic-perceptual dimension, McAndrew's research shows that complex environments, from a perceptual perspective, stimulate users' mental exploration and attention. If the environment contains a balanced level of sensory stimuli, the level of presence increases (Ghal-e Noii & Jebal Amelian, 2019, 64). The lack of efficient public spaces leads to reduced vitality, social isolation, and the formation of abandoned spaces, and makes urban investments fruitless. When cities seek to enhance quality of life, attending to multisensory components can improve urban landscape design, increase a sense of belonging, and rebuild social capital. In Tehran, many public spaces lack attractive features, and delaying their improvement results in missed opportunities for social interaction and impedes sustainable development, ultimately confronting the city with social and identity crises.

Research Background

Some studies have identified and analyzed the criteria that shape perceptions of the environment to improve the quality of human presence in urban spaces. The physical-mental dimension of the urban landscape is the primary focus of the present study. Landscape is a dynamic phenomenon that arises from the interaction between the external world and human experience, and is understood directly through sensory perception (Mansouri, 2005). In the philosophy of perception, one of the most fundamental levels of cognition is external perceptions that are obtained through the five senses. According to "Molla Sadra", these senses include: vision, hearing, smell, taste, and touch, which play a fundamental role in the perception and interpretation of environmental realities (Omidvari et al., 2024). This philosophical framework provides a suitable theoretical basis for understanding perceptions of the urban landscape. In urban design, Lynch (1960) was the first researcher to systematically document the sensory qualities of public spaces and the roles of vision and mental imagery in the perception of the urban environment. Lynch (1976) further expanded his analysis to emphasize the importance of sensory perception in the design process. In his later works, he specifically addressed the interplay between vision and hearing in the perception of urban environments. This approach paved the way for the development of multisensory design theories and methods in the urban landscape. In many recent studies related to the presence of urban spaces, criteria such as spatial attractiveness, appropriate scale, accessibility, the presence of facilities and services, social interactions, diversity of cultural activities and uses, etc. have been considered as effective factors in attracting people to public spaces (Marouf & Seyedi, 2022; Azadeh, 2024; Shojaee & Partovi, 2015). In another study, visual factors such as form, geometry, dimensions, and proportions were identified (Razavizadeh et al., 2015). Additionally, research on sociability focuses on physical and social presence, and visual and auditory interactions are considered forms of passive social interaction (Naghiloo & Falahat, 2016). No direct research has been conducted on the relationship between presence and the five senses. Background of Related Studies With a multisensory approach, it can be divided into two parts: first, research conducted on specific places, such as examining the senses in a historical covered market, comparing a historical market and a modern shopping complex, a Persian garden, and the sensory dimension of the tourism experience in coastal areas that have addressed multiple senses simultaneously (Buzova et al., 2021; Fathipour, & Ekhtiari, 2020; Mojtabavi et al., 2022; Samadi et al., 2020), second, research that has specifically addressed the perception of a landscape based on the senses. For example, we can refer to studies on the relationship between the auditory and visual senses in shaping audience perception of the environment (Gan et al., 2014). In a study related to this research, only the effects of auditory and visual senses on the audience's greater presence in the landscape are mentioned. At the end, it is emphasized that due to the consideration of only a few senses in landscape perception, only a superficial experience is formed. It is necessary to attend to all five senses to understand the environment (Razani & Sharghi, 2025).

In perceiving the environment, the human senses complement one another, and their simultaneous processing in the brain underlies the overall perception of space. Sensory stimuli can interact with one another and, under different conditions, strengthen or weaken the perception of other senses (Zheng et al., 2024). Since landscape perception is more comprehensive and realistic when the senses are examined together, and because no comprehensive study of the interaction of the five senses in urban public spaces (sidewalks) has been conducted to date, the present study examines the role of the five senses in shaping people's presence. This study not only examines the effects of each sense separately but also analyzes their mutual relationships and their simultaneous effects on one another and on the level of presence. Achieving this mechanism can lead to a deeper, more qualitative understanding of spatial experience and ultimately improve the quality of urban spaces and their presence.

Research Objectives

This study seeks to comprehensively examine the impact of multisensory components on the perception of urban spaces, the interactions among these senses, and how to enhance presence through multisensory design. Presence, as a dependent variable, is affected by the multisensory design approach.

Main question: How does the multisensory approach in the design of urban spaces help to enhance presence?
Sub-question: Among the senses studied, which sense has the most significant impact on presence? To answer the questions, the hypothesis is that the multisensory design approach enhances presence and improves understanding of the environment by simultaneously stimulating sensory perceptions in the audience.

Research Method

The research is qualitative. Its primary strategy is to conduct a case study of three accessible, multisensory public urban spaces in Tehran and to examine the relationship between the two categories: "multisensory design" and "accessibility"(Fig. 1). Accordingly, data were collected in two ways: through the library and through fieldwork. In the library section, theoretical sources were first reviewed to identify the components of accessibility, which were then summarized in Table 1.
In Table 1, indicators and criteria are presented across the human, environmental, semantic, and physical dimensions. Some of these categories are inherently flawed, and qualitative and quantitative criteria are integrated into them. To ensure conceptual coherence and a logical structure in the assessment of presence, the results have been reviewed. The way this classification works is as follows: presence is not simply a pre-existing characteristic of an individual, but rather the result of the interaction of behavioral factors. Therefore, its dimensions can be classified into two logical levels: qualitative (human, behavioral, and social) and quantitative (physical and spatial) (Li et al., 2024). Accordingly, the nature, indicators, and components of presence can be classified and explained.

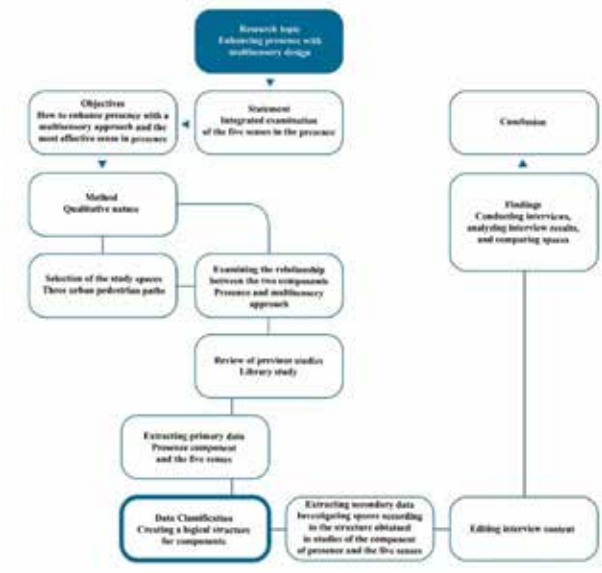

Fig. 1. Conceptual model of the research process. Source: Author.

