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Effective Factors on Increasing Users' Satisfaction with Housing by Biophilic Approach

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ABSTRACT

The residential satisfaction of housing users in cities has much importance in urban housing planning. Besides the physical and mental health of the residents, the residents' satisfaction with the residential environment is effective on the important indicators of planning, such as the quality of life, the displacement rate, and the housing demand forecast. Identifying various factors in the residents' satisfaction of a neighborhood from the quality of their residential environment can better decide to improve the quality level of their residence location and assess the qualitative situation of the quality components in the desired residential environment. The present research was conducted to improve the quality of the architectural space of housing with a biophilic approach in District 1 of Tehran city. This applied research is based on descriptive-correlational and field research. The statistical population of this research was all the citizens over 18 years of age in District 1 of Tehran city. A questionnaire was used to collect data, and the questionnaire was randomly distributed among 384 people in a simple stratified manner, statistical analyzes were performed using this number of respondents. The results of data analysis showed that the indicators of satisfaction with housing, the criteria involved in improving the quality and desirability of the residential environment, criteria involved in traditional biophilic architecture and biophilic architecture are placed on moderate to a high level and have a favorable condition. Also, the results of multiple regression indicated that modern and traditional biophilic architecture criteria have a positive effect on users' satisfaction with housing.

Keywords: *Satisfaction with housing, Quality of life, Biophilic, Biophilic design*

1. Introduction

Satisfaction with the residential environment has been studied as an important criterion for evaluating the quality of the residential environment and in various fields such as housing [1], health [2], finance [3], and leisure time [4], has been investigated. Analysis of the quality of life in a residential environment from focusing on the individual to friendships, marriage, family, community, and place of residence [5] as well as the different dimensions of the quality of the environment, and perceived residential characteristics,depends on cognitive understanding of endogenous and exogenous natural and artificial components and their perceived value [6].

Past research has assessed the quality factors of the environment from residents' perceptions of a multidimensional structure with several psychological measures of specific aspects of environmental quality, including the Perceived Environmental Quality Index (PEQI) [4] and Perceived Residential Environmental Quality Index (PREQI) [7]. Four major aspects comprise the second indicator: spatial, human, functional, and contextual dimensions [5]. In this framework, the spatial dimension refers to architecture and urban planning, and the human dimension refers to people and social relations.

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The functional dimension refers to the services and facilities in a certain place, and the contextual dimension shows the speed of life, environmental health, and pollution, as well as maintenance and care. Empirical studies related to residential satisfaction adopt one of two approaches [8]. Some (For example, Speare [9]; Newman and Duncan [10]) consider residential satisfaction as a predictor of behavior. It can predict behaviors such as house change or home improvement [11]. This approach assumes that any incompatibility between the set of needs and desires and the current housing situation can be reduced by moving or making adjustments to the current unit or location [12]. Accordingly, studies considering residential mobility and its consequences, use residential satisfaction as a predictor of moving/coping behavior. Another approach uses residential satisfaction as a criterion for residential quality [12-17]. There are factors-both residential environment factors and individual factors - that determine the level of satisfaction of a person with his/her residential environment. It is said that factors such as time duration of residence, tenure status, physical characteristics of the house and neighborhood, social ties, and social and demographic characteristics of residents affect the level of satisfaction [12]. A new direction in this approach began with the study of housing satisfaction by Canter and Rees [18]. They used multidimensional scaling and developed a general model of housing satisfaction that places the user's goals at the center of the evaluation of the residential environment. They argue that user evaluation should form the cornerstone of evaluation research and that "feedback" or "evaluation" is an integral part of the design process [18]. Finally, another approach regarding users' satisfaction with conventional housing is the biophilic approach. The biophilic approach seeks to create a good place of residence for people as a living biological organism in the modern environment that improves people's health, fitness, and well-being. Thus, the successful application of biophilic design brings a wide range of physical, mental, and behavioral advantages. Physical benefits include increased physical fitness, lower blood pressure, increased comfort and satisfaction, fewer disease symptoms, and improved health. Mental benefits include increased satisfaction and motivation, and less stress and anxiety, to improve problem-solving and creativity. Positive behavior change includes coping and mastery skills, more attention and concentration, better social interaction, and less hostility and aggression [19]. Biophilic architecture for artificial and man-made environments can be the best process for building design. Biophilic architecture during the design and execution of houses has a positive effect on improving the quality of housing and increasing users' satisfaction with their housing. Investigations show that so far, no research has been conducted on the identification of qualitative indicators of housing architecture space with a biophilic approach in the studied community. Concerning the lack of research the present study aims to investigate and explain the qualitative indicators of housing architectural space with a biophilic approach in District 1 of Tehran city and by examining the current situation and housing formation, in improving the quality of residential architectural space in Iran has taken an effective step with the biophilic approach, so the main issue of this research is to identify the qualitative indicators of the housing architecture space with the biophilic approach in District 1 of Tehran city.

2. Theoretical Foundations and Research Empirical Background

We respond to the forms, processes, and patterns of nature [20]. These psychological mechanisms originate from prehistoric times when human interaction with other living species (plants and organisms) is more direct, active, and frequent than in the current urban living environment [21]. An evidence study has been provided to show that humans have a higher level of happiness and well-being in the natural environment [22]. We have changed our living habits and surroundings since prehistoric times. Our current living conditions in cities allow for less interaction with other species. It has led to a decrease in human well-being and happiness [23]. Bringing the natural environment or green space into the office, workplace, or personal home has a positive effect on the satisfaction of residents [24]. Greenness in offices has a positive relationship with productivity and a negative relationship with stress in residents. Indoor plants help to improve indoor air quality [25]. They help to reduce indoor air pollution by reducing volatile organic compounds produced by indoor furniture and various artificial materials [26]. Inactive viewing of natural stimuli through windows can reduce stress and increase the positive mood of residents. A field study reports that workers who have a window view of nature feel more frustrated and less satisfied than workers who are built in a non-green environment [27]. Plants and nature help reduce stress and anxiety even outside the building. It has been reported that views of nature and plants from the windows help to reduce the anxiety and tension of the residents and help to increase their productivity and well-

being of the residents [28]. In a study that has been conducted by American psychologists, windows views of the outside world are included as one of the primary requirements for office occupants to achieve satisfaction in an office space. Introducing low-cost biophilia can have healthy effects on the residents of an environment and higher productivity. Children can learn up to 20% faster in bright environments [29]. Health benefits and happier psychological support affect workers' perceptions of the workplace. A study reports a 10% reduction in worker absenteeism because of introducing biophilia in office space [30]. Biophilic architecture is one of the new approaches in today's architecture, which seeks to design buildings using the elements of nature so that people can achieve mental peace. Biophilic is defined as an innate human tendency toward natural systems and processes and encourages us to relate architecture to other forms of life [24]. The biophilic concept proposed the idea that contact with nature plays an essential role in human physical and psychological well-being. Several studies have been conducted to prove the benefits of biophilic (nature) for restoring people's spirits and improving people's quality of life [31]. Biophilic, like green space, plays an important role in social and family relationships in modern society [32] and is useful for office workers in dense urban areas and students and university staff to reduce stress [33]. Soderlund and Newman [34] reviewed and evaluated the evidence related to the inherent mental and physiological connection of humans with nature and spoke about the many social, environmental, and economic benefits of Biophilic. As Bi Nasreldin and Abdelfattah [35] emphasized, nature is not optional and selective, but it is a necessary principle of modern urban life. Newman [36], added that if biophilic is applied in buildings and cities, it can help overcome dependence on fossil fuels and create a more resilient city. The fundamental benefits of biophilic encourage us to not only conserve and restore the remarkable natural elements that already exist but find new ways for growth and incorporate new forms of nature for the 21st century [37]. Regarding the research empirical background, Table 1 provides lists of some of the most important studies in order of the research topic.

Table 1: Summary of the research experimental background

Researcher	Research title	Result
Gür and Kaprol [38]	Contribution of biophilic design in post-pandemic living space design	Biophilic design provides the potential to use nature, daylight, air, and vitality as design elements to improve the quality of spaces and support communities' experiences. Biophilic design can enrich multisensory and multidimensional experiences both individually and socially by allowing users to take part in this experience. While this approach supports healthy and safe living spaces.
Jaheen and El-Darwish [39]	Biophilic Design Elements in Modern Buildings	The research findings confirm that many biophilic features inspired by historical buildings are found in the three contemporary study areas, but not all of them work properly.
Abed [40]	The residential environment after the epidemic in Oman	The results of the study have indicated that apartment buildings in Oman are qualitatively and quantitatively both in apartments with outdoor space and in ordinary floor units without outdoor space in particular. There are shortages. While quantitative deficiency is associated with poor layout in terms of area, performance, and diversity. A quality related to the absence of inspiration from nature, which includes the five senses. This emphasizes the need for formulation of design guidelines and strategies, considering psychological well-being to improve outdoor spaces as a center for activities.
Al-Dmour et al. [41]	The Flourishing of Biophilic Workplaces: Second Home Offices as a case study	The resident responses provide evidence that biophilic design is a promising approach to improving workplace health, well-being, and productivity. However, the results show two points related to the compan''s use of this plan. First, using biophilic as an aesthetic value is not enough to achieve the best environmental quality as well as the expectations of the residents in the office environment. The second is that biophilic should go hand in hand with other technological

		features, all of which are equally well designed to control the quality of the indoor environment, such as thermal comfort, air quality, lighting, acoustic comfort, and proper spatial arrangement in offices.
Nouhi Bezenjani and Nikpour [42]	Recognition of the effect of biophilic architecture principles on people's sense of satisfaction	Research that biophilic architecture principles provide more suitable conditions for obtaining a sense of satisfaction and improving the quality of people's living environment
Ghorbani Param et al. [43]	The evaluation of the effect of biophilic architectural principles on the quality of housing design in the northern region of Iran in the city of Gorgan	Research indicated that focusing on the principles and indicators of biophilic architecture during the design and implementation of residential complexes in the northern regions of Iran in improving the quality and consequently increasing the level of satisfaction of their residents has a major impact.
Parvar and Karimpour [44]	The study of the effectiveness of biophilic architecture principles in improving the quality level of the human environment	Designing based on the biophilic approach, due to establishing a deep multi-faceted relationship with nature, can provide more favorable living conditions for users besides meeting all the physiological and psychological needs of users, building and improving the quality level of their environment.
Didehban and Kakavand [45]	Biophilic architecture as a solution to increase the environmental quality of residential complexes	The presence of nature and plants is an effective factor in human physical and mental health. Increasing the quality of the environment of residential complexes is one of the factors influencing the desirability of the environment, which can affect the quality of life.

The main goal of this research was to determine the factors effective in increasing the satisfaction of users from their conventional housing in District 1 of Tehran city by using the biophilic approach. To investigate this objective, first, the research literature was examined and the indicators of quality and desirability of the residential environment in various studies, including internal research, such as Bahrampour and Modiri [46]; Nouri and Asadpour [47]; Alizadeh and Mohammadi [48]; Pourdehghan et al. [49], in foreign research such as Lee [50], Kshetrimayum, et al. [51]., were selected which these indicators and their resources are presented in the following table.

Table 2: Indicators of the quality and desirability of the residential environment

Indices	References
Light and luminance	Bahrampour and Modiri [46]
The situation of roads, in terms of the coverage and width of roads	Alizadeh and Mohammadi [48]
The appearance of alleys, streets and squares, parks and green spaces	Das [52]
The condition of the facade of the buildings and the setback of the buildings, the formation and organizing of the space	Kshetrimayum et al. [51]
The existence of suitable social spaces	Bahrampour and Modiri [46]
The existence of a suitable space for the reception of guests	Alizadeh and Mohammadi [48]
The existence of suitable prospects	Alizadeh and Mohammadi [48]
The condition form of asphalts and flooring	Alizadeh and Mohammadi [48]

Shape, variety, and quality of buildings and houses	Das [52]
The network of public space facilities (lights, benches, trash cans, footpaths, etc.)	Lee [50]
The variety of dimensions and proportions and other aesthetic dimensions	McGirt et al. [53]
View and landscape, beauty and pleasantness	Kshetrimayum et al. [51]
Security, calmness	Khaef and Zebardast [54]
The use of traditional architecture in urban planning and new architecture	Bahrampour and Modiri [46]
Using regular geometry in design-focus on the law of plurality in the unity	Lee [50]
Placing the courtyard in the heart of the complex	Alizadeh and Mohammadi [48]
The use of strong symmetry in the design and focus on the center	Alizadeh and Mohammadi [48]
Using numbers symbolically and special identity based on the use of symbols and cultural signs	Alizadeh and Mohammadi [48]
The feeling of familiarity and associating	Khaef and Zebardast [54]
The sense of belonging and attachment to the residence place	Kshetrimayum et al. [51]
Focusing on the law of plurality in unity in using materials	Dabagchi and Abbas Hadi [55]
The use of traditional architectural elements to present the meaning and building construction	Bahrampour and Modiri [46]
The use of local culture in choosing the type of materials, the construction method	Bahrampour and Modiri [46]
Considering appropriate activities before focusing on the visual order of the environment	Siadati and Karimifard [56]
The use of different uses, both in terms of the type of use and in terms of existence	Siadati and Karimifard [56]
Social mixing and flexibility of spaces	Nosrati Ershad and Javan Faruzandeh [57]

Readability of the environment, freedom of choice, and creating motivation through the use of different urban forms	Bahrampour and Modiri [46]
The possibility of a social life versus a private life	Khaef and Zebardast [54]
Listening to the voice of the past in the concept of readability of cultural heritages	Nouri and Asadpour [47]
Considering local regional ties as designs	Nouri and Asadpour [47]
Historical preservation and urban restoration	Bahrampour and Modiri [46]
Focusing on the architectural values of the environment and the importance of places compared to buildings	Van Paul [58]
The use of traditional urban planning experiences in the new construction	Khaef and Zebardast [54]
Integration of nine themes and achieving more effective environmental combinations	Bahrampour and Modiri [46]
Recognizing most opinions, individual freedom, and the right to individual and universal choice	Amerigo and Aragones [16]
Creating a context for participation and dialogue by preserving individual and collective identity and values	Bahrampour and Modiri [46]
Maintaining individual and collective rights and creating the context of individual and collective psychological security	Amerigo and Aragones [16]
The possibility of using space for the public and freedom of movement in space	Ghalambordezfoli and Naghizadeh [59]
The ability to talk and interact at different levels from virtual to face-to-face in the space	Ghalambordezfoli and Naghizadeh [59]
Ability of meaningfulness of the environment and definition of collective and individual territories	Pourdehghan et al. [49]
Preservation of social dignity	Bahrampour and Modiri [46]
Distinctiveness	Pourdehghan et al. [49]
Respect for privacy	Amerigo and Aragones [16]
Intimate relationship with the neighbors	Bahrampour and Modiri [46]
Lack of oversight and sense of privacy	Pourdehghan et al. [49]

Also, the indicators of users' satisfaction with their conventional housing based on the literature and theoretical foundations of the research were extracted, which were presented in Table 3.

Table 3: Indicators of housing satisfaction

Indices	References
The dimensions of the rooms, kitchen, present, and reception of the residential unit	Van Paul [58], Nouri and Asadpour [47]
The possibility of monitoring the external spaces of the building from inside the residential unit	Sajjadzadeh et al. (2016)
The cleanliness of the stairs	Chen et al. [60]
Street lighting and public space of the city	Rafieian et al. [61]
The level of safety and security of the residential complex and unit	Rafieian et al. [61], Nouri and Asadpour [47]
Distance to centers related to life, including work centers, hospitals, stores	Nouri and Asadpour [47], Van Paul [58]
Factors related to water, including water pressure, water quality, water outage,	Turkoglu [62], Chen et al. [60]
Residential unit area, maintenance cost, lighting, plumbing, purchase cost	Van Paul [58], Rafieian et al. [61], Nouri and Asadpour [47]
Existence of parks, green spaces, commercial plates, and shopping malls in the complex	Van Paul [58], Rafieian et al. [61]
The state of noise pollution, bad smell, garbage, the state of sewage	Van Paul [58], Rafieian et al. [61], Nouri and Asadpour [47]
The condition of the gas network, electricity network, sewage network, and suitable parking	Van Paul [58]
Ethnic diversity, attendance at ceremonies, implementation of customs	Ghalambordezfoli and Naghizadeh [59]
Suitable furniture	Ghalambordezfoli and Naghizadeh [59]
Readability, taking advantage of sensory contact and environmental protection	Ghalambordezfoli and Naghizadeh [59]
The cleanliness of the place, trash cans, the maintenance of the complex and green environments	Ahmadi and Charehjo (2021)
No sound pollution, no air pollution, the optimal density of the medical population	Tebi Masrour and Rezaei Moayed (2014)
Mixing of uses, compatibility, and desirability of uses, adequacy of local medical services	Tebi Masrour and Rezaei Moayed (2014)

Costs of access to service centers and employment, land price, diversity of medical income	Tebi Masrour and Rezaei Moayed (2014)
Neighbors' interactions, neighbors' characteristics, neighbors' similarities, and neighbors' support	Bahrampour and Modiri [46]
Next to nature, a view of the green space	Bahrampour and Modiri [46]
The quality of infrastructure, health services, existence of educational, sports facilities, etc.	Bahrampour and Modiri [46]
Observance of privacy, the feeling of social security, and mutual trust	Pourdehghan et al. [49]
The optimal layout of spaces in a residential environment, the beautiful facade of the building	Pourdehghan et al. [49]

3. Methods

This research in terms of purpose is applied research and its approach is based on a comparative approach. The type of research is quantitative research. To collect data, two methods of library studies and a questionnaire were used. The questionnaire of this research is composed of two parts. The first part is related to demographic questions, including age and gender, education, etc., and the second part is related to specialized research questions, which are based on the review of the theoretical foundations of the research, as well as the opinions of experts, about 70 questions were considered which they are based on the 5-point Likert scale. To review the face validity, the opinions of the target sample group or research participants are used and this part of the validity of the test does not need the opinions of expert experts. To review the face validity, a preliminary test of the questionnaire was distributed among the members of the statistical population. To measure the face validity, it was asked from the respondents expressed their opinion about the appropriateness of the questionnaire questions to measure the desired index and the existing ambiguities while answering the questions, and then their corrective comments were applied. In this research, after reviewing the validity of the questionnaire, its reliability was also evaluated and confirmed through Cronbach's alpha. The population of respondents to the questions of this research in the qualitative section included 10 people of experts, and in the quantitative section, all the people of District 1 of Tehran city. The sample size in the present study was estimated using Cochran's formula, which is one of the common statistical methods for calculating the sample size. The sample size for generalization to the research population was obtained with a 95% confidence level because of the unlimited statistical population of about 384 people. The probability sampling method was used in this research. In probability sampling, the researcher has significant measurement tools in controlling the selection of people and their selection methods. After extracting indicators of the quality and desirability of the residential environment and satisfaction with the residential environment and compiling the indicators based on the literature, the Delphi method was used to agree on these indicators.

In the first round of the Delphi method, based on the factors and indicators obtained from the research literature, a questionnaire including 69 indicators, of which each indicator refers to a general or partial factor, was designed and provided to ten experts. After analyzing the results obtained from experts' scores, most of them were confirmed and only 15 indicators were not agreed upon. In the second round of the Delphi method, a questionnaire was established, which included the ratings obtained from the opinion of the panel members in the first round. This questionnaire was again sent to the members to confirm or change their answers according to the opinion of other panel members. According to the analysis of the results and the fact that there were few differences in the indicators on which the agreement upon it was small, and continuing the Delphi would not create any change, therefore, the continuation of the Delphi was ceased and the approved components were confirmed as the components of users' satisfaction with their conventional housing and the components of quality and desirability of the residential environment. In the quantitative

part, these indicators were provided to the respondents as a questionnaire, and the respondents were asked to rate the importance of each indicator regarding their satisfaction with housing based on a 5-point Likert scale.

In the following Table 4, the criteria studied in the questionnaire are introduced.

Table 4: Indicators of traditional and modern biophilic architecture

Indicators of traditional and modern biophilic architecture	Criteria of quality and desirability of residential environment	Criteria of satisfaction with housing
Visual communication with nature	Light and illumination, condition of roads in terms of coverage and width of roads	The dimensions of the rooms, kitchen, hall, and living room of the residential unit
Non-visual communication with nature	The appearance of alleys, streets and squares, parks and green spaces	The possibility of monitoring the outside spaces of the building from inside the residential unit
Sensory unbalanced stimulation	The condition of the facade of the buildings and the retreat of the buildings, shaping and organizing of the space. The presence of suitable social spaces, a suitable space for receiving guests	The cleanliness of the stairs
Presence of water	The presence of suitable landscapes, the condition of asphalts and flooring	The lighting of the streets and the public space of the city
Thermal variation and airflow	The network of public space facilities (lights, benches, trash cans, footpaths, etc.)	The level of safety and security of the complex and residential unit, factors related to water including water pressure, water quality, water cut
Dispersed and dynamic light emission	Variety of dimensions and proportions and other aesthetic dimensions	Residential unit area, maintenance cost, lighting, plumbing, purchase cost
Direct connection with natural systems	View and landscape, beauty and pleasantness	The existence of parks, green space, commercial plaques, and retail in the complex
Biomorphic objects and forms	Security, peace	The state of noise pollution, bad smell, garbage, the state of sewage
Complexity and order	The use of traditional architecture in urban planning and new architecture	The condition of the gas network, electricity network, sewage network, and suitable parking
Connection with natural materials	The shape, variety, and quality of buildings and houses	Ethnic diversity, attending ceremonies, holding rituals
Landscape		The cleanliness of the place, trash cans, maintenance of the complex and green environments
Shelter	Using regular geometry in design-focus on the law of plurality in unity	No noise pollution, no air pollution, optimal population density
Be mysterious	Placing the courtyard in the heart of the complex	Mixing of uses, compatibility, and desirability of uses, adequacy of local services

Risk (Be in danger)	Using numbers symbolically and a special identity to the building based on the use of symbols and numbers	Costs, access to service centers and employment, land price, income diversity
Culture	Feeling of belonging and attachment to the place of residence	Neighbor interactions, neighbor characteristics, neighbor similarity, and neighbor support
Economy	Using traditional architectural elements to provide meaning	Next to nature, view to green space
Environment	Social mixing and flexibility of spaces	The quality of infrastructure, health services, the existence of educational centers, sports, and...
Environmental psychology	Hearing the past voice to the concept of legibility of cultural heritage	Respect for privacy, the feeling of social security, and mutual trust
	Considering regional native links as plans	Optimal arrangement of spaces in the residential environment, beautiful view of 20 building
	Historical preservation and urban restoration	
	Using traditional urban planning experiences in new construction	
	Protecting individual and collective rights and creating a context for individual and collective psychological security	
	The possibility of using space for everyone and freedom of movement in space	
	The ability to talk and interact at different levels from virtual to face-to-face in space	
	The capability of meaningfulness of the environment and the definition of collective and individual territories	
	Social dignity preservation	
	Respect for privacy	
	Not being open and having a sense of privacy	
	Integrating nine themes and achieving more effective environmental combinations	

4. Results

The first question of the research was whether, by using the biophilic approach, it is possible to take an effective step towards increasing the users' satisfaction with their conventional housing in District 1 of Tehran?

To answer this question, a linear regression test was used. The following hypothesis is proposed:

H0: The use of biophilic architectural approaches does not affect increasing users' satisfaction with their conventional housing.

H1: The use of biophilic architectural approaches affects increasing users' satisfaction with their conventional housing.

$$\begin{cases} H_0: \\ \alpha=0 \\ H_1: \ \alpha \neq 0 \end{cases}$$

Table 5: Summary results of the research model

Regression model	Correlation coefficient	Determination coefficient	Adjusted coefficient	Significance level	Durbin-Watson's statistic
1	0.69	0.47	0.47	0.000	1.90

According to Table 5 and the output results of SPSS software, the correlation coefficient between two independent variables, i.e., traditional and modern biophilic architecture, and the dependent variable, i.e. satisfaction with housing, is equal to 0.69, and the determination coefficient or R^2 is equal to 0.47, which has good explanatory power. This value shows that 0.47% of the changes in the dependent variable (satisfaction with conventional housing) are related to the independent variables (traditional and modern biophilic architecture criteria), but since this value does not consider freedom, therefore the adjusted coefficient of determination is used for this purpose which is equal to 0.47 in this test.

This shows that 0.47% of satisfaction with housing is predicted by traditional and modern biophilic dimensions and indicators. Durbin-Watson's statistic has been used to investigate the correlation between residuals. Durbin-Watson's number value is equal to 1.90 and is between 1.5 and 2.5. Therefore, there is no correlation between the errors in this model, so according to the mentioned indicators, an appropriate fitness model provides the effect of the dimensions and indicators of traditional and modern biophilic architecture criteria on the users' satisfaction with conventional housing.

Table 6 is called ANOVA subject. The mentioned table indicates the importance of whether the regression model can significantly (and properly) predict the changes in the dependent variable. To investigate the significance, we should use the last column of the table which is the significance level (sig.). This column shows the statistical significance of the regression model if the obtained value is less than 0.05, we conclude that the used model is a good predictor for the variable of users' satisfaction with housing.

Table 6: Regression analysis of variance (ANOVA)

Model	Set of squares	Degree of freedom	Mean of squares	f Statistic	Significance level
Regression	42.54	2	21.27	110.70	0.000
Residuals	47.07	382	0.192		
Total	89.61	384			

Based on the results of the ANOVA table in SPSS software and Table 5, the obtained value of F was calculated as equal to 110/70. In addition, it is significant according to the significance level and at an error level smaller than 0.05. So it shows that the independent variables (traditional and modern biophilic architecture) have acceptable explanatory power and can explain well the number of changes and variance of the dependent variable (i.e. satisfaction with housing). Therefore, the F statistic or significance level (Sig) is used for the significance of the whole regression. The value of Sig=0 indicates the rejection of the H0 hypothesis against the H1 hypothesis. Therefore, the regression at α = 0.05 level is significant.

Table 7 - Coefficients give us information about predictor variables. This table provides us with the necessary information to predict the dependent variable (satisfaction with conventional housing).

Table 7: Regression equation coefficients for research variables

Model	Non- standardized coefficients		Standardized coefficients	t Value	Sig.
	β	SD	Beta		
Fixed value	0.47	0.218		1.91	0.057
Modern biophilic	0.39	0.073	0.365	5.380	0. 000
Traditional biophilic	0.48	0.088	0.375	5.53	0.000

According to Table 7, the constant value of the model was calculated as equal to 0.41. The coefficient of independent variables was obtained equal to 0.39 and 0.48 respectively. In addition, according to Table 6, the value of the t statistic for independent variables has been calculated as equal to 5.38 and 5.53, respectively which is greater than the positive and negative standard value (1.96) and this value is significant according to (sig=0.000) at the 95% confidence level, so it can be said that modern and traditional biophilic architecture criteria have a positive effect on users' satisfaction with housing.

The second question of the research was whether, by using the biophilic approach, it is possible to take an effective step towards improving the quality and desirability of the residential environment in District 1 of Tehran?

To answer this question, like the fourth question of the research, a linear regression test was used. The results are:

Table 8: Summary results of the research model

Regression model	Correlation coefficient	Determination coefficient	Adjusted coefficient	Significance level	Durbin-Watson's statistic
1	0.804	0.646	0.643	0.000	1.75

According to Table 8 and the output results of SPSS software, the correlation coefficient between two independent variables, i.e. traditional and modern biophilic architecture, and the dependent variable, i.e. quality with housing, is equal to 0.804, and the determination coefficient or R^2 is equal to 0.646, which has good explanatory power. This value shows that 0.646 % of the changes in the dependent variable (quality and desirability of housing) are related to the independent variables (traditional and modern biophilic architecture criteria), but since this value does not consider the degree of freedom, therefore the adjusted coefficient of determination is used for this purpose which is equal to 0.643 in this test. This shows that 0.64% of housing quality is predicted by traditional and modern biophilic dimensions and indicators.

Table 9: Regression analysis of variance (ANOVA)

Model	Set of squares	Degree of freedom	Mean of squares	f Statistic	Significance level
Regression	40.31	2	20.15	223.58	0.000
Residuals	22.05	382	0.090		
Total	62.40	384			

The obtained value of F was calculated as equal to 223/58. In addition, it is significant according to the significance level and at an error level smaller than 0.05. So it shows that the independent variables (traditional and modern biophilic architecture) have acceptable explanatory power and can explain well the number of changes and variance of the dependent variable (i.e. quality and desirability of the residential environment). Therefore, the F statistic or significance level (Sig) is used for the significance of the whole regression. The value of Sig=0 indicates the rejection of the H0 hypothesis against the H1 hypothesis. Therefore, the regression at $\alpha = 0.05$ level is significant.

Table 10: Regression equation coefficients for research variables

Model	Non- standardized coefficients		Standardized coefficients	t Value	Sig.
	β	SD	Beta		
Fixed value	0.496	0.150		3.31	0.001
Modern biophilic	0.357	0.050	0.40	7.127	0. 000
Traditional biophilic	0.503	0.060	0.47	8.37	0.000

According to Table 10, the constant value of the model was calculated as equal to 0.496. The coefficient of independent variables was obtained equal to 0.357 and 0.503 respectively. In addition, according to Table 9, the value of the t statistic for independent variables has been calculated as equal to 7.127 and 8.37, respectively which is greater than the positive and negative standard value (1.96) and this value is significant according to (sig=0.000) at the 95% confidence level, so it can be said that modern and traditional biophilic architecture criteria have a positive effect on quality and desirability of the residential environment.

4.1. Findings

The results of the research on the first question showed that the value of the constant number of the model was calculated as equal to 0.41 and the coefficient of the independent variables was obtained as equal to 0.39 and 0.48 respectively. In addition, the value of the t statistic for the independent variables was calculated as equal to 5.38 and 5.53, respectively, which is greater than the standard value of positive and negative (1.96), and this value according to (sig=0.000) at the confidence level 95% is significant, so it can be said that modern and traditional biophilic architecture criteria have a positive effect on users' satisfaction with their housing in District 1 of Tehran city. Finally, the results of the research on the second question showed that the value of the constant number of the model was calculated as equal to 0.496 and the coefficient of independent variables was obtained as equal to 0.357 and 0.503, respectively. In addition, the value of the t statistic for the independent variables i.e. traditional and modern biophilic architecture was calculated as equal to 7.127 and 8.37, respectively, which is greater than the standard value of positive and negative (1.96), this value according to (sig=0.000) is significant at the 95% confidence level, so it can be said that modern and traditional biophilic architecture criteria have a positive effect on the quality and desirability of the residential environment.

5. Conclusion

This research showed that the modern and traditional biophilic architectural criteria in District 1 of Tehran municipality have a positive effect on the satisfaction and quality and desirability of the housing of the users in District 1 of Tehran city. Dissatisfaction with the quality of life and the lack of a sense of belonging to a place in today's cities is one of the serious problems of societies. The role of architecture, especially architecture that is created and built in harmony with nature, has special importance in creating a good feeling in humans. Biophilic architecture is one of the most important factors that can have a significant impact on human mood. Humans need a space to get inspiration and spirit from their surroundings, and feel comfortable and satisfied in it. The findings of this research showed that all the indicators of traditional biophilic architecture in the Municipality of District 1 of Tehran city had an average score of 3 or more. According to the findings and experimental results of this research, it is suggested to use traditional biophilic architectural indicators in architecture. These indicators include the cases such as: focusing on the visual connection with nature in the indoor and outdoor spaces of traditional houses, birds and smell of flowers and plants in the living space and focusing on the variety of colors and the entry of light in the interior spaces of traditional houses, water, seeing, hearing or contacting with it in the central yard of traditional houses, taking advantage of wind traps, taking advantage of the mobility and dynamism of daylight and using four-season plants in traditional houses, taking advantage of natural patterns, formal, numerical and symbolic arrangements. should be noted. In the construction, one should pay attention to light and illumination, the condition of the roads in terms of coverage and width of the roads, the appearance of the alleys, streets and squares, parks and green spaces, and the condition of the facade of the buildings and the

setback of the buildings, forming and organizing of the space, geometry and arrangement and coordination and harmony. In construction, focus on access. This issue of access should be in a way that it is easy to other parts of the city and public transportation. Also, access to educational centers and shopping centers, health services, sports facilities, etc. should be made possible to a certain extent, so that the satisfaction of the housing users of District 1 of Tehran city can be achieved from this point of view.

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