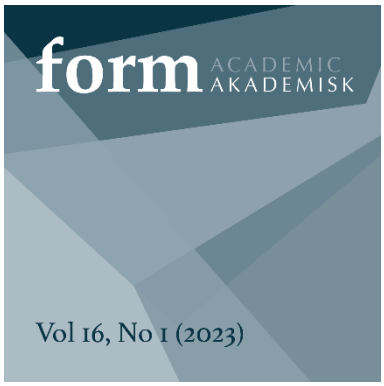

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Investigating the Mechanism of the Effect of Nature-based Architectural Components on Residential Satisfaction

ABSTRACT

The development of multi-unit urban housing, especially in the metropolises of Iran, does not take into account the effects of cultural factors on the perceived quality of housing architecture. Since the community is diverse in metropolises, especially on a sub-culture scale, it is impossible to provide housing development strategies and practical actions concerning the factors related to this scale of culture. The compatibility of lifestyle at the national or structural level with housing can be considered a general strategy to solve this problem. Based on the position of nature in the foundations of the Islamic lifestyle, it is possible to accommodate humans' significant needs through inspiration from nature. This paper intends to investigate the mechanism of the effect of nature-based architectural components (NBAC) on residential satisfaction (RS) from the Islamic lifestyle perspective to apply the findings in architectural planning and programming processes. The results demonstrate that as adherence to the Islamic lifestyle increases, residential preferences related to the formal and semantic dimensions of NBAC also increase. Qualitative deficiencies in these components cause a decrease in perceived quality and, consequently, RS. Therefore, high residential preferences regarding semantic and formal components lead to the intensification of deficiencies in qualitative perception. In such conditions, a large part of the RS is due to residents' adaptive behaviors. Therefore, measuring RS based on accommodating residential needs cannot be considered an objective criterion to determine housing architecture quality to test the fit of housing development patterns with residential needs. This proves the necessity for the measurement of the perceived quality of housing architecture based on the main influential factors involved, which are NBAC.

Keywords:
Nature-based architectural components, Residential satisfaction, Housing architecture, Lifestyle, Residential needs.

INTRODUCTION

The compatibility of housing development patterns, especially the qualitative aspects of architecture, with cultural factors that are relevant to the target community is required to improve residential satisfaction (RS). Housing pattern formation is affected by cultural, economic, and climatic conditions, and reciprocally, housing affects the residents' lifestyles and cultural habits. Therefore, housing is more than a basic human need, and specialists should study it, taking into consideration the myriad factors that accommodate human residential needs. RS is a concept based on the perception of space. It is affected by the response to a set of residential needs that is rooted in each city and region's culture, lifestyle, geography, and climate. RS is determined by the quality of the environment and is an indicator of the efficiency of a habitat. It serves as an indicator to analyse, compare, and determine the value of the residential environment's ability to respond to human residential needs (Shabani, 2016). Significant portions of residential needs, especially those that deal with the immaterial dimensions of human existence, are defined through culture and lifestyle. When evaluating and proposing housing development patterns, it is essential to determine what residential needs are and the importance they hold from the perspective of the target community's lifestyle. As there is mostly no geographical concentration of subcultures in metropolises, proposing housing development models that improve the level of RS requires investigating the relationship between housing and culture, and its sub-categories, in larger cultural groups.

The concept of lifestyle consists of four levels: global, national or structural, subcultures and social situations, and individual (Jensen, 2007). The concepts of Iranian or Islamic lifestyles are at the second level of this division. Similarities in the customs and habits of a country, society, or culture are fundamental at this level. In the theoretical framework of the Islamic lifestyle, all behavioral patterns, and, accordingly, the system of human activities, are on the axis of a monotheistic worldview and value system, and attitudes and tendencies follow suit. Furthermore, all human relationships fall within the four areas of a relationship with God, the self, others, and nature.

As nature is the basis of all human activities, the construction of any structure whose primary purpose is to accommodate human needs requires touching nature and concentrating on the threefold relationship between man, nature, and architecture. The type and importance of human needs, especially concerning immaterial dimensions, greatly depend on the foundations of the residents' lifestyle. In the foundations of the Islamic lifestyle, God invites man to exploit nature to accommodate the requirements of the various dimensions of existence, which makes nature the basis of all human relations and the source of accommodation for all aspects of human needs, including residential needs. Therefore, the accommodation of human residential needs depends on the quality of the nature-based architectural components (NBAC). This paper therefore aims to investigate the mechanism of the effect of NBAC on housing architecture and RS quality.

Most experimental studies on RS use basic models that are unable to provide detailed explanations for the mechanism of the influence of personal and cultural factors on RS. Therefore, this research seeks to fill the gap in this field. Its primary aim is to investigate the interaction between variables that determine RS based on the perceived quality of housing architecture. This will provide a platform to present strategies and practical actions to increase RS level based on the importance of NBAC. To achieve this, the different types of NBAC and their indicators should be identified. Additionally, the mechanism to infer the perceived quality of housing architecture's different dimensions from the quality of NBAC should be investigated. It is necessary to answer the following questions:

- What factors play a crucial role in the effect of architectural and cultural factors on RS?
- What is the nature of the interaction between NBAC and RS?

MATERIAL AND METHODS

The research method is causal–comparative, and the nature of the data is mixed (quantitative and qualitative). The data collection process has been conducted at the theoretical and experimental level.

At the theoretical level, the components and indicators of the variables involved in the proposed mechanism have been extracted based on a systematic review of literature that was conducted using the qualitative content analysis method. The protocols of this systematic review are outlined in Table 1.

At the experimental level, the authors surveyed five residential complexes in Tehran. A questionnaire with a 5-point Likert scale was used to measure the variables. The questions were based on the operational definitions of the variable indicators. The section of the questionnaire measuring adherence to the Islamic lifestyle was based on the Glock and Stark (1965) religiosity questionnaire that has been adapted to Islam by authors. The conceptual model was validated using the path analysis method from the Amos-Version24 software.

TABLE 1. The protocols of the systematic review of literature.

Search title	Nature-based architectural components	Keywords	Visual connection with the sky, Visual connection with nature, Visual connection with vegetation, Pond, Fountain, Tree in architecture, Plant in architecture, Airflow in architecture, Daylight in architecture, Natural-based materials, Cultivated shrubs and plants, Abstraction of natural elements, Climatic form, Climatic orientation, Climatic materials, Moderation, Local symmetry, Balance, Geometric balance, Similar forms, Similar shapes, Modular, Logical proportions, Arithmetic proportions, Geometric proportions, Similar proportions, Separation of areas, Mass reduction, Dominance of space over mass, Visual continuity, Sequence of spaces, Permeability, Reflection, Light-transmitting openings, Matching the facade with performance, Functional components, Transfer of loads, Self-standing form, Nature-based materials	The language of texts	English, Persian
Purpose	Identifying the indicators related to the application of the qualitative aspects of nature in housing architecture			Database	Specialized books, Scopus, Web of Science, Noormags, SID
Question	How is the objective appearance of nature and the qualities derived from the laws of nature incorporated into housing architecture?			The logic of selection	The substantive relationship of concepts, including keywords with the presence of objective appearance of Nature or quality derived from Nature in housing architecture
				Publication date	2022 and before
Search title	Residential needs from the Islamic lifestyle perspective	Keywords	Physical security, Climatic comfort, Light comfort, Visual comfort, Physiological functions, Personal privacy, Family privacy, Sensual beauty, Mental security, Social interactions, Interactions with neighbours, Semantic depth, Understanding layers of meaning, Understanding spiritual beauty	The language of texts	English, Persian
Purpose	Identifying the indicators related to accommodating human residential needs based on the definition of human existential dimensions in the foundations of Islamic thought			Database	Specialized books, Scopus, Web of Science Noormags, SID
Question	What are the criteria and indicators of accommodating human residential needs from the perspective of the Islamic lifestyle?			The logic of selection	The relationship between the concepts, including keywords with the residential needs of the material, psychological, and spiritual aspects of human beings
				Publication date	2022 and before

Search title	The quality of housing architecture	Keywords	Semantic quality, Vernacular architectural motifs, Symbolic dimension of architectural elements, Concepts of geometric shapes, Concepts of colour and texture, Functional quality, Physical security, Environmental comfort, Compatibility of space with function, Functional relationships, Form quality, Stability, Visual balance, Aesthetics of form, Compatible form with urban fabric, climate	The language of texts	English, Persian
Purpose	Identifying housing quality indicators influenced by factors related to architectural design.			Database	Specialized books, Scopus, Web of Science, Noormags, SID,
Question	What are the dimensions of the quality indicators of housing architecture?			The logic of selection	The relation of concepts, including keywords, with the quality of formal, functional, and semantic aspects of housing architecture
				Publication date	2022 and before

THE CONCEPT OF SATISFACTION

RS originates from the theories of satisfaction found in psychology and marketing literature, such as the assimilation theory, which is based on Festinger's theory of cognitive dissonance. Based on this theory, consumers naturally seek to reduce dissatisfaction with products by synchronizing their expectations with the product's actual performance and reducing the subjective importance of dissatisfaction criteria (Anderson, 1973). Cardozo's contrast theory (1965) presents a viewpoint that is almost the opposite of the assimilation theory; it posits that people tend to magnify the contrasts between their expectations and the actual performance of the used products. Anderson (1973) presented the assimilation–contrast theory, which claims that people only tend to adapt their preferences and expectations to actual product performance as long as that the difference between the two is at an acceptable threshold. Otherwise, people magnify these differences. Based on the negativity theory by Carlsmith and Aronson (1963), any discrepancy between perceived performance and initial expectations creates a negative impression on the user. Regardless of whether the performance was higher or lower than expected, this discrepancy creates a negative attitude toward the approval process. The most reliable conceptualization of satisfaction is from the expectation–confirmation/disconfirmation theory (Oliver, 1980). Based on this theory, satisfaction is directly influenced by the confirmation/disconfirmation of beliefs and actual product performance, and it is indirectly influenced by people's initial expectations.

These theories demonstrate that satisfaction is either a process or result. In the first case, when it's a process, the definitions emphasize on factors that create satisfaction. This is the result of comparing users' expectations and the product's actual performance. In the second case, when satisfaction is a result, the definitions consider the nature of the satisfaction. Some researchers have classified satisfaction as an emotional response to a specific consumption experience (Rust & Oliver, 1994), and others consider satisfaction to be the result of fulfilling users' preferences and needs (Westbrook & Reilly, 1983).

RESIDENTIAL SATISFACTION AND THE ISLAMIC LIFESTYLE

Many researchers have conducted comprehensive experimental studies that measure RS in different cultural contexts. Based on a systematic review, we classified these studies as either general view, objectives, or scale, as outlined in Table 2.

Table 2. Classification of residential satisfaction studies. Derived from Azizibabani et al. (2021).

	Descriptions
General view	RS is a criterion to determine the quality of the living environment.
	RS is a predictor of residents' behavior regarding residential mobility, improving housing status, or adaptation to the current situation.
Objectives	Determining the relationship between the factors affecting RS.
	Predicting RS in residential environments.
	Investigating settlements based on the factors affecting RS.
Scale	Investigating RS at the scale of urban apartments to residential complexes.
	Investigating RS at the neighbourhood or urban scale.
	Investigating RS at the urban geography scale.

The theoretical framework of RS experimental studies is primarily based on fundamental theories that go back to the 1940s. Reimer (1943) believed that human residential needs are determined by two factors: time and type of household. Based on Reimer's theory, Rossi (1955) considered residential mobility to be a natural strategy to accommodate human residential needs during a family's life cycle. Morris and Winter (1975) emphasized the role of cultural and family norms when determining residential needs. Galster (1985) introduced a new social index called the "marginal residential improvement priority". He believes that people prioritize improving the quality of their housing unit to improve their RS level. Amerigo and Aragones (1997) proposed a systematic RS model based on the effects of personal characteristics. They considered RS to be the primary factor contributing to life satisfaction. McCrea (2007) emphasized the effect of people's comparative standards as the primary reason for the weak correlation between objective dimensions of the environment and people's subjective assessments.

The literature review about RS demonstrates the undeniable way the quality of architectural and environmental factors affect it. Furthermore, the target community's personal and cultural characteristics and lifestyle, as an objective manifestation of personal and cultural characteristics, play a role in the perception of the quality of architectural and environmental factors (Figure 1).

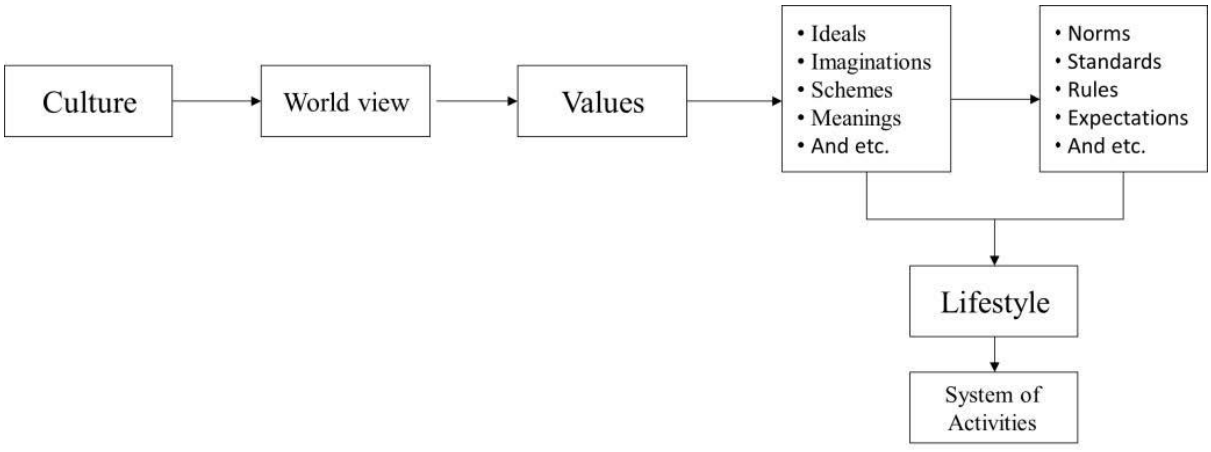

FIGURE 1. The conceptual model of the relationship between culture and lifestyle. Source: Rapoport (2005).

Structural theories about lifestyle have mainly been proposed in the fields of sociology and psychology. Simmel (1990) believed that lifestyle is the embodiment of human beings' effort to identify their superior fundamental values or individuality in their culture and introduce it to others. Consumption and following fashions are ways to strengthen the sense of self, maintain personal authority, and show social class to others. Weber (1968) as cited by Fazeli (2003) considered lifestyle to include shared values and customs that provide the group with a sense of collective identity. Bourdieu considered lifestyle to be the main factor of differentiation between social classes. He divided the social classes into three

based on the capital assets they acquire in the social fields. These are upper, middle, and lower classes, and each was introduced with a corresponding lifestyle (Bourdieu, 1984). Adler (1956) as cited by Fazeli (2003) believed that being human is equivalent to experiencing limitations and feeling inferior. Since this feeling is familiar to all humans, it cannot be considered a sign of weakness or abnormality. His definition of lifestyle thus includes all a person's behaviors, thoughts, feelings, and movements to eliminate this imaginary or natural feeling of inferiority.

Investigating the above theories shows that the indicators of each lifestyle are presented in the form of behavioral patterns. Behavioral patterns originate from a person's worldview and are a direct result of their attitude towards the world. The likelihood of performing these attitudes in the form of behavioral patterns has several influences, such as environmental factors, prominence of a particular lifestyle in society, ideology, and human relations (Figure 2).

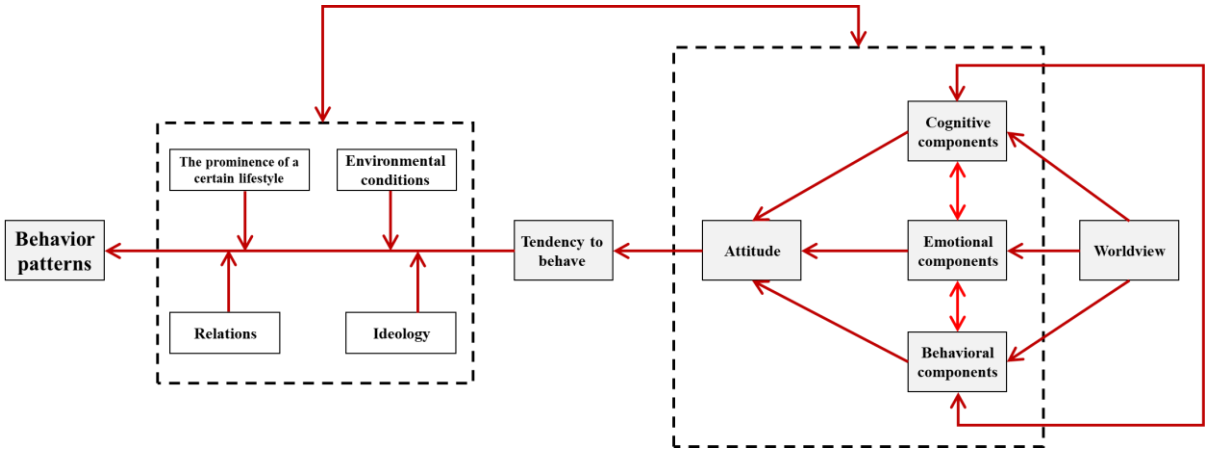

FIGURE 2. Factors affecting behavioral patterns. Source: Authors.

Based on the above model, the Islamic lifestyle can be identified as the sum of insights, behavioral patterns, and human tendencies organized within the framework of Islamic ideology and values that are derived from a monotheistic worldview and Islamic culture. Our research problem concerns the dispersion of subcultures in Iranian metropolises. The Islamic lifestyle, defined at both the national or structural level, is proposed as a factor that includes most personal and cultural characteristics of the study's target community. Directly measuring RS through the Islamic lifestyle perspective is equivalent to measuring the quality of accommodating the residential needs of this lifestyle. As per the protocols mentioned in the second part of Table 1, there are three categories of residential needs: material, psychological, and spiritual.

THE INTERACTION BETWEEN NATURE-BASED ARCHITECTURAL COMPONENTS AND RESIDENTIAL SATISFACTION

In Islam, nature manifests God's presence, and God invites humans to contemplate nature (Azizibabani et al., 2022). Traditional Iranian housing, which is designed as per the Islamic lifestyle, brings absolute satisfaction to its occupants (Raeisi, 2019; Bemanian & Zandi, 2018; Adeli, 2013). These houses are in harmony with nature, and the having representatives of nature within their spatial organization is inevitable (Haeri, 2009).

Kaplan (1985) investigated the effect that the natural environment around residential apartments has on RS. He believed that creating a platform to promote social interactions through communal gardens and high-quality trees, landscape design, and appropriate walking paths are the main factors that improve RS. Taylor et al. (1998) believed that integrating urban housing projects with the surrounding nature leads to better relationships between neighbours, reduces abnormal behaviors, and increases RS. Kearney (2006) considered the indicators of human–nature relationships in the built

environment to be the main reason for satisfaction, because they provide platforms necessary for interactions with neighbours. Hadavi et al. (2017) believed that certain measures, such as proper sidewalk design, increased vegetation quality, and reduced barriers to visual and physical contact with nature elements, are essential for improved RS at the neighbourhood scale. Other studies in this field have arrived at similar conclusions (Kaplan et al., 2004; Ellis et al., 2006; Kaplan & Kaplan, 1989; Ward Thompson & Aspinall, 2011; Berien, 2005).

The NBAC were identified based on the protocols mentioned in the first part of Table 1. They consist of qualities that are derived from the objective appearance of nature (primary, secondary, and abstraction appearance) and laws that are applied to architecture (adaptability, balance, repetition and rhythm, unity, hierarchy, transparency, and honesty). This classification's validity and the indicators of NBAC increased through the Delphi technique. Azizibabani et al (2022) conducted a semi-structured interview with 26 experts in the field of housing design and classified these components and indicators using the discourse analysis method.

Considering the context of this paper, the interaction of NBAC with RS needs to be clarified. Housing is considered a comprehensive system that accommodates residential needs. This system consists of cooperation with NBAC. Housing's function in accommodating the material dimension of residential needs is slightly different from the other dimensions of human existence. A person has to first evaluate the primary function of the components that accommodate residential needs through their five senses. After meeting the necessary standards, perceived quality that is influenced by personal and cultural factors is discussed. For example, to provide climatic comfort, which is a part of the criteria to accommodate the material dimension of residential needs, the necessary standards have to be met in the first step. Then, the perceived qualities of the function of related components are considered in the RS process. For example, how much sustainability has been observed in the provision of climatic comfort? The perceived quality of the function of its related components is influenced by the values defined in the framework of the individual's lifestyle. The first step of accommodating the residential needs of other aspects of human existence is the perceived quality influenced by personal and cultural characteristics. Subsequently, the function of the system can be summarized in Figure 3.

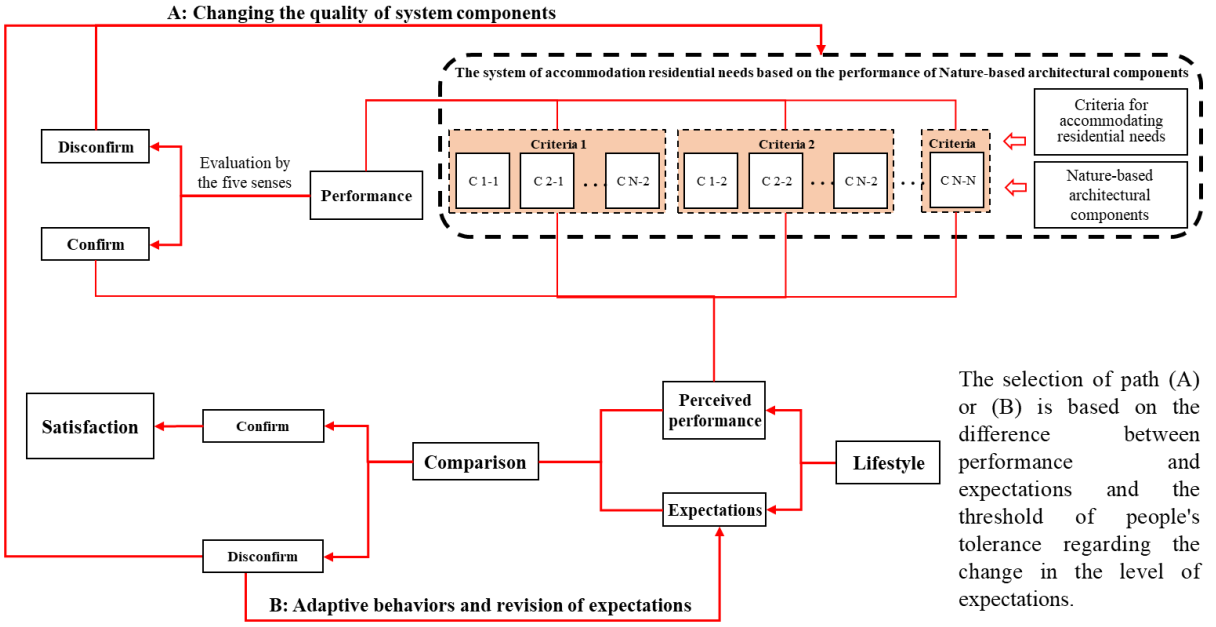

FIGURE 3. The performance of the residential needs accommodation system to achieve RS. Source: Authors.

The perceived quality of NBAC directly impacts RS, and the quality of housing architecture is significant contributing factor to this impact. Therefore, as shown in Figure 4, these architectural components are

considered the main reasons for improving the quality of housing architecture in the formal, functional, and semantic dimensions (Azizibabani & Bemanian, 2022, Azizibabani et al., 2022).

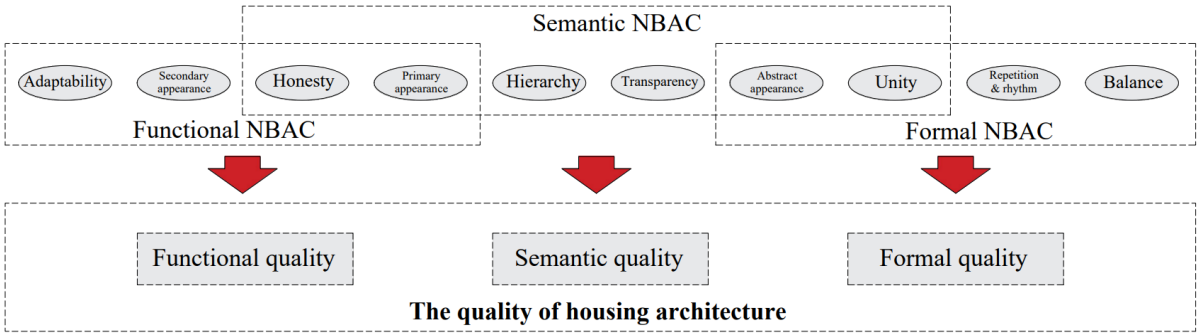

FIGURE 4: The effects of NBAC on the quality of housing architecture. Source: adopted from Azizibabani and Bemanian (2022) and Azizibabani et al. (2022).

In the process of perception, personal and cultural characteristics influence all variables related to architectural and environmental factors. These characteristics are presented in the form of adherence to the Islamic lifestyle, and are demonstrated in the variable of the residential preferences related to NBAC. Therefore, concerning the first research question, it is hypothesized that NBAC play a crucial role in the influence of architectural and cultural factors on RS. The second research question requires investigating the effect of NBAC on the different dimensions of housing architecture. This has been determined by analysing the results of the survey.

SURVEY AND RESULTS

The authors surveyed five residential complexes in Tehran to validate the mechanism of the effects of NBAC on RS: (1) Baghe Behesht, (2) Ekbatan, (3) Baghe Zaferaieh, (4) Baghe Vanak, and (5) Niavaran Residential complex. The statistical population includes 12,000 residents of the selected residential complexes. Based on Cochran's formula with a 5% error, the statistical sample size should be a minimum of 372. The number of respondents in each case study and the average and standard deviation of each variable are presented in Table 3, which shows the normal distribution of the data. The resident population in each case study is calculated based on the number of residential units and the average size of households, which is 3.

TABLE 3. Mean and standard deviation of variables. Source: Authors.

			Perceived quality of nature-based architectural components	Perceived quality of housing architecture	Adherence to the Islamic lifestyle	Residential preferences related to nature-based architectural components	Residential satisfaction
Case study 1 (1200 units)	*Mean*		0/4487	0/4148	0/5350	0/5414	0/4450
	Number	Acceptable	153	153	144	147	148
		Missing	4	4	13	10	9
	Standard deviation		0/07781	0/09818	0/10129	0/08453	0/10291
Case study 2 (2500 units)	*Mean*		0/4528	0/4157	0/5339	0/5435	0/4493
	Number	Acceptable	188	188	174	178	181
		Missing	6	6	20	16	13
	Standard deviation		0/08211	0/09614	0/10151	0/09002	0/10203
The sum of 3, 4, and 5 case studies (300 units)	*Mean*		0/4602	0/4132	0/5369	0/5433	0/4694
	Number	Acceptable	82	91	87	90	92
		Missing	15	6	10	7	5
	Standard deviation		0/08509	0/09630	0/09688	0/08789	0/10938
The sum of case studies	*Mean*		0/4529	0/4148	0/5449	0/5427	0/4521
	Number	Acceptable	423	432	405	415	421
		Missing	25	16	43	33	27
	Standard deviation		0/08103	0/09674	0/10023	0/08744	0/10387

Analysing the survey results using the path analysis method illustrates the existence of significant statistical relationships as follows:

- The variable of adherence to the Islamic lifestyle has an inverse relationship with residential preferences related to NBAC. This relationship is established in the semantic and formal components and does not exist for the purely functional components.
- Residential preferences related to NBAC have an inverse effect on the perceived quality of semantic and formal NBAC. Additionally, residential preferences have an inverse effect on RS.
- The perceived quality of NBAC directly impacts the perceived quality of housing architecture. The highest coefficient of influence (beta) in the formal, semantic, and functional dimensions relates to components of unity, hierarchy, and adaptability. This variable also has a direct impact on RS.
- The perceived quality of housing architecture directly impacts RS.

Based on the theoretical framework in the context of the survey results, the mechanism of the NBAC's effect on RS has been presented in Figure 5. According to the comparative analysis between the results related to variable measurement in case studies, a range of perceived qualities in NBAC was identified. The perceived quality of the housing architecture within the range is lower. In other words, this qualitative range has worsening perceived quality of housing architecture. However, RS (direct measurement) has decreased less in the range due to the occurrence of adaptive behaviors. In this study, this range is called the range of quality deficiency of NBAC. We believe that most of the urban housing apartment projects in Iran fall within this quality range, especially from the perspective of the NBAC variable.

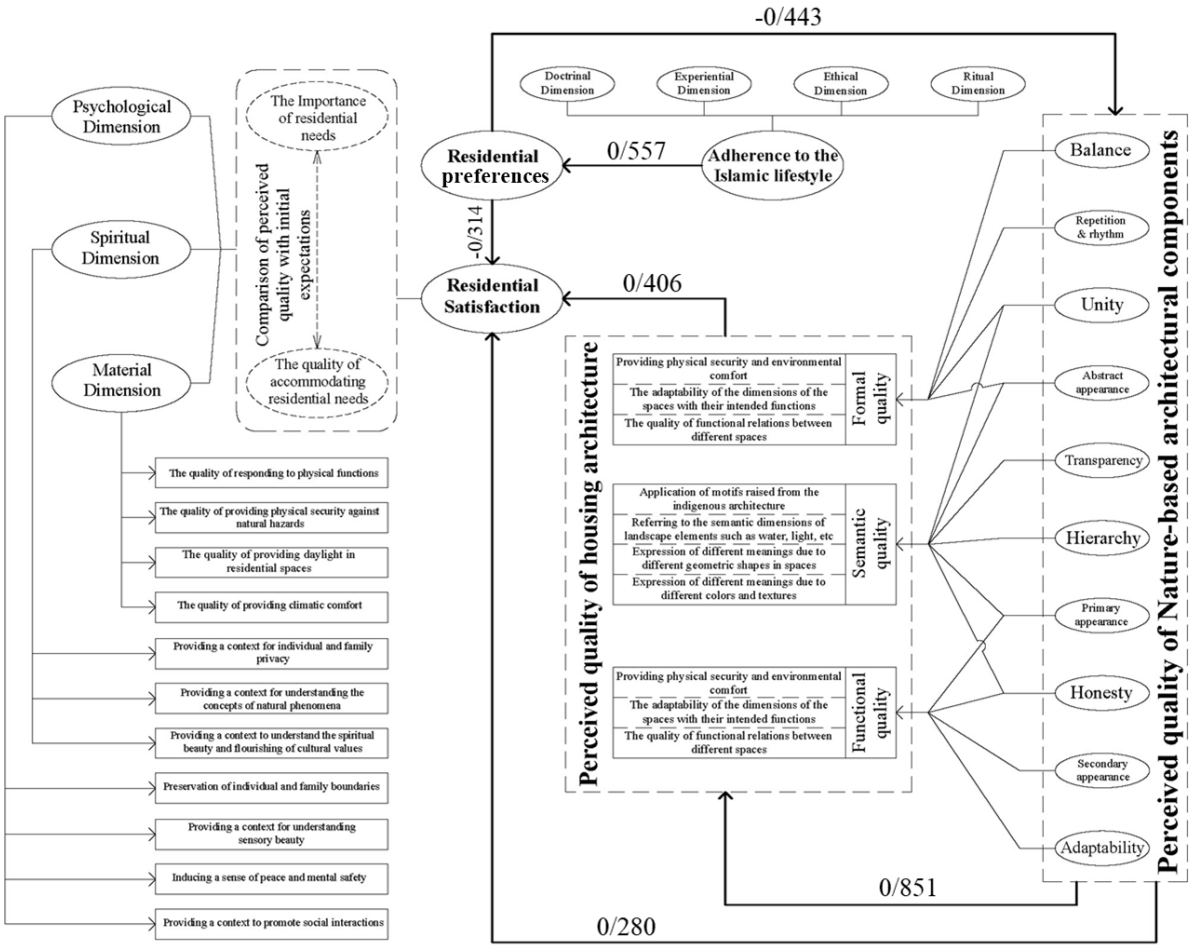

FIGURE 5. The mechanism of the effect of NBAC on RS. Source: Authors.

DISCUSSION

Determining causal mechanisms is one of the most critical factors for a theoretical explanation. In the explained theoretical framework, the various dimensions of the perceived quality of the housing architecture are directly influenced by the perceived quality of NBAC. In terms of semantic and formal components, the perception of these qualities is influenced by people's residential preferences and lifestyles at the structural level. The three mentioned factors (perceived quality of NBAC, perceived quality of housing architecture and residential preferences) are the leading causes of RS. The relationships between the variables indicate that, considering the indirect effect of variables and their role in defining other variables, the perceived quality of NBAC is the primary factor of RS.

The extent of people's adherence to the Islamic lifestyle, which is influenced by the sum of personal and cultural factors, affects the level of their residential NBAC preferences. When in the form of a direct relationship (Figure 6), this effect is first seen on semantic components and then on formal components.

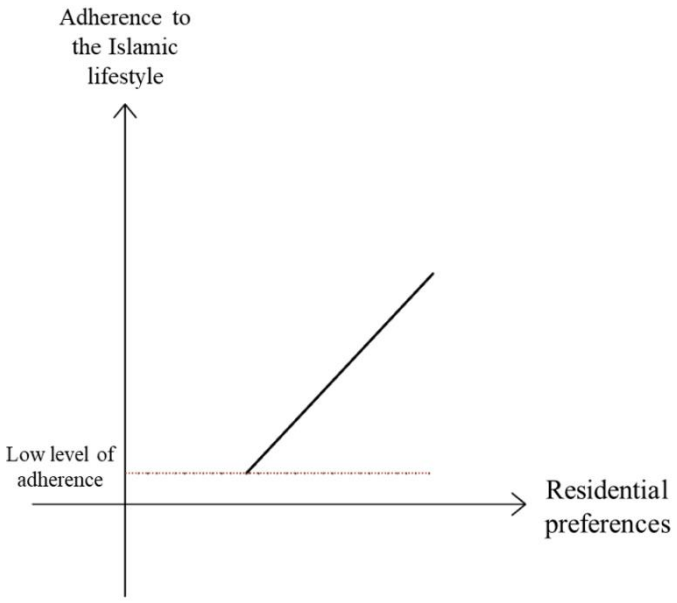

FIGURE 6. The relationship between adherence to Islamic lifestyle and residential preferences. Source: Authors.

The relationship between people's residential preferences and the perceived quality of NBAC and RS is conditional on the existence of quality deficiency at the level of semantic and formal components. This relationship is inverse. The intensity of its effect increases in proportion to the decrease in quality on the level of the mentioned components or in proportion to high residential preferences for said components (Figure 7). In other words, people's residential preferences for semantic and formal components lead to an increase in initial expectations for the qualitative aspects of housing and thus intensify the quality deficiency in these components in the perception process.

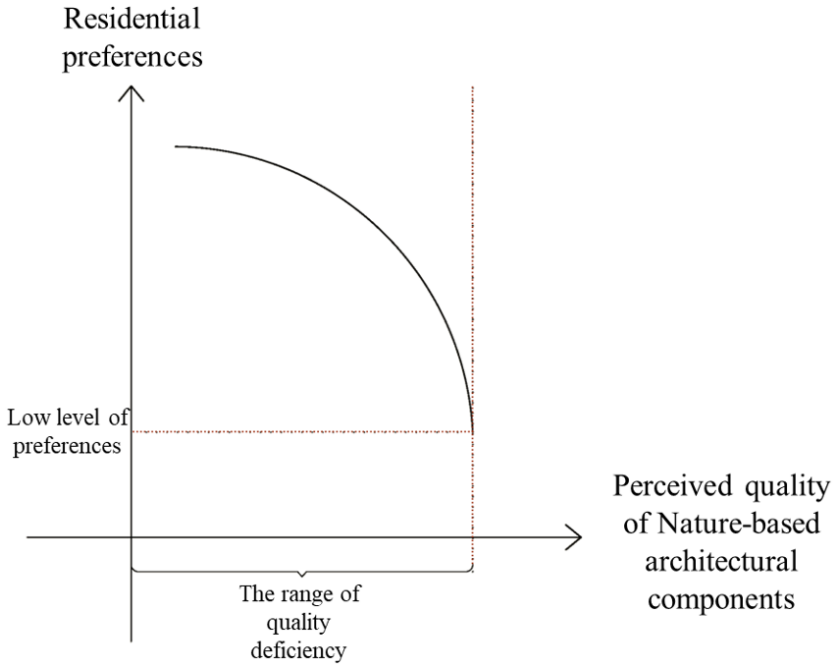

FIGURE 7. The relationship between residential preferences and perceived quality of NBAC. Source: Authors.

In such conditions, a large part of the relative stability of RS is due to the adaptive behavior of the residents when accepting the housing's qualitative features. This has been illustrated in the red area in Figure 8.

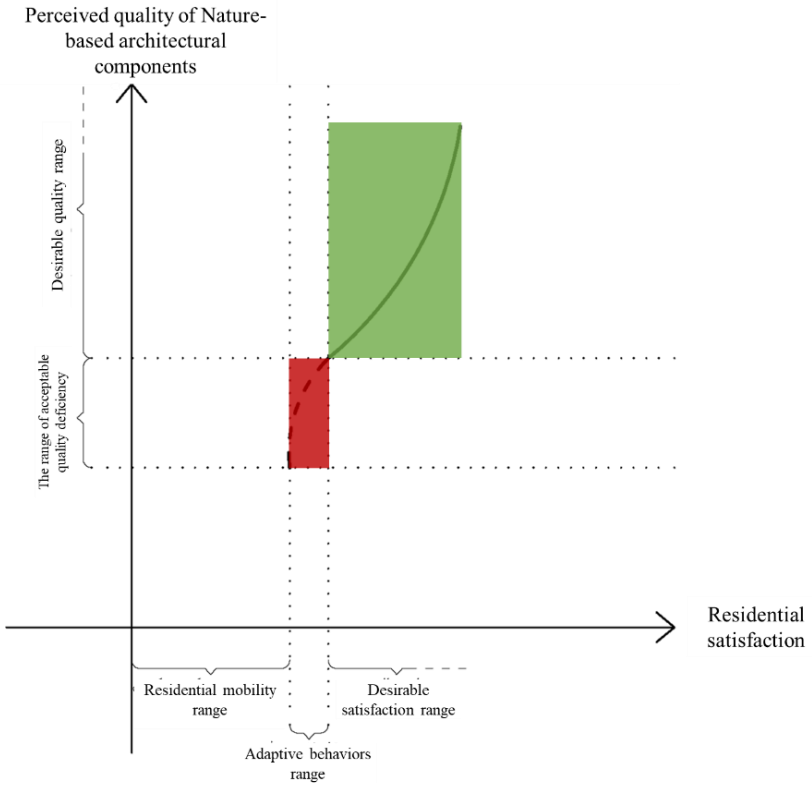

FIGURE 8. The relationship between perceived quality of NBAC and RS. Source: Authors.

CONCLUSION

Explaining the mechanism of the effect of NBAC on RS provides the necessary platform to prioritise and present strategies and practical actions to promote this concept. This prioritization was based on NBAC's importance in improving the perceived quality of housing architecture and responding to the residential needs of different dimensions of human existence within the anthropological foundations of the Islamic lifestyle. The results of this research demonstrate that, in the conditions of the qualitative deficiencies of the NBAC, direct measurement of RS based on the accommodation of residential needs cannot be considered an objective criterion to determine the qualitative level of housing architecture or test the fit of housing development patterns with the target community's requirements. This finding demonstrates the necessity to measure RS and housing architecture quality based on the primary factors that affect them, which are the NBAC. Following this, the provision of practical strategies to improve housing architecture quality and, as a result, RS depends on the determination of priorities to improve NBAC quality in the process of planning and programming housing. The authors identified the components of unity, hierarchy, and adaptability as being key factors for this. They were also determined to be the basis of the qualitative perception of other NBAC on the various aspects of housing architecture quality (Figure 9).

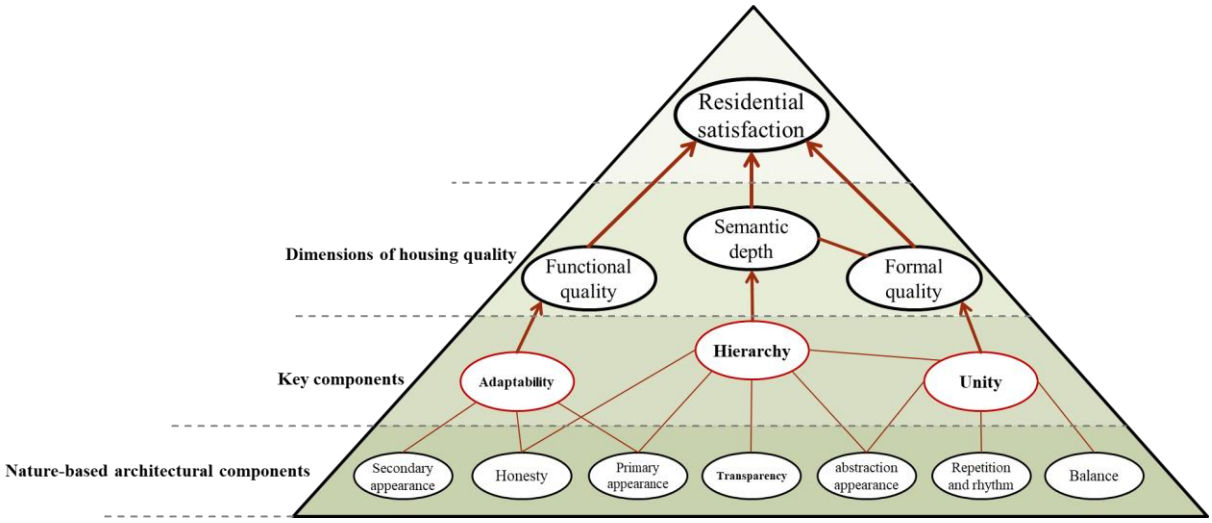

FIGURE 9. The hierarchy of the importance of causes of RS from the Islamic lifestyle perspective. Source: Authors.

The effect of personal and cultural factors on RS has been investigated in the form of adherence to lifestyle at a structural level. Social contexts with less subcultural diversity, including all personal and cultural factors, should lead to further refinement of the proposed model. This can be considered one of the proposed axes for future studies. Examining the proposed mechanism at the level of affordable housing projects, to examine the impact of adaptive behaviors on achieving RS, is another potential area for future research.

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