EXAMINING THE EFFECTS OF HIGH-DENSITY HOUSING ON USERS' MENTAL JUDGMENTS

Navid KHALEGHIMOGHADDAM[1*]
[1] Konya Food and Agriculture University, Faculty of Engineering and Architecture, Interior Architecture Department, Konya
ORCID No: https://orcid.org/0000-0003-2505-207X

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Abstract

Today, high-density urban areas have emerged as a result of an economic approach to accommodate more people. The concept of density as a quantitative measure indicating the density of settlements and the population living in them has profound implications for social living conditions, safety in communal spaces, and perceptions of the environment. In such cases, residents evaluate environmental density based on their own impressions. This mental process of perception and assessment is based on physical features. Therefore, to address this issue thoroughly, the present study aims to consider the psychological effects and other dimensions of density. By identifying these factors, the study tries to propose any potential soluations for lessening the detrimental impacts of high residential density. To this end, it examines the effects of housing density on residents' mental judgements in the city of Karaj, Iran, and focuses on the socio-economic structures of residents in order to improve understanding of housing units arrangement. In this context, literature review was conducted to investigate the notion of housing density, and the factors influencing mental judgments were extracted and given in the form of a conceptual model of study. Then, to test the relevant model, a survey and field studies were used. Findings showed that the location, the height, and the interior design of the residential units influence the users' mental judgements. Furthermore, the findings indicated that the perception of density in residential environments is affected by structural features, preferences for housing type, and the presence of common open spaces in complexes.

ÇOK YOĞUN KONUT YAPILAŞMALARININ KULLANICILARIN ZİHİNSEL YARGILARI ÜZERİNDEKİ ETKİLERİNİN ARAŞTIRILMASI

Anahtar Kelimeler
Yoğun Konut Yapılaşması
Zihinsel Yargı
Konut
Sakinler
Karaj

Öz

Günümüzde, ekonomik bir yaklaşımın sonucu olarak daha fazla insanı bir yerde barındırmak adına yoğun kentsel alanlar ortaya çıkmaktadır. Yoğunluk kavramı, yerleşim birimlerinin ve içinde yaşayan nüfusun yoğunluğunu gösteren nicel bir ölçü olarak sosyal yaşam koşullarını, ortak alanlardaki güvenliği ve çevre algısını derinden etkilemektedir. Bu durumda, konut sakinleri, çevresel yoğunluğu kişisel algılarına dayanarak değerlendirirler. Bu zihinsel yargı ve değerlendirme süreci, çoğunlukla fiziksel faktörler olarak kabul edilen etkenlere dayanmaktadır. Dolayısıyla, bu konuyu kapsamlı bir şekilde ele alabilmek için, bu çalışma yoğunluğun psikolojik etkilerini ve diğer boyutlarına dikkat çekmeyi amaçlamaktadır. Araştırma, bu etkenleri tanımlayarak çok yoğun konut yapılaşmalarının olumsuz etkilerini azaltmak için potansiyel çözümler önermeye çalışmaktadır. Buna göre, araştırma konut birimlerinin düzenlenmesi ile ilgili tasarım bilgisini geliştirmeyi hedefleyerek sakinlerin sosyo-ekonomik yapılarına odaklı İran'ın Karaj şehrindeki konut yoğunluğunun sakinlerin zihinsel yargıları üzerindeki etkisini incelemektedir. Bu bağlamda, konut yoğunluğu kavramını incelemek üzere literatür taraması yapılmış olup zihinsel yargıları etkileyen faktörler çıkarılmış ve çalışmanın kavramsal modeli şeklinde sunulmuştur. İlgili modeli test etmek için anket ve alan çalışması kullanılmıştır. Bulgular, konut birimlerinin konumu, yüksekliği ve iç tasarımının kullanıcıların zihinsel yargılarını etkilediğini göstermektedir. Ayrıca, bulgular konut çevrelerindeki yoğunluk algısının yapısal özelliklerden, konut tipi tercihlerinden ve komplekslerdeki ortak açık alanların varlığından etkilendiğini göstermektedir.

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* Sorumlu yazar: navid.khaleghi1363@gmail.com
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1. Introduction

In view of population growth and the importance of the residential environment, the concept of density in residential complexes is considered one of the prerequisites for developed cities. Rapid population growth has posed many problems for the settlement and construction of human societies, complexities that have impacted the economic, social, and environmental dimensions. In the planning and design of residential environments, population growth has made the densification of urban spaces a new element in dealing with urban issues, the dimensions of which are not limited to population growth (Kuddus, Tynan, & McBryde, 2020). Density is a theoretical concept in architectural planning and design, and it is considered to predict and control the way land is used (Boyko & Cooper, 2011). It is influenced by the social and cultural context as well as by political and economic attitudes (Pont & Haupt, 2007). Generally, urban and housing planning regulations are set on the basis of population density, housing density, and the degree of land use, which is considered one of the greatest challenges in contemporary urban planning and design (Zhang & Yan, 2023; Ahmadian et al, 2019). For this reason, researchers, and practitioners in the fields of urban planning, urban design, architecture, transportation, economics, sociology, psychology, anthropology, and ecology have paid particular attention to this concept (Sivam, Karuppannan, & Davis, 2012).

"High-density housing" often refers to residential projects that contain a significant number of dwelling units on a small plot of land. The definition of high density varies based on local legislation, urban planning goals, and cultural preferences, but it typically entails squeezing more residential units into a given space than lower-density constructions. To maximise land usage efficiency, high-density housing frequently includes taller buildings. This can vary from mid-rise to high-rise constructions. The proportion of a lot that can be covered by buildings. High-density buildings may have larger lot coverage to allow more dwelling units. Units in high-density housing are frequently smaller in order to fit more people into a building or complex. Regardless of the increased density, there is frequently an emphasis on providing appropriate facilities and open spaces inside or near high-density complexes to improve inhabitants' quality of life (Cho & Sawaki, 2007). In this sense, units per acre or hectare is one of the most often used housing density measurements. High-density housing frequently has a much larger number of dwelling units per unit of land area than lower-density buildings. Low density is defined as 1-10 housing units per acre, medium density as 10-30 dwelling units per acre, and high density as 30 or more dwelling units per acre (Ellis, 2004). While not a direct measure of density, building height is commonly linked to density in high-density housing developments. Taller constructions allow for more vertically stacked living units, resulting in a greater total density. Building height limitations vary widely depending on local zoning rules and urban development objectives.

In recent decades, with the introduction of the concept of sustainable development and the criticism of the indiscriminate expansion and low density of cities, the policy of densification has been considered a solution for most new planning approaches on a global scale (Ahlfeldt, Redding, Sturm, & Wolf, 2015). However, it should be noted that dense development has been proposed as a strategy in European and North American countries and makes sense. Although the situation in developing countries is not the same as in industrialised countries, the issue of urbanisation has developed fundamentally differently in developing countries than in Western countries (Ahmadi et al., 2019). In recent years, cities in developing countries have grown rapidly due to rapid economic development. At the same time, however, they have also faced serious challenges such as a lack of housing and infrastructure and urban poverty (Dave, 2010). In this way, despite their high density, most urban areas and settlements in these countries do not have the advantages of dense development (Chokhachian, Perini, Giulini & Auer, 2020). In Iran, the growth of cities and increasing urban density solely to solve the problem of housing shortages is a view with quantitative coordinates that ignores quality. Iranian cities today are confronted with the phenomenon of quantitative growth, in which the discussion of development as a qualitative concept is absent.