In Table 2, in the library section, indicators and criteria related to the five senses were selected from classical sources (Omidvari et al., 2024), and the corresponding criteria were compiled from previous studies.
In the field section, the components of presence and the five senses were identified by direct observation and surveying the desired spaces. An open interview was also used to measure the relationship between environmental senses and user presence. The interview content consists of three parts: 1- Background questions. 2- Questions 1 to 4, examining presence and the factors affecting it. 3- Questions 5 to 8, related to the experience of the five senses[1] . The research community was purposefully formed from users who frequently visit three selected urban spaces (Figs. 2, 3 & 4)[2].
The sample size was determined based on the theoretical saturation principle. The selected spaces have standard and distinctive features. The area of each space is about 2000 square meters. Their nature and location are different to broaden the scope of the study.
All selected spaces are capable of being present and are distinct in terms of the experience of the five senses, and have been selected in the order shown in Fig. 5, from greatest to least, to compare the degree of influence of the senses on presence.

Review of the Studied Spaces

Chitgar Lake: Almost all the senses are stimulated well. The sense of taste (cafes and restaurants), the sense of hearing (music playing in the play centers), the sense of smell (planting rosemary and stock flower), the sense of sight (lake and water, surrounding buildings, planting plan and lighting elements) and the sense of touch (humidity, flooring suitable for sports and differences in the height of the paths) are experienced.
Baghrah: Although it is a new space, it has a remarkable visual richness with the visual appearance of the elements, planting plan, lighting, materials used in flooring, chairs, and other elements. The diverse paths, mixed uses, and height differences activate the sense of touch. In the southern part of the walkway, the bushes have a pleasant aroma. The sense of hearing is impaired by its proximity to the street, and the absence of food stalls does not stimulate the sense of taste.
Keshavarz Boulevard: Visually, it is desirable with old trees, grass cover on the path, and the flowing Karaj Stream in the middle. The audience on the boulevard experiences a noticeable temperature difference, attributable to tree shading and irrigation from a water fountain; the sense of touch is firmly engaged. Hearing is impaired by traffic and the rapid movement of cars. There are no stalls or booths for food sales, and the absence of fragrant vegetation prevents any odors from accumulating in the space.

Table 1. Components of public space presence extracted from previous research. Source: Author.

Example of measurable criteria	Index	Dimension
People present in the space (Naghiloo & Falahat, 2016, 1114)	Audience presence (Naghiloo & Falahat, 2016, 1114)	Human (Naghiloo & Falahat, 2016, 1114)
Pedestrianism, safety, quality of urban furniture, accessibility (Amirfakhrian et al., 2024, 70)	Physical quality of space (Naghiloo & Falahat, 2016, 1114)	Environmental (Naghiloo & Falahat, 2016, 1114)
Sense of belonging to the space, sense of identity (Marouf & Seyedi, 2022, 9; Mehri Gharabolia et al., 2023, 554)	Interaction between humans and space (Naghiloo & Falahat, 2016, 1114)	Semantic-perceptual (Naghiloo & Falahat, 2016, 1114)
Separation of pedestrians from cyclists, aesthetic elements, various functions, vegetation, desirable flooring, temperature, and sound (Shojaee & Partovi, 2015, 100)	Security, aesthetic quality, use mix, environment, flooring, physical comfort (Shojaee & Partovi, 2015, 100; Marouf & Seyedi, 2022, 9)	Physical (Shojaee & Partovi, 2015, 100)
Lighting, shading, pedestrian access, presence of functions of sitting, moving, conversation, and children's play (Mousavi Sarvine Baghi, 2018, 141-142)	Safety, climatic comfort, permeability, vitality (Mousavi Sarvine Baghi, 2018, 141-142)	Qualitative (Mousavi Sarvine Baghi, 2018, 141-142)
Sudden and unorganized social interaction, different ages, crime control, activities, Collective (Shojaee & Partovi, 2015, 100; Marouf & Seyedi, 2022, 9)	Social interactions, people's presence, security, participation (Shojaee & Partovi, 2015, 100; Marouf & Seyedi, 2022, 9)	Social (Shojaee & Partovi, 2015, 100)
Walking, conversation, live music, cafe restaurant (Shojaee & Partovi, 2015, 100)	Selective, social, public, lateral activity (Kanaani, 2022, 118; Shojaee & Partovi, 2015, 100)	Activity (Shojaee & Partovi, 2015, 100)

Table 2. Classification of components of presence. Source: Author.

Nature	Indicators	Example of measurable criteria
Quantitative	Safety (Mousavi Sarvine Baghi, 2018, 141-142), use mix, environment, flooring, physical comfort (Shojaee & Partovi, 2015, 100; Marouf & Seyedi, 2022, 9)	Roadway-pedestrian separation, different functions, vegetation, desirable flooring, temperature, and sound (Shojaee & Partovi, 2015, 100)
	Audience presence (Naghiloo & Falahat, 2016, 1114)	People present in the space (Naghiloo & Falahat, 2016, 1114)
	Selective, social, public, lateral activity (Kanaani, 2022, 118; Shojaee & Partovi, 2015, 100)	Live music, cafe, restaurant
Qualitative	Physical quality of space (Naghiloo & Falahat, 2016, 1114)	Pedestrianism, quality of urban furniture, accessibility (Amirfakhrian et al., 2024, 70)
	Interaction between humans and space (Naghiloo & Falahat, 2016, 1114)	The audience's sense of belonging to the space, sense of identity (Marouf & Seyedi, 2022, 9; Mehri Gharabolia et al., 2023, 554)
	Security, climatic comfort, permeability, vitality (Shojaee & Partovi, 2015, 100; Marouf & Seyedi, 2022, 9)	Appropriate lighting, shading, pedestrian access, the presence of functions of sitting, moving, talking, and children's play (Mousavi Sarvine Baghi, 2018, 141-142)
	Aesthetic quality (Shojaee & Partovi, 2015, 100; Marouf & Seyedi, 2022, 9)	Aesthetic elements in the environment (Shojaee & Partovi, 2015, 100)

Theoretical Foundations

Successful urban spaces are more than physical structures; they are platforms for active presence, social interaction, and shared experiences among citizens, and their vitality, more than any other factor, depends on the quality of human presence in space. Contemporary research shows that concepts such as sense of place, identity, social belonging, and evocativeness are formed through environmental perception and mediate the relationship between environmental characteristics and social behavior. Human perception of the urban environment is a multidimensional, multisensory process that extends beyond the visual. The experience of space is shaped by the simultaneous activation of multiple senses, including

Fig. 2. The open area on the eastern side of the artificial Chitgar Lake, District 22, Tehran. Source: Author.

