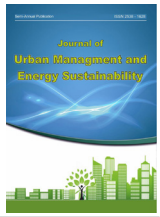
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Physical–Spatial Determinants of Semi-Private Spaces Associated with Reduced Resident Anxiety in Mid-Rise Residential Complexes: A Survey-Based Study in Mashhad, Iran

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ABSTRACT

In dense urban housing, the semi-private spaces that mediate between private dwellings and the public realm are increasingly recognised as determinants of residents' psychological well-being rather than merely functional circulation zones. Yet the specific physical–spatial characteristics through which these spaces alleviate or aggravate residents' anxiety and apprehension remain poorly defined, particularly in mid-rise complexes shaped by economic and floor-area pressures. This study aimed to identify the physical–spatial characteristics of semi-private spaces associated with lower anxiety and apprehension among residents of mid-rise residential complexes and to translate them into evidence-based design strategies. A quantitative, descriptive–analytical survey was conducted with 153 residents of five mid-rise complexes in Mashhad, Iran, using a researcher-developed questionnaire on semi-private-space characteristics and the standardised Generalised Anxiety Disorder-7 scale, with data analysed in SPSS 26 through Pearson correlation and multiple regression while controlling for general anxiety. A significant association emerged between the perceived quality of semi-private spaces and residents' anxiety, with territoriality and perceived surveillance, spatial enclosure and privacy, spatial legibility, proportion and scale, environmental quality, and natural elements entering the regression models as significant predictors. The relative weight of these predictors varied across the complexes, indicating that anxiety is shaped by the integrated configuration of space rather than by any single attribute. Designing semi-private spaces to strengthen perceived security and control, spatial legibility, lighting and material quality, and contact with nature may therefore foster calmer and more psychologically supportive residential environments; because the design is cross-sectional and correlational, the reported relationships are associational rather than causal.

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INTRODUCTION

Anxiety and stress-related conditions have become defining features of contemporary urban life, and their prevalence continues to rise in large cities worldwide (Kessler et al., 2005; World Health Organization, 2022). A growing body of evidence indicates that these experiences are shaped not only by individual and clinical factors but also by the quality of the everyday environments in which people live (Evans, 2003; Bratman et al., 2019). Because residential settings account for the largest share of daily life, the design of housing and especially of the spaces that surround and connect dwellings has direct implications for residents' mental health. Within residential complexes, semi-private spaces shared entrances, pilotis, lobbies, corridors, courtyards, and communal greenery occupy the threshold between the private unit and the public realm. As transitional zones they regulate privacy and social interaction (Altman, 1975), support natural surveillance and a sense of defensibility (Newman, 1972), and can act as restorative settings that ease mental fatigue when they incorporate natural elements (Kaplan & Kaplan, 1989; Ulrich, 1991). High-quality intermediate spaces have long been associated with social contact, belonging, and everyday well-being (Gehl, 2011). Despite this, the psychological role of semi-private spaces is frequently overlooked in mid-rise complexes particularly in Mashhad, Iran—where economic considerations and the maximisation of gross floor area often govern design decisions. Within the Iranian context, the spatial quality of residential environments has been examined in urban-design scholarship (Golkar, 2001; Abbaszadegan & Rezazadeh, 2013; Shahcheraghi & Bandarabad, 2015), and broader work underscores how culture (Low, 2017) and sustainable, human-centred neighbourhood design (Newman & Jennings, 2008) shape everyday spatial experience. Although social relations, security, and residential satisfaction have been widely examined, comparatively little research has isolated which physical–spatial characteristics of semi-private spaces most influence residents' anxiety and apprehension, and much of the available evidence is embedded in cultural contexts whose findings do not transfer directly to Iranian mid-rise housing (Lewicka, 2011). Accordingly, this study aims to identify the physical–spatial characteristics associated with reduced anxiety in the semi-private spaces of mid-rise complexes and to propose corresponding design strategies, addressing two questions: which characteristics are associated with lower anxiety, and what design strategies can operationalise them? The paper first synthesises foundational theories and prior evidence to derive a conceptual framework; on this basis a questionnaire is developed and administered to residents of five mid-rise complexes in Mashhad; finally, the key characteristics are identified through statistical analysis and translated into practical design strategies.

MATERIALS AND METHODS

Physical-Spatial Characteristics Physical

Spatial characteristics comprise a set of measurable and observable components within the built environment that influence perceptual and behavioral experiences. These include natural and artificial lighting, legibility, spatial scale, the layout of environmental elements, material quality, and the organization of access points. Such characteristics significantly impact individuals' sense of security, environmental surveillance, and psychological well-being. They play a vital role in shaping daily experiences within living spaces, particularly as these environments serve as the primary setting for frequent, routine encounters (Gifford, 2014; Evans, 2003). In terms of ownership and accessibility, semi-private spaces occupy an intermediary position between private residential units and public areas. These spaces include entrances, lobbies, corridors, stairs, landings, elevators, pilotis (open ground floors), shared courtyards, collective terraces, and transition spaces. They are essential for regulating the boundary between personal privacy and social interaction, influencing residents' sense of

belonging and security (Altman, 1975; Newman, 1972). Furthermore, the design quality of these spaces directly affects the level of social interaction and overall residential satisfaction (Gehl, 2011).

Anxiety and Apprehension as Mental Health Indicators

Anxiety and apprehension are among the most critical indicators of mental health, manifesting as unpleasant emotional states characterized by worry, tension, and the anticipation of future threats. These states are recognized as mental disorders (American Psychiatric Association, 2022). From a cognitive-behavioral perspective, anxiety is linked to distorted and negative thought patterns (Beck et al., 1979). The built environment can either exacerbate or mitigate these feelings; for instance, illegible or dark spaces where individuals lack perceived security and opportunities for surveillance tend to increase anxiety levels. Conversely, well-lit, orderly, and predictable spaces can reduce anxiety and apprehension (Evans, 2003; Ulrich, 1984).

Mental Health in Architecture and Mid-Rise Residential Complexes

In the architectural context, mental health refers to a state in which the built environment actively reduces anxiety and apprehension, fosters a sense of tranquility, enhances perceived surveillance, and improves quality of life. This condition is reinforced by the integration of daylighting, natural elements, adequate ventilation, and spaces designed to facilitate social interaction (Ulrich et al., 2008; WHO, 2022). Mid-rise residential complexes are defined as housing developments typically ranging from four to eight stories, designed to balance land-use efficiency with quality of life. Recognized as a dominant housing model in rapidly growing cities, these complexes play a prominent role in shaping the lived experience within dense urban fabrics (Rapoport, 1982; Gehl, 2011).

Research Background

Relevant literature was identified through Scopus, Web of Science, Google Scholar, PubMed, and ScienceDirect using keywords such as semi-private spaces, transitional spaces, residential architecture, mental health, well-being, anxiety, and sense of belonging. After screening titles, abstracts, and full texts, a standardised form was used to extract each study's design, population, and findings on physical–spatial characteristics (e.g., scale, visual access, enclosure, views, lighting, and materials) and on anxiety-related indicators, yielding a categorised inventory that informed the conceptual framework. The synthesised evidence consistently links spatial quality to psychological outcomes. Environments marked by coherence, legibility, perceptual interest, and natural elements reduce mental fatigue and stress (Kaplan & Kaplan, 1989), exposure to daylight, greenery, and favourable views lowers psychological tension (Ulrich, 1984), and shared spaces that support interaction mitigate isolation (Manzo & Devine-Wright, 2014). The concept of defensible space, residents' sense of surveillance and security is strengthened by a clear organisation of private, semi-private, and public territories (Newman, 1972), while human scale, spatial legibility, territoriality, and greenery are repeatedly associated with psychological comfort (Gehl, 2011; Lewicka, 2011). Conversely, dense, dark, placeless, and low-quality settings heighten alienation, anxiety, and insecurity (Evans, 2003).