Simply increasing building density without considering the relationship between the various criteria (e.g., site selection, surrounding land use, neighborhood compatibility, number of family units, common open spaces, indoor and outdoor spaces, unit size, parking, security, noise control, etc.) related to density and the role of each criterion in influencing the quality of the residential environment and the mentality of users will not lead to a favorable result. Therefore, this study aims to examine the effects of housing density in forming residents' mental judgements of the environment in which they live. Additionally, based on such aim, this study attempts to appraises the visual significance of the external environment of the house for the inhabitants. In this regard, the following questions need to be answered:

1) Is perceived density, as a subjective dimension of density, affected by the characteristics of the built environment?

2) Which physical characteristics affect the perception of density?

3) Does typological diversity affect users' perception?

To answer the questions raised, a mixed research method and a survey were used to collect data. In the first step, the study focuses on theories and studies on density and its aspects. In the second step, by analyzing the results of previous studies and considering the concepts related to the topic, the classification of factors that influence the perception of density is presented. In order to experimentally verify and identify these factors in residential areas, in the third step, data are collected using a survey, which is examined and compared in four residential complexes in the city of Karaj, Iran. Finally, the data will be analysed through an exploratory factor analysis.

The findings are expected to cover various aspects, including cognitive issues, perception of the environment, and general mental health. This study's scope will largely research residential situations characterized by high density, as well as assess users' mental judgments, which will include a wide variety of subjective impressions and physical characteristics that persons encounter when living in such dwellings.

2. Literature Review

2.1. The concept of density in residential complexes

In recent decades, with the advent of sustainable development, many studies have attempted to propose a reasonably desirable density, considering the advantages and disadvantages of high densities, and each of them has addressed this issue from a different perspective (e.g. Gibson & Law, 2023; Gomes, 2020; Montgomery, 2013). In this way, a new approach emerged whose tenets were based on optimal density, mixed use, and better access to local services, rather than focusing on the importance of the impact of design on the perception of the built environment and often ignoring the human condition (Raman, 2010). This is despite the fact that density and overpopulation are two connected issues. Observing the criteria for measuring and determining density is not the only solution; the human state decides whether the environment is favorable or unfavorable. When analyzing residential environments, determining density as a starting point forms the basis for making design decisions. All behavior in residential environments is analyzed in terms of density, as various factors influence behavioral qualities in common environments (Mellen & Short, 2023). Therefore, it seems necessary to study and diagnose the conditions that occur in such environments. Even in studies where density is not used, important measures of density are used, such as the amount of open space, the economic conditions of residents, housing types, and open space enclosure systems (Tahvonen & Airaksinen, 2018).

In general, density in residential areas can be considered on the basis of three different criteria: population density, residential density, and floor area ratio (building density). Population density refers to the number of people per unit area. Residential density, which is the focus of this study, indicates the number of housing units per hectare but not the size of the housing units. The building density (floor area ratio) is the ratio between the total enclosed living space and the total area of the property. It refers to the total area of residential infrastructure on the floors of the entire property, which indicates the amount of built-up area (Kearney, 2006). Biddulph (2007) has divided the relationship between different urban forms and the density of residential complexes into three categories: A) Low altitude, high occupancy rate, with 3 to 4 stories and a common open space; B) Medium altitude, medium occupancy rate, with 4 to 8 floors, and C) High altitude, low occupancy rate, that feature 8 to 14 stories and are designed to make the most use of available space to provide comfort (Figure 1). According to this classification, the same residential densities do not create the same perceptual conditions. The same residential density can have different occupancy levels on the ground floor. In this way, it is possible to have the same density but different forms.

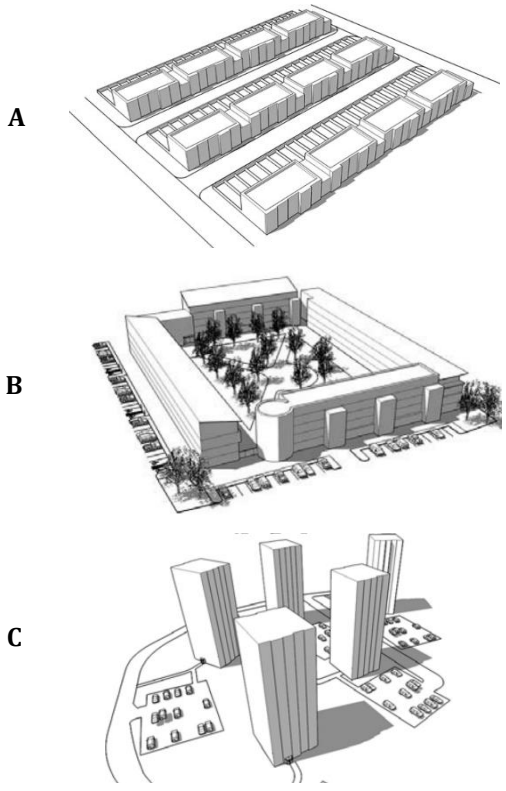

Figure 1. Relationship Between Different Urban Forms and the Density of Residential Complexes (Biddulph, 2007).

2.2. The mental aspects of density in housing

While planners and designers often make decisions about residential environments with a holistic view and density criteria, the evaluation of the living environment by non-experts is clearly different. The physical aspects of the environment that pass through the filter of perception and evaluation influence the satisfaction of the residents. Since non-experts have daily life experiences in residential areas, it is important for experts to examine residents' perspectives and explore the subjective dimensions of density in them. There are three main concepts related to density and how it affects people's lives: criteria for measuring and determining optimal density, perceived density, and crowding (Hur, Nasar, & Chun, 2010). According to Rappaport (1975), density is an objective, quantifiable, and neutral term because it cannot be classified as negative or positive based on a number. While density in living spaces may have both mental and qualitative consequences. Congestion is one of these mental effects which, according to psychologists, is called a state of mental anxiety caused by the qualitative evaluation of congestion (Mangrio & Zdravkovic, 2018). Congestion is the result of a psychological process and a mental and emotional experience that is affected by physical conditions, situation variables, individual characteristics and coping assests (Jacobs & Burch, 2023). On the other hand, density is not a suitable concept to express human experiences of the environment, and crowding is also influenced by cultural characteristics and is completely subjective and intangible. Therefore, the concept of perceptual density is proposed as an objective to subjective concept that is easier for designers to deal with than the concept of crowding (Fisher-Gewirtzman, 2018).