Fig. 3. The upper space of the Tehran-Tabriz railway tunnel (Baghrah), District 18, Tehran. Source: Author.

Fig. 4. Keshavarz Boulevard, District 6, Tehran. Source: Author.

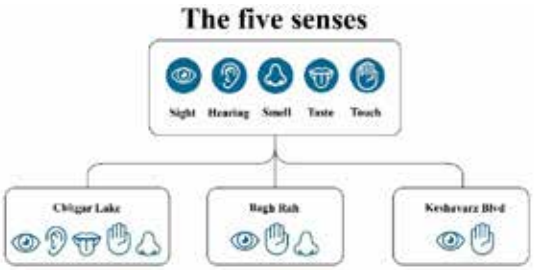

Fig. 5. Field detection of desirable and perceptible senses of spaces, based on the criteria in Table 3. Source: Author.

hearing, smell, touch, and taste; this sensory interaction determines the quality of presence and the degree of attachment to the place. Accordingly, the multisensory design approach can enhance vitality, presence, and the quality of spatial experience in urban spaces by enriching environmental perception.

Successful and vibrant urban space: The vitality of an urban space depends on the quality of people's presence and activity in it. Although design can facilitate or constrain this presence, the primary determinant of vitality is people themselves; in such a space, people are actively present and use it continuously. These spaces share four common characteristics: easy access, active human presence, an attractive appearance, and sociability; in other words, places where people not only meet one another but also bring others with them (Project for Public Spaces & Metropolitan Planning Council, 2008).

The concept of presence in urban space: Concepts such as sense of place, social belonging, identity, beauty, and evocativeness are among the perceptual factors that have bidirectional relationships with presence. These factors mediate between the environmental and human dimensions and thus affect individuals' social behavior. Urban space extends beyond its physical form and acquires meaning when it serves as a platform for citizens' presence, interaction, and shared experiences. The central characteristic of such a space is presence. That is, it attracts a diverse range of people, enables collective activities, and provides the basis for the formation of memories and collective identity through the environment's dynamism and vitality (Mardani, 2017).

Multisensory urban spaces: They are formed through human interaction with the surrounding environment, with perception at the center of this interaction. The simultaneous activation of multiple senses mediates perception, and humans perceive the environment by integrating multisensory data (Jafari et al., 2022). Rodaway (2002) considers being in a place a multisensory experience; that is, sound, smell, touch, and taste shape our perception of the environment, and emphasizes that no single sense alone can enable understanding of a place. Historically, discussions of the senses date back to Aristotle, who first listed the five ordinary senses (sight, hearing, smell, taste, and touch). Today, this list has expanded to include temperature, kinesthetic, balance, joint, muscular, sixth sense, and pain (Jarecka-Bidzinska, 2021). Later, Porteous (1990) introduced the term "sensory landscape" to describe the world that is formed from sensory interactions with a place (El-Hakim, 2021, 1). Accordingly, a multisensory design approach yields a richly sensory environment and a pleasant, aesthetic experience (Shahcheraghi, 2010). It is said that attachment to a place is rooted in sensory perception, and the experience of the senses is the first step in creating this emotional bond (Mojtabavi et al., 2022).

The five senses: Among the senses mentioned, the most common part is considered in this study. It includes vision (cultural phenomena, landscapes, geological phenomena, agricultural activities), hearing (music and auditory arts, wildlife sounds, silence), smell (smell of water, aroma of plants), taste (food and drinks, various flavors), touch (experience of weather, climatic comfort, social relationships) (Rodaway, 2002, 5). According to the research conducted, the strongest stimuli are visual elements. Then, auditory and olfactory experiences become more important (Abd El-Hakim, 2021).

How the senses function in the environment: Human perception is not limited to the sense of sight alone, but is the result of the interaction of different senses. The senses are processed in the brain, with each complementing the others, to form an integrated and coherent understanding of the environment. Positive senses can enhance the overall experience and improve other sensory perceptions. Negative stimuli have a reducing effect on the overall perception. Excessive dominance of one sense prevents the effective reception of other senses. Therefore, balancing sensory stimuli is fundamental to improving the quality of experience and perception of the environment (Zheng et al., 2024). For example, hearing can significantly affect the visual experience. Therefore, the examination of landscapes should be conducted using a multisensory approach to help people understand the real environment (Gan et al., 2014).

Findings

In this section, the findings from the analysis of the field data of the research are presented. The data, collected through interviews in the targeted spaces, were presented as Tables 3, 4 & 5, graphs and statistical descriptions after processing and analysis to examine users' presence status and multisensory experience in the studied space. The number of interviewees is in the column (number). The age range was 23- 55 years, and an attempt was made to achieve gender balance. In the section (statement), the views are summarized; initial coding is conducted in two stages of review, and the sub-themes are organized by component and criterion (Tables 6 & 7). The main themes are presented in a concise and precise manner, referring to the dependent and independent variables.

• Review of sub-themes, main themes, and summary of the diagrams

Figs. 6, 7 & 8, Analysis of the main themes of questions 1 to 7. These questions address the extent and reasons for users' presence in the space, their sensory perceptions, and the extent of the audience's perception across the five senses.

Figs. 9, 10 & 11, Sub-themes of question 7. The audience has selected the most sensory-stimulating elements in order, taking into account their surrounding environment and prior experiences.

Figs. 12, 13 & 14, Shows the effect of the five senses on the audience's presence. The diagram is drawn by analyzing the sub-themes of questions 1 to 5. These questions indirectly refer to sensory perceptions of the environment in the form of reasons for being in the space.

Figs. 15, 16 & 17,Compares the senses that need reinforcement and those that have been perceived, according to the answers to questions 1 to 8.

Analysis and Explanation of Charts

Amount of perception of senses: In Figs. 6, 7 & 10, it was determined which senses are perceived and to what extent. Based on audience responses and field observations, several contradictions are evident, particularly in the areas of Baghrah and Keshavarz Boulevard. The number of desired senses identified does not correspond to the senses perceived by the audience.

Dominant senses: According to Figs. 1, 9 & 11, the sense of sight and smell are the most perceived senses by the audience, respectively.

Qualitative indicators affecting sensory perception: In questions 1 to 5, sub-themes show that qualitative indicators of presence have affected sensory perception. Figs. 12, 13 & 14 show the extent to which the senses affect the presence of individuals. Despite the multisensory nature of spaces, the senses of sight and touch have had the most significant impact. Lynch (1960) considered the sensory perception of space to be based on visual perception, and, in this study, sight also holds first place. The skin surface, as the body's first point of contact with the environment, is a site of sensory perception. In Figs. 13 & 14, touch ranks second after sight. In Chitgar Lake (Fig. 6), the experience of the sense of touch is more vivid than sight. (Fig. 9) shows that the audience perceives the sense of touch, although it ranks lowest among the senses.

Discussion

Most perceived senses: The results showed that in the spaces of Baghrah and Keshavarz Boulevard, the sense of sight plays the most significant role in environmental perception. In Chitgar Lake, the sense of touch is the priority, and sight is the second. This difference may be due to the functional nature of the space, as a sports- and health-oriented destination that offers a variety of physical activities, thereby increasing tactile stimulation.

Least-perceived senses: The diminished role of hearing is evident in the spaces along Keshavarz Boulevard and Baghrah. It may be due to traffic noise on nearby streets.

Table 3. Open area on the eastern side of Chitgar Lake. Source: Author.

	Number	Question	Proposition	Initial code	Sub-theme	Main theme	Interpretation
Presence	A1-A2-A4-A5-A6-A7-A9	1	I come most of the time.	Continuous presence	Affordability	Presence	- It has a large audience due to its nature and suitable landscape. - Audiences keep coming.
	A3-A8-A10		I come a lot when the weather is cool.	Pleasant environment	Climate comfort	Experience of the sense of touch	
	A1-A7-A9	2	We have access to water.	Natural environment	Environmental comfort	Presence	- Reason for visiting: Liveliness and approachability, sports environment with various functions side by side. - Sense of sight and touch are involved.
	A2		The cafe is nearby.	Short distance	Accessibility		
	A1-A2-A3		It is lively.	Desirable environment	Vitality	Visual experience	
	A4-A6		It is close and safe for us women.	Social security	Security	Presence	
	A10-A5-A8		Long walking path.	Proper function	Physical quality	Tactile experience	
	A1-A2-A3-A5	3	Life is flowing.	Family environment	Social Security	Presence	- Conveys a sense of peace and security.
	A3- A6-A7-A8-A10		It is a family environment.	Proper living environment	Belonging		
	A4		It feels peaceful and natural.	Social security	Security		
	A6-A9		It is really safe.	Social security			
	A2-A3-A4-A5-A8-A10	4	Cycling, running, and group sports.	Various function	Physical quality	Experience of the sense of touch	- Audiences performed various physical (touch) activities and found them memorable.
	A1		Being at peace.	Environmental peace	Functional mixing	Presence	
	A9		We fed the ducks.	Natural environment			
	A7		Picnic with my friend.	Various function			
	A1-A2-A4-A5-A6-A7-A8-A9-A10	5	Florence, Istanbul, Ardabil's grove. Because of water and trees.	Belonging to nature	Physical quality	Visual experience	- In this section, most of the comments have focused on the sense of sight.
	A3-A8		Cities that have water.	Nature			
Multisensory space	A1-A2-A3-A4-A5-A6-A7-A8-A9-A10	6	Brickwork of the building, lighting, artistic decorations, green space, and a natural lake.	Seeing architecture, beauty, and nature	Mostly visual sense	Visual experience	- By being present in the space, the audience is engaged with their senses of sight, taste, and touch, and to a desirable extent, their sense of smell and hearing.
	A1-A2-A3-A4-A6-A8-A9		The smell of coffee, the smell of dampness and freshness, the smell of the lake and plants.	Smell of nature and food	Almost olfactory sense	Smell experience	
	A1-A2-A3-A4-A6-A8-A9-A10		The taste of ice cream is tempting.	Taste of food	Almost gustatory sense	Taste experience	
	A3-A4-A6-A7-A10		The sound of crickets, the waves of water, the music.	Sound of nature and music	Almost auditory sense	Aural experience	
	A3-A4-A5-A6-A7-A8-A9-A10		Wind on my skin, elevation changes, and suitable running surfaces.	Good weather, flooring, exercise	Almost tactile sense	Tactile experience	

Rest of Table 3.

	Number	Question	Proposition	Initial code	Sub-theme	Main theme	Interpretation
Multisensory space	A1-A2-A3-A4-A6-A7-A8-A9-A10	7	Sight and trees Birds in the water.	Seeing nature	Mostly visual sense	Visual experience	- The audience considers the visual dimension of space to be special. After vision, they identified the senses of smell, hearing, and touch, in that order.
	A1-A7-A8		Hearing, music, and water.	Sound of water and music	Sometimes the auditory sense	Aural experience	
	A2-A3-A4-A6		Smell, plants, and restaurants.	Smell of nature, food	Sometimes the olfactory sense	Smell experience	
	A5		Touch, wind, humidity, and exercise.	Wind and exercise	A little tactile sense	Tactile experience	
	A1-A4-A6-A9	8	Hold a festival. Better lighting, famous statues, and more water.	Physical modifications of the environment	Lack of vision	Need to strengthen the sense of sight	- Despite the relative desirability of the sense of sight, the need to strengthen this sense is felt to some extent. - The senses of touch and smell, respectively. Next, the sense of hearing has often been identified as undesirable, necessitating its correction.
	A1		More fragrant plants.	Smell enhancement	Lack of smell	Need to strengthen the sense of smell	
	A2-A6		More chairs, an island for exercise.	Tactile enhancement	Lack of touch	Need to strengthen the sense of touch	
	A2-A3-A7-A8-A9-A10		Soft music playing, no amusement park.	Environmental sound modification	Enhanced hearing	Need to strengthen the sense of hearing	

Table 4. The upper space of the Tehran-Tabriz railway tunnel (Baghrah). Source: Author.

	Number	Question	Proposition	Initial code	Sub-theme	Main theme	Interpretation
Presence	B1-B2-B3-B4-B5-B6-B7B8	1	We live here, and we always come.	Continuous presence	Affordability	Presence	- The Baghrah project contrasts with the surrounding environment and has attracted the attention of the audience.
	B5		We come in groups.	Collective presence	Social Activity	Visual experience	
	B1	2	Spacious, newly built space.	Aesthetic quality	Physical Quality	Visual experience	- Audiences come back regularly. - Some come for the proximity and functional space. Others come for the high level of security, social engagement, and sense of belonging in the space.
	B2-B8		The pedestrian path is separate from the car, and we do not have to worry about bags (thieves), due to its lighting.	Pedestrianization	Security	Presence	
	B3-B4		Exercise, walking, and playing.	Various functions	Physical quality	Tactile experience	
	B5-B6		Conversation and socializing.	Comfort	Environmental comfort	Presence	
	B7-B8		I planted plants here.	Activity	Interaction with space		
	B1-B8	3	I feel safe.	Environmental tranquility	Security	Presence	- This space is energizing and conveys a sense of peace and security to the audience.
	B2-B4-B6-B7		It is relaxing.				
	B3-B5		It has visual diversity. Plants give energy.	Physical quality	Vitality	Visual experience	

Rest of Table 4.

	Number	Question	Proposition	Initial code	Sub-theme	Main theme	Interpretation
Presence	B1-B2-B4-B5-B6	4	I talk to my friends. Walking and playing with friends.	Activity and interaction with the environment	Social activity	Presence	- Most audiences have experienced social connections and communal memories in this space.
	B3		People came here frequently during the rocket barrage; it was relaxing.	Presence in space	Affordability		
	B7-B8		We planted trees here with our neighbors.	Interaction with space	Belonging		
	B1-B5-B7	5	Babolsar, Pardisan Park, green space, and walking.	Green space and function	Physical quality	Visual experience	- In this section, most of the audience's attention was focused on the sense of sight and communal memory.
	B6-B8		I was reminded of Isfahan because of the brick benches.	Belonging	Physical quality of collective memory		
	B7-B3-B4		Valiasr trees. Water and Fire Park.	Nature	Physical quality		
Multisensory space	B1-B2-B3-B4-B5-B6-B7-B8	6	Occasional lighting. Lush trees. Beautiful elements and the facade of the building.	Lighting	Mostly visual sense	Visual experience	- By being present in the space, the audience's senses of sight, touch, smell, and hearing are stimulated, respectively.
	B2-B7		The sound of birds in the morning. It does not include park sounds and is relaxing.	Trees and architecture	Sometimes the auditory sense	Aural experience	
	B4-B5-B7		Have stock flowers. Spring. Bushes.	The quiet sound of mornings	Almost olfactory sense	Smell experience	
	B2		We have picnics.	-	Taste sense	-	
	B1-B2-B3B5-B7-B8		Evening breeze. Walking, skating, and cycling on suitable pavement. Seating platforms.	Cool air, suitable flooring	Almost tactile sense	Experience of the sense of touch	
	B1-B2-B3-B6-B7-B8	7	Watching the sunset and seeing the surroundings.	Seeing the environment	Often vision	Experience of the sense of sight	- They consider the sense of sight to be special, and they have identified the sense of smell.
	B4-B5		Smell for the sake of plants.	Smell of plants	Sense of smell	Experience of the sense of smell	
	B1-B2-B5-B6-B8	8	The view and lighting are not varied.	Enhancing the sense of sight	Lack of vision	Need for enhanced vision	- Despite the excellent visual sense, it is felt that it needs to be strengthened. - The auditory and gustatory senses have also been suggested, respectively.
	B6-B7B3		The sense of hearing.	Enhancing hearing	Lack of hearing	Need for enhanced hearing	
	B1-B3B5-B6-B7-B8		Plants and lighting for beauty. The quality of the view and the repair of the bench material.	Enhancing the sense of sight	Enhanced vision	Need for enhanced smell	
	B2		They should have a mobile cafe so we can eat.	Enhancing the sense of taste	Lack of taste	Need for enhanced taste	

Table 5. Keshavarz Boulevard. Source: Author.

	Number	Question	Proposition	Initial code	Sub-theme	Main Theme	Interpretation
Presence	C1-C2-C3-C4-C6	1	I always and usually come to this space.	Continuous presence	Affordability	Presence	- Keshavarz Boulevard is still a popular environment, despite poor management in maintaining the space. - People continue to visit this space.
	C5		I come a lot with my friends.	Massive presence	Social activity		
	C1-C4-C5-C6	2	It has easy access and is very close.	Short distance	Accessibility		
	C4		There are no thieves here.	Crime control	Security		
	C2-C3-C4-C6		The trees, water, and nature are beautiful.	Environment	Physical quality	Visual Experience	
	C2-C6	2	It is cozy and quiet.	Comfort	Environmental comfort	Presence	- Convenient access and greenery of the space.
	C5		Good for walking.	Being active	Interaction with space		
	C6-C2-C1	3	It feels peaceful.	Environmental tranquility	Belonging	Presence	- This space gives the audience a sense of peace.
	C3		It has pleasant air.	Favorite air	Climate comfort	Tactile experience	
	C4		The flow of life.	Presence of people	Liveliness	Visual experience	
	C5		The naturalness of the space.	Nature	Physical quality		
	C1-C5-C6	4	Conversation, walking. Picnics and games.	Activity and interaction with the environment	Social activity	Presence	- Most audiences have experienced social connections and communal memories in this space.
	C1-C5		The lights of the middle of Shaban. Watching people.	Environmental beauty	Physical quality	Visual Experience	
	C2		Spending the night on the boulevard.	Safety of the space	Security	Presence	
	C3		All the good memories from years of life.	Memorability	Belonging		
	C1-C3-C6	5	It is like nowhere else.	Sense of belonging to the space	Belonging	Presence	- In this section, most of the audience's attention was focused on the sense of sight, and the sense of touch was rarely involved.
	C4-C5		Valiasr, Charbagh, Shahmizad, Bagh Ferdous, because of the trees.	Nature	Physical quality	Visual experience	
Multisensory	C1-C2-C3-C4-C5-C6	6	The shade of beautiful trees and the color of the space.	Seeing trees	Mostly visual sense	Visual experience	- The senses of sight, hearing, and rarely the senses of smell, taste, and touch are stimulated, respectively.
	C1-C2-C4C6		The sound of the wind blowing through the trees, the running water, and the birds in the early morning.	Hearing the sound of the wind and ...	Almost auditory sense	Aural experience	
	C2-C3-C4-C5		The smell of plants and rain.	Smell of plants	Sense of smell	Smell experience	
	C1-C2-C5		Food is available during festivals.	Festival food	Sometimes the gustatory sense	Taste experience	
	C1-C2		The feeling of coolness.	Cool air	Sense of touch	Tactile experience	
	C1-C2-C3-C4-C5-C6	7	My sense of sight when watching the environment.	Seeing the environment	Mostly visual sense	Visual experience	- Audiences have identified the senses of sight, smell, and, to a lesser extent, hearing, respectively.
	C3-C5-C6		The sense of smell of plants.	Smell of plants	Sense of smell	Smell experience	
	C5		Hearing, wind, and water.	Sounds of nature	Sense of hearing	Hearing experience	

Table 6. Multisensory space indices extracted from previous research. Source: Author.

Example of measurable criteria	Index	Sense (Buzova et al., 2021, 2)
Building facade, light shade, variety, rhythm, fullness, and emptiness of space, trees, lighting, light and color of surfaces, spatial dimensions of depth and distance (Samadi et al., 2020, 26)	Objective images or scenery	Sight
People's voices, birds' voices, water and wind sounds, memorable artificial sounds (Fathipour & Ekhtiari, 2020, 545-548)	Sound quality	Hearing
Pleasant aroma, smell of shops, smell of plants (Samadi et al., 2020, 26)	Olfactory stimulus	Smell
Taste of local food, memorable taste (Fathipour & Ekhtiari, 2020, 545-548; Imamovic et al., 2020, 113)	Taste experience	Taste
Unevenness of paving stones, material texture, heat, cold, surface difference, wind (Li, 2022, 33; Samadi et al., 2020, 26)	Tactile experience	Touch

Table 7. Field survey of the presence of spaces based on the indicators in Table 2. Source: Author.

Nature	Example of measurable criteria	Space		
		Keshavarz Blvd	Bagh Rah	Chitgar Lake
Qualitative	Accessibility and pedestrianization	●	●	●
	Crime control	-	-	●
	Quality of urban furniture	●	●	●
	Aesthetic elements in the environment	●	●	-
	Sense of belonging to the audience in the space	●	●	●
	Different age groups	●	●	●
	Shading	●	-	-
	Access for pedestrians	●	●	●
	Sitting, moving, talking	●	●	●
	Social interaction and collective activities	●	●	●
Quantitative	Separation of pedestrians from vehicles	-	●	●
	Different functions	-	●	●
	Desirable vegetation and flooring	●	●	●
	Temperature and sound	-	●	●
	Appropriate lighting	●	●	●
	People are present in the space.	●	●	●

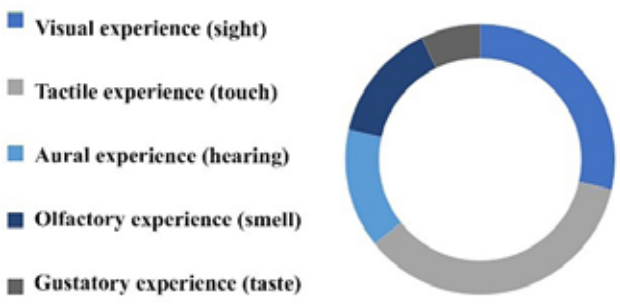

Fig. 6. The level of perception of the five senses in Chitgar Lake. Source: Author.

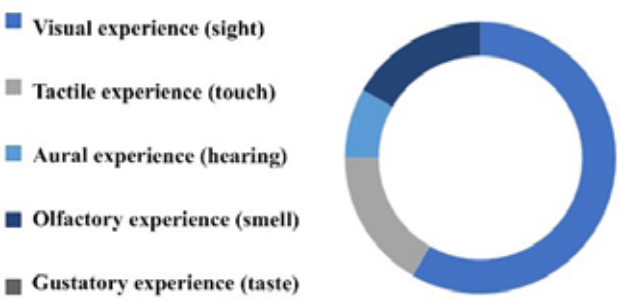

Fig. 7. The level of perception of the five senses in Baghrah. Source: Author.

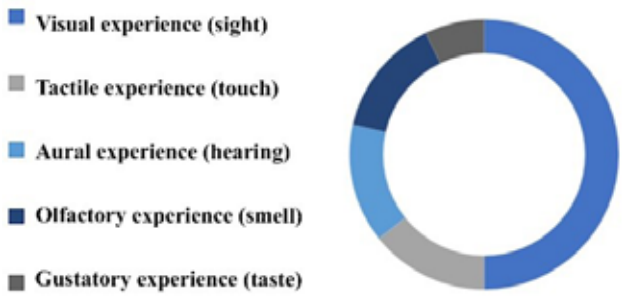

Fig. 8. The level of perception of the five senses on Keshavarz Boulevard. Source: Author.

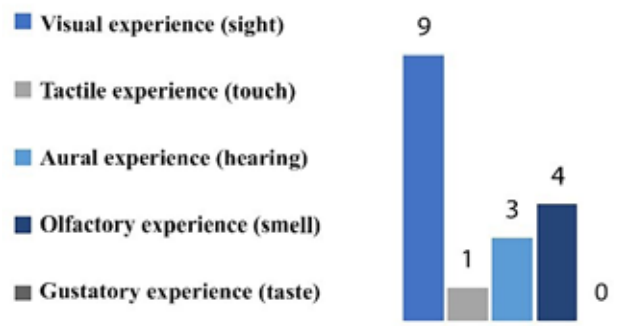

Fig. 9. The first feeling the audience gets at Chitgar Lake. Source: Author.

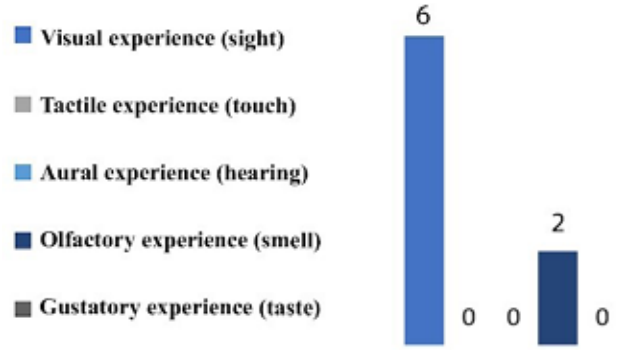

Fig. 10. The first sensation the audience perceives in Baghrah. Source: Author.

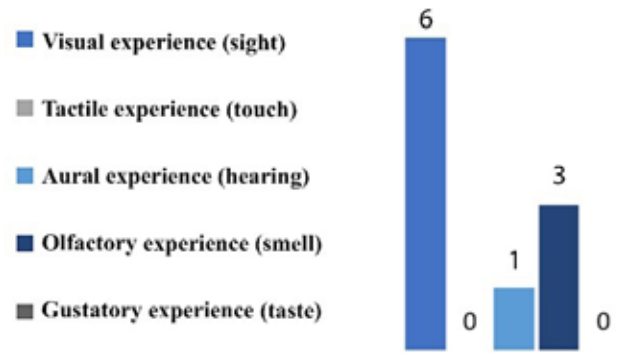

Fig. 11. The first feeling that the audience perceives on Keshavarz Boulevard. Source: Author.

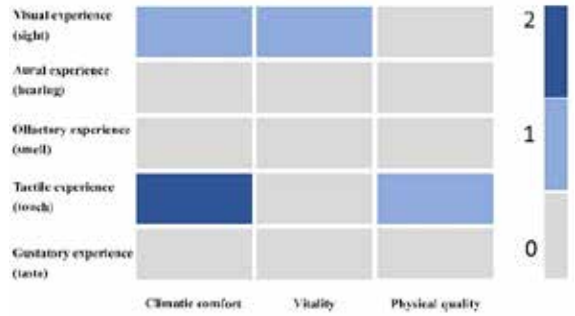

Fig. 12. The effect of the five senses on the presence of people in Chitgar Lake. Source: Author.

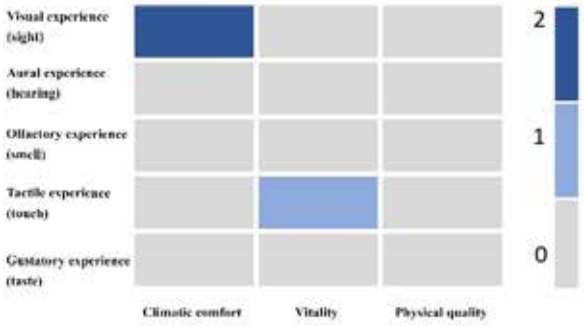

Fig. 13. The effect of the five senses on people's presence in Baghrah. Source: Author.

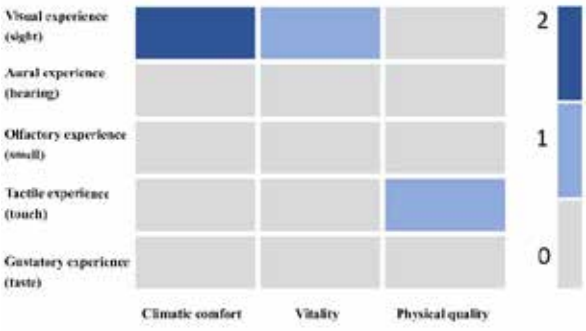

Fig. 14. The effect of the five senses on the presence of people on Keshavarz Boulevard. Source: Author.

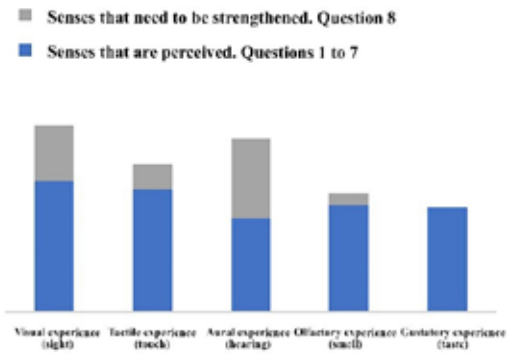

Fig. 15. Comparison of the level of sensory perception and enhancement in Lake Chitgar. Source: Author.

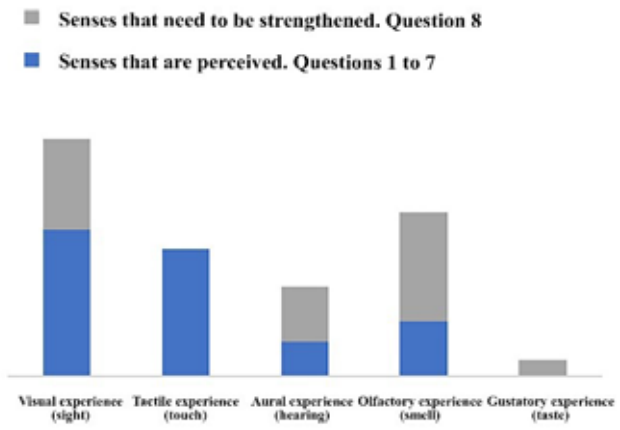

Fig. 16. Comparison of the level of perception and sensory enhancement in Baghrah. Source: Author.

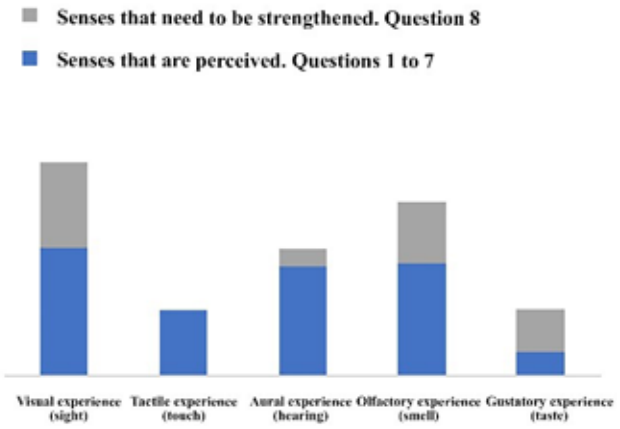

Fig. 17. Comparison of the level of perception and sensory enhancement on Keshavarz Boulevard. Source: Author.

Chitgar Lake also faces a similar situation, as the music being played may not be pleasant to all audiences.

First perceived senses: In most spaces, the sense of sight is activated first, and then the sense of smell becomes important.

Need for sensory reinforcement: The charts indicate that the senses requiring reinforcement in the answers to question 8 vary according to the sensory possibilities and perceptions of each space.

Unexpected results: Comparing the findings with previous studies indicates that the audience's sense of belonging to the space and their connection to the place's history can affect the perception of desirable or disturbing sensory qualities in the environment. Therefore, it is suggested that, in future research, spaces with the same historical background, the number of desirable senses, and the exact nature and function be examined and compared to more accurately explain this relationship.

Conclusion

The findings of this study show that in addition to the known factors affecting presence in urban spaces, a multisensory design approach can play a significant role in strengthening and sustaining user presence. A comparison of the perception of the five senses in the three spaces of Chitgar Lake, Baghrah, and Keshavarz Boulevard indicates that in these spaces, sensory perceptions, whether consciously and directly such as observing vegetation and special lighting, smelling the scent of planted aromatic plants, touching the wind flow, and contact with water, or unconsciously and indirectly such as using sports spaces, enjoying the pleasant air caused by the microclimate, or the quality of modern architecture, by activating the senses, encourage users to perform various activities such as watching, walking, exercising, picnicking, eating, and ultimately returning to the space.

Despite the multisensory nature of the studied spaces, the findings indicate that sight and touch have the greatest impact on users' sense of presence. Meanwhile, environmental quality indicators such as vitality, climatic comfort, and physical quality play a decisive role in enhancing sensory experiences and increasing the desire to be present. Specifically, the senses of sight and touch, by enhancing vitality and physical quality, and the sense of touch, by influencing climatic comfort, vitality, and physical quality, ensure the continued presence of people in the space. Comparing results for each space separately and across the three studied spaces indicates that simultaneous, balanced perception of sight and touch increases presence, as reflected in an improvement in the physical quality index. Based on interviewees' responses, the main components of this index in the Chitgar Lake area include the diversity and proportionality of functions, belonging to the place, and the desirable quality of the space's natural character. In contrast, in the other two spaces, the dominance of visual perception over other senses is observed, which has been accompanied by a decrease in the level of presence in the same proportion. In Chitgar Lake, according to the graph related to the level of perception and enhancement of the senses, the intensity of perception of different senses is almost at an equal level, which, based on previous studies, can be concluded that the integration of sensory perception has been an effective factor in promoting the presence of this space.

It is worth noting that, in the field observations of Keshavarz Boulevard, the sense of hearing was rated as undesirable, and the sense of smell as weak. At the same time, the contribution of olfactory perception to the quantitative results is stated above. To explain this contradiction, we can refer to previous studies showing that different senses can interact with one another's perceptual quality and that strengthening or weakening one sense also affects the perception of other senses.

In spaces where the design focus has been on the sense of touch, the role of taste has diminished. In contrast, the presence of restaurants and cafes, and the possibility of a picnic at Chitgar Lake, have made a more significant contribution to the sense of taste. However, compared to other senses, the sense of taste has the least contribution to the overall perception of the users of each space.

In response to the research sub-question, it was determined that, given the nature of the activities and users' goals in the Chitgar Lake space, the sense of touch is more effective than other senses in maintaining audience presence. Although the sense of sight is perceived consciously and immediately, the sense of touch, through physical interaction with space, has played a more enduring role in the experience of presence. This finding underscores the need to prioritize balanced multisensory design, particularly the simultaneous enhancement of sight and touch, in the planning and design of urban spaces.

Functional Solution for How to Enhance Presence with Multisensory Design

The design of public spaces can foster a multisensory, lasting experience when all five senses are considered simultaneously and equally. Attention to sensory qualities should be considered a fundamental principle in the design process. By identifying and reducing disturbing sensory factors in the environment and enhancing or adding desirable sensory stimuli, it is possible to achieve a relative balance between the senses. The sensory perception of users can vary depending on the type and function of each space; therefore, the degree of emphasis on each sense should be determined in accordance with the function of that space. In line with this approach, based on the results of the research, a set of practical recommendations is presented to improve the quality of multisensory design:

Sense of sight: creating open spaces for watching the sky, diverse lighting, utilizing Iranian architecture and aesthetic elements in the design of spaces, appropriate coloring, and height variation along paths or seating areas, and paying attention to natural space, planting trees, creating an animal-friendly environment, and strengthening the bond between humans and nature.

Sense of hearing: Separating noisy uses from quiet spaces, planting suitable trees to attract birds, playing soft music in the environment, and enjoying the sound of running water.

Sense of smell: Planting perennial and seasonal aromatic plants, positioning cafes or ice cream shops for edible aromas, using natural smells that are memorable to the audience and remind them of a pleasant memory.

Sense of touch: Designing walking, cycling, and skating paths, using high-quality, diverse materials that are appropriate for the function of the spaces, creating suitable seating platforms, sports, and play spaces. Shading with trees or awnings and creating a temperate, humid microclimate to enhance user comfort.

Sense of taste: Designing spaces for picnics, fixed and mobile cafes, ice cream shops, and other small-scale services that stimulate the sense of taste.

Overall, implementing these recommendations can create a space that not only meets users' functional needs but also provides a multisensory, prosperous, and sustainable experience of being in the environment.

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Conflict of Interest

The authors declare no conflict of interest regarding this study.

Endnotes

1. a) How many times do you come to this space in a month?

b) What is the reason you come to this space?

c) How do you feel about this space?

d) What memories do you have of this space?

e) What other spaces are similar to this one you have experienced before? How are they similar?

f) Pay attention to your surroundings. What do you like most about this space?

The facade of the buildings/ The shade of the trees/ The emptiness of the space/ The art decorations/ The trees/ The lighting/ The colors/ The sound of birds/ The sound of water/ The sound of the wind/ The sound of music/ The pleasant aroma of the plants/ The smell of coffee/ The taste of the food/ The food and beverage store/ The unevenness of the flooring/ The heat and cold/ The stairs/ The wind/ Sitting on the stairs/ Walking on pebbles

g) Which of your five senses is stimulated when you are here? Touch/ Taste/ Smell/ Hearing/ Sight

What did you receive these senses from?

h) If there was a way to change and improve this space, what would you prefer to do?

2. Data were collected on holidays (7, 14, 18 to 24 and 28 of September 2025) and in the evening hours of summer.

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