Two further factors recur across studies. Natural light influences circadian rhythms, sleep, and mood, so its provision in semi-private spaces improves environmental quality and reduces adverse psychological outcomes (Walker et al., 2020), and accessibility, barrier-free, legible circulation for children, older adults, and people with mobility impairments, is a prerequisite for inclusive, low-anxiety environments (World Health Organization, 2022). Because intermediate spaces uniquely balance interaction and privacy, their design quality is closely tied

to perceived control, satisfaction, and place attachment (Rapoport, 1982; Lewicka, 2011). Consistent with biophilic theory (Wilson, 1984) and environment–behaviour models (Bell et al. 2001) access to greenery is associated with lower stress and safer residential settings (Kondo et al., 2018), while the sensory and tactile qualities of materials shape spatial atmosphere and comfort (Pallasmaa, 2012). Based on various international studies relevant to this field, Table 1 summarizes some of the most significant research conducted in this area: (Tab. 1)

Table 1: Research Background. (Source: Authors)

No.	Author and Year	Research Area	Key Research Findings
1	Sternberg (2022)	Well-Being at Home and Health-Oriented Architecture	Gradually transitioning intermediate spaces play an infrastructural role in reducing residents' anxiety and supporting psychological regulation by establishing a balance between individual privacy and collective interaction
2	Sussman & Hollander (2021)	Cognitive Architecture and Neuroarchitecture in Practice	Soft boundaries and predictable semi-private spaces directly mitigate environmental anxiety at a human scale and foster a sense of security.
3	Dovey (2008)	Spatial Conceptualization and Power in the Urban Form	Intermediate spaces in high-density residential complexes serve as settings for everyday life and place attachment, helping to prevent social alienation and spatial anxiety.
4	Low (2017)	Spatializing Culture and the Ethnography of Space and Place	Attending to residents' lived experiences, cultural contexts, and the social meanings of space is essential in designing thresholds and interstitial spaces. Neglecting these dimensions may result in spaces that are poorly aligned with users' needs and may reinforce feelings of social exclusion.
5	Nieuwenhuijsen (2020)	Integrating Human Health into Urban Planning	Semi-public and intermediate green spaces serve as vital interfaces between people and nature, enhancing mental health recovery in residential environments.
6	Newman & Jennings (2020)	Sustainable Residential Ecosystems	Shared intermediate spaces strengthen social resilience and neighborhood interactions, thereby reducing the psychological stress associated with residential living.
7	(Kaplan & Kaplan, 1989)	Qualitative Components of Open Spaces and Mental Restoration	The visual and physical quality of semi-private shared spaces has a direct and significant effect on residents' cognitive restoration and the reduction of anxiety and apprehension.
8	(Kaplan & Kaplan, 1989; Han & Baek, 2026)	Spatial Quality and Cognitive Restoration in Housing	Designating intermediate spaces as "psychological refuges" provides opportunities for pause and rest, thereby reducing mental fatigue, anxiety, and apprehension.
9	(Altman, 1975)	Housing Physical Quality and Psychological Well-Being	Improving the physical-spatial quality of intermediate spaces increases residential satisfaction and moderates environmental disturbance variables.
10	(Gifford, 2014)	Environmental Psychology: Principles and Practice	Monitoring variables such as crowding, privacy, and territoriality in semi-public spaces substantially reduces spatial anxiety.
11	(Newman, 1972)	Assessment of Defensible Space and Security Components	Boundary transparency and natural surveillance in corridors and entrances significantly reduce perceived insecurity, anxiety, and apprehension.

12	(Manzo & Devine-Wright, 2014)	Place Attachment and Spatial-Psychological Manifestations	Strengthening residents' emotional bonds with semi-private spaces enhances their sense of residential identity and psychological well-being.
13	(Gehl, 2010)	Cities for People	The quality of intermediate and semi-private spaces improves by enhancing opportunities for presence, informal interactions, and a sense of psychological security.
14	(McMillan & Chavis, 1986)	Sense of Place and Neighborhood Interactions	Providing opportunities for everyday interactions in shared spaces increases perceived security and reduces the anxiety and apprehension associated with high-density living.
15	(Altman, 1975; Hillier & Hanson, 1984)	Environment–Behavior Interaction in Housing	The degree of enclosure, physical-spatial proportions, and daylight availability in semi-private spaces shape users' behavioral patterns and level of psychological comfort.
16	(Newman, 1972)	Defensible Space Design and Territoriality	Clear spatial boundaries and opportunities for residents to monitor shared transitional spaces can enhance perceived surveillance and security while reducing the potential for undesirable behaviors.
17	(Altman, 1975)	Principles of Residential Space Design in Iran	The alignment of semi-private spaces with cultural needs, such as privacy and territorial boundaries, prevents psychological tension arising from territorial infringement.
18	(Evans, 2003)	The Built Environment and Mental Health	Physical-spatial elements of housing and intermediate spaces directly contribute to reducing the incidence of mental disorders by moderating anxiety- and stress-inducing stimuli.
19	(Hillier & Hanson, 1984)	The Social Logic of Space (Spatial Configuration)	The configuration of circulation paths and the connections between intermediate spaces shape behavioral patterns and the structural anxiety-inducing potential of the environment.
20	(Ulrich, 1984)	Stress Recovery Through Views of Nature (Psychophysiology)	Views of natural elements and exposure to sunlight through openings and semi-open spaces significantly influence the rate of psychological restoration and anxiety reduction.
21	(Alexander et al., 1977)	A Pattern Language in Architectural Design	Threshold patterns, shared courtyards, and transitional spaces constitute systematic spatial responses to users' psychological and security needs.
22	(Rapoport, 1977)	Human Aspects of Urban Form	Intermediate spaces regulate the balance between individual privacy and social interaction, thereby supporting residents' psychological well-being.
23	(Hall, 1966)	The Hidden Dimension of Proxemics	The regulation of soft private–public boundaries, or proxemics, plays a fundamental role in the perception of security and in preventing psychological tension.

Environmental Perception and Behavioural Perspectives and Mental Health

Environmental psychology frames semi-private spaces as active regulators of experience rather than neutral backgrounds. Privacy-regulation theory treats privacy as a dynamic boundary process in which individuals continually adjust between engagement and withdrawal; semi-private spaces support psychological security when they afford controlled visibility, access, and interaction (Altman, 1975; Lang, 2017). Complementarily, defensible-space theory holds that natural surveillance, clear boundaries, adequate lighting, and visible activity reduce spatial ambiguity and

feelings of insecurity (Newman, 1972; Jacobs, 1961). The person–environment fit perspective adds that anxiety rises when density, unpredictability, or complexity exceed users' perceptual and psychological capacities, so intermediate spaces must be scaled to their occupants (Lawton & Nahemow, 1973; Gifford, 2014), while legibility research shows that clear cues, spatial hierarchy, and understandable pathways enhance environmental mastery and lower confusion and anxiety (Lynch, 1960). A second stream links the built environment directly to mental health. Restorative-environment and attention-restoration research demonstrates that contact with natural and quasi-natural elements relieves psychological apprehension and supports cognitive recovery, allowing everyday semi-private settings to function as short-term restorative places (Kaplan & Kaplan, 1989; Ulrich, 1991). Conversely, environmental-stress research identifies crowding, noise, poor lighting, and visual complexity as recurring stressors whose effects accumulate because these spaces are used repeatedly and daily (Evans, 2003). Taken together, this evidence indicates that the optimal design of semi-private spaces can reduce anxiety, improve quality of life, and raise resident satisfaction (Gifford, 2014).

Design of Semi-Private Spaces and Social Interaction

A third perspective emphasises the social role of intermediate spaces. As transitional zones, semi-private spaces psychologically prepare residents as they move between private and public domains (Zeisel, 2006), and their human-centred, inviting design strengthens social interaction, belonging, and quality of life (Gehl, 2011). Routine encounters in these settings build trust and social integration, mitigating isolation and the anxiety associated with it (Putnam, 2000), while territoriality, the capacity to oversee and appropriate a space, remains a fundamental need that enhances perceived security (Altman, 1975; Hall, 1966). Collectively, these perspectives position semi-private spaces at the intersection of environmental psychology, architectural design, and urban sociology, and inform the study's conceptual framework; a summary of the foundational perspectives is presented in (Tab.2)

Table 2: Foundational Perspectives of the Study. Source: (Source: Authors)

Reference	Link to Anxiety Reduction in Semi-Private Spaces	Key Concepts	Field	Perspective
(Altman, 1975)	Semi-private spaces enable the regulation of social interactions; a lack of visual and access control generates anxiety.	Privacy, Interaction Monitoring, Behavioral Boundaries	Environmental Psychology	Privacy Regulation
(Lawton & Nahemow, 1973)	A mismatch between density, lighting, and spatial complexity and individuals' perceptual capacities increases anxiety.	Person–Environment Fit, Environmental Stress	Environmental Psychology	Person–Environment Behavior
(Lynch, 1960)	Legible environments in semi-private spaces reduce confusion and anxiety.	Legibility, Spatial Structure, Wayfinding	Urban Design	Environmental Legibility
(Evans, 2003)	Adverse environmental factors in semi-private spaces increase anxiety.	Density, Noise, Surveillance	Environmental Psychology	Environmental Stress
(Kaplan & Kaplan, 1989)	Spaces incorporating natural elements reduce mental fatigue and anxiety.	Soft Fascination, Cognitive Restoration	Environmental Psychology	Attention Restoration

(Ulrich, 1984)	The presence of nature in semi-private spaces rapidly reduces anxiety.	Nature, Emotional Response, Relaxation	Environmental Psychology	Anxiety Reduction Through Nature
(Kaplan & Kaplan, 1989)	Ordered spaces induce less anxiety and apprehension than complex spaces.	Visual Order, Environmental Complexity	Environmental Psychology	Perceived Order and Complexity
(Newman, 1972)	Increasing natural surveillance and establishing clear boundaries in semi-private spaces reduce anxiety and apprehension.	Ownership, Surveillance, Security	Architecture / Urban Sociology	Defensible Space
(Wilson & Kelling, 1982)	Spatial disorder increases feelings of insecurity, anxiety, and apprehension.	Disorder, Perceived Insecurity	Urban Sociology	Broken Windows
(Altman, 1975)	A sense of territoriality in semi-private spaces enhances psychological security and reduces anxiety and apprehension.	Spatial Monitoring, Sense of Ownership	Environmental Psychology	Territoriality
(Zeisel, 2006)	The quality of semi-private spaces affects psychological comfort during transitions between spaces.	Threshold, Transition, Entry/Exit Experience	Architecture	Transitional Spaces
(Gehl, 2011)	High-quality semi-private spaces enhance social interactions and reduce anxiety and apprehension.	Social Interactions, Intermediate Spaces	Urban Design	Life Between Buildings
(Putnam, 2000)	Positive interactions in semi-private spaces reduce anxiety associated with isolation and loneliness.	Social Trust and Cohesion	Urban Sociology	Social Integration
(Oldenburg, 1989)	Semi-private spaces function as third places when they foster social interaction and support and reduce feelings of loneliness.	Third Place, Everyday Sociability, Social Relationships	Spatial Experience	Attention Restoration

Theoretical Framework

The conceptual framework of the study was derived from the reviewed theories and empirical evidence. It links the physical–spatial characteristics of semi-private spaces (independent variables) to residents' anxiety and apprehension (dependent variable), both directly and indirectly through three mediating pathways, perceived security, place attachment and identity, and perceived environmental control, while accounting for individual moderators (age, gender, length of residence) and general anxiety as a control variable (Fig. 1).

Methodology

A quantitative, descriptive–analytical, cross-sectional design was adopted. A review of theoretical and empirical literature was first used to identify the physical–spatial characteristics of semi-private spaces associated with anxiety reduction and to construct the conceptual framework and its variables. The study was conducted in five mid-rise residential complexes in Mashhad, Iran, Arman, Reza, Sajjad, Ghadir, and Fanoos selected as comparable cases of the mid-rise housing model that dominates the city's recent residential fabric. Purposive sampling was employed to select the five aforementioned mid-rise residential complexes. Efforts were made to ensure the samples shared similar characteristics. The selection criteria included: a construction date within the last 15 years (due to constraints in questionnaire

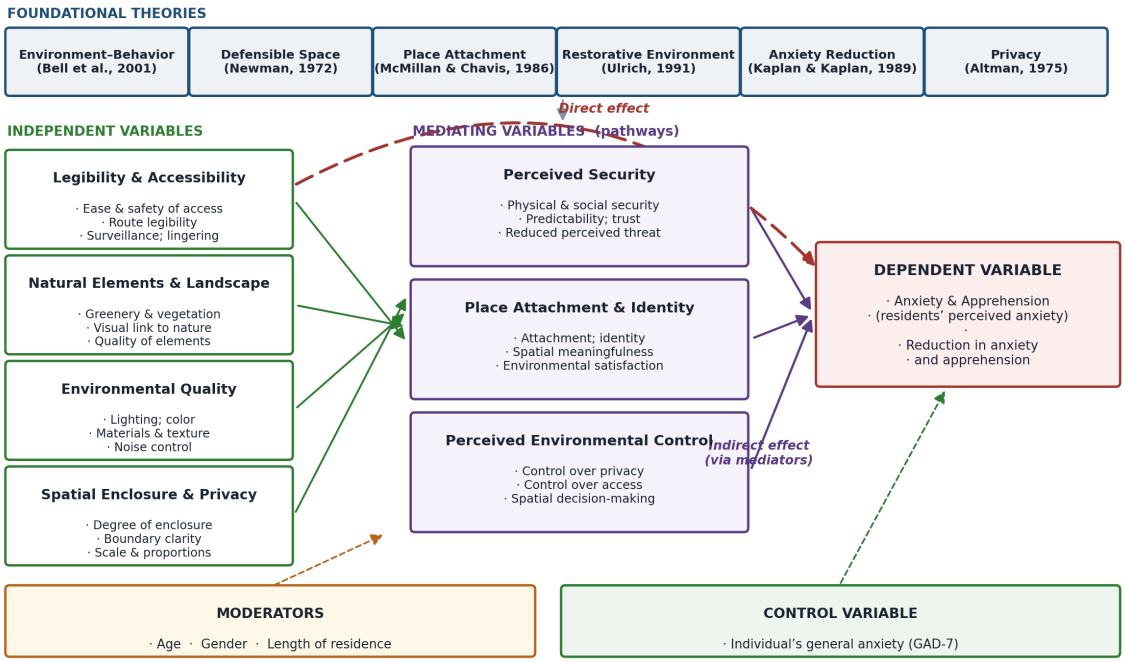


Figure 1: The proposed conceptual framework of the study. (Source: Authors)

distribution), similar socio-cultural locations, purely residential single-use status, and a height of 4 to 8 stories (mid-rise). Questionnaires were distributed among eligible residents aged 22 and above. The data collection process took place over approximately three weeks during the summer (July–August) of 2026. Given the unknown total population size, the sample size was determined using the Cochran formula for infinite populations. With a 95% confidence level and a 5% margin of error, the Cochran formula for an infinite population indicates a required sample of approximately 384. Owing to access constraints during fieldwork, 153 completed questionnaires were ultimately collected across the five complexes and used for statistical analysis; the achieved sample is therefore smaller than the value implied by the formula, and the results - especially the complex-level analyses - should be interpreted with corresponding caution. The independent variable was the physical–spatial characteristics of semi-private spaces (natural and artificial lighting; spatial proportions and dimensions; geometry and form; materials and colour; layout and furniture; green space and natural elements; odour; and sound), and the dependent variable was residents' anxiety and apprehension; age, gender, history of anxiety, and frequency of use were treated as contextual variables, and general anxiety measured with the GAD-7 scale was entered as a control variable. Data were gathered with a researcher-developed Likert questionnaire on semi-private-space characteristics together with the standardised GAD-7 scale; content validity was confirmed by an expert panel and a pilot administration, and internal consistency was verified using Cronbach's alpha. Data were analysed in SPSS 26 using descriptive statistics, Pearson correlation, and multiple regression to test the predictive role of the physical–spatial characteristics while controlling for general anxiety; the results were then interpreted against the conceptual framework and compared with previous research to derive evidence-based design strategies. Detailed information and visual documentation of the selected complexes are provided in Table 3 and Picture 2. The GAD-7 is a validated screening scale (Spitzer

et al., 2006), and internal consistency was evaluated following established reliability guidance (Cortina, 1993; Kline, 2000). The location of case studies as shown. The study was carried out in the city of Mashhad, the second most populous city in Iran and the capital of Razavi Khorasan Province in the north-east of the country. The five surveyed mid-rise residential complexes Sajjad, Ghadir, Fanous (the former Taxi Company complex), Arman, and Reza are located within the western and north-western residential districts of the city, at varying distances from the historic core marked by the Imam Reza Holy Shrine, which serves as the principal spatial reference of Mashhad. The complexes were deliberately selected from socio-culturally comparable neighbourhoods so that differences in residents' perceptions could be attributed primarily to the physical–spatial characteristics of the semi-private spaces rather than to broad contextual disparities. Together they represent the prevailing mid-rise housing pattern of the city, ranging from smaller developments of three to five blocks and three to four storeys (Reza, Fanous, and Arman) to larger complexes of five to twelve blocks and six to seven storeys (Ghadir and Sajjad), and spanning construction dates from 2011 to 2024. The relative positions of the complexes, the city's approximate urban extent, the north arrow, and the graphic scale are presented (Fig. 2)

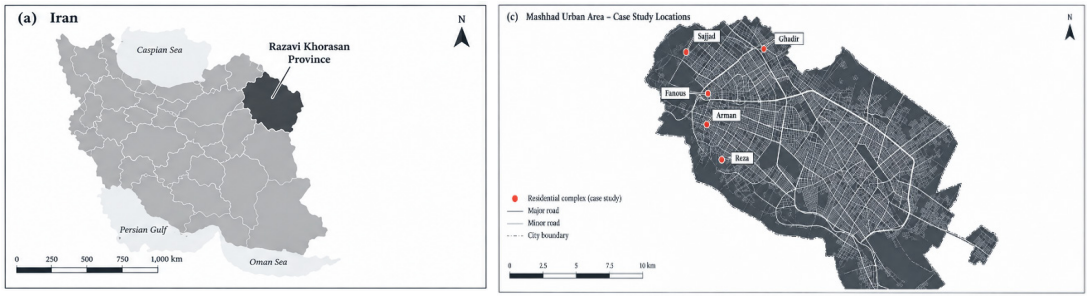
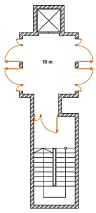
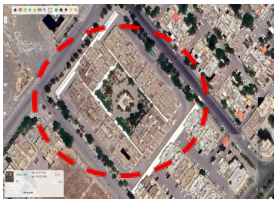


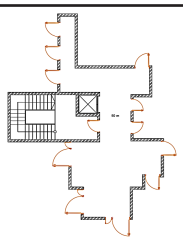
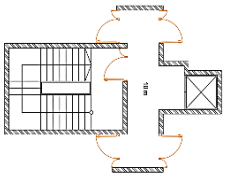
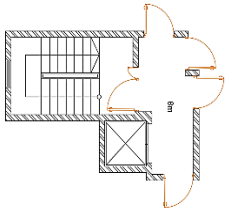
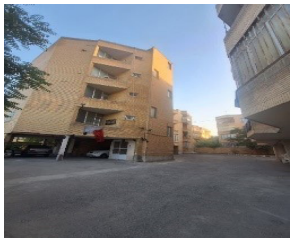
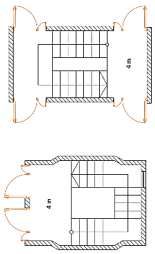
Figure 1: The proposed conceptual framework of the study. (Source: Authors)

Table 3: Specifications of the residential complexes selected for the field study. (Source: Authors)

No.	Residential Complex	Year of Construction	Number of Floors	Number of Blocks	Number of Units	Approximate Area
1	Sajjad	2011	6	12	288	11990
2	Ghadir	2024	7	5	255	7285
3	Fanous (Former Taxi Company Complex)	2011	4	3	48	2026
4	Arman	2013	4	4	100	3557
5	Reza	2011	4	3	36	1350

Table 4: Visual documentation of the residential complexes. (Source: Authors)

Residential Complex	Elevation	Semi-Private Space Plan	Location
Sajjad			

Ghadir			
Fanous			
Arman			
Reza			

FINDINGS AND DISCUSSION

Internal Consistency Analysis

To assess the reliability and internal consistency of the items, Cronbach's alpha coefficient was calculated for the researcher-developed questionnaire measuring the physical-spatial characteristics of semi-private spaces in residential complexes and for the standardized Generalized Anxiety Disorder scale (GAD-7) before item analysis. The results are presented in (Tab. 4)

Table 5: Internal consistency assessment of the researcher-developed questionnaire and the GAD-7 scale among residents. (Source: Authors)

Reliability Status	Cronbach's Alpha*	Number of Items	Research Dimensions
Acceptable	0.681	5	Enclosure and Privacy
Acceptable	0.653	5	Accessibility and Legibility
Acceptable	0.682	4	Environmental Quality
Acceptable	0.664	3	Natural Elements and Landscape
Acceptable	0.695	5	Perceived Environmental Control

Good	0.712	6	Perceived Security
Good	0.794	5	Sense of Place Attachment and Place Identity
Very Good	0.875	5	Environmental Anxiety and Apprehension
Very Good	0.877	7	General Anxiety (GAD-7)

Descriptive Analysis of Likert Scale Items by Residential Complex

The mean scores for the items measuring the physical-spatial characteristics of semi-private spaces, rated on a five-point Likert scale, along with the total scores obtained from the Generalized Anxiety Disorder scale (GAD-7), which range from 0 to 21, were calculated separately for each of the studied residential complexes. The results are presented in (Tab. 5).

Table 5: Mean scores for the physical-spatial characteristics of semi-private spaces and generalized anxiety levels among residents. (Source: Authors)

Residential Complex	Enclosure and Privacy	Accessibility and Legibility	Environmental Quality	Natural Elements and Landscape	Perceived Environmental Control	Perceived Security	Sense of Place Attachment and Place Identity	Environmental Anxiety and Apprehension	General Anxiety Level (GAD-7)
Arman	3.45	3.58	3.40	3.64	3.50	3.33	3.32	3.18	7.97 — Mild
Reza	3.38	3.77	3.39	3.77	3.59	3.62	3.53	2.77	4.46 — Minimal
Sajjad	3.66	4.05	3.81	3.78	3.87	3.90	3.85	2.29	6.00 — Mild
Ghadir	4.15	4.01	3.90	3.91	3.96	3.86	4.08	3.29	2.48 — Minimal
Fanous	3.98	3.74	3.37	2.51	3.95	3.38	3.75	2.24	4.95 — Minimal

The Pearson correlation coefficients between the independent variables related to the physical-spatial characteristics of semi-private spaces in residential complexes and the dependent variable, residents' anxiety, were calculated separately for each of the studied residential complexes. The results are presented in (Tab. 6).

Table 6: Significance level of the relationship between physical-spatial variables and anxiety and apprehension.(Source: Authors)

Residential Complex	Highest Positive Correlation (Increasing Anxiety and Distress)	Significance Level (Sig.)	Correlation Coefficient (r)	Highest Negative Correlation (Reducing Anxiety and Distress)	Significance Level (Sig.)	Correlation Coefficient (r)
Arman	Natural Elements and Landscape	0.001	r = 0.390+	Sense of Control over the Environment	0.004	r = −0.344**
Reza	Environmental Quality	0.008	r = 0.299+	Sense of Place Attachment	0.038	r = −0.197*
Sajjad	Spatial Enclosure and Privacy	0.002	r = 0.324+	Sense of Control over the Environment	0.009	r = −0.289**

Ghadir	Perceived Security	<0.001	r = 0.476+	Sense of Place Attachment	0.021	r = −0.251*
Fanoos	Environmental Quality	0.028	r = 0.237+	Sense of Place Attachment	0.045	r = −0.183*

Hierarchical Multiple Regression Analysis with GAD-7 as a Control Variable

Table 7 presents a stepwise regression analysis examining the contribution of the physical–spatial characteristics of semi-private residential spaces to explaining residents' anxiety and apprehension. In the first step, general anxiety (GAD-7) was entered as a control variable to account for its contribution to residents' anxiety and apprehension. In the second step, variables representing the physical–spatial characteristics of semi-private residential spaces were added to the model to determine their incremental contribution and predictive role in explaining residents' anxiety and apprehension after controlling for general anxiety. (Tab. 7)

Table 7: Multiple Regression Analysis. (Source: Authors)

Residential Complex	Physical Variables Influencing Anxiety (Entered into the Model)	Model Predictive Power (R^2)	Percentage of variance in environmental anxiety and apprehension explained by the model
Arman	Spatial Enclosure and Privacy	0.273	27.3% of the variance in environmental anxiety and apprehension was explained by the model.
Reza	Natural Elements and Landscape + Environmental Quality + Accessibility and Legibility	0.392	39.2% of the variance in environmental anxiety and apprehension was explained by the model.
Sajjad	Spatial Enclosure and Privacy + Sense of Control over the Environment	0.388	38.8% of the variance in environmental anxiety and apprehension was explained by the model.
Ghadir	Perceived Security	0.320	32.0% of the variance in environmental anxiety and apprehension was explained by the model.
Fanoos	Accessibility and Legibility + Sense of Place Attachment and Place Identity	0.334	33.4% of the variance in environmental anxiety and apprehension was explained by the model.

8.5. Table 8 presents the regression coefficients for the physical–spatial characteristics of semi-private spaces in residential complexes separately for each study complex. Each row corresponds to an independent variable and reports its coefficient and associated statistical indices. This format enables a detailed examination and comparison of the contribution of each physical–spatial characteristic of semi-private residential spaces to explaining residents' anxiety and apprehension.

Table 8: Details of the Statistical Regression Coefficients. (Source: Authors)

Residential Complex	Physical-Spatial Variable	Unstandardized Coefficient (B)	Standard Error (SE)	Standardized Coefficient (β)	Test Statistic (t)	Significance Level (Sig.)
Arman	Enclosure and Privacy	0.382	0.124	0.433	3.08	0.036*
Reza	Natural Elements and Landscape	0.721	0.231	0.833	3.12	0.004**
	Environmental Quality	0.485	0.152	0.549	3.19	0.034*
	Accessibility and Legibility	−0.310	0.123	−0.610	−2.52	0.050*

Sajjad	Enclosure and Privacy	0.845	0.276	0.968	3.06	0.032*
	Sense of Control over the Environment	−1.105	0.230	−1.249	−4.80	<0.001**
Ghadir	Perceived Security	−0.624	0.213	−0.817	−2.93	0.004**
Fanoos	Accessibility and Legibility	0.492	0.195	0.553	2.52	0.020*
	Sense of Place Attachment and Identity	−0.415	0.168	−0.476	−2.47	0.018*

RESULTS AND CONCLUSION

The analysis of the research findings indicates that residents' cognitive and behavioral responses to space cannot be regarded as a simple linear function of physical-spatial characteristics. Rather, these responses are shaped by the interaction among spatial attributes, the way space is perceived, and the conditions under which it is used. The regression analysis also revealed differences across the studied residential complexes. The pattern of physical-spatial variables associated with anxiety and apprehension in the semi-private spaces of the five residential complexes was not consistent. Specifically, "enclosure and privacy" remained in the final regression model for the semi-private space of Arman Residential Complex; "natural elements and landscape," "environmental quality," and "accessibility and legibility" remained in the model for Reza Residential Complex; "enclosure and privacy" and "sense of monitoring over space" remained in the model for Sajjad Residential Complex; "perceived security" remained in the model for Ghadir Residential Complex; and "accessibility and legibility" and "place attachment and identity" remained in the model for Fanous Residential Complex. Furthermore, the R^2 values of these models were 0.273, 0.392, 0.388, 0.320, and 0.334, respectively. Thus, both the magnitude and the composition of the explained variance in anxiety and apprehension within the semi-private spaces of the residential complexes differed. Because these complex-level models were estimated on small sub-samples, and because some bivariate correlations differed in sign from their corresponding regression coefficients, the complex-specific patterns should be regarded as exploratory and read together with the limitations reported in Section 12.

These differences indicate that the relationship between the quality of semi-private spaces and anxiety and apprehension cannot be reduced to a single physical-spatial attribute. In fact, a specific physical-spatial characteristic may operate differently in each residential complex in combination with other attributes, and the meaning residents assign to it is influenced by spatial organization, accessibility, the degree of natural surveillance, and the perceived quality of the environment. Accordingly, the findings do not suggest the existence of a single "determining element." Rather, they emphasize the importance of the combination and organization of physical-spatial characteristics in shaping residents' psychological experiences of space. Among these findings, "enclosure and privacy" were included in the regression models for the semi-private spaces of Arman and Sajjad Residential Complexes. However, the positive coefficient of this variable in both models indicates that greater enclosure cannot simply be equated with greater psychological comfort. This finding is particularly significant from an architectural perspective because the quality of enclosure does not depend solely on the degree of spatial closure. Rather, the definition of boundaries, the level of visual privacy, spatial proportions, and the possibility of visual connections with the surrounding environment also influence residents' experiences. From this perspective, desirable enclosure should establish a balance between two seemingly conflicting needs: a sense of refuge and privacy on the one hand, and visibility, legibility, and connection with the surrounding space on the other. This interpretation is consistent with the

theoretical discussions of territoriality and privacy presented in the study. Within the defensible space literature, the clear definition of territories and the possibility of environmental surveillance are regarded as among the main principles for organizing semi-private spaces in residential complexes.

Another important finding concerns the sense of monitoring over semi-private space in Sajjad Residential Complex. The standardized coefficient of this variable in the regression model was negative, indicating that an increase in perceived monitoring was associated with a decrease in residents' environmental anxiety and apprehension scores. This finding can be interpreted within the framework of territoriality and environmental surveillance. According to Newman, territoriality is strengthened when spatial structures create recognizable and manageable boundaries for residents and enhance their ability to monitor the surrounding environment. Therefore, the design implication of this finding is that semi-private spaces should not be regarded merely as transitional areas. Instead, they should be organized in a way that enables residents to clearly identify their position, territorial boundaries, and relationship with other parts of the residential complex.

Similarly, perceived security in the semi-private space of Ghadir Residential Complex showed a significant inverse relationship with residents' anxiety and apprehension. These results indicate that security in the experience of semi-private spaces is not limited to the presence of protective equipment or mechanical surveillance systems. Rather, it is partly related to residents' perceptions of the semi-private environment. Visibility, opportunities for natural surveillance, clarity of spatial boundaries, and environmental predictability contribute to the formation of this perception. The defensible space literature also emphasizes the relationship between territoriality and natural surveillance in creating secure semi-private spaces within residential complexes.

By contrast, the findings related to accessibility and legibility showed that this variable was included in the models for the semi-private spaces of Reza and Fanous Residential Complexes. However, the direction of its coefficient was not the same in the two complexes. This difference is important from an interpretive perspective and indicates that accessibility and legibility cannot be evaluated independently of the spatial structure of each residential complex. Therefore, merely increasing accessibility or shortening movement paths should not be treated as a general strategy for reducing residents' anxiety and apprehension in semi-private residential spaces. The findings suggest that the quality of route organization, the clarity of spatial hierarchy, and the ability to identify one's position and destination within semi-private spaces are more important considerations. Consequently, circulation routes should be designed in a way that allows residents to recognize entrances, exits, primary paths, and stopping areas without confusion.

Natural elements and landscape, as well as environmental quality, were also included in the model for the semi-private space of Reza Residential Complex. However, their positive coefficients indicate that the mere presence of green spaces or natural elements cannot be considered a definitive factor in reducing anxiety and apprehension. This finding highlights the importance of the quality and integration of natural elements within the spatial structure. In other words, vegetation, landscape, or natural lighting may contribute to a more desirable experience of semi-private spaces only when they do not conflict with privacy, visibility, accessibility, opportunities for staying, and other physical-spatial characteristics. Design recommendations in this area should therefore move beyond the simple "addition of green space" approach and focus on the actual quality of the spatial experience.

In the semi-private space of Fanous Residential Complex, place attachment and identity showed a significant inverse relationship with individuals' anxiety and apprehension. This find-

ing suggests that the experience of semi-private spaces is not limited to the perception of physical characteristics and that residents' meaningful and emotional relationships with these spaces are also associated with their psychological experiences. However, because place attachment and identity were examined in this study as variables included in the anxiety and apprehension model, the analysis does not support the conclusion that a specific design feature directly increases place attachment. The present finding supports only the existence of a significant inverse relationship between place attachment and anxiety and apprehension in the studied residential complex.

Overall, the findings provide a multidimensional understanding of the relationship between semi-private spaces and anxiety and apprehension. On the one hand, enclosure, privacy, monitorability, perceived security, and legibility are related to the organization and perception of spatial structure. On the other hand, environmental quality, natural elements, and place attachment represent perceptual and experiential dimensions of space. The differences in patterns across the residential complexes indicate that none of these components can be considered independently, and without regard to other spatial conditions, as a definitive solution for reducing residents' anxiety and apprehension in the semi-private spaces of residential complexes. Therefore, the main contribution of the findings lies not in identifying a single attribute but in demonstrating the importance of balancing privacy and visibility, enclosure and openness, security and opportunities for presence, and monitorability and social interaction in the design of semi-private spaces.

From this perspective, the statistical findings have direct implications for design practice. If perceived monitoring and security in a semi-private space of a residential complex are inversely related to anxiety and apprehension, design should enhance opportunities for natural surveillance and the clear recognition of territorial boundaries. If enclosure shows a direct relationship with anxiety and apprehension, simply increasing enclosure cannot be considered an appropriate solution; instead, the quality of privacy and spatial proportions should be reconsidered. If accessibility and legibility appear in the model, route organization and the reduction of spatial ambiguity become important. If place attachment is inversely related to anxiety and apprehension, design should facilitate opportunities for presence, staying, familiarity, and the formation of positive and meaningful experiences within shared spaces. Accordingly, the design recommendations of this study are not separate from the statistical findings. Rather, they represent a spatial translation of the empirical findings of the research.

Physical-Spatial Characteristics Associated with Reduced Anxiety and Apprehension among Residents in Semi-Private Spaces of Mid-Rise Residential Complexes in Mashhad

Integrating the correlation and regression results with the conceptual framework yields five design priorities for reducing anxiety and apprehension in the semi-private spaces of mid-rise complexes. Because the significant predictors and their direction varied across the five complexes, these are proposed as transferable design principles rather than fixed prescriptions and are summarised in (Tab. 9).

Design Strategies for Reducing Anxiety and Apprehension in Semi-Private Spaces of Mid-Rise Residential Complexes in Mashhad

Based on the empirical and statistical findings of the study, architectural design principles and strategies were developed to improve the quality of semi-private spaces, strengthen perceived monitoring and security, and reduce residents' anxiety and apprehension at three scales: macro, intermediate, and micro. At the macro scale, the relationships between semi-public realms and semi-private spaces, as well as the organization of residential blocks, are considered. At the intermediate scale, courtyards, shared open spaces,

Table 9: Prioritization of Physical-Spatial Characteristics. (Source: Authors)

Rank	Psychological Mechanism for Reducing Anxiety and Apprehension	Psychological Mechanism for Reducing Anxiety and Apprehension	Key Architectural Design Indicator
First	Strengthening the sense of monitoring, familiarity, and attachment to space, and reducing ambiguity and concerns arising from the presence of unfamiliar individuals	Strengthening the sense of monitoring, familiarity, and attachment to space, and reducing ambiguity and concerns arising from the presence of unfamiliar individuals	Clear definition of entrances, transparent lobbies, gradual territorial transitions, and the use of level differences and flooring patterns to reinforce spatial boundaries
Second	Creating a balance between a sense of refuge and privacy on the one hand, and visual connection and openness on the other, without generating feelings of spatial pressure and restriction	Creating a balance between a sense of refuge and privacy on the one hand, and visual connection and openness on the other, without generating feelings of spatial pressure and restriction	Attention to the proportional relationship between wall height and courtyard width, and avoiding excessively open, undefined spaces or the absence of visual refuge
Third	Enhancing perceived security through opportunities for mutual observation and awareness of others' presence, without compromising residents' privacy	Enhancing perceived security through opportunities for mutual observation and awareness of others' presence, without compromising residents' privacy	Appropriate orientation of windows and living spaces toward courtyards, strengthening visibility of lobbies and shared spaces, and establishing visual connections with play areas and spaces of residents' presence
Fourth	Reducing spatial ambiguity and confusion while strengthening orientation and predictability of the environment	Reducing spatial ambiguity and confusion while strengthening orientation and predictability of the environment	Providing natural lighting along circulation routes, creating visual landmarks, improving route visibility, and avoiding complex corridors and blind spaces
Fifth	Contributing to the reduction of everyday psychological stress and improving relaxation and the quality of spatial experience in shared spaces	Contributing to the reduction of everyday psychological stress and improving relaxation and the quality of spatial experience in shared spaces	Use of gardens and vegetation, visual access to green spaces, incorporation of elements such as water, and appropriate use of natural lighting in lobbies and semi-private spaces

access routes, and areas for staying and presence are examined. At the micro scale, block entrances, lobbies, corridors, stair landings, spaces in front of residential units, and other transitional spaces between residential units and semi-private realms are addressed. The primary objective of these strategies is to establish a balance between privacy and visibility, enhance legibility and territorial hierarchy, and provide appropriate conditions for natural surveillance and residents' sense of monitoring over semi-private spaces.

Macro-Scale Strategies: Organizing Semi-Public Realms and Their Connections to Semi-Private Spaces in Residential Complexes

The regression findings showed that variables related to enclosure and privacy, sense of monitoring over space, accessibility and legibility, and perceived security played different roles in explaining anxiety and apprehension, depending on the characteristics of each residential complex. Therefore, at the macro scale, the design

objective should not be limited to increasing enclosure or closing the spaces between residential blocks. Rather, it should focus on establishing an integrated structure among public, semi-public, semi-private, and private realms. At this scale, the organization of building blocks should ensure that open spaces between blocks are transformed from undefined residual areas lacking territorial definition into recognizable and usable environments for residents. The formation of defined courtyards, shared open spaces between several blocks, and pedestrian paths that gradually transition from semi-public areas to block entrances and then to semi-private spaces can strengthen the legibility of the spatial hierarchy. Previous studies on territoriality in residential complexes have also shown that defining shared and semi-public spaces, together with establishing clear territorial boundaries, contributes to residents' presence, interaction, and sense of security. Within this framework, courtyard-oriented patterns or semi-open block configurations, where appropriate to site conditions, can help create defined intermediate spaces between residential blocks. However, a specific semi-open pattern cannot be introduced as the "optimal solution" for all residential complexes. The primary criterion is to achieve balanced enclosure, maintain visual connections, and prevent the formation of blind and undefined spaces or environments that lack opportunities for residents' natural presence. In establishing visual relationships between residential blocks, natural surveillance should also be combined with the preservation of residential privacy. Therefore, where directly facing openings create excessive overlooking, design measures such as limited façade setbacks, recessed balconies, appropriate parapets, semi-transparent elements, and perforated screens can be used. The purpose of these elements is not to eliminate visual connections but to regulate visibility in a way that allows residents to remain aware of semi-private spaces without disrupting the visual privacy of semi-private and private residential areas.

Intermediate-Scale Strategies: Organizing Courtyards, Shared Routes, Staying Areas, and Natural Elements within Semi-Private Realms

At the intermediate scale, attention is primarily directed toward spaces that residents use daily for movement or short-term presence, including shared courtyards, pedestrian paths, spaces in front of block entrances, seating and staying areas, and open spaces adjacent to residential blocks. At this level, the appropriate integration of accessibility, legibility, presence, and natural elements can improve the perceived quality of semi-private spaces. Accordingly, access routes to residential blocks should not be designed merely as circulation paths. Through the provision of staying points, limited seating areas, shading elements, and vegetation, they can become transitional spaces between movement and presence. Placing these elements within residents' visual fields can also increase residents' natural presence in semi-private spaces and, consequently, strengthen informal awareness and monitoring of the environment. Previous studies on semi-private spaces in residential complexes have emphasized the roles of accessibility, lighting, green spaces, furniture, and spatial organization in shaping territoriality and residents' presence. Regarding natural elements, green spaces should move beyond a marginal and purely decorative role and become integrated into residents' everyday movement patterns and semi-private environments. Linear planting along block entrances, vegetation around staying areas, shade trees in shared courtyards, and direct visual connections from lobbies or circulation routes to green spaces are examples of this approach. In addition, parts of courtyards can be designed with denser vegetation as semi-enclosed areas for short-term staying and conversation. This spatial organization enhances the continuity of shared spaces while enabling the formation of smaller, recognizable territories. At this scale, the location of children's play areas is also important. Placing play spaces within the visual range of res-

idential blocks and connecting them to residents' everyday movement routes can increase natural presence and opportunities for informal surveillance. Therefore, play areas should not be located in completely detached areas outside residents' visual fields. Instead, while maintaining the required safety and distance, they should remain visually connected to spaces where residents move and stay.

Micro-Scale Strategies: Block Entrances, Lobbies, Corridors, Stair Landings, and Transitional Spaces within Semi-Private Territories

At the micro scale, block entrances and transitional spaces between shared areas and residential units are particularly important because they represent gradual transitions from public or semi-public realms toward semi-private and then private territories. Their design should therefore allow residents to perceive this spatial transition as clear and gradual. At block entrances, creating a small transitional space between courtyards or shared paths and the lobby can prevent direct and abrupt entry into interior spaces. This transitional space can be defined through recessed entrances, canopies, porches, semi-enclosed forecourts, or changes in floor materials. The purpose of these strategies is to create a gradual and legible boundary between different realms, enabling residents to recognize their position in relation to external and internal spaces upon entry. Within lobbies, the arrangement of entrances, elevators, stairs, and access routes to residential units should be clear and comprehensible. Fully blind corners, unnecessary changes in direction, and spaces lacking visual connections with entrances or primary circulation paths should be avoided as far as possible. In addition, providing a small staying area adjacent to the lobby, without obstructing circulation, can support residents' presence and everyday interactions. In corridors and stair landings within semi-private spaces, natural lighting and visual connections with the outside environment are also important. Where side windows cannot be provided, skylights, end openings, or controlled visual connections with courtyards can improve the environmental quality of circulation spaces. Creating spatial landmarks along long corridors, introducing limited variations in materials or lighting, and avoiding monotonous corridor continuity can further enhance legibility and help residents recognize their location.

In front of residential units, transitional spaces between corridors and unit entrances should preferably not be designed as direct areas fully exposed to the movement of other residents. Limited entrance setbacks, small forecourts, or semi-transparent elements can make the boundary between shared and private spaces more legible while preventing direct visual intrusion into residential interiors. Overall, at this scale, the design objective is to create a recognizable transitional space that is neither entirely semi-public nor directly connected to the private interior of the dwelling unit. Accordingly, the proposed strategies at the macro, intermediate, and micro scales are presented in Table 10. These strategies do not emphasize absolute increases in enclosure or greater physical surveillance. Rather, they focus on establishing a balance among privacy, visibility, legibility, sense of monitoring, perceived security, and spatial quality within the semi-private spaces of residential complexes.

This study should be interpreted in light of several limitations. First, the design is cross-sectional and correlational; accordingly, the reported relationships indicate association rather than causation, and the language of "reduction" should be understood in this predictive sense. Second, the total sample of 153 residents was distributed across five complexes, so the complex-level correlation and regression models rest on modest sub-samples; coefficients estimated at this level - particularly standardized coefficients approaching or exceeding unity - should be read with caution, as they may reflect multicollinearity, suppression effects, and sampling variability rather than stable population parameters. Third, all constructs were measured through residents' self-reports using a single instrument, which may

introduce common-method variance. Fourth, the study was confined to five mid-rise complexes in a single city (Mashhad), which constrains generalizability. Finally, perceived security, sense of control, and place attachment were entered as predictors rather than formally tested as mediators. Future research should employ larger, adequately powered and probability-based samples, longitudinal or quasi-experimental designs, objective environmental measurements, and mediation and multilevel modeling to test the proposed pathways more rigorously. The contributions of this research can be discussed across three main domains: environmental psychology, methodology, and the practical application of research findings in architectural design. The first contribution of this study is the differentiation of the relative roles of physical-spatial characteristics and individuals' general anxiety levels in explaining environmental anxiety and apprehension. In many architectural and behavioral studies, anxiety perceived within architectural spaces is directly attributed to physical-spatial characteristics, although this experience may also be partly influenced by individuals' general anxiety levels. In the present study, the standardized Generalized Anxiety Disorder scale (GAD-7) was incorporated as a control variable into the hierarchical regression model to distinguish the role of general anxiety from the relationship between physical-spatial characteristics and environmental anxiety and apprehension. The results indicated that, after controlling for general anxiety, the physical-spatial variables continued to explain a significant proportion of the variance in environmental anxiety and apprehension across the different models. The explained variance of the models for the semi-private spaces of the five investigated residential complexes ranged from 27% to 39%. From this perspective, incorporating general anxiety as a control variable can be considered a methodological approach for evaluating more accurately the relationship between the quality of semi private spaces in residential complexes and residents' psychological responses. This approach may also be considered in future environment–behavior studies.

The theoretical contribution of this research lies in highlighting the interactive and context-dependent nature of security, monitoring, place attachment, and physical-spatial quality in mid-rise housing. The findings demonstrated that the quality components of semi-private spaces in residential complexes cannot be regarded as a set of independent factors with equal effects. Rather, their significance and relationships with anxiety and apprehension vary across different residential complexes. In particular, the roles of variables such as enclosure and privacy, perceived ability to monitor the space, perceived security, accessibility and legibility, place attachment, and place identity across the different models highlight the importance of compatibility between spatial characteristics and residents' perceptions and use of semi-private spaces. Accordingly, security and comfort in semi-private spaces are not achieved solely by increasing enclosure or surveillance. Instead, achieving a balance among visual accessibility, monitoring, privacy, legibility, and territorial definition is essential. From an applied perspective, this research contributed to translating its findings into physical-spatial principles and design strategies for semi-private spaces in residential complexes. The results indicated that a single design pattern is not necessarily effective across all residential complexes and that design priorities vary according to the physical and perceptual characteristics of each space. For example, in the semi-private spaces of the Sajjad residential complex, the roles of enclosure, privacy, and perceived monitoring of the space in the prediction model indicate that greater attention should be given to territorial definition, the creation of balanced enclosure, and the strengthening of residents' sense of monitoring over semi-private spaces. These should be considered design priorities. In contrast, in the semi-private spaces of the Reza residential complex, the presence of variables such as natural elements and landscape, environmental

quality, accessibility, and legibility in the model indicates the importance of improving environmental quality, enhancing pathway legibility, and considering the integration of natural elements into semi-private spaces. Accordingly, the findings support a context-based design approach in which architectural strategies are developed based on the spatial characteristics, patterns of use, and residents' perceptions of semi-private spaces within residential complexes. Overall, the findings demonstrate that improving the quality of semi-private spaces cannot be achieved solely by enhancing physical characteristics or adding aesthetic elements. Rather, the quality of these spaces emerges from the interaction among spatial organization, legibility, territorial definition, opportunities for monitoring and visibility, privacy, and the quality of the spatial experience. Accordingly, designing semi-private spaces in residential complexes through a balance among privacy and visibility, enclosure and openness, accessibility and monitoring, and legibility and spatial diversity may be associated with a more supportive environment for lower anxiety and apprehension and strengthening residents' positive experiences of semi-private spaces. This approach avoids proposing a fixed solution applicable to all residential complexes and enables the development of design strategies tailored to the physical and perceptual conditions.

Table 10: Design Strategies for Reducing Anxiety and Apprehension. (Source: Authors)

Design Strategy	Specific Design Location	Physical-Spatial Design Solutions	Suggested Materials	Perceptual-Psychological Objective
Daylight quality and natural lighting	Floor corridors, access corridors to residential units, stair landings, lobbies, and semi-private entrance spaces of residential blocks	1. Providing openings or end windows in long corridors to strengthen visual connections with the exterior and reduce the perception of dead-end spaces. 2. Using skylights or side openings in stair landings and low-light areas. 3. Facilitating the penetration of natural light into lobbies and shared circulation routes. 4. Avoiding the formation of dark and blind spots at changes in corridor directions.	Glare-controlled glazing, frosted or semi-transparent glass where privacy is required, materials with appropriate light reflectance, and complementary artificial lighting with intensity and color characteristics appropriate to the function of the space.	Enhancing environmental visibility, facilitating wayfinding, reducing spatial ambiguity, and improving perceived comfort in shared circulation areas.
Biophilic design and connection with nature	Block entrances and lobbies, semi-private courtyards, spaces in front of block entrances, seating areas, and shared terraces or balconies	1. Avoiding excessively long and complex corridors without spatial cues. 2. Creating focal points and pause areas along extended routes. 3. Establishing visual connections among lobbies, corridors, stairs, and elevators. 4. Creating limited setbacks or transitional spaces at residential unit entrances to enhance the identity of each threshold. 5. Using simple spatial cues to distinguish floors and circulation routes.	Floor and wall materials with limited and purposeful variations in texture or color; clear wayfinding signs; and matte, low-reflective materials in circulation areas.	Improving the quality of environmental experience, creating opportunities for pause and relaxation, and strengthening residents' psychological connection with shared spaces.

Simple spatial geometry and route legibility	Residential distribution corridors, landings, routes from lobbies to elevators and stairs, and access paths to residential units	1. Creating a clearly defined spatial threshold between corridors and residential unit entrances. 2. Using semi-enclosed transitional spaces at block entrances or lobbies to create a gradual transition between courtyards and interior spaces. 3. Defining boundaries between pedestrian paths, seating areas, and vehicular routes in shared courtyards. 4. Providing controlled visual permeability in semi-private spaces without direct overlooking into residential units. 5. Using setbacks, recessed balconies, or semi-transparent elements in areas where direct visual exposure occurs.	Low walls, vegetation elements, vertical and horizontal louvers, semi-transparent perforated screens, brick, textured stone, and differentiated paving materials for territorial definition.	Reducing spatial ambiguity and confusion, facilitating orientation, and increasing the perceived predictability of semi-private spaces.
Territorial definition, privacy, and opportunities for natural surveillance	Block entrances, lobby thresholds, spaces in front of residential units, semi-private courtyards, and transitional zones between shared spaces and residential entrances	1. Improving sound insulation of shared walls between residential units and circulation spaces. 2. Reducing sound transmission from elevators and building equipment to corridors and residential units. 3. Using sound-absorbing materials in parts of lobbies and seating areas. 4. Avoiding extensive use of hard and reflective surfaces in long corridors. 5. Introducing limited and coordinated variations in material texture and finish to enhance the perceptual quality of semi-private spaces.	Appropriate acoustic insulation materials for walls and ceilings; wooden or sound-absorbing matte-finish panels; interior brick surfaces; and flooring materials with suitable sound absorption or acoustic control properties.	Strengthening the sense of surveillance and attachment to shared spaces, enhancing perceived security, and maintaining a balance between privacy and awareness of semi-private environments.
Sensory quality of materials and acoustic comfort	Shared walls adjacent to residential units, corridors, landings, lobbies, elevator areas, and floor surfaces	1. Increasing the thickness and acoustic insulation of walls surrounding elevators and the building's main corridors to control sound transmission. 2. Strictly avoiding excessive use of highly polished, glossy, and dark materials on walls, which may evoke a sense of coldness and insecurity in users.	Installation of sound-insulating layers such as rock wool within the walls surrounding common areas; use of interior decorative brick, matte wood panels, and warm-toned architectural finishes such as warm cream, beige, and ivory.	Reducing noise disturbance caused by circulation and adjacency of residential units, improving sensory comfort, and creating a sense of calmness and warmth in semi-private spaces.

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