

Original Article

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Evaluation of social sustainability components of urban squares from the perspective of elderly happiness (case study: Naqsh-e Jahan Square, Isfahan)

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Abstract

Demographic transformations in recent decades and the growing elderly population in Iranian cities have made redesigning public spaces with a human-centered approach a primary concern. Urban squares, as the beating heart of collective life, play a decisive role in enhancing happiness and social sustainability for this group. This study aims to evaluate the components of social sustainability in urban squares from the perspective of elderly happiness, with a case study of Naqsh-e Jahan Square in Isfahan. The research employs a sequential exploratory mixed-method approach, utilizing field observations, interviews with 12 key informants, and a questionnaire survey of 400 elderly individuals aged 60 and above. Instrument reliability was confirmed with a Cronbach's alpha coefficient of 0.83. Data were analyzed using SPSS software. Findings indicate that among 25 items across five components of social sustainability and happiness, "architectural identity and authenticity" (mean=4.81), "memorability of space" (mean=4.62), and "sense of place attachment" (mean=4.45) received the highest scores. Conversely, "adequate resting furniture" (mean=2.67), "universal accessibility" (mean=2.84), and "access to restrooms" (mean=3.02) were identified as the most significant shortcomings. Pearson correlation results show that all five components of social sustainability positively and significantly relate to elderly happiness. The "sensory-psychological" component ($r=0.92$) shows the strongest correlation, while "accessibility and transportation" ($r=0.69$) shows the weakest. Despite its deficiencies, Naqsh-e Jahan Square, through its immense semantic and historical capital, provides a worthy setting for elderly happiness.

Keywords

Elderly
happiness
Isfahan
Naqsh-e Jahan Square
social sustainability
urban squares

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1. Introduction

In recent decades, demographic developments in many countries, including Iran, have revealed the need to rethink the quality of urban spaces for all age groups, especially the elderly (Alalhesabi & Rafiee, 2013). Increased life expectancy and improved health and medical conditions have made aging not an exception but a natural and significant part of cities' population structure. In the meantime, cities, as the main habitat of the human population, must provide platforms where all citizens, regardless of age and physical abilities, can enjoy a desirable quality of urban life (Ghafari & Mohamadi Dehcheshme, 2013). As vital arenas of human interaction, public spaces play an unparalleled role in achieving this goal. If public spaces fail to meet the needs of the elderly, this valuable group will gradually be excluded from the context of society and will face problems such as social isolation, decreased mental health, and decreased quality of life (Jalaliyan et al., 2020). Meanwhile, urban squares have a prominent and distinctive position. The square is the beating heart of the city, where history, culture, economy, and social relations are intertwined. Squares do not only have a traffic function or simply an open space, but also act as a "living room of the city" where citizens from different classes and generations watch, talk, shop, rest, and enjoy the space (Toofan & Shiroyeh zad, 2026). For the elderly, the urban square can be a refuge from everyday loneliness, an opportunity to be seen and heard, and an arena to renew collective memories. However, many urban squares, especially those in historical contexts, were shaped by past needs and standards and may be far from today's requirements of "age-friendly design" (Yadollahi, 2013). Hence, the question arises as to "what the most important components of the social sustainability of an urban square are from the perspective of the elderly and what place each has in assessing their happiness?" The central concept here is called "social sustainability." Social sustainability refers to a place's ability to create and maintain positive interactions among users, strengthen a sense of belonging and identity, provide security and spatial justice, and improve the quality of life for all social groups. In the framework of sustainable development, social sustainability is placed alongside economic and environmental sustainability. It is perhaps more fundamental than the two, because without a cohesive and participatory society, no development plan will achieve the desired result (Isalou et al., 2015). On the other hand, "happiness" is a concept that goes beyond

fleeting pleasure to deep satisfaction with life, mental health, meaningful activities, and a sense of social belonging. For the elderly, who face numerous changes such as retirement, declining physical abilities, loss of peers, and sometimes loneliness, happiness depends more than any other age group on the quality of the living environment and opportunities for social interaction (Shirouyезд & Doozdoozani, 2025). Therefore, assessing the social sustainability of an urban space from the perspective of elderly happiness can be an operational and sensitive criterion for measuring the success of that space in responding to this vulnerable group's needs. In this regard, the second question is: what is the relationship between the square's social sustainability and the happiness of the elderly present in it, and which dimension (physicality, social interactions, security, and sense of belonging) correlates most strongly with happiness? In the meantime, Isfahan's Naqsh-e Jahan Square, one of the most famous and most visited squares in the world, is an exceptional case for such an assessment. Located in the heart of Isfahan and a relic of the flourishing Safavid era of architecture and urban planning, this square welcomes thousands of citizens and tourists daily. Unique features such as its regular and impressive geometry, the presence of significant historical monuments on all four sides, the central pond, the Lakhki gardens, the surrounding bazaar, and the shady courtyards all provide high potential for creating a pleasant and social space. Considering the gaps identified in the existing literature, the innovation of the present study can be explained on three levels: first, this is the first study that simultaneously and with a mixed method evaluates the components of social sustainability of Naqsh-e-Jahan Square from the perspective of a specific group of elderly people; while previous studies have either generally measured the quality of space or have focused on abstract concepts. Second, this study, for the first time, places "happiness" as the final dependent variable alongside social sustainability and measures the direct relationship between these two structures in a historical square. This approach has no analogue in the domestic literature. Third, this study, using correlation analysis and multivariate regression (or correlation analysis), identifies the most prioritized components of social sustainability in explaining the happiness of the elderly and shows that the sensory-psychological dimension, with a correlation coefficient of 0.92, has the strongest correlation and greatest role in the positive experience of the elderly. This finding pushes design strategies

from a purely physical approach towards strengthening semantic and memorable capital. Social sustainability, as an independent variable, affects the happiness of the elderly through a causal chain. Physical quality and accessibility provide the infrastructure for the presence of the elderly. This platform provides the basis for social interactions as an intermediary link that elevates the experience to a psycho-emotional level. Sensory-psychological dimensions (sense of belonging, memorability, identity) mediate and intensify the impact of interactions on happiness. Security also acts as an overarching boundary condition; without it, the entire chain is disrupted. In this hierarchy, the human-centered approach is the overall framework, the age-friendly design is the operational approach, social sustainability is the intermediate goal, and the happiness of the elderly is the outcome and dependent variable of the research. Accordingly, the main research questions are directly extracted from these gaps and innovations. However, the fundamental question is whether these potentials are used in practice to benefit the elderly. Do elderly people who come to the square with limitations in walking, a frequent need to sit and rest, sensitivity to light and heat, and a desire for quiet social interactions feel comfortable, safe, and happy in this historical square? Daily experiences and initial observations show that although Naghsh-e Jahan Square is visually magnificent and culturally rich, it faces shortcomings in physical details and welfare services for the elderly. The lack of adequate and suitable furniture with backrests and handles, the unevenness of the square's carpet for using walkers or canes, the lack of sufficient shade during hot hours of the day, and the crowding of tourists at certain times are among the challenges that can negatively affect the elderly's experience of being in the square. On the other hand, the presence of traditional coffee houses, viewing platforms, and numerous opportunities to watch cultural and social events are strengths that can improve interactions and happiness for the elderly. But how do these strengths and weaknesses weigh together? In other words, the third question of this research is: what are the main obstacles and challenges in Naqsh-e Jahan Square that disrupt the realization of social sustainability for the elderly, and what strategies can transform this space into an example of an "elderly-friendly and happiness-creating square"? The answers to these three questions can guide urban managers, transportation and public space planners, landscape architects, and even cultural heritage custodians in providing a more

inclusive, equitable, and vibrant environment for the elderly in this region while preserving the historical authenticity of the square. In the following, the theoretical foundations and conceptual framework of the research will be presented, and then the field findings will be analyzed by describing a mixed methodology (quantitative and qualitative).

2. Theoretical and empirical background

2.1. Theoretical background

The theoretical foundations of the age-friendly city are rooted in the critique of purely physical approaches to urban spaces and emphasize the importance of social, psychological, and participatory dimensions in designing environments for the elderly. Using the meta-synthesis method, Harandi et al. (2021) introduced four main dimensions of the age-friendly city: presence, security, age-friendly communities, and sense of place. They emphasized that policymaking draws on the two pillars of "place" and "participation." In the "Manifesto of the Age-Friendly City Movement," Baffel and Phillipson (2018) criticize the traditional approaches of the World Health Organization for neglecting structural inequalities, poverty, and social justice, and call for the elderly's active participation in planning processes. In the following, the key concepts of the research, including social sustainability, happiness, and the relationship between these two constructs in urban spaces, are explained based on the theoretical framework of human-centered urban planning, environmental psychology, and age-friendly city theories. As one of the three main pillars of sustainable development, social sustainability is linked to categories such as spatial justice, collective cohesion, social capital, sense of belonging, and quality of life (RezaeiRad & Molaei, 2026). In urban planning literature, social sustainability is defined as a place's ability to foster positive interactions among users, maintain collective identity over time, and meet the basic needs of all social groups without discrimination (Buffel & Phillipson, 2018). A square is socially sustainable if it can provide a platform for the simultaneous, peaceful presence of different age, gender, economic, and ethnic groups, and no group is marginalized. From this perspective, assessing a square's social sustainability without considering its most vulnerable users, namely the elderly, would be incomplete (Mousavi et al., 2025). In the present study, social sustainability is operationalized using five components: physical-functional quality, social

interactions, sensory-psychological dimensions, security, and accessibility and transportation. In positive psychology, happiness is a multidimensional construct that includes life satisfaction, frequent experience of positive emotions, sense of meaning and purpose, and quality of social relationships (Singh & Kumar, 2024). It is necessary to distinguish happiness from “mental health” and “emotional well-being.” Mental health emphasizes the absence of illness, while happiness is a positive concept that goes beyond that. Emotional well-being focuses solely on the emotional aspect, but happiness also includes cognitive evaluation of life satisfaction and a sense of meaning and purpose (Elias Bibri & Krogstie, 2019). For the elderly, who have reduced physical capital, changing social roles, and a more limited network of friends, happiness is of additional sensitivity (Rezaei-Rad & Molaei, 2026). The relationship between social sustainability and happiness is explained by integrating the theories of “behavioral environmentalism,” “place attachment,” and “social capital.” According to behavioral environmental theory (Barker, 1968), the objective characteristics of space as environmental stimuli facilitate or inhibit positive behaviors (Yadollahi, 2013). Social sustainability components such as physical quality, security, and accessibility provide the context for social interactions and sensory-psychological dimensions (Alalhesabi & Rafiee, 2013). Physical-functional components alone are not sufficient for happiness and require social and psychological dimensions (Isalou et al., 2015). Place attachment theory emphasizes that collective memories, identity markers, and emotional bonds form a deeper layer of spatial experience that leads to sustainable happiness (Brown et al., 2017). The elderly see the historical field as a collection of individual and collective memories, identity markers, and lived experiences (RezaeiRad & Molaei, 2026), which is a huge asset for happiness (Sadeghi et al., 2023). Social capital theory (Putnam, 2000) emphasizes the role of interactions in creating trust, solidarity, and shared norms, which underpin a sense of belonging and happiness. Social stability affects happiness through three mechanisms: a suitable physical environment, facilitating interactions to reduce loneliness, and strengthening sensory-psychological dimensions for emotional attachment. Security plays a key role as a “boundary condition.” Without it, other components lose their effectiveness (Mousavi et al., 2025). Security has two aspects: physical (separation of vehicles and pedestrians, safe crossings, lighting) and social (feeling

of immunity from crime and harassment) (Brown et al., 2017; Elias Bibri & Krogstie, 2019).

2.2. Empirical background

Empirical research on age-friendly cities has mainly focused on evaluating objective and subjective indicators of urban spaces. Mousavi et al. (2025) in Miandoab city showed that “outdoor spaces and buildings” are the highest priority, aligning with the findings of the present study. Ahani et al. (2027), in a study entitled “A justice-oriented multilayer analysis of urban travel behavior in Tehran: Integrating psychological, social, and structural dimensions,” analyzed urban travel behavior using an exploratory-interpretive mixed-methods approach. The findings indicated that achieving transportation justice requires going beyond formal equality in access and simultaneously paying attention to lived experience, regional differences, and the socio-psychological dimensions of urban mobility. This study is important for the present research because it emphasizes the role of subjective perceptions and psychological dimensions in citizens’ spatial experience, aligning with the current research’s approach in evaluating the sensory-psychological dimensions of social sustainability. Maroufi et al. (2024) in Mohammadih, Qazvin, confirmed the significant role of age-friendly city indicators in predicting the social belonging of the elderly and revealed the direct relationship of these indicators with “sense of place.” Rezaei et al. (2023) in Mellat Street, Shahrekord, showed that despite the presence of suitable physical components, without safety and accessibility, the elderly’s psychological satisfaction is not achieved, a finding consistent with the lowest scores in the present study regarding rest furniture and inclusive accessibility. Eaisalou et al. (2015) in the central streets of Qom identified physical-functional problems, such as lack of rest furniture, stairs and uneven surfaces, fear of falling, and feeling of insecurity, which overlap with the physical deficiencies of Naqsh-e Jahan Square. Toofan and Shirvayezad (2026), in a study entitled “Analysis of socio-economic effects of extensive pedestrian walkways on the revitalization of decayed neighborhood centers (case study: Feizabad Neighborhood, Kermanshah),” analyzed the economic and social effects of pedestrianization using a mixed-methods approach and a field survey of 365 people. The findings showed that extensive pedestrian walkways are strongly connected with neighborhood

revitalization, with correlation coefficients of 0.91 for the economic factor and 0.87 for the social factor. This study is important for the present research because it emphasizes the role of pedestrian-oriented spaces in strengthening social interactions and revitalizing neighborhood identity, aligning with the present research's findings regarding the role of social interactions and sensory-psychological dimensions in the happiness of the elderly. Internationally, Buffel and Phillipson (2018) and Golant (2014) have emphasized the need to consider the socio-psychological needs and genuine participation of the elderly. A review of experiences shows that most research has either focused on objective indicators or addressed subjective dimensions separately, and the main gap is the absence of an integrated model for simultaneously measuring these components in historical squares with a focus on elderly happiness.

2.3. Analytical framework and conceptual model of the research

The conceptual framework of the present study is based on the causal-correlation approach. Accordingly, social sustainability is defined as a multidimensional

construct with five main components, including physical-functional quality, social interactions, sensory-psychological dimensions, security, and accessibility and transportation, which play the role of predictor variables. In contrast, elderly happiness is considered the outcome and dependent variable of the study, resulting from the cumulative and interactive effect of the five aforementioned components. The conceptual distinction between social sustainability as a context and happiness as an outcome is one of the present study's innovative aspects. Based on this framework, the main research question examines the degree of correlation and the contribution of each of the five social sustainability components in explaining the happiness of the elderly (Figure 1). It is worth noting that despite the approach of some previous studies in considering happiness as one of the components of social sustainability (Buffel & Phillipson, 2018; Golant, 2014), in the present study, based on the theoretical foundations of human-centered urban planning and environmental psychology, happiness has been included as a dependent variable and outcome.

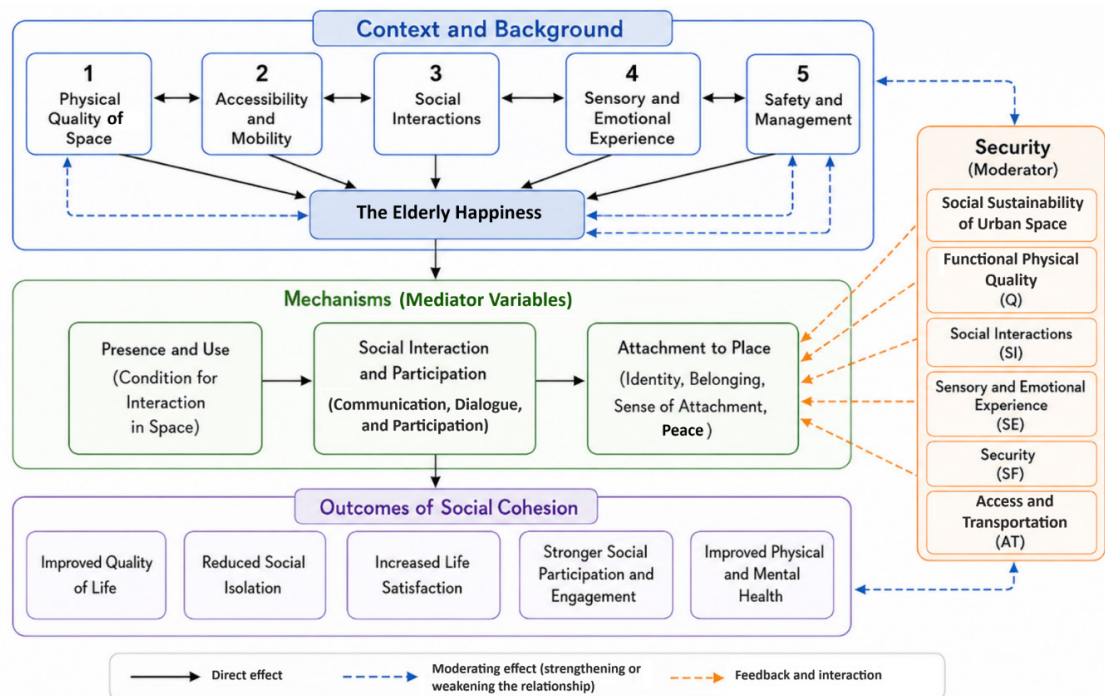


Figure 1. Conceptual model of research based on the causal-correlation approach (five components of social sustainability as independent variables and elderly happiness as the dependent variable)

3. Materials and methods

The present study is applied in purpose and, in terms of data collection, uses a sequential exploratory mixed-

methods design. This approach was chosen because social sustainability and elderly happiness are multidimensional, and measuring these concepts

requires more than quantitative methods alone. It also requires a deeper understanding of the elderly's lived experiences and subjective perceptions. In this design, the qualitative phase precedes the quantitative phase, and the findings from the qualitative stage were used to develop and enrich the quantitative instrument. Qualitative findings also played a complementary and explanatory role in interpreting quantitative results.

3.1. Study area

Naqsh-e Jahan Square in Isfahan, built between 1598 and 1629 AD by order of Shah Abbas I of the Safavid dynasty and today considered one of the most prominent works inscribed on the UNESCO World Heritage List, was selected as the study area. The choice of this location as a case study was not merely based on its historical and architectural values. As one of the most dynamic public spaces in Iran, this square provides a unique setting for examining the relationship between social sustainability and elderly happiness. With an area of over 89,600 square meters, Naqsh-e Jahan Square is not only one of the largest historical squares in the world but also, as the “living room” of Isfahan, plays a central role in citizens' collective life and hosts thousands of residents and tourists daily.

The diverse functions of this space, such as social interaction, recreation, shopping, cultural and ritual events, and leisure time, have made it an arena for the simultaneous presence of different age, gender, and social groups. Among the reasons for selecting this square is its high capacity for studying patterns of social interaction among the elderly, as the elderly's daily presence in this space indicates its relative attractiveness and efficiency for this age group. Also, the square's historical and identity nature has high semantic and memorability value, making it an excellent place to study the sensory-psychological dimensions of social sustainability. Despite this square's importance, no comprehensive, systematic study using a social sustainability approach focused on the elderly has been conducted in this space to date. On the other hand, Naqsh-e Jahan Square, despite its vast historical and social capital, faces numerous physical and functional challenges, including the lack of standard rest furniture, uneven paving, insufficient shading, and inadequate access to restrooms. This contrast between rich semantic capital and evident physical deficiencies makes this space an exceptional case for examining the role of each of these two categories of factors in elderly happiness.

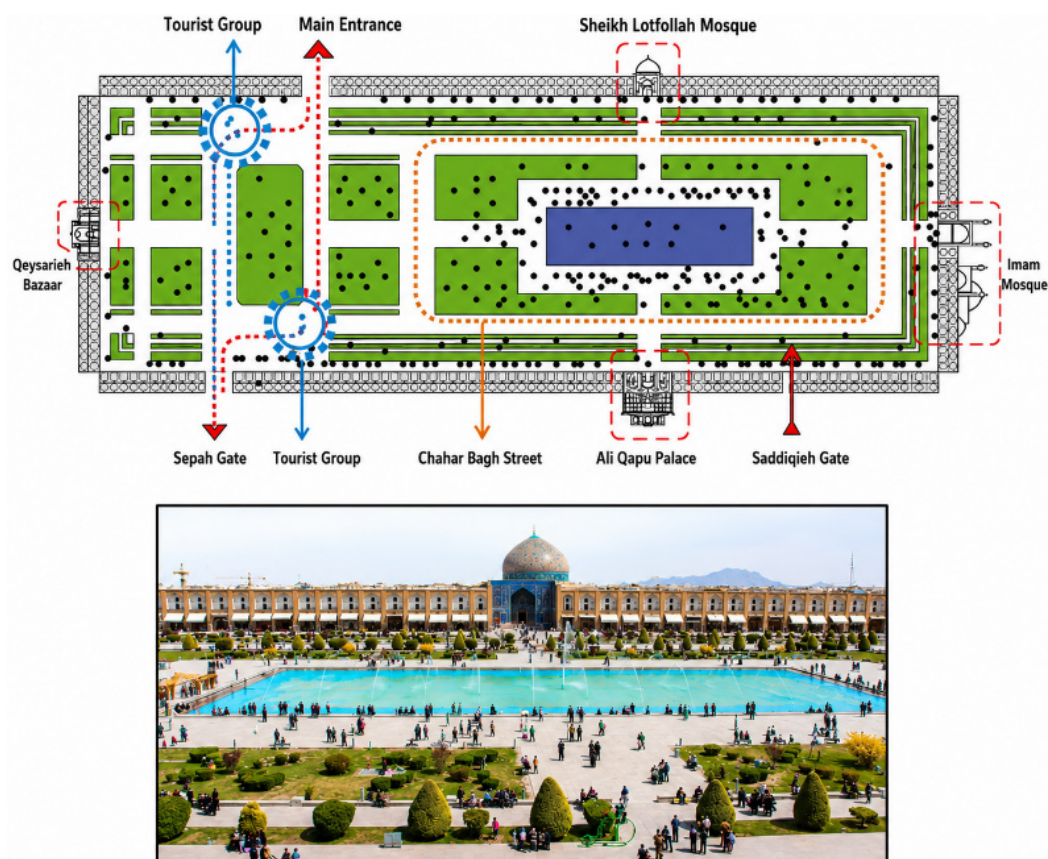


Figure 2. Study area

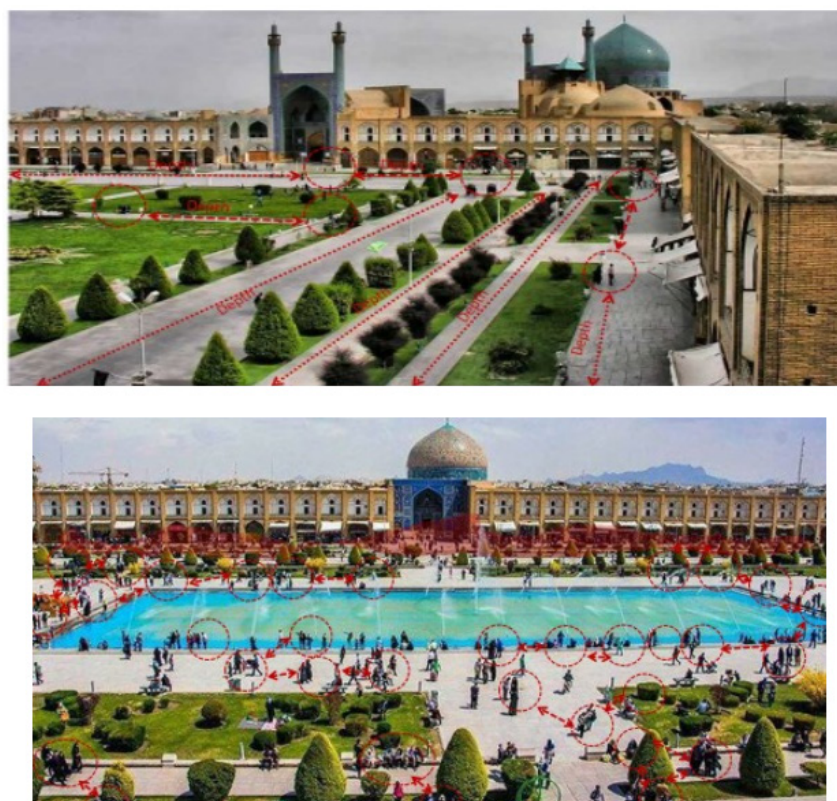


Figure 3. Social interactions of the elderly

3.2. Components and measurement indicators

Based on the theoretical framework and research background, social sustainability is operationalized with five main components. The first component, physical-functional quality, includes indicators of paving smoothness and safety, adequate rest furniture, shading and climatic comfort, access to restrooms, and quality of daylight and lighting. The second component, social interactions, is measured by indicators of opportunities for meetings and encounters, diversity of collective activities, generational and social mixing, and possibility of face-to-face dialogue and interaction. The third component, sensory-psychological dimensions, includes sense of place attachment,

spatial memorability, architectural identity and authenticity, and visual appeal and tranquility. The fourth component, safety, is evaluated by indicators of traffic safety, night lighting, natural surveillance, and social security. The fifth component, accessibility and transportation, includes indicators of access to public transportation, universal accessibility, and adequate parking. Elderly happiness, the dependent variable, is measured by five indicators: satisfaction with presence in the square, feeling of pleasure and vitality in the space, willingness to repeat presence, reduced loneliness, and sense of meaning and purpose. The total indicators include 25 items designed based on a five-point Likert scale.

Table 1. Components of the urban environment affecting elderly happiness

Component	Key indicators	Operational definition in urban square
Physical-functional quality	Smoothness and safety of paving	Flat, non-slip, and obstacle-free surface enabling movement with a cane, walker, or wheelchair
	Adequate rest furniture	Benches with backrests and armrests, standard height (45-50 cm), logical spacing (every 50-100 m)
	Shading and climatic comfort	Presence of trees, canopies, or shading structures in the main core and high-traffic routes
	Access to restrooms	Appropriate distance from gathering points, cleanliness, easy access without stairs or steep slopes
	Quality of daylight and lighting	Adequate lighting during the day and gentle, uniform lighting at night without glare
Social interactions	Opportunities for meetings and encounters	Presence of spaces such as teahouses, cafes, group seating platforms enabling face-to-face conversation
	Diversity of collective activities	Holding cultural events, traditional ceremonies, live music, or local markets at appropriate times of day
	Generational and social mixing	Simultaneous presence of different age groups in the space without dominance of a specific group
	Possibility of face-to-face dialogue and interaction	Space designed to facilitate eye contact and calm conversation, without physical or acoustic barriers
Sensory-psychological	Sense of place attachment	Feeling of psychological ownership, emotional attachment, and desire to return to the space
	Memorability	Ability of space to evoke individual and collective memories through historical and architectural signs
	Identity and authenticity	Preservation of native and historical elements connected to the elderly's lived experience
	Visual appeal and tranquility	Architectural proportions, colors, lighting, and presence of water and green space as sources of positive sensory stimulation
Safety	Traffic safety	Separation of pedestrian and vehicular paths, safe crossings, speed bumps, and warning signs
	Night lighting	Adequate and uniform lighting at dusk and night without blind spots and dark areas
	Natural surveillance	Design so that the space is always under observation of passersby and users (eyes on the street)
	Social security	Feeling of safety from crime, harassment, and deviant behaviors in the space
Accessibility and transportation	Access to public transportation	Proximity to bus, metro, or taxi stations with appropriate distance for elderly walking
	Universal accessibility	Presence of ramps, elevators, or step-free paths for entering the square and surrounding buildings
	Adequate parking	Presence of nearby parking with safe distance and smooth path to the square entrance

Component	Key indicators	Operational definition in urban square
Elderly happiness (outcome)	Satisfaction with presence in the square	Positive evaluation by the elderly of the experience of being in the square space
	Feeling of pleasure and vitality in the space	Experience of positive emotions and liveliness during movement and stopping in the square
	Willingness to repeat presence	Intention and desire of the elderly to return to the square in the future
	Reduction of loneliness	Feeling of companionship, connection, and solidarity with others in the square space
	Sense of meaning and purpose	Understanding the value and importance of activities performed in the square for the elderly's life
Social interactions	Adequate rest furniture	Benches with backrests and armrests, standard height (45-50 cm), logical spacing (every 50-100 m)
	Shading and climatic comfort	Presence of trees, canopies, or shading structures in the main core and high-traffic routes
	Access to restrooms	Appropriate distance from gathering points, cleanliness, easy access without stairs or steep slopes
	Quality of daylight and lighting	Adequate lighting during the day and gentle, uniform lighting at night without glare
	Opportunities for meetings and encounters	Presence of spaces such as teahouses, cafes, group seating platforms enabling face-to-face conversation

3.3. Data collection and analysis process

In the qualitative phase, structured field observations and in-depth semi-structured interviews were used to initially identify the components and enrich the questionnaire. Field observations were conducted at different times of the day (morning, noon, and evening) and on weekdays and holidays from August to October 2025. Using a researcher-made observation checklist, the researcher recorded the elderly's behavioral patterns, such as gathering and stopping points, pause duration, activity type, and traffic routes. Semi-structured interviews were conducted with 12 key actors, including the elderly, businessmen, and cultural heritage experts. Qualitative data were analyzed using Brown and Clark's six-stage content analysis method, resulting in 87 primary codes, 12 sub-themes, and six main themes. In the quantitative phase, the statistical population was elderly people aged 60 and older living in Isfahan who had trafficked in the field. Given the fluid nature of the society, convenience sampling was used, and sampling was conducted at different times and days. The sample size was determined to be 400 people. To increase the reliability of qualitative findings, participant review, peer review (0.78), and triangulation methods were used. The validity of the questionnaire was confirmed through face and content validity methods and by asking for opinions from 6 experts (CVR=0.81,

CVI=0.86). The reliability of the instrument was confirmed by Cronbach's alpha coefficient (0.83) and test-retest with an interval of two weeks (0.79). Quantitative data were analyzed using SPSS version 26 software at two descriptive and inferential levels. First, the Kolmogorov-Smirnov test was used to examine the normality of the data distribution. Given the large sample size ($n=400$) and the statistical strength of parametric tests, the Pearson correlation coefficient was used to examine the two-way relationship between each of the five components and the elderly's happiness. To ensure the accuracy of the results, Spearman's nonparametric test was also performed as an alternative, and its results were consistent with the findings of the Pearson test. In the next step, using the simultaneous method, a multiple linear regression analysis was conducted to measure the simultaneous effect of the five components of social stability on the happiness of the elderly. In this analysis, the five components of social stability were entered into the model as predictor variables and the happiness of the elderly as the criterion variable. Before running the regression, the assumptions, including normality of errors, independence of errors (Durbin-Watson test), non-multicollinearity (variance inflation index), and linearity of relationships, were evaluated and confirmed. To identify the factor structure and verify the validity of the constructs, confirmatory factor

analysis using the principal components method and Varimax rotation was used. The significance level for all tests was set at 0.05.

4. Findings

The description of the demographic characteristics of respondents, including gender, is as follows:

Table 2. Frequency and percentage of individual characteristic variables of respondents

Gender		Age		Education		Marital status	
Male	212	60-70 years	197	Below diploma	59	Single	166
				Diploma	173		
		Female	188	71-80 years	126		
Master's	61						
81 years and above	77			PhD	12		

Table 2 shows the frequency and percentage distribution of demographic variables of the elderly participating in the study. Among the 400 eligible respondents (elderly aged 60 and above present at Naqsh-e Jahan Square), 212 (53%) were male, and 188 (47%) were female. This relatively balanced gender distribution suggests that Naqsh-e Jahan Square is approximately equally attractive to elderly males and females. In terms of age distribution, the 60-70 age group has the highest frequency with 197 individuals (49.25%). The 71-80 age group, with 126 individuals (31.5%), and the 81 and above age group, with 77 individuals (19.25%), are in the next ranks. This shows that as age increases, the presence of the elderly in the square decreases, which may be due to declining physical abilities and increasing dependence on others. In terms of education level, the highest frequency is for diploma (173 individuals, 43.25%), and the lowest is for PhD (12 individuals, 3%). Bachelor's degrees account for 95 people (23.75%), master's degrees for 61 people (15.25%), and under-diploma for 59 people (14.75%). In terms of marital status, 234 individuals (58.5%) are married and 166

(41.5%) are single (including never married, widowed, and divorced). This population distribution shows that the statistical sample has good diversity in demographic characteristics. The significant presence of younger elderly (60-70) and the predominance of the married group may influence the attitudes and perspectives presented in responses to the questionnaire. The diversity of education also shows that Naqsh-e Jahan Square is a destination for elderly with different literacy levels. These findings allow the researcher to analyze the impact of variables such as age and gender on perception of social sustainability and happiness.

4.1. Qualitative findings: Field observations and thematic analysis of interviews

Before presenting quantitative findings, the results of the qualitative phase of the research are presented, including structured field observations and thematic analysis of semi-structured interviews with 12 key informants. These findings not only served as the basis for developing the questionnaire but also play a complementary role in interpreting quantitative results.

Table 3. Example of open, axial, and selective coding process in thematic analysis of interviews

Quotation from participant	Open code (initial)	Sub-theme	Main theme	Corresponding questionnaire item
I come here every day, but there is no place to sit. I have to sit on the edge of the pool or the mosque steps, which hurts my back.	No place to sit / unsuitable bench	Physical deficiencies	Physical-functional quality	Adequate rest furniture
The restroom is on the other side of the square, too far for me with knee pain.	Distance to restroom	Physical deficiencies	Physical-functional quality	Access to restrooms
I met my wife here fifty years ago. Every time I come, I feel the same way.	Memories of youth tied to the square	Emotional attachment	Sensory-psychological dimensions	Spatial memorability

Quotation from participant	Open code (initial)	Sub-theme	Main theme	Corresponding questionnaire item
This is the only place where I can see people and talk to someone. At home I'm alone.	Seeing others / reducing loneliness	Social interactions	Social interactions	Reduction of loneliness
Whenever I feel down, I come here and look at the domes. It's as if all my sorrows are forgotten.	Space tranquility / mood change	Emotional impact of space	Happiness	Feeling of pleasure and vitality in the space

Spatial behavior of the elderly in Naqsh-e Jahan Square

Systematic field observations at different times of day showed that the elderly's spatial distribution pattern in the square follows a certain order. The highest density of elderly presence was recorded during 16:00 to 19:00 (evening) and on holidays. In terms of spatial distribution, the eastern side (adjacent to Sheikh Lotfollah Mosque) and the western side (adjacent to Ali Qapu Palace) accounted for the most stops and pauses by the elderly. This concentration is due to natural shading from the height of the buildings, the presence of low seating platforms in front of the buildings, and relative access to traditional teahouses on these sides. Spatial behavioral analysis showed that the elderly mostly appear in groups of two to four people; their dominant activities are, in order, watching events and passersby (42% of presence time), face-to-face conversation (28%), resting and watching nature (18%), and shopping and strolling in the bazaar (12%). Social interactions mostly took place in the open space of the square on low platforms and brick edges, which lack any ergonomic standards for the elderly. During hot hours (12:00-14:00), the

presence of the elderly in the square's central core decreased sharply, and they took refuge in shaded margins under the bazaar's arcades. In terms of movement, the elderly chose routes around the central pool and the flanking gardens for walking, but the unevenness of the brick paving and gentle slopes, especially for elderly individuals using walkers or canes, were a source of fatigue and concern. For example, in six observation sessions, elderly individuals were seen forced to stop on the marginal grass due to fatigue from walking on uneven paving.

Findings from thematic analysis of interviews

Thematic analysis of semi-structured interviews with 12 key informants extracted 87 initial codes, 12 sub-themes, and six main themes that were fully consistent with the six factors of the research's conceptual model. The coding process was conducted at three levels: open coding (extraction of initial concepts), axial coding (categorizing concepts into sub-themes), and selective coding (selecting main themes and their relationships). The following table presents the extracted main themes along with frequent codes, frequencies, and sample quotations from participants.

Table 4. Main themes, frequent codes, and sample quotations from thematic analysis of interviews

Main theme	Frequent codes	Frequency (out of 12 interviews)	Sample quotation
Physical-functional quality	No place to sit	10	"I come here every day, but there is no place to sit. I have to sit on the edge of the pool or the mosque steps, which hurts my back. They won't install a proper bench with a backrest." (72-year-old male)
	Restroom is far	7	"The restroom is on the other side of the square, too far for me with knee pain. I have to walk a long way to get there." (68-year-old female)
	Brick paving is hard for walking with a cane	6	"These bricks are really bad for my cane; it vibrates, and I'm afraid of falling." (75-year-old male)
	Summer is too hot, and there's little shade	5	"At noon when the sun is strong, there's no shade in the square. We have to go under the arcades, which are crowded too." (70-year-old female)

Main theme	Frequent codes	Frequency (out of 12 interviews)	Sample quotation
Social interactions	Seeing tourists and young people makes me feel good	8	"This is the only place where I can see people and talk to someone. At home I'm alone. At least here it's full of life." (65-year-old female)
	I make appointments with friends here	7	"Every week I arrange to meet a few friends here. We come, drink tea, chat, and watch the tourists." (70-year-old male)
	The teahouses around are good places for chatting	6	"When we go to the Qeysarieh teahouse, there are lots of familiar people there. We sit for a few hours and talk." (74-year-old male)
Sensory-psychological	Memories of youth tied to this square	9	"I met my wife here fifty years ago. Every time I come, I feel the same way. This square is not just a square for me; it's the memory of my life." (78-year-old male)
	This square is the identity of Isfahan; it gives a sense of pride	8	"Whenever I have guests from other cities, I bring them here first. This square represents our authenticity and history." (67-year-old female)
	Every time I come, I remember the old days	7	"These domes and minarets are the same as sixty years ago. It's as if time has stopped here." (80-year-old male)
Safety	I'm afraid of motorcyclists passing through the walkway	5	"Motorcyclists pass through the walkway; they come from behind suddenly, I'm afraid of falling." (69-year-old female)
	There's not enough light at night	4	"At dusk, some corners get dark. I can't walk anymore." (76-year-old male)
Accessibility and Transportation	When you get off the bus, you have to walk a long way	5	"From the bus station to the square is a long way. It's hard for me with my breathing problems." (71-year-old female)
	The bazaar entrance has stairs; I can't go	4	"I'd like to go shopping in the bazaar, but the stairs at the Qeysarieh entrance are impossible for my knee pain." (73-year-old male)
Happiness	Coming here changes my mood	11	"Whenever I feel down, I come here, look at the domes, the water in the pool, the children running around. It's as if all my sorrows are forgotten. This place is like medicine for me." (69-year-old female)
	This square has tranquility	9	"Sitting by the pool and watching the water and sky has a strange tranquility. This is the only place where I can get away from everything for a few hours." (77-year-old male)

As shown in Table 4, the theme of "happiness" with the code "coming here changes my mood" (11 repetitions) had the highest frequency among participants, indicating the deep impact of this space on the mental health and emotional well-being of the elderly. After that, the theme of "physical-functional quality," with the code "no place to sit" (10 repetitions), is considered the square's most important physical challenge from the elderly's perspective. The theme of "sensory-psychological dimensions," with the code "memories of youth tied to this square" (9 repetitions), indicates the immense semantic and memorable capital of this historical space, which acts as the square's strongest asset in attracting and retaining the

elderly. The theme of "social interactions," with the frequent code "seeing tourists and young people makes me feel good" (8 repetitions), indicates that the elderly enjoy the generational diversity and social dynamism of the square, which helps reduce loneliness and increase their vitality. In contrast, the themes of "safety" and "accessibility and transportation" appeared less frequently (5 and 4 repetitions) in the interviews, but the codes raised in these themes (such as fear of motorcyclists and the stairway entrance to the bazaar) indicate serious barriers for the elderly with mobility limitations. A noteworthy point in the qualitative findings is the semantic overlap between the extracted themes and the six factors of the

research conceptual model, indicating the validity of the developed theoretical framework. Also, the high repetition of codes related to “happiness” and “sensory-psychological dimensions” compared with “physical-functional quality” and “accessibility” codes shows that the elderly, rather than complaining about physical deficiencies, are attached to the space’s semantic and memorable capital. This emotional

attachment encourages them to continue attending the square despite numerous deficiencies. This qualitative finding is fully convergent with the quantitative results (highest scores for sensory-psychological components and lowest scores for rest furniture), increasing the validity of both sets of findings.

Table 5. Frequency distribution of physical-functional quality factor variables

Factor	Component	Indicator	Very low
Physical-functional quality	Smoothness and safety of paving	Count	34
	Adequate rest furniture	Count	89
	Shading and climatic comfort	Count	45
	Access to restrooms	Count	67
	Quality of daylight and lighting	Count	23

Table 5 shows the unequal status of physical-functional quality indicators of Naqsh-e Jahan Square from the perspective of the elderly. Among the components, “quality of daylight and lighting” has the highest satisfaction rate, with 243 responses (60.8%) in the “high” and “very high” categories. This finding indicates that the square has relatively favorable natural light during the day and artificial lighting at night, and the elderly feel safe and comfortable in this regard. Also, “smoothness and safety of paving,” with 221 responses (55.25%) in the “high” and “very high” categories, ranks second, indicating that the square’s paving condition is relatively acceptable for the elderly’s movement. In contrast, “adequate rest furniture,” with only 98 responses (24.5%) in the “high” and “very high” categories and 201 responses (50.25%) in the “very low” and “low” categories, shows the lowest satisfaction rate. This finding

indicates a severe shortage of standard benches with backrests and armrests for the elderly in Naqsh-e Jahan Square. Similarly, “access to restrooms,” with 143 responses (35.75%) in the “high” and “very high” categories and 156 responses (39%) in the “very low” and “low” categories, shows that the distance and quality of restrooms are not suitable for the elderly. These findings are important for the present study because they show that although Naqsh-e Jahan Square has acceptable lighting and relatively smooth paving, the lack of standard rest furniture and inadequate access to restrooms are among the main obstacles to achieving social sustainability and happiness for the elderly. An elderly person who cannot find a place to sit and rest cannot experience happiness in the space. Therefore, improving these two indicators is suggested as a priority intervention in the square.

Table 6. Frequency distribution of social interactions factor variables

Factor	Component	Indicator	Very low
Social interactions	Opportunities for meetings and encounters	Count	21
	Diversity of collective activities	Count	23
	Generational and social mixing	Count	18
	Possibility of face-to-face dialogue and interaction	Count	19

The results of Table 6 show the very favorable status of social interaction components in Naqsh-e Jahan Square from the elderly’s perspective. Among the indicators of this factor, “opportunities for meetings

and encounters” has the highest satisfaction rate with 278 responses (69.5%) in the “high” and “very high” categories. This finding indicates that the presence of teahouses, traditional cafes, and group seating

platforms in the square has provided a suitable context for friendly meetings and social encounters of the elderly. Also, “generational and social mixing,” with 281 responses (70.25%) in the “high” and “very high” categories, shows that the square has created a space for the simultaneous presence of different age groups without any specific group dominating the space. “Possibility of face-to-face dialogue and interaction,” with 271 responses (67.75%), and “diversity of collective activities,” with 254 responses (63.5%) in the “high” and “very high” categories, also indicate favorable conditions. These findings suggest that the square’s spatial design does not create significant physical or acoustic barriers to the elderly’s

conversation, and that holding cultural events, traditional ceremonies, and live music in the square provides a context for their social participation. Social interactions, a key component of social sustainability, play a direct role in reducing loneliness and increasing the happiness of the elderly. The results show that Naqsh-e Jahan Square, despite its physical deficiencies, has been very successful in creating opportunities for social interaction. This immense social capital can be considered the square’s main strength in promoting elderly happiness, and it is suggested that improvement actions prioritize preserving and strengthening this valuable asset.

Table 7. Frequency distribution of sensory-psychological factor variables

Factor	Component	Indicator	Very low
Sensory-psychological	Sense of place attachment	Count	12
	Spatial memorability	Count	8
	Identity and architectural authenticity	Count	7
	Visual appeal and tranquility	Count	11

Table 7 shows that the sensory-psychological factor, with a mean of 4.45-4.81, is evaluated at the highest level. “Identity and architectural authenticity” (4.81) and “spatial memorability” (4.62) have the highest means among all components. “Sense of place attachment” (4.45) and “visual appeal and tranquility” (4.52) are also evaluated at a high level. The low

standard deviation in these components (0.65 to 0.74) indicates strong consensus among respondents in positive evaluation of these dimensions. This finding suggests that Naqsh-e Jahan Square, by preserving native and historical elements, has established a connection with the lived experience of the elderly, which is reflected in their evaluation.

Table 8. Frequency distribution of safety factor variables

Factor	Component	Indicator	Very low	Low	Moderate	High	Very high
Safety	Traffic safety	Count	45	67	89	112	87
	Night lighting	Count	23	45	78	134	120
	Natural surveillance	Count	21	34	67	145	133
	Social security	Count	19	32	56	134	159

Table 8 shows the relatively favorable status of safety components in Naqsh-e Jahan Square from the elderly’s perspective. Among the indicators of this factor, “social security” has the highest satisfaction rate, with 293 responses (73.25%) in the “high” and “very high” categories. This finding indicates that the elderly feel a relatively good sense of safety from crime, harassment, and deviant behaviors in the square space. This sense of security may result from the active and diverse presence of people at different

times of day and existing natural surveillance. “Natural surveillance,” with 278 responses (69.5%), and “night lighting,” with 254 responses (63.5%) in the “high” and “very high” categories, are in the next ranks. These findings indicate that the square’s physical design ensures the space is under the observation of passersby and users (eyes on the street), and lighting at dusk and night is relatively acceptable. In contrast, “traffic safety,” with 199 responses (49.75%) in the “high” and “very high” categories, and 112 responses

(28%) in the “very low” and “low” categories, shows the lowest satisfaction rate among safety indicators. This finding indicates that the separation of pedestrian and vehicular paths, safe crossings, and warning signs in the square and surrounding streets need fundamental improvement. Safety, as a basic need of the elderly, is a necessary condition for their presence in public space. Although Naqsh-e Jahan Square is

relatively good in terms of social security and natural surveillance, weakness in traffic safety can be a source of fear and concern, especially for the elderly with poorer physical balance. Improving traffic safety through physical separation of pedestrian and vehicular paths and creating safe crossings is suggested as one of the square’s improvement priorities to increase elderly happiness.

Table 9. Frequency distribution of accessibility and transportation factor variables

Factor	Component	Indicator	Very low	Low	Moderate	High	Very high
Accessibility and Transportation	Access to public transportation	Count	23	45	78	134	120
	Universal accessibility	Count	78	98	101	76	47
	Adequate parking	Count	56	78	89	98	79

Table 9 shows the unequal status of accessibility and transportation components in Naqsh-e Jahan Square from the elderly’s perspective. Among the indicators, “access to public transportation” has the highest satisfaction rate with 254 responses (63.5%) in the “high” and “very high” categories. This finding indicates that the square’s proximity to bus, metro, and taxi stations, and their appropriate distance for elderly walking, is relatively favorable. This locational advantage has made the square an accessible destination for elderly residents across the city. In contrast, “universal accessibility,” with only 123 responses (30.75%) in the “high” and “very high” categories, and 176 responses (44%) in the “very low” and “low” categories, shows the lowest satisfaction rate. This finding indicates a severe shortage of ramps, elevators, and step-free paths for entering the square and surrounding historical buildings. Elderly people using wheelchairs, walkers, or canes face barriers in

accessing parts of the square and prominent buildings. Also, “adequate parking,” with 177 responses (44.25%) in the “high” and “very high” categories, and 134 responses (33.5%) in the “very low” and “low” categories, shows a moderate to low condition. Easy access to the square is the primary precondition for the elderly’s presence and happiness in the space. If the elderly cannot easily and safely reach and move within the square, other components of social sustainability (such as social interactions or sensory-psychological dimensions) will practically be unusable. Therefore, although the square has suitable access to public transportation, the lack of universal accessibility for elderly people with mobility limitations is a fundamental gap that should be a priority for improvement actions. Designing appropriate ramps at main entrances and creating step-free paths in historical buildings are among the proposed solutions for realizing an age-friendly square.

Table 10. Frequency distribution of elderly happiness factor variables

Factor	Component	Indicator	Very low	Low	Moderate	High	Very high
Elderly happiness	Satisfaction with presence in the square	Count	12	23	56	134	175
	Feeling of pleasure and vitality in the space	Count	14	28	67	145	146
	Willingness to repeat presence	Count	18	34	78	134	136
	Reduction of loneliness	Count	34	56	89	112	109
	Sense of meaning and purpose	Count	11	23	67	123	176

Table 10 shows that “sense of meaning and purpose” has the highest scores in the happiness factor, with a mean of 4.48; “satisfaction with presence in the square,” with a mean of 4.38; and “feeling of pleasure

and vitality in the space,” with a mean of 4.19. “Willingness to repeat presence” is also relatively high, with a mean of 4.08. In contrast, “reduction of loneliness,” with a mean of 3.57, has the lowest score

in this factor, indicating that despite existing social interactions, some elderly still do not experience a deep sense of companionship and solidarity.

Table 11. Statistical indicators of social sustainability components and elderly happiness in Naqsh-e Jahan Square

Factor	Component	Mean	Standard deviation	Min	Max
Physical-functional quality	Smoothness and safety of paving	3.54	0.92	1	5
	Adequate rest furniture	2.67	0.98	1	5
	Shading and climatic comfort	3.41	0.87	1	5
	Access to restrooms	3.02	0.91	1	5
	Quality of daylight and lighting	3.86	0.84	1	5
Social interactions	Opportunities for meetings and encounters	4.02	0.83	1	5
	Diversity of collective activities	3.92	0.86	1	5
	Generational and social mixing	4.08	0.79	1	5
	Possibility of face-to-face dialogue and interaction	3.97	0.81	1	5
Sensory-psychological	Sense of place attachment	4.45	0.74	1	5
	Spatial memorability	4.62	0.71	1	5
	Identity and architectural authenticity	4.81	0.65	1	5
	Visual appeal and tranquility	4.52	0.73	1	5
Safety	Traffic safety	3.38	0.94	1	5
	Night lighting	3.84	0.88	1	5
	Natural surveillance	4.02	0.83	1	5
	Social security	4.17	0.79	1	5
Accessibility and transportation	Access to public transportation	3.87	0.85	1	5
	Universal accessibility	2.84	0.96	1	5
	Adequate parking	3.32	0.91	1	5
Elderly happiness	Satisfaction with presence in the square	4.38	0.76	1	5
	Feeling of pleasure and vitality in the space	4.19	0.82	1	5
	Willingness to repeat presence	4.08	0.85	1	5
	Reduction of loneliness	3.57	0.96	1	5
	Sense of meaning and purpose	4.48	0.74	1	5

Table 11 shows differences in the means of the six components of social sustainability and elderly happiness in Naqsh-e Jahan Square. The sensory-psychological factor, with a mean of 4.45 to 4.81, has the highest mean among the six factors. "Identity and architectural authenticity" (4.81) and "spatial memorability" (4.62) were identified as the components with the highest means. The social interaction factor ranks second, with a mean of 3.97 to

4.08. The happiness factor, as the main dependent research variable, is evaluated at a relatively high level, with a mean of 3.57 to 4.48. In contrast, the physical-functional quality factor has the lowest mean among the factors, with a mean of 2.67 to 3.86. "Adequate rest furniture" achieved the lowest scores, with a mean of 2.67, and "universal accessibility" with a mean of 2.84.

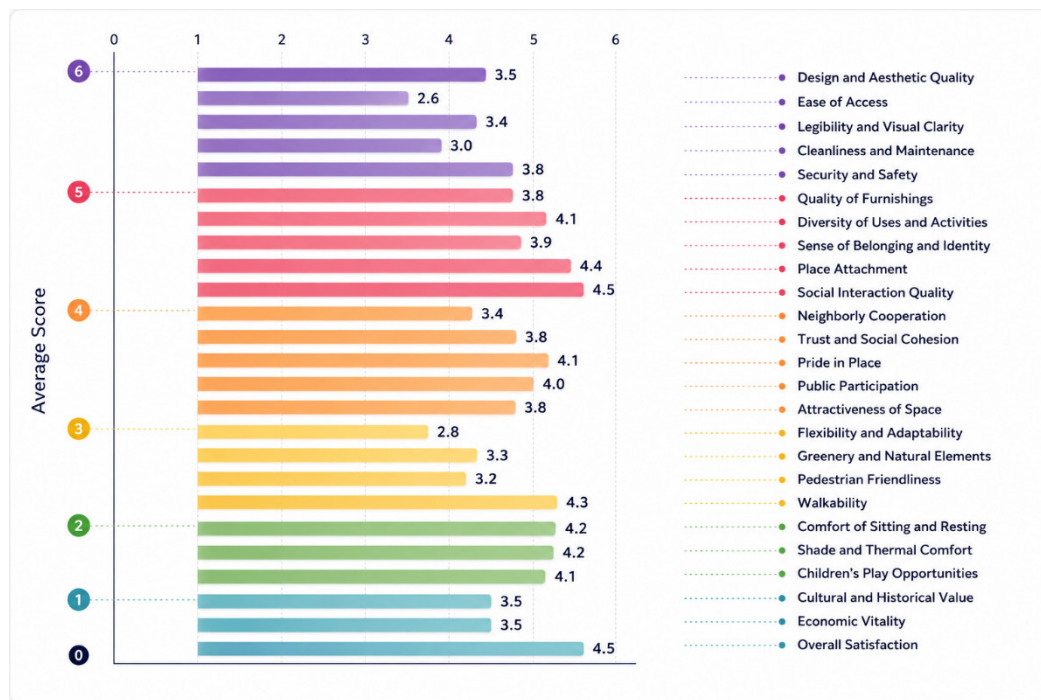


Figure 4. Statistical indicators of social sustainability components and elderly happiness in Naqsh-e Jahan Square

Table 12. Factor loadings and Cronbach's Alpha coefficients of social sustainability components and elderly happiness

Factor	No.	Component	Factor loading	Cronbach's Alpha
Physical-functional quality	1	Smoothness and safety of paving	0.72	0.79
	2	Adequate rest furniture	0.81	0.82
	3	Shading and climatic comfort	0.68	0.77
	4	Access to restrooms	0.74	0.80
	5	Quality of daylight and lighting	0.70	0.78
Social interactions	6	Opportunities for meetings and encounters	0.82	0.85
	7	Diversity of collective activities	0.79	0.83
	8	Generational and social mixing	0.77	0.82
	9	Possibility of face-to-face dialogue and interaction	0.80	0.84
	10	Sense of place attachment	0.85	0.88
Sensory-psychological	11	Spatial memorability	0.88	0.89
	12	Identity and architectural authenticity	0.91	0.90
	13	Visual appeal and tranquility	0.84	0.87
Safety	14	Traffic safety	0.69	0.76
	15	Night lighting	0.71	0.78
	16	Natural surveillance	0.76	0.81
	17	Social security	0.80	0.83

Factor	No.	Component	Factor loading	Cronbach's Alpha
Accessibility and transportation	18	Access to public transportation	0.73	0.79
	19	Universal accessibility	0.75	0.80
	20	Adequate parking	0.67	0.75
Elderly happiness	21	Satisfaction with presence in the square	0.86	0.88
	22	Feeling of pleasure and vitality in the space	0.83	0.86
	23	Willingness to repeat presence	0.79	0.84
	24	Reduction of loneliness	0.70	0.78
	25	Sense of meaning and purpose	0.87	0.89

Table 12 shows the appropriate fit of the measurement model and high reliability of the research instrument. The factor loadings and Cronbach's alpha coefficients provide a clear picture of the validity and reliability of the constructs examined in this study. Regarding factor loadings, which indicate each component's contribution to explaining the respective factor, all calculated values for the 25 components are above 0.50. This indicates that each questionnaire item has significant explanatory power and all are retained in the final research model. Among all factors examined, the sensory-psychological factor with very high factor loadings (between 0.84 and 0.91) plays the strongest role in explaining the social sustainability of Naqsh-e Jahan Square. "Identity and architectural authenticity" contributed highly to this factor, with a factor loading of 0.91, followed by "spatial memorability" (0.88) and "sense of place attachment" (0.85). This indicates that the semantic and historical capital of Naqsh-e Jahan Square is its most important asset for promoting social sustainability and elderly happiness. The component "visual appeal and tranquility," with a factor loading of 0.84, also significantly contributed to this factor. In the social interaction factor, "opportunities for meetings and encounters," with a factor loading of 0.82, and "possibility of face-to-face dialogue and interaction," with 0.80, have the highest contributions. "Diversity of collective activities" (0.79) and "generational and social mixing" (0.77) rank next. In the physical-functional quality factor, "adequate rest furniture" has the highest contribution with a factor loading of 0.81, indicating the vital importance of this component in the elderly's evaluation of the square space quality. "Access to restrooms," with 0.74, "smoothness and safety of paving," with 0.72, and "quality of daylight and lighting," with 0.70, rank next. "Shading and climatic comfort," with 0.68, has the lowest factor loading in this factor. In the safety factor, "social

security," with a factor loading of 0.80, has the highest contribution, followed by "natural surveillance," with 0.76, "night lighting," with 0.71, and "traffic safety," with 0.69. In the accessibility and transportation factor, "universal accessibility," with 0.75, "access to public transportation," with 0.73, and "adequate parking," with 0.67, respectively, have the highest to lowest contributions. In the elderly happiness factor, as the main dependent variable of the research, "sense of meaning and purpose," with a factor loading of 0.87, and "satisfaction with presence in the square," with 0.86, have the highest contributions. "Feeling of pleasure and vitality in the space," with 0.83, "willingness to repeat presence," with 0.79, and "reduction of loneliness," with 0.70, are in the next ranks. Regarding Cronbach's alpha coefficients, which indicate internal reliability or consistency of questions within each component, all calculated values are above 0.75. This finding indicates the high reliability of the research instrument and appropriate consistency of items in each section. The highest reliability coefficients belong to the components "identity and architectural authenticity" (0.90) and "spatial memorability" (0.89), indicating very high consistency among the questions in these sections. "Sense of place attachment" (0.88) and "visual appeal and tranquility" (0.87) also have high reliability. The lowest reliability coefficient belongs to the component "adequate parking," with a value of 0.75, which is still within the acceptable and standard range. These findings are significant for the present study. Table 12 clearly shows that the designed questionnaire instrument has desirable construct validity (appropriate factor loadings) and reliability (high Cronbach's alpha). Therefore, the results obtained in answering the research questions can be trusted. It is also confirmed that the sensory-psychological and happiness components have the highest internal consistency and

are the strongest constructs of the research. This finding further highlights the importance of Naqsh-e

Jahan Square's historical and semantic capital in promoting elderly happiness.

Table 13. Kolmogorov-Smirnov test for normality of research variables

No.	Variable	Test statistic	Significance level (p-value)	Result
1	Smoothness and safety of paving	0.118	0.072	Normal
2	Adequate rest furniture	0.142	0.031	Non-normal
3	Shading and climatic comfort	0.125	0.065	Normal
4	Access to restrooms	0.131	0.048	Non-normal
5	Quality of daylight and lighting	0.119	0.069	Normal
6	Opportunities for meetings and encounters	0.108	0.085	Normal
7	Diversity of collective activities	0.126	0.059	Normal
8	Generational and social mixing	0.135	0.042	Non-normal
9	Possibility of face-to-face dialogue and interaction	0.121	0.067	Normal
10	Sense of place attachment	0.114	0.078	Normal
11	Spatial memorability	0.109	0.088	Normal
12	Identity and architectural authenticity	0.097	0.112	Normal
13	Visual appeal and tranquility	0.115	0.076	Normal
14	Traffic safety	0.138	0.038	Non-normal
15	Night lighting	0.124	0.063	Normal
16	Natural surveillance	0.129	0.055	Normal
17	Social security	0.117	0.074	Normal
18	Access to public transportation	0.122	0.066	Normal
19	Universal accessibility	0.141	0.034	Non-normal
20	Adequate parking	0.133	0.046	Non-normal
21	Satisfaction with presence in the square	0.111	0.081	Normal
22	Feeling of pleasure and vitality in the space	0.120	0.068	Normal
23	Willingness to repeat presence	0.127	0.058	Normal
24	Reduction of loneliness	0.143	0.029	Non-normal
25	Sense of meaning and purpose	0.113	0.079	Normal

Although the Kolmogorov-Smirnov test showed that 8 of 25 research variables have non-normal distributions, this test was used to examine correlations due to the statistical robustness of the Pearson test in large sample sizes ($n = 400$) and confirmation of the linearity assumption through scatter plots. For greater assurance, the non-parametric Spearman test was also conducted as an alternative; the results were fully convergent with the Pearson results, indicating that

deviation from normality at this sample size did not affect the correlation results.

To measure the construct of elderly happiness as a dependent variable, its composite score was first created by calculating the average of the five relevant items (Table 10). Then, the correlation of this composite score with each of the five components of social sustainability was calculated.

Table 14. Results of Pearson and Spearman correlation coefficients between the five components of social sustainability and happiness of the elderly

Factor	Pearson correlation	Spearman correlation	Significance level	Result
Physical-functional quality	0.78	0.76	0.000	Significant
Social interactions	0.85	0.83	0.000	Significant
Sensory-Psychological	0.92	0.90	0.000	Significant
Safety	0.74	0.72	0.000	Significant
Accessibility and Transportation	0.69	0.67	0.000	Significant

Table 14 shows a positive and significant correlation between all five factors of social sustainability and elderly happiness at the 99% confidence level ($p = 0.000$). The sensory-psychological factor, with a coefficient of 0.92 (Pearson) and 0.90 (Spearman), has the highest correlation, while the accessibility and transportation factor, with coefficients of 0.69 and 0.67, has the lowest. The convergence of Pearson and Spearman coefficients indicates the stability of the results and the non-influence of findings from deviation of data from a normal distribution. In other words, the semantic and historical capital of the square (sensory-psychological) plays the strongest role in explaining elderly happiness, while accessibility and

physical components have a smaller contribution. Quantitative findings show that Naqsh-e Jahan Square performs favorably in the sensory-psychological and social interaction dimensions; however, it faces significant deficiencies in the physical-functional and accessibility dimensions. Based on Pearson correlation test results, the sensory-psychological factor, with a coefficient of 0.92, has the highest correlation with elderly happiness, and the accessibility and transportation factor, with a coefficient of 0.69, has the lowest. This prioritization indicates that the square's semantic and historical capital plays a more decisive role in elderly happiness despite physical deficiencies.

Table 15. Results of multivariate linear regression analysis (beta coefficients and significance levels)

Variable	Standardized Beta (β)	Standard error	t-statistic	Significance (p-value)
Physical-Functional Quality	0.07	0.054	1.30	0.194
Social Interactions	0.23	0.048	4.79	0.000
Sensory-Psychological	0.54	0.041	13.17	0.000
Safety	0.16	0.051	3.14	0.002
Accessibility & Transportation	0.04	0.049	0.82	0.413

The multivariate regression analysis shows that the research model, with a coefficient of determination of 0.78, is able to explain 78 percent of the changes in the happiness of the elderly. Among the five components of social stability, "sensory-psychological dimensions," with a standardized beta coefficient of 0.54, has the highest direct contribution to predicting the happiness of the elderly. "Social interactions," with a coefficient of 0.23, and "security," with a coefficient of 0.16, rank next. In contrast, the components "physical-functional quality," with a coefficient of 0.07, and "accessibility and transportation," with a coefficient of 0.04, do not contribute significantly to explaining happiness. The Durbin-Watson statistic is 1.89, and the variance inflation index is less than two for all variables,

indicating the independence of errors and the absence of multicollinearity in the model.

5. Discussion and interpretation

The findings of the present study showed that among the five components of social sustainability, the sensory-psychological dimensions, with a correlation coefficient of 0.92, had the strongest relationship with the elderly's happiness. This finding is consistent with Harandi et al. (2021), who introduced "sense of place belonging" as one of the main dimensions of an age-friendly city. It also aligns with Ma'roufi et al. (2024), who showed that the indicators of an age-friendly city play a significant role in predicting older adults' social belonging. In other words, both studies identify the

semantic and identity dimensions of space as a determining factor in the elderly's quality of life. At the international level, Bafel and Philipson (2018), who emphasize the elderly's active participation in planning processes, are consistent with the approach of the present study in the simultaneous evaluation of physical and sensory-psychological dimensions. In contrast, the lowest scores were related to the physical-functional components (rest furniture with a mean of 2.67 and inclusive accessibility with a mean of 2.84), which is in line with the study by Mousavi et al. (2025), who showed that "outdoor spaces and buildings" have the highest priority among the criteria of an age-friendly city. Isalou et al. (2015) also pointed to similar problems such as the lack of seating space, stairs, and uneven surfaces, which is fully consistent with the findings of the present study. Also, the study by Rezaei et al. (2023) on Mellat Street in Shahrekord showed that despite the presence of suitable physical components, in the absence of safety and accessibility, the elderly's psychological satisfaction is not achieved, which is consistent with the lowest scores of the present study in rest furniture and inclusive accessibility. In some cases, the findings of the present study differ from the results of previous studies. The innovation of the present study can be explained at three levels. First, this is the first study that simultaneously and with a mixed-method approach evaluates the components of social sustainability of Naqsh-e Jahan Square from the elderly's perspective. Second, this research, for the first time, places "happiness" as the final dependent variable alongside social sustainability and measures the direct relationship between these two constructs in a historical square. Third, using confirmatory factor analysis, this study weights and prioritizes six key factors and shows that the sensory-psychological factor plays the strongest role in the elderly's positive experience; a finding that shifts design strategies from a purely physical approach toward strengthening semantic and memorable capitals. The study limitations include the use of convenience sampling instead of random sampling, which is associated with selection bias and makes the generalizability of the results cautious. Also, focusing on Naqsh-e Jahan Square as a unique historical space limits the possibility of generalizing the results to other urban squares. Conducting the research within a specific time period (August to October) and not examining seasonal changes are other limitations. Despite these limitations, the use of a triangulation strategy, an

appropriate sample size (400 people), and the convergence of the findings with previous studies have provided acceptable reliability for the results.

6. Discussion and conclusion

The present study aimed to evaluate the components of social sustainability of Naqsh-e Jahan Square from the perspective of elderly people's happiness, using a sequential exploratory mixed-method approach. The findings obtained from the analysis of quantitative and qualitative data showed that Naqsh-e Jahan Square, despite clear shortcomings in the physical and functional domains, can create a desirable level of happiness among the older adults present in the space by virtue of its immense semantic capital, rich historical background, and favorable context for social interactions. The study's most important achievement is the indispensable role of sensory-psychological dimensions in explaining older adults' happiness. Components such as identity and authenticity of architecture, memorability of space, and sense of place belonging showed the strongest correlation with older adults' happiness and were able to overcome the physical deficiencies of the space. This finding confirms that in historical spaces possessing semantic weight, intangible and identity-related capitals can play a more determining role in enhancing the elderly's quality of life than merely providing furniture and physical facilities. In other words, what turns a historical square into a happiness-inducing place for older adults is not merely benches and sanitary services, but the identity, collective memory, and emotional attachment that the space evokes in them. In contrast, the lowest levels of satisfaction were assigned to the physical-functional components, especially rest furniture, inclusive accessibility, and sanitary services. This finding indicates that although the square's semantic capitals have considerably compensated for existing shortcomings, neglecting the elderly's basic and objective needs can seriously challenge their experience of presence. An older adult who lacks a suitable place to sit and rest, or who must traverse a long distance to access a sanitary service, will not fully benefit from the spatial qualities. Therefore, providing the minimum physical essentials as a precondition for the elderly's effective presence in public spaces is unavoidable. Also, the positive and significant correlation between all components of social sustainability and older adults' happiness indicates that realizing social sustainability in public

spaces will pave the way for happiness among users. This finding, by emphasizing a human-centered approach to the design of urban spaces, reveals the need for simultaneous attention to physical, social, psychological, and security dimensions. Thus, the design of public spaces for the elderly should not be limited to providing physical facilities but should also focus on strengthening social interactions, fostering a sense of belonging and identity, and ensuring psychological and physical security. The conceptual separation of happiness from social sustainability is among the notable innovations of this study. Unlike some previous studies that have subsumed happiness under social sustainability, the findings of the present study show that happiness is itself the outcome and final consequence of realizing social sustainability components and does not have an independent and parallel role alongside them. This conceptual distinction provides a more precise analytical framework for measuring and evaluating public spaces. Among the fundamental limitations of the study is the use of convenience sampling instead of random sampling. Although the sample size (400 people) has acceptable statistical adequacy, this method is inherently associated with selection bias, meaning that respondents may possess characteristics that distinguish them from other older adults present in the square. This makes the generalizability of the results to the entire older adult population of Isfahan cautious. Also, the geographic distribution of residence and the socioeconomic diversity of respondents, which could have influenced the pattern of presence in the square, were not considered in this study. Focusing on Naqsh-e Jahan Square as a unique historical space with unparalleled semantic and memorable capitals limits the possibility of generalizing the results to other urban squares. There is also the possibility of respondent bias; perhaps older adults who voluntarily participated in the study had a more positive attitude toward the square's atmosphere. Conducting the research within a specific time period (August to October) and not examining seasonal changes and the effect of climatic conditions on the presence pattern of older adults are other methodological limitations of this study. Despite these limitations, the use of a triangulation strategy, an appropriate sample size, and the convergence of findings with previous studies have brought about acceptable reliability for the results.

Based on the weighted prioritization of components and the lowest scores obtained, the following

strategies are presented at three levels: physical, sociocultural, and managerial-institutional. At the physical level, the most urgent measure proposed is the immediate installation of standard benches with backrests and armrests at regular intervals on the eastern and western sides, which have the highest foot traffic of older adults. Also, the construction of new sanitary services with special standards for older adults near the northern and southern sides, the design and implementation of access ramps at the main entrances of the square and significant historical buildings such as the Qeysarieh Portal, Sheikh Lotfollah Mosque, and Ali Qapu Palace, increasing shading in the central core through the installation of retractable awnings or the planting of deciduous trees that do not block the view of historical buildings, and the physical separation of pedestrian paths from vehicular paths in the surrounding thoroughfares by creating pedestrian crossings equipped with special lights with longer crossing times are among other essential physical strategies. At the sociocultural level, holding cultural programs and collective events specifically for older adults, such as memory nights, traditional music, and handicraft exhibitions at appropriate hours of the day (16 to 19), is recommended to strengthen the sense of belonging and memorability. Also, designing semi-private spaces for small group interactions on the eastern and western sides and creating "elderly tables" in traditional coffeehouses to facilitate regular group interactions can help reduce feelings of loneliness and increase social solidarity. At the managerial-institutional level, forming an older adults' participation council in decisions related to the square, using smart technologies to inform about events and facilitate the presence of older adults, and designing online request systems for benches or services needed by older adults are among the effective strategies for enhancing the efficiency of the proposed interventions. Naqsh-e Jahan Square, despite its physical-functional and accessibility shortcomings, has been able to create a high level of happiness in older adults by virtue of its immense semantic, historical, and social interaction capital, and removing the identified obstacles can turn this valuable space into a model of an inclusive public space responsive to the needs of older adults. It is hoped that the findings of this study will guide designers, urban planners, and cultural heritage authorities in creating more equitable, more human-centered, and more happiness-inducing public spaces for the elderly of this land.

Authors' Contributions

This article has been entirely written and prepared by Yasmin Doozdoozani. She has been responsible for all stages of the research, including data collection, analyses, final text compilation, and final review. There has been no other contribution to the production of this scientific work, and all research activities have been carried out individually by her.

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Conflict of Interest

The author declares no conflicts of interest.

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