2.3. Perceived density

Perceptual density is usually defined as an estimate of the number of people and their activities, i.e., the volume of people's presence in space, judged by a set of signs in the environment. It seems that the active factors in the perception of density include the physical dimensions, the symbolic perception of an environment, and its socio-cultural characteristics (Pons, Giroux, Mourali, & Zins, 2016). In contrast to measurable density, perceived density is a quantitative and qualitative issue that relates to the physical environment and is based on the perception of the inhabitants. This concept states that the same density is perceived differently by different people in different contexts and cultures (Plane & Mu, 2021). Perceived density means that there are particular conditions in each environment that determine the presence of people and their intensity. This problem usually concerns the way people use and behave. Certain signs can be interpreted as indicators of a dense environment or they can be signs of a dense environment. In both cases, these signs are at least somewhat independent of the actual average number of people per unit area (Wen, Kenworthy, & Marinova, 2020). Tu and Lin (2008) consider perceived density as the result of physical density and individual cognitive and socio-cultural factors. Accordingly, physical density is not always equal to measurable density. Physical density implies both the measurable density and quality criteria of the environment. Qualitative criteria therefore include various aspects such as the variety of shapes, heights, and details of buildings and landscapes that cannot be measured precisely. Godoy-Shimizu, Steadman and Evans (2021), for example, have shown that low-density detached single-family houses appear denser when the orientation of the houses is unfavorable or the private yards are very small.

In environmental design, the way in which space is organized with objects and with people is of particular importance. In this situation, the arrangement of the elements that make up the environment, i.e., the distances and the proximity to each other and to people, plays the main role in the feeling of density. The feeling of high perceived density arises from the degree of spatial confinement, the illegibility and complexity of spaces and a high level of activity in them; This means that the sense of density is gained through the observation of objects and also through secondary information (Csanady, 2019). Therefore, if designers are aware of perceptual density, they can design physical spaces to convey a sense of lower perceptual density. The design method can amplify or attenuate physical sensory stimuli to increase the low density of an environment and reveal the potential or actual presence of people; But one should not ignore the influence of resources, the proper placement of public services, and the mixing of uses on the perception of density. The nuisances caused by high densities are reduced by increasing the number and quality of access to resources and services such as social services and public parks (Gifford, 2007). After reviewing and analysing the previous writings, it can be concluded that in environments with the same residential density, which differ in form and organisation, the perception of density is influenced by the type of spatial arrangement and spatial organisation. In this way, the factors that influence the perception of density can be divided into two categories: mass configuration (housing units) and spatial configuration (the type of spacing between volumes).

2.4. Factors related to mass and residential units

Size of the house: The meaning and consequences of living in densely populated areas are different from the meaning of living in a house with a large number of people. This does not imply that one is more significant than the other, but these are different and cannot be

categorised as densely populated. The size of the house plays a curical role in density perception. Residents who had less space per person had a more negative image of their home. This correlation between the feeling of confinement in the house and the overall perception of density is quite impressive (Zacharias & Stamps, 2004).

Neighborhood size: with similar densities in housing complexes, a single density can be experienced completely differently in large and small neighborhoods (Gifford, 2007). The different dimensions of the projects can also lead to a different experience and perception, despite the same residential density. In a situation where the complexes are very large and comprise a large number of units, the residents will feel uncomfortable. By dividing it into smaller, identifiable groups and categories, it appears less dense than it actually is (Gifford, 2007).

The size of the blocks: The length of the blocks and the number of intersections correlate strongly with the perception of density. Areas with smaller blocks and more intersections appear to have fewer units per block and are perceived as less dense, and the environment appears to be more favourable (Parra, Gomez, Pinzon, Brownson, & Millett, 2018).

Housing form: Different urban forms and different housing types create different perceived densities despite the same numerical density. The type of housing can have a symbolic effect on the perception of density, which also depends on the cultural context. Residential areas with detached houses indicate a low density. On the other hand, tall buildings with close spacing are symbols of high density due to the proximity of the dwellings to each other and the greater number of windows (Aurand, 2010).

Visual diversity: Visual diversity plays a lesser role in density perception than other factors. Physical features such as the distance between houses, front gardens, and the variety of house styles have a greater impact on perceived density compared to visual diversity. However, it should be borne in mind that repetition of similar views creates a sense of visual uniformity, and diversity in the design of blocks creates a lower perception of density (Bolton, 2021).

2.5. Factors related to space and spacing

The distance and height of buildings: The variety of architectural forms, the distance between volumes, and the height of buildings influences the perception of density and depends on how it manifests itself (Crajé, Santello, & Gordon, 2013). are considered effective qualitative measures for the perception of density. Different arrangements can be created at the same density, resulting in different perceived densities. People who live in residential areas close to large open spaces perceive their living environment as less dense because they have open views (Dave, 2011). Large distances between buildings create more privacy.

Visibility from inside the house: The distances between buildings affect the visibility from inside the house (visibility from inside to outside). Kearney (2006) has shown that a view of nature and a reduced view of the neighbours' houses can decrease the feeling of dissatisfaction with density. In other words, residents who have more views of the natural landscape and fewer views of other people's houses are less likely to feel a lack of privacy and less likely to complain about the distance between houses. This result suggests that good visibility can make high densities acceptable. Housing units should be oriented to maximise views of nature and minimise views of busy streets and neighbours' houses. The presence of trees and grasses evokes feelings that are quite different from the sight of other buildings and people. The feeling of openness in the interior space, which is considered one of the satisfaction factors of the residents, is achieved through the view of the green spaces outside. The absence of views of green spaces from the units does not contribute to the impression of density (Anastasiou & Manika, 2020).

Dominating view: Spacing between buildings affect the view of the surrounding area. In high-density residential complexes, the prevention of dominant views is an important factor for resident satisfaction. Maintaining privacy is achieved either by creating distance or by separating spaces from others. The mass spacing method can lead to a high perceived density. In residential units with large courtyards, open spaces provide the necessary distance to protect privacy. In high-density residential complexes, curtains, fences, barriers and walls protect private spaces from being seen (Sivam, Karuppannan, & Davis, 2012).

Organisation of public space: When designing public spaces, such as shopping facilities and children's playgrounds, the privacy of residential units should be separated from the privacy of public spaces that are used and needed by all people. Neglecting to properly organize the children's play area is linked to increased density. Even observing a modest number of children on the playground might evoke a sense of crowding or high density. The feeling of overcrowding intensifies when residents look for parking spaces. In a situation where the size of the spaces between units is appropriate and well designed but residents have no access to private open space, a sense of overcrowding and high density is likely to result. As density increases, it will be inevitable to lower standards and reduce social open space (Milanovi & Vasilevska, 2018).

Following the discussion in the literature review, the most significant factors of density in residential complexes that influence users' mental judgements

were explained from both mental and physical perspectives and classified into two main factors: A) space and spacing, and B) mass and residential units (Figure 2). These variables have been identified as the foundation of this study's conceptual framework. Based on this approach, questions in the form of a survey were created and evaluated throughout the study.

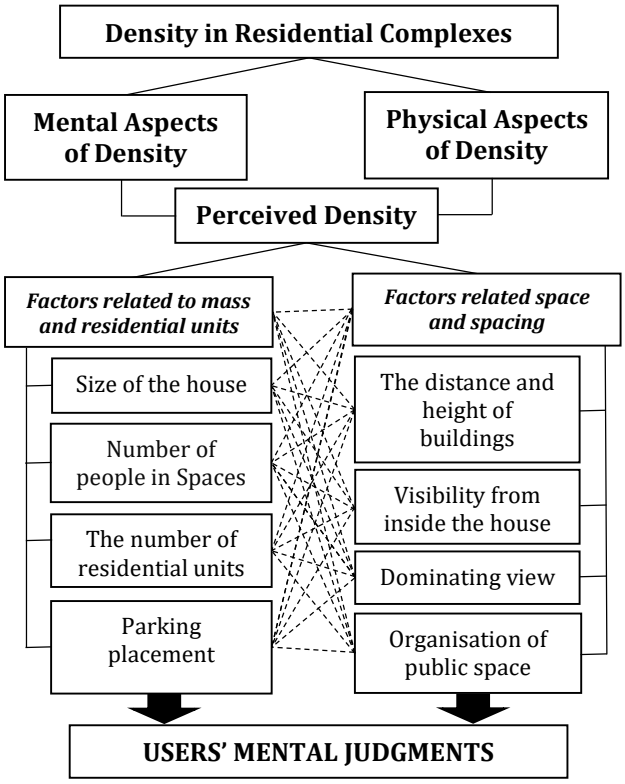

Figure 2. The Conceptual Model of the Study (Author).

3. Methodology

In this study, an exploratory factor analysis was used to identify factors that influence the perception of density (Figure 2). Factor analysis is a statistical technique that aims to simplify complex data sets. Four neighbourhoods of Karaj City, Iran, were selected to examine the study's conceptual model and investigate the effect of spatial configuration and the method of grouping housing units on the perception of density. The selected neighbourhoods were similar in housing density, population density, and socioeconomic location of residents but differentiated in terms of housing type and method of spatial arrangement. Since the change in density over time can significantly impact residents' perceptions, this was also considered when selecting the areas where the research was carried out. All participants were property owners who had lived in the neighborhood for more than five years. The data was collected through surveys, and field observations. In order to control for the effects of the intervening variables, the factors related to the characteristics of the neighborhood were also taken into account when selecting the ranges (population density, location of the neighborhood, facilities and services, age of the neighborhood, permanence of residential use).

To design the survey, a comperhensive literature review on density was conducted and the associated criteria were extracted and classified. In this regard, books and studies on high-density buildings were collected and analysed, ranging from architectural design principles to sustainability standards and socioeconomic aspects. Documents were chosen to serve as the foundation for study, providing a rich tapestry of insights into the difficulties of high-density urban settings. Then, a coding scheme with a structured framework that serves as a guide for the analytical process was created. This scheme organized key themes and criteria for high-density buildings, facilitating methodical extraction of relevant data. Each source was thoroughly examined to provide precise information. This entailed reading between the lines, recognizing repeating trends, and merging various views to reveal the fundamental factors that influenced the creation of high-density structures. During the analysis, the retrieved criteria were thoroughly examined for relevance, application, and robustness. Finally, the findings were combined into a cohesive narrative, with important criteria drawn from the literature underlined. Accordingly, the target content tables were defined on the basis of the results obtained, and the content and items of the survey were formulated in consultation with experts in the field of research. The variables that played a role in the selection of the neighborhoods and in the formulation of the statements in the survey are described in Table 1. Finally, the data was collected using the survey with 44 statements and four-point Likert scale from 1 "strongly agree" to 4 "strongly disagree". Kline's correlation was used to estimate the sample size. With 44 items in the survey, the required sample size would be 190. To guarantee the accuracy of the instrument's application, a factor analysis using 220 surveys was performed. Of these, 200 were returned complete and in excellent condition, providing as the foundation for computations. Indeed, 200 residents (93 men and 107 women, average age = 41 years) of four neighborhoods (each neighborhood: n=50) were asked to participate via home visits. The survey was completed during the week and at different times of the day. Data collection took 4 days, and each survey took 6–8 minutes to complete.

Table 1. The Summary of Variables Used in Survey

Control	-Appropriate placement of public services -Community -Variety of land uses
Independent	-The arrangement of buildings and the number of buildings in the field

	of view. -Housing type. -Block sizes.
Dependent	-Residents' perception of their neighborhood in terms of crowding of buildings. -Residents' perception of their neighborhood in terms of crowding of people. -Residents' perception of their house size. View of other residential units. View from the inside to the outside.

The survey consisted of 26 items. Questions 1–3 addressed the issue of height and distance perception. In this context, the first question was addressed to analyze the relationship between building height and sensations of confinement, disorientation, and perplexity: *The height of the buildings in the residential complex where I live makes me feel cramped and bewildered.* The second question sought to assess the effect of building distribution on the provision of pleasant outdoor places for social interaction and children's play: *The spacing between the buildings has created appropriate open spaces for socializing and children's play*. The third question aimed to determine satisfaction with building distance in terms of perceptions of openness, freedom of movement, contribution to environmental aesthetics and livability, and allows for adequate natural light and ventilation in living spaces: *The buildings in the residential complex where I live are spaced appropriately apart, and I am satisfied with the distance between them*. Questions 4–6 covered the subject of viewing from inside to outside. In this regard, considering the determination of several qualitative aspects such as contentment with the view, emotional effect, connection to nature, impression of desirability, and everyday enjoyment, the following questions were posed: *The nice view of the outdoor environment is one of the things I value about my residence; My house's exterior areas are such that I tend to peek out the window at them; Only the opposing buildings can be seen from my house's windows.*

Questions 7-9 are designed to assess perceived dominance and visibility from the outside to the interior of high-density housing units. The primary qualitative qualities of these issues are privacy concerns, a sense of control, security, and comfort: *I feel less lonely if my neighbours gaze into my house; I frequently have the impression that my neighbours are peering into my home; It is critical to me that the house's windows are set in such a way that others cannot look in.* Related to the organization of green and public spaces, question 10 assesses whether people are comfortable strolling in the open spaces around their residential complex. It seeks to collect views of accessibility and safety in these regions: *The open spaces of the neighborhood or the surrounding of the residential complex are such that I can walk in it calmly.* Question 11 focuses on the availability of open and green places inside the residential complex for people to unwind and relax. Its goal is to examine the availability of recreational facilities and their potential function in stress reduction: *My flat complex includes an open and green space where I can relax after a long day at work.*

Question 12 asks if people have views of open and green landscapes from their residences. It seeks to convey views of visual aesthetics and the incorporation of natural elements into residential settings: *From my house it is possible to see an open and green landscape.* Questions 13-15 were meant to examine several qualitative aspects of parking spots in high-density residential neighbourhoods. *Many automobiles are frequently parked on the street where I live*. This question aims to examine several qualitative aspects of parking spots in high-density housing zones. *Parking automobiles in my neighborhood's streets and open areas has generated congestion.* This question is on the potential consequences of parking cars on the neighborhood's streets and open spaces, such as congestion. It seeks to collect impressions of traffic effect and the amount of inconvenience caused by overcrowded parking lots. *If I don't want to park in the lot, I'll have to seek for a spot on the street for a long.* This question focuses on people's experiences looking for parking places on the street rather than in parking lots. It seeks to measure the time and effort necessary to locate a good parking place, emphasising the difficulties and frustrations connected with street parking.

Questions 16-19 intend to measure numerous qualitative features associated with the presence of people in common open spaces within high-density housing. In this context, *I'm not comfortable being outside the home because of the presence of unknown persons in open places and tunnels,* concerns people's comfort levels when they leave their houses because of the presence of strangers in public places. It seeks to capture sentiments of safety and comfort, emphasizing worries about encountering strangers in shared outdoor spaces. *The children's loudness has taken away my comfort*, and *The noise of passing cars is annoying*, discuss the effect of noise caused by children and passing automobiles on people's comfort levels. They intend to analyze citizens' views of noise pollution and the extent to which it disrupts their peace and tranquility in public settings. *Our neighbourhood has a high volume of foot activity*, emphasizes the volume of foot traffic in the neighborhood, suggesting congestion and human presence in public open places. It seeks to gather perceptions of how densely packed these locations are and whether inhabitants are

overwhelmed by the quantity of activity. Overall, these qualitative features are intended to give insights into how the quantity of people in shared open spaces influences people's perceptions, behaviours, and experiences in high-density housing regions. They discuss topics such as safety, noise levels, social dynamics, privacy, and environmental quality, which contribute to a thorough grasp of the issue.

In accordance with the number of housing units factor, three questions were considered. The first question asks if people believe that the large number of residents in the residential complex has affected families' peace and individual lives. It seeks to document views of community cohesiveness and how high-density living impacts inhabitants' feeling of peace and tranquillity: *Despite the vast number of inhabitants in this residential complex, the families' serenity and individual lives have not been disrupted*. The second (*I know the names of many of our block's or block's residents*) and third (*The number of residential units on the block is sufficient for me to know the majority of my neighbours*) questions are about people's acquaintance with their neighbours and the number of residential units in their block. They intend to examine how well inhabitants know their neighbours and feel linked to their surrounding community, emphasising the significance of social ties in high-density living conditions.

Questions 22-26 were designed related to the organisation of green and public spaces factor. The first question concerns people's impressions of their home's location and whether they think it's perfect. It seeks to collect subjective evaluations of the home environment, such as closeness to facilities, accessibility to transit, and general desirability: *My house's location is ideal.* The second and third questions address the availability of private places within the house where people can be alone and complete personal work. They seek to analyse the degree of privacy and autonomy provided by the living environment, which might impact residents' feeling of well-being and comfort: *At home, I have a private space where I can be alone,* and *I have a private room at home where I can easily accomplish my own work.* The fourth question investigates the role of economic constraints on people's housing decisions. It seeks to determine whether inhabitants regard their present living arrangement as a compromise owing to budgetary restrictions, which might affect their happiness with the home environment: *I only live in a residence of this size due to economic limitations.*

The SPSS software was used to calculate the acceptance coefficient, the purity coefficient, and the loop method. The purpose of this evaluation is to check the accuracy and inadequacy of the individual questions and to show the weaknesses, strengths, and validity of the survey. Based on these calculations, it was found that 12 out of 44 questions did not fit the topic and purpose of the survey due to ambiguity for the respondents. Therefore, these questions were removed from the analysis process. After they were removed, the reliability coefficient of the remaining 32 questions was calculated. Since Cronbach's alpha is 0.8, this results in a value of 0.89, an acceptable coefficient that demonstrates the validity of the survey. The exploratory factor analysis method was used to categorize the factors and determine the variables that influence the perception of density, with the aim of creating a general pattern among the variables. The factor loadings were used to identify the main variables.

4. Case Area

The capital of the province of Alborz, Karaj, is considered a major immigration hub in Iran. Hosting a population around 1.97 million, as recorded in the 2016 census, it is the fourth-largest city in Iran. Compared to other cities, its population is younger. The earliest records of Karaj date back to 30th century BC. The city was developed under the rule of the Safavid and Qajar dynasties and is home to historical buildings and memorials from those eras. Until the second half of the 20th century, it used to be known mainly as a summer resort. Today, it is a major industrial city, with factories. To investigate the users' perception and mental judgments related to high-density housing, four significant neighborhoods of Karaj —Azimiyeh, Owj, Baghestan, and Baraghan—were chosen. The selection of these residential districts was based on the variations in the urban context, neighbourhood size, date of settlement, and services offered.

The urban context criteria relate to the general surroundings and features of the urban region where the residential districts are located. In this context, factors like the level of development, variety of infrastructure, the presence of commercial or industrial zones, transportation networks, and the overall layout of the neighborhoods were taken into account. Variations in neighborhood size might have facilitated a more nuanced examination of urban design, spatial planning, and community dynamics in this study. By using neighborhood size as a criterion, the goal was to represent the varied variety of urban experiences and features seen in various-sized residential districts. The use of the criterion "date of settlement" for evaluating the impact of high-density housing on persons' cognitive judgments is critical. This criterion can be used to predict the psychological and behavioral effects of high-density housing reliably. For example, persons who live in densely crowded places for an extended length of time may face limits such as restricted space, noise, and congestion, as well as difficulties such as worry or higher stress levels. As a result, in the current study, attempts were made to identify neighborhoods

with both human activity and longer tenure, assuring a greater degree of antiquity and density. In addition, by assessing the variety and quality of amenities and services in neighborhoods, we can gain insight into how well high-density housing meets the diverse needs and preferences of its residents, informing urban planning and housing policies aimed at creating healthier and more livable communities. As a result, neighborhoods were chosen based on the availability of a diverse range of recreational amenities of variable quality. The typological diversity of selected neighborhoods is expected to reveal differences in levels of users' mental judgments. Their position inside the city is seen in Figure 3.

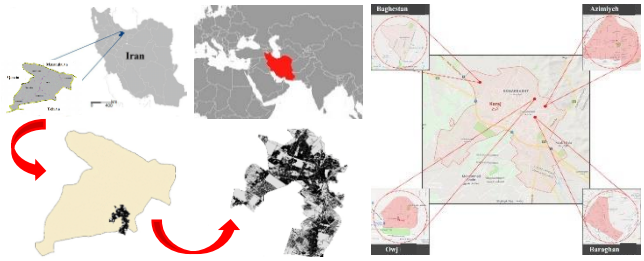

Figure 3. Location of the Neighborhoods in the City of Karaj, Alborz Province, Iran (Google Map).

Azimiyeh neighborhood: The neighborhood of Azimiyeh is situated northeast of Karaj. Its placement has resulted in uneven surfaces and a steep slope. Due to the neighborhood's consistent fairly good weather and the presence of several reliable water sources, it has long been regarded as one of the most desirable areas of Karaj to dwell. This neighborhood has seen a rise in population during the past few decades. Some of the local attractions are Nour Mountain, Karaj Baam, and a plethora of dining establishments.

Figure 4. The Palcement and General View of the Azimiyeh Neighborhoods in the City (Top view: Google Map; Fotographs: Author).

Owj neighborhood: The Owj neighbourhood is situated close to Alborz Mountain in the northern part of city. The Tehran-Karaj highway, boulevards, and metro station provide easy access to this neighbourhood. Along the main street in this neighbourhood are three- to four-story buildings and residential complexes. Its residential complex for families of military personnel is its major feature.

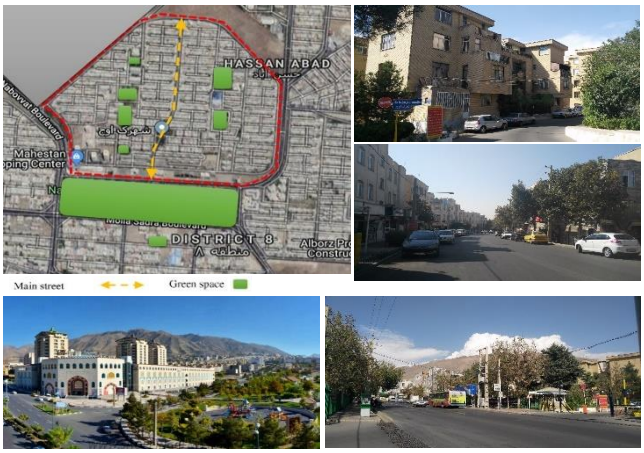

Figure 5. The Palcement and General View of the Owj Neighborhoods in the City (Top view: Google Map; Fotographs: Author).

Baghestan neighborhood: Baghestan neighborhood is located in the north-west of Karaj, near to Atashgah village (one of the tourist spots). This area has been developed from the North and the West. Western Baghestan is one of the newly settled neighborhoods with the high rate of construction statistics and average-income residents. Due to the fact that this neighborhood is relatively new, a large number of segregated lands for residential use exist among residential blocks.

Figure 6. The Palcement and General View of the Baghestan Neighborhoods in the City (Top view: Google Map; Fotographs: Author).

Baraghan neighborhood: Baraghan neighborhood is located in the center of the city. At the East, it is edged with Karaj Square, at the West is edged with Taleghani intersection, and at the North and the South is edged with Baraghan and Mazaheri streets, respectively. This neighborhood has irregular and organic urban context.

Figure 7. The Palcement and General View of the Baraghan Neighborhoods in the City (Top view: Google Map; Fotographs: Author).

5. Findings

In the diagnosis of each factor, the correlation coefficient was higher than 40%, and the results of the rotated matrix test were used as decision criteria. The test results showed that the examined issues can be summarised into eight factors (Table 2). Based on the explanatory variance associated with each of these factors, the factor of distance and height of buildings is the factor that respondents felt explained the most variance in the perception of density. But the sum of the first eight factors could explain 54% of the total variance in density perceptions. That is, if we assume that all minor problems mentioned in the survey account for 100% of the total variance in density perception, these eight categories, as baseline factors, may explain more than half of this variance, and all density perception difficulties can be reduced to eight variables.

Table 2. Factors and Explained Specific and Cumulative Variance Values Related to Each Factor

Factors	Explained Varience Specific	Cumulative
Height and distance perception	12.78	13.34
View from inside to outside	9.41	19.58
Dominating view	7.71	21.22
Open and green space	9.32	27.74
Parking placement	5.96	33.65
Perception of the number of people in common open space	6.23	39.31
The number of residential units	7.01	37.65
House size	5.82	54.01

In the following, statements on each factor of the survey and some descriptive statistics (mean values, standard deviation, and standard deviation error) are presented in order to compare the neighborhoods investigated:

Factor 1 - The perception of the distance and height of buildings: The distance and height of buildings are actually influenced by the choice of house type and the way the mass is designed. According to the values obtained, in terms of height and distance, the Azimiyeh residential complexes are perceived better rather than the other three complexes (M=1.87, SD=0.66). In these complexes, the distance between the blocks is designed as an open space, and the skyline is varied (Table 3).

Table 3. Data Analysis for Distance and Height of Buildings Factor

Residential Complexes	M	SD
Azimiyeh	1.87	0.66
Owj	1.99	0.57
Baghestan	2.74	0.41
Baraghan	2.16	0.36

-The height of the buildings in the residential complex where I live makes me feel cramped and bewildered.
- The spacing between the buildings has created appropriate open spaces for socialising and children's play.
- The buildings in the residential complex where I live are spaced appropriately apart, and I am satisfied with the distance between them.

Factor 2 - The view from the inside to the outside of the housing unit: With regard to this factor, Azimiyeh complexes provide better visibility than the other complexes (M=1.75, SD=0.63) due to the attention paid to the defined open spaces, and most housing units have a relatively good view of the open spaces (Table 4).

Table 4. Data Analysis for Visibility from Inside the House Factor

Residential Complexes	M	SD
Azimiyeh	1.75	0.63
Owj	1.88	0.77
Baghestan	2.31	0.54
Baraghan	2.02	0.69
- The nice view of the outdoor environment is one of the things I value about my residence. - My house's exterior areas are such that I tend to peek out the window at them. - Only the opposing buildings can be seen from my house's windows.		

Factor 3 - Dominaiting, and visibility from the outside to the inside of the housing units: Maintaining privacy, ensuring visual privacy, and preventing the aristocracy of housing units are important issues in the design of dense environments. The presence of open spaces in the Baghestan complex (M=1.81, SD=0.59), the size of the open spaces, and the way the buildings are placed and interact with the open spaces have overshadowed the view and aristocracy of the housing units towards each other (Table 5).

Table 5. Data Analysis for Visibility from Outside the House Factor

Residential Complexes	M	SD
Azimiyeh	2.84	0.77
Owj	2.10	0.63
Baghestan	1.81	0.59
Baraghan	2.37	0.71
- I feel less lonely if my neighbours gaze into my house. - I frequently have the impression that my neighbours are peering into my home. - It is critical to me that the house's windows are set in such a way that others cannot look in.		

Factor 4 - The presence of open and green spaces: In both the Azimiyeh (M=1.44., SD=0.47) and Owj (M=1.45, SD=0.47) complexes, the presence of vegetation created better conditions, and residents rated them as more suitable (Table 6). It means that in addition to groomed open spaces, vegetation has an essential qualitative influence on the feeling of density. Qualitative factors of these two complexes are more important than quantitative factors. Green spaces between the buildings are seen through the windows of the residential units, and led to residents feel close to each other, which has an impact on the feeling of density.

Table 6. Data Analysis for Organisation of Green and Public Spaces Factor

Residential Complexes	M	SD
Azimiyeh	1.44	0.47
Owj	1.45	0.47
Baghestan	2.93	0.88
Baraghan	2.77	0.61
- The open spaces of the neighborhood or the surrounding of the residential complex are such that I can walk in it calmly. - My flat complex includes an open and green space where I can relax after a long day at work. - From my house it is possible to see an open and green landscape.		

Factor 5 - Organisation of parking spaces: Cars, as a sign of the presence of people, can mean a dense environment. In both the Azimiyeh (M=2.79, SD=0.68) and Owj (M=2.76, SD=0.69) complexes, the car parks are arranged at ground level. However, one of the positive side in the Azimiyeh complex is the separation of pedestrian walkways and open spaces from the bridleways. In the design of this complex, short vegetation was used to mark the boundaries of parking lots and walkways. Also, in contrast to the other three complexes, fewer cars are exposed due to the division of the parking lot into small groups (Table 7).

Table 7. Data Analysis for Parking Spaces Factor

Residential Complexes	M	SD
Azimiyeh	2.79	0.68
Owj	2.76	0.69
Baghestan	3.11	0.74
Baraghan	2.99	0.71
- Many automobiles are frequently parked on the street where I live. - Parking automobiles in my neighborhood's streets and open areas has generated congestion. - If I don't want to park in the lot, I'll have to seek for a spot on the street for a long.		

Factor 6 - Perception of the number of people in common open spaces: A large number of people or signs of their presence, such as noise, can be associated with high density. According to the observations and statements of the residents, the open spaces in the Baraghan complex are less used (M=1.73, SD=0.64) due to the lack of attention paid to the design of the open spaces and are, in a sense, considered residual areas of building design (Table 8).

Table 8. Data Analysis for Number of People in Common Open Spaces Factor

Residential Complexes	M	SD
Azimiyeh	2.04	0.61
Owj	2.15	0.62
Baghestan	2.63	0.78
Baraghan	1.73	0.64

- I'm not comfortable being outside the home because of the presence of unknown persons in open places.
- The children's loudness has taken away my comfort.
- The noise of passing cars is annoying.
- Our neighbourhood has a high volume of foot activity.

Factor 7 - The number of housing units in each building: As mentioned in the literature, the perception of density includes both social and spatial aspects. The large number of housing units in each structure affects the number of social encounters between residents and can lead to a different assessment. In the Baraghan complex, there are fewer housing units in each structure, which justifies the favourable condition of this area compared to others. Table 9 shows that the Owj complex (M=2.00, SD=0.67), with 24 housing units per building, does not provide suitable conditions, and residents are dissatisfied.

Table 9. Data Analysis for the Number of Housing Units Factor

Residential Complexes	M	SD
Azimiyeh	2.44	0.57
Owj	2.00	0.67
Baghestan	3.18	0.68
Baraghan	2.27	0.61

- Despite the vast number of inhabitants in this residential complex, the families' serenity and individual lives have not been disrupted.
- I know the names of many of our block's or block's residents.
- The number of residential units on the block is sufficient for me to know the majority of my neighbours.

Factor 8 - House size: High housing density often goes hand in hand with small apartment sizes and little open space. The negative effects of inadequate housing and indoor overcrowding on health, social relationships, and loneliness are inevitable. Knowing the importance of cultural context, it is very important to consider the internal relationships between density, housing size, and quality of life. The average area available per person in Owj complex is lower in the top group (M=2.77, SD=0.57) than in the other areas, and this is consistent with the figures in Table 10.

Table 10. Data Analysis for Organisation of Green and Public Spaces Factor

Residential Complexes	M	SD
Azimiyeh	3.32	0.87
Owj	2.77	0.57
Baghestan	3.85	0.79
Baraghan	3.49	0.71

- My house's location is ideal.
- At home, I have a private space where I can be alone.
- I have a private room at home where I can easily accomplish my own work.
- I only live in a residence of this size due to economic limitations.

6. Discussion

One of the main aims of this study was to assess the visual significance of the external environment of the house for the inhabitants. The questions about the importance of the view of the external environment provided us with valuable information about the role of this aspect in the residents' experience of life. Based on the results of the first factor, it can be concluded that the open design in the Azimiyeh complexes as an architectural solution creates a sense of space and freedom for the residents beyond the provision of open space. This enables residents to take a closer look at the height and spacing of the buildings and to better understand and evaluate their living situation in general. The presence of changes in the skyline as one of the visual characteristics of the environment can give the region a special attraction and identity. These changes not only contribute to the diversity of vision but also have a direct impact on the residents' perceptions of the distance and height of the buildings.

Regarding the second factor of the research, it can be argued that the view from the inside to the outside is one of the most important features in the design of housing that has a direct impact on the residents' experience. A good view of the open spaces not only creates the feeling of an open and natural space but also helps to improve the mood and quality of life of the residents. The results showed that attention to open spaces in Azimiyeh complexes helps to provide a good view from the inside out. This can be achieved through the proper design and strategic location of these spaces. The units that paid attention to the proper design of open spaces were able to provide residents with the opportunity to enjoy the impressive views of the outside world. As for the other complexes, the results showed that the majority of residents are limited to looking only at the buildings in front of them. This may affect the residents' visual experience of their surroundings and indicate limitations in this area.

Regarding the analysis of the third factor, the results showed that the residential complex in Baghestan with

its open spaces, the appropriate size of these spaces, and the arrangement of the buildings with these spaces have a significant impact on the residents' experience of the residential environment. In other words, maintaining personal privacy and preventing unwanted visits from outside were significant factors that determined residents' attitudes towards their subjective judgements. It seems that these criteria can be considered the first principles of architecture in the design of dense residential buildings. The results showed that the fourth factor, the presence of open and green spaces, had an important effect on the subjective judgements of the residents in the Azaimiyeh and Owj complexes. The presence of plants and vegetables in these complexes created better conditions, and residents rated them as a more suitable environment. The presence of green spaces between the buildings, which can be seen from the windows of the residential units, has made the residents feel close to each other. This relationship seems to have a positive impact on the overall sense of community, reducing feelings of loneliness and strengthening social ties.

The results of the study of the fifth factor have shown that in the Azimiyeh and Owj complexes, the separation of walking paths and open spaces from parking lots is seen as positive. In the design of these complexes, small plants were used to delineate parking lots and walkways. Also, in contrast to the other three complexes, fewer cars are parked as the parking lot is divided into smaller groups. The emphasis on separating the pedestrian paths from the parking paths in these two complexes demonstrates order and organisation in the management of the parking areas. This link between tidiness and the sense of density of the living environment is an important point for designers and city administrators, which can help to improve the experience of residents in dense complexes. These measures not only contribute to the beauty and pleasantness of the environment but are also effective in reducing the negative impact of the presence of cars. With regard to the sixth factor, the results showed that the presence of too many people, noise, and the inappropriate use of open spaces cause discomfort among residents in the Berghan housing estate. From the questions asked of the residents, it is clear that the presence of unknown people in the open spaces made the residents uncomfortable. This can lead to a heightened sense of insecurity and fear among residents. Based on these findings, issues such as biological measures can be considered in the design of common areas and traffic routing to ensure that high-density housing complexes provide a peaceful and satisfying environment for residents.

The results for factor seven showed that housing density has various effects on residents' subjective assessments. For example, a residential complex with a lower density offers more favourable conditions for residents than a complex with a higher density, which leads to positive thinking about the residential environment. According to the information received, it was found that with fewer units per building, the inhabitants of the Baraghan complex were able to get to know their neighbours better and socialise more. It can therefore be argued that the number of housing units in each housing complex plays an important role in shaping the social space. This information can help formulate appropriate measures to increase social connections and positive perceptions of density. Based on the results of the eighth factor, several aspects of the effects of housing density can be addressed. The small size of the dwellings and the lack of open spaces can lead to physical and psychological complications, such as feelings of confinement and anxiety. The following expresses the cultural significance in this context, as housing needs and preferences may be different in each culture. In addition, we can discuss the impact of housing density on quality of life. The data presented shows that a higher density in the peak complex provides less space for each person, which can have a negative impact on quality of life. This problem can also encompass other social and economic dimensions, such as the possibility of tensions and social disparities in high-density environments. In this context, solutions and suggestions are offered to improve housing conditions in high-density areas. This can include an appropriate urban planning policy, more green spaces, and the creation of suitable social spaces. Studying successful examples of cities or projects that have been successful with high-density housing can be inspiring. This can include innovative designs, sustainable strategies, and effective measures to improve the quality of life.

Generally, whatever found from findings can be summarized that the location, height, and interior design of residential units (which provide vision from inside to outside the house and domaining view) impact users' mental judgments. Furthermore, the data revealed that structural elements, housing type preferences, and the existence of public open spaces in complexes all influence how people perceive density in residential situations. It means that a complex interaction between the mental elements of density and its physical manifestations in residential contexts. Location appears as a key factor, with urban environments possibly eliciting sensations of crowding and congestion, whilst suburban or rural settings provide a sense of space and tranquillity. Similarly, the height of residential structures affects people' perceptions, with towering buildings possibly evoking feelings of confinement or elevation depending on floor level and views. Interior design is critical in influencing occupants' mental judgements, since intelligent spatial layouts and décor choices may either ease or worsen feelings of congestion and discomfort. Furthermore, the

spatial design of residential complexes, together with individual preferences for dwelling type, influences tenants' sense of density and personal space. Common open areas inside complexes are essential facilities that reduce feelings of confinement and promote social interaction, improving residents' general well-being. Overall, findings highlight the significance of holistic design methods that prioritise people' psychological comfort and quality of life in high-density living situations (Table 11).

Table 11. The Most Important Factors Affecting Users' Mental Judgments in High-Density Housing

Factors Affecting Mental Judgments	Perception of Density
Location	Physical features
Height	Preferences for housing type
Interior design	Public open spaces

It is worth noting that, while defining the scope and constraints of the study, specifying the selection criteria and briefly explaining their contribution to the study's objectives would be beneficial. In this regard, it should be noted that the findings may not be universally relevant due to variations in cultural norms, urban planning rules, and socioeconomic considerations between locations and people. While the study identified links between high-density living and mental judgements, determining causal relationships may be difficult owing to confounding variables such as individual variations, pre-existing mental health issues, and external stresses. Participants' replies to surveys or interviews may be impacted by social desirability bias or subjective interpretations of their experiences, which might undermine the data's dependability. External variables such as neighborhood safety, access to green areas, and community facilities may impact participants' mental judgments but are not explicitly addressed in the research design. By recognizing these scope and constraints, this study might successfully contribute to understanding the complicated interaction between high-density housing and users' mental judgments, delivering insights that could guide urban planning, housing policy, and public health treatments.

7. Conclusion

Density is an important concept in the design of residential environments and is directly related to subjective perception, the need for security, and the need for peace and privacy. Densification cannot be seen as a suitable solution for all areas or as a synonym for sustainability. This is because the acceptance of high-density living and its evaluation do not depend on the method used to calculate density, but on social and cultural conditions and vary from case to case. In contrast to quantitative density, the concept of perceptual density refers to subjective and qualitative aspects such as expectations, ideas, attitudes, and the way people make judgements and evaluate the environment. The importance of this concept lies in the fact that, despite the increase in low densities, physical spaces can be designed in such a way that the perception of density is reduced. In this context, this article aimed to identify the factors that influence the perception of density and the subjective judgements made by residents.

To understand the impact of the planning method on the perception of density, four residential neighborhoods in the city of Karaj with similar net residential and population densities and the same socio-economic base of residents were selected, controlling for variables such as age and location of the neighborhood. The residents responded to the questions posed in a survey created for this purpose. In response to the first question of this study and by comparing the selected areas, the results show that although the criteria for measuring density are methods for controlling and familiarising oneself with the conditions of the residential environment, they influence the design method, perception, and experience of density, and that physical factors play an important role in this. In relation to the second research question, the total factors related to density perception were categorized into eight factors using exploratory factor analysis. These factors were able to explain more than half of the variance in density perception. These factors show that in residential environments of similar density, the choice of housing type and the way in which housing units are combined, as well as the type of spacing between masses, interact with the common space. Also, in response to the third question of the study, such finding revealed that typological diversity affects users' perception. And finally, the method of general design of the complex is one of the most important factors influencing the perception of density.

Overall, the current study addressed an important aspect of urban living: the effect of high-density housing on people's mental judgments. In this regard, the subtle link discovered between many environmental elements and mental impressions provides important insights into how people perceive and assess their living environments. To begin, the identification of location as a strong effect on mental judgments emphasizes the relevance of context in molding people's perspectives. Whether in a hectic city center or a calm suburban neighborhood, people's perceptions of their living circumstances are heavily influenced by their surroundings. Height, too, appears as a significant factor, with high buildings either creating emotions of imprisonment or elevation, depending on people' psychological inclinations.

Moreover, this study highlights the significance of interior design (providing visibility from inside to outside the house and domaining view) in influencing inhabitants' mental judgments. From spatial arrangement to aesthetic aspects, the interior setting has a considerable influence on tenants' sense of comfort and privacy. These findings, which elucidate the interaction between design decisions and mental judgements, might provide major direction for architects and urban planners seeking to build residential settings that promote pleasant psychological outcomes.

Furthermore, research into density perception revealed a complex connection driven by a variety of structural and environmental elements. Individuals' housing choices, for example, reflect their own spatial demands and lifestyle preferences, influencing their perceptions of density in residential surroundings. Another important component is the provision of common open spaces, which allow inhabitants to engage in social contact, relax, and feel a sense of community in the midst of high-density living. This study enriches our understanding of urban psychology by shedding light on the complicated interplay between environmental elements and mental judgements, as well as providing practical ideas for constructing more livable, sustainable, and psychologically supportive residential situations. In an era of rising urbanization and densification, the findings of this study are an important resource for creating future cities with human well-being at their center.

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References

Ahlfeldt, G. M., Redding, S. J., Sturm, D. M., & Wolf, N. (2015). The economics of density: Evidence from the Berlin Wall. *ECONOMETRICA Journal of the Econometric Society*, 83(6), 2127-2189. https://doi.org/10.3982/ECTA10876

Ahmadian, E., Sodagar, B., Mills, G., Byrd, H., Bingham, K., & Zolotas, