Original Article

The role of biophilic elements in the spatial experience of contemporary commercial complexes and their impact on customers' behavioral health

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Abstract

Background: This study explores the integration of biophilic elements in contemporary commercial centers and their impact on customer well-being and spatial experience. With increasing recognition of the importance of natural environments in urban life, biophilic design has emerged as a key approach in commercial architecture.

Methods: In the first phase, a thematic analysis of existing literature was conducted to identify relevant themes, categories, and relationships, leading to the development of a conceptual model. In the second phase, a survey-based study was carried out among 119 visitors to nominated commercial centers to validate and generalize the findings. Structural analysis of the collected data was performed using SPSS and SmartPLS (v.3), confirming that the conceptual framework of biophilic design in commercial spaces is shaped by six key factors.

Results: The results indicate strong and meaningful interactions among these factors, reinforcing the significance of biophilic principles in shaping customer behavioral well-being. Furthermore, the study highlights how integrating biophilic elements into commercial environments can enhance both mental and physical well-being, ultimately fostering more positive customer experiences.

Conclusion: These findings underscore the need to prioritize human-centered and environmentally conscious design strategies in commercial space development.

Keywords: Biophilic Elements; Spatial Experience; Customer Behavioral Well-being; Contemporary Commercial Centers.

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Introduction

Enhancing urban environment quality is one of the primary concerns of urban design specialists, particularly in the creation of public centers that offer tranquility, entertainment, social interactions, and accessibility. This aspect holds significant importance (1). However, the current disregard for urban environmental degradation, the reduction of green space per capita, the destruction of agricultural lands and forests, as well as the loss of plant and animal species, are among the crises emerging from uncontrolled urban expansion (2). These crises showed a direct impact on the quality of life and mental health.

In the modern world, where urban life and technological advancements have distanced individuals from nature, biophilic design

has emerged as an innovative approach to integrating natural elements into indoor areas/spaces to enhance comfort and well-being (3). Additionally, the primary purpose of visiting these locations extends beyond purchasing commodities: it includes meeting friends and family, engaging in spontaneous encounters, and spending leisure time without particular purposes (4). Furthermore, these transformations particularly affect behavioral well-being, as shopping malls provide areas for social interactions and stress reduction, contributing to both mental and social well-being (5;6).

Moreover, in today's competitive market, commercial centers face substantial pressure to attract visitors and improve shopping experiences. Tourists who seek enjoyable environments prefer areas that offer relaxation and security, thereby increasing their attraction to these venues (7; 8). Thus, the successful design of commercial centers requires attention to various factors, including accessibility, appropriate spatial arrangements, and open pedestrian areas to support mental well-being(9). Accordingly, incorporating biophilic design principles and spatial arrangements based on proxemic theories may significantly improve customers' spatial perception (10).

Another crucial aspect of the commercial center design is the environmental ambiance, which significantly influences users' sense of relaxation and satisfaction.The use of environmental elements such as graphics, colors, lighting, and scents may improve social engagement and elevate customers' enjoyment (11;12;13). Overall, the environmental and architectural design of commercial centers is likely to directly shape customer behavior and purchasing procedures. Such designs increase visitors' propensity to linger and return to shopping centers (14; 15).

In recent years, biophilic design has surged in popularity, delivering multiple benefits to the built environment. Grounded in the concept of biophilia, this approach provides a multi-sensory experience that is likely to influence psychology, cognition, and behavior (3). The term "biophilia" describe the innate human tendency to affiliate with nature and natural processes, an evolutionary imperative for human welfare (16). Consequently, biophilic design not only promotes individual well-being but also exerts a powerful influence on customer behavior and commercial engagement.

Research Question

What is the conceptual model explaining the role of biophilic elements in the spatial experience of contemporary commercial centers and their influence on customer behavior?

Theoretical Framework

Figure 1 shows the theoretical framework:

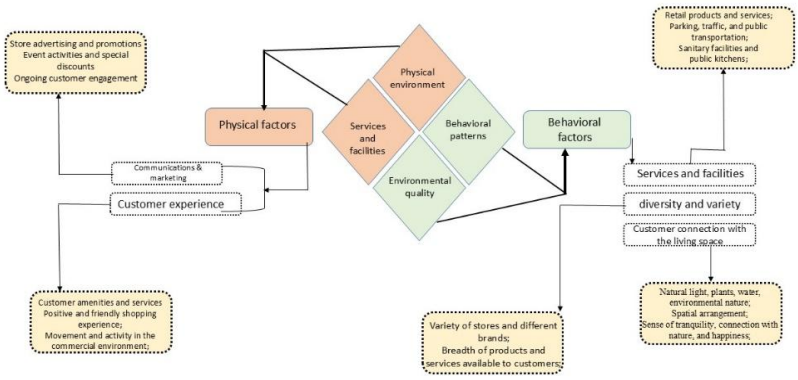

Figure 1. Theoretical Framework of the Research Factors

Methods

In the present study, a systematic, process-oriented quantitative approach was adopted to advance the research problem and overcome epistemic limitations. It employs an applied methodological framework tailored to a broad spectrum of stakeholders (17). The comparative deductive quantitative approach, grounded in the post-positivist paradigm, guided the selection of a systematic quantitative methodology with clearly defined protocols. Moreover, applying a standardized search strategy, 245 articles/papers were retrieved from the Scopus citation database to serve as the study's literature corpus, upon which the conceptual model was constructed (18). Furthermore, Variance-based structural equation modeling was chosen to test the hypotheses, owing to its alignment with the necessary analytical conditions (19).

Population and Sample

The target population to which this study seeks to generalize its findings (20) comprises patrons of contemporary commercial centers in Iran. Additionally, a substantial segment of this active customer base was designated as the accessible population, and sampling was conducted employing a systematic probability design. To find a representative sample, the required sample size was estimated at 119 participants based on equation-based techniques (17) via G*Power. However, this sample size corresponded to an effect size of 0.05, a 99% confidence level, and a 95% power for generalizability. Field data were collected from the distributed questionnaires, which yielded an acceptable 84% response rate (21).

Statistical Population

The statistical population examined in the quantitative phase consists of patrons of contemporary commercial centers in Iran. The nominated shopping centers are listed in Table 1 and include 13 sites.

Figure 2 shows determination of the minimum sample size based on statistical power and generalizability of results.

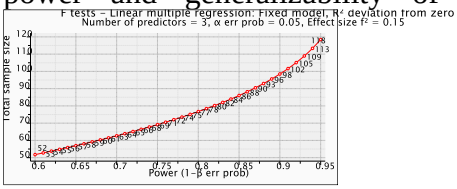

Fig 2. Determination of the Minimum Sample Size Based on Statistical Power and Generalizability of Results

Table 1. List of Contemporary Commercial Centers

No.	Shopping Centers	Location
1	Sam Center Shopping Mall	North Tehran
2	Boutique Mall Mellal	Fereshteh Street
3	Zafaraniyeh Plaza Shopping Center	Zafaraniyeh
4	Palladium Shopping Center	Moghaddas Ardabili Street
5	Modern Elahieh Shopping Center	Elahieh Street
6	Rosha Department Store	Niavaran Street
7	Almas Iran Shopping Center	Aghdasiyeh
8	Sky Center Shopping Mall	Lavasan
9	Tandis Shopping Center	Tajrish Square
10	Arg Center Shopping Mall	North Side of Tajrish Square
11	BamLand Shopping Center	Shahid Hemmat Highway
12	Mega Mall Shopping Center	Shahid Sattari Highway
13	Kourosh Shopping Center	North Sattari Highway

Fig 3. Contemporary commercial centers

Table 2: Factors and Indicators of the Role of Biophilic Elements in the Spatial Experience of Contemporary Commercial Centers and the Impact on Customer Behavioral Well-Being

Dimension	Factors
Causal Conditions	**Sustainable and Human-Centered Design** • Quality and diversity of biophilic elements • Balanced natural and artificial lighting • Benefiting from natural sounds and scents • Interaction with and accessibility to natural elements • Awareness and attention to customer well-being • Environmental sustainability and responsibility
Contextual Conditions	**Comprehensive and Sustainable Management in Design and Development** • Environmental and sustainability considerations • Technology and innovation • Economic considerations • Regulations and Policies
Core Phenomenon	**Customer Experience Design and Brand-Oriented Environment** • Enhancing aesthetic appeal • Reducing stress and creating a sense of relaxation • Strengthening the shopping experience • Reinforcing emotional connection with the brand
Intervening Conditions	**Sustainable Design Management Based on Customer Experience** • Technology and innovation • Sustainability and environmental considerations • Diversity and quality of biophilic elements • Economic and investment returns • Customer experiences and expectations
Strategies	**Sustainable and Innovative Transformation Management** • Sustainable and flexible evolution • Technology and innovation • Education and awareness enhancement • Continuous evaluation and revision
Outcomes	**Human-Centered and Sustainable Design** • Increased satisfaction and relaxation • Strengthening customer connection to the place • Stimulating environmental responsibility awareness

Table 2. Results of Cronbach's Alpha, Composite Reliability, and Convergent Validity

(Source: Research Findings)

Construct	Cronbach's Alpha	Average Variance Extracted (AVE)	Composite Reliability (CR)
Human-Centered and Sustainable Design	0.784	0.698	0.874
Customer Experience Design and Brand-Oriented Environment	0.837	0.671	0.891
Sustainable and Human-Centered Design	0.901	0.670	0.924
Sustainable and Innovative Transformation Management	0.824	0.659	0.885
Comprehensive and Sustainable Management in Design and Development	0.856	0.697	0.902
Sustainable Design Management Based on Customer Experience	0.830	0.596	0.880

Therefore, within the framework of this study, structural equation modeling (SEM) is applied to each dimension of the model: the relationships between indicators and their latent constructs are tested via confirmatory factor analysis (CFA) in the measurement model, and subsequently, the paths among model dimensions are evaluated in the structural model. Accordingly, the measurement models are first examined (Table 3), and once sufficient evidence of validity and reliability is found, the structural model is assessed. Following fitting both measurement and structural models, the overall model fit—integrating measurement and structural factors—is evaluated, and upon confirmation of satisfactory fit, the assessment of the complete SEM is finalized.

Subsequently, the dependent variable and its relationship with the biophilic-element factors of the spatial experience in contemporary commercial centers—and the impact on customer behavioral well-being —were quantitatively assessed to determine each component's effect size. In Partial Least Squares Structural Equation Modeling (PLS-SEM), the Fornell–Larcker criterion is employed to evaluate discriminant validity, reflecting the extent of partial correlations between a construct's indicators and those of other constructs. Accordingly, the square root of each construct's average variance extracted (AVE) must exceed its correlations with all other constructs, meaning that the diagonal entries of the Fornell–Larcker matrix must be larger than any off-diagonal value in the corresponding column. Table 3 presents the Fornell–Larcker matrix for the constructs related to the role of biophilic elements in spatial experience and their influence on customer behavioral well-being.

Structural Model Fit

To assess the structural model's fit by PLS-SEM, this study employed the R^2 coefficients and Stone–Geisser's Q^2 criterion. R^2 links the measurement and structural factors of the model by

Table 3. Fornell–Larcker Discriminant Validity Matrix

(Source: Research Findings)

Construct	1	2	3	4	5	6
1. Human-Centered and Sustainable Design	0.779					
2. Customer Experience Design and Brand-Oriented Environment	0.447	0.819				
3. Sustainable and Human-Centered Design	0.529	0.503	0.818			
4. Sustainable and Innovative Transformation Management	0.523	0.485	0.494	0.811		
5. Comprehensive and Sustainable Management in Design and Development	0.551	0.475	0.590	0.589	0.834	
6. Sustainable Design Management Based on Customer Experience	0.444	0.523	0.571	0.417	0.517	0.772

Table 4. R^2 and Q^2 Values *(Source: Research Findings)*

Construct	Q^2	R^2
Human-Centered and Sustainable Design	0.338	0.522
Customer Experience Design and Brand-Oriented Environment	0.403	0.670
Sustainable and Innovative Transformation Management	0.274	0.470

quantifying the proportion of variance in each endogenous construct explained by its exogenous predictors. Q^2, introduced by (22), evaluates the model's predictive relevance. Table 4 presents the R^2 and Q^2 values.

The R^2 and Q^2 values indicate that the structural model exhibits satisfactory explanatory power and predictive capability. However, the research model and hypothesis testing via the structural equation modeling approach are detailed below.

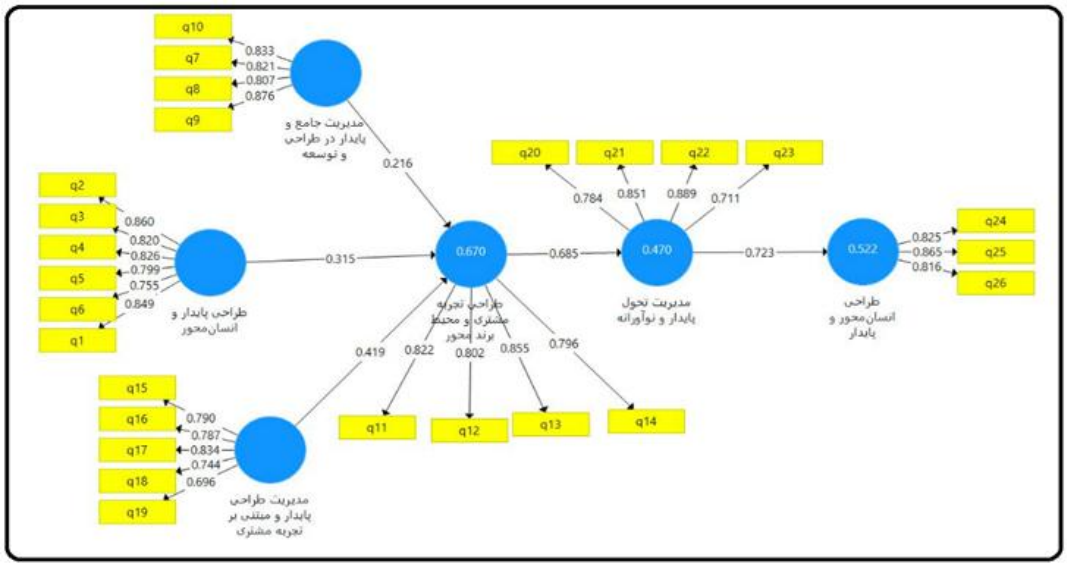

Diagram 1. Path Coefficients for the Role of Biophilic Elements in the Spatial Experience of Contemporary Commercial Centers and the Impact on Customer Behavioral Well-Being

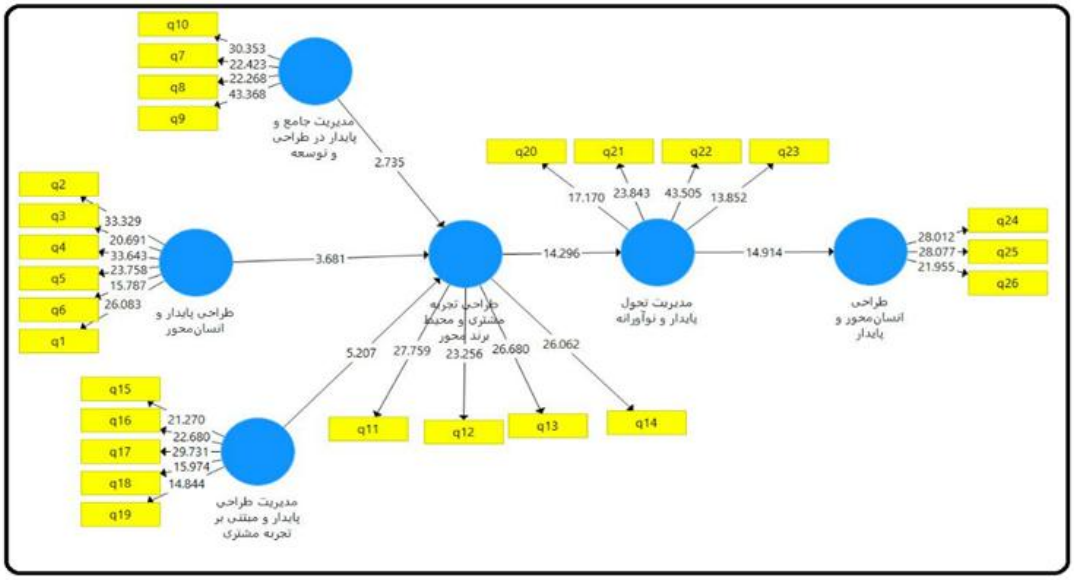

Diagram 2. Significance Levels of the Path Coefficients for the Role of Biophilic Elements in the Spatial Experience of Contemporary Commercial Centers and the Impact on Customer Behavioral Well-Being

Table 5. Path Coefficients and Significance Levels for Final Study Variables

Path	Path Coefficient	t-value
Sustainable & Human-Centered Design → Customer Experience Design & Brand-Oriented Environment	0.315	3.681
Comprehensive & Sustainable Design Management → Customer Experience Design & Brand-Oriented Environment	0.216	2.735
Sustainable Design Management Based on Customer Experience → Customer Experience Design & Brand-Oriented Environment	0.419	5.207
Customer Experience Design & Brand-Oriented Environment → Sustainable & Innovative Transformation Management	0.685	14.296
Sustainable & Innovative Transformation Management → Human-Centered & Sustainable Design	0.723	14.914

Furthermore, the Goodness of Fit (GoF) index in PLS-SEM provides an overall assessment of model quality, ranging from 0 to 1; values closer to 1 indicate a better-fitting model. Moreover, GoF evaluates the model's predictive capability for endogenous latent variables. Thresholds for GoF are: 0.10 (small), 0.25 (medium), and 0.36 (large). In this study, however, the GoF of **0.6069** confirms an adequate overall fit. Based on the data analysis, the hypothesis test results are summarized in Table 5.

Discussion and Conclusion

The present study, which aimed to investigate the role of biophilic elements in the spatial experience of contemporary commercial complexes and their impact on the health of customers' behavior, achieved profound results that emphasize the necessity of paying attention to the principles of biophilic design in commercial spaces. In the present era, when the process of urbanization and industrialization of societies has led to a decrease in the connection between humans and nature, designing spaces that can reduce this distance and restore the connection between humans and nature has become one of the requirements for sustainable development and improving the quality of life in urban environments.

The results of the study show that the use of biophilic elements in the design of commercial complexes, including elements such as natural light, vegetation, water, natural materials, biological patterns, and open spaces, can have positive and meaningful effects on the spatial experience of customers and their mental and physical health(23). The conceptual model presented in this study, which was extracted based on qualitative and quantitative analyses, consists of six key components, each of which has directly or indirectly affected the spatial perception and behavior of customers. These components represent principles and criteria that urban designers and planners can exploit to create higher-quality spaces. The findings of this study reveal that commercial complexes, as one of the most important social and public spaces in contemporary cities, can become a platform for improving the quality of life of citizens by integrating biophilic design principles. This not only leads to the creation of attractive and pleasant environments for customers but also improves their mental and physical health by reducing stress, increasing a sense of calm, and strengthening social connections(24). In other words, biophilic design can create a positive and lasting experience for customers and, at the same time, play a role as an effective solution in responding to the social and psychological needs of contemporary humans(4).

In the quantitative part of this study, testing the structural model and analyzing the relationships between components confirmed the strong and significant impact of biophilic elements on the health of customers' behavior. These results show that design based on biophilic principles not only affects the functional and aesthetic

aspects of space, but also can promote social interactions, strengthen the sense of belonging to the place, and create a positive spatial experience for users. In addition, the findings indicate that customers who are present in biophilic environments are more inclined to spend longer time in these spaces, and their purchasing behaviors also improve significantly under the influence of a positive spatial experience.

The study also highlights the role of biophilic design in reducing the challenges associated with urban living, including high population density, environmental pollution, reduced interaction with nature, and increased stress(4). By incorporating natural elements into their design, shopping malls can act as spaces to restore customers' mental and physical balance and provide a new and distinct experience of being in a modern shopping environment. This is especially important in communities that face multiple challenges arising from urban living. From a practical perspective, this study recommends that designers, architects, and managers of shopping malls consider biophilic design principles as a fundamental and strategic approach in the design and planning process of these spaces(25). These principles can include the use of natural light, the design of indoor and outdoor green spaces, the use of natural materials, creating views and landscapes to nature, and the integration of water as a relaxing element. These measures can improve the quality of commercial spaces, increase customer satisfaction, strengthen loyalty, and ultimately enhance the economic success of these spaces.

Finally, the results of this study emphasize that biophilic design is not only an aesthetic or functional choice, but also a social and environmental necessity that can be used as a sustainable solution to face the challenges of urban life(18). Paying attention to these principles in the design of commercial complexes can be an effective step towards creating more humane, sustainable, and environmentally friendly spaces that are more compatible with the psychological and environmental needs of users(26). This not only leads to improved quality of life for customers but also helps to achieve sustainable development goals and increase positive interaction between humans and nature.

Authors' contribution

HA, BR, AK developed the study concept and design. HA, AK acquired the data. HA, BR, AK analyzed and interpreted the data, and wrote the first draft of the manuscript. All authors contributed to the intellectual content, manuscript editing and read and approved the final manuscript.

Informed consent

The fundamental value of confidentiality in scientific research, particularly in human studies, is rooted in the ethical principles of respecting participants' autonomy and privacy. This principle requires that personally identifiable information be carefully protected and made available to the research team only with participants' informed consent and within a strictly controlled framework. Violating this principle not only undermines public trust in science but can also have serious social and psychological consequences for participants.

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Conflict of interest

The authors declare that they have no conflict of interests.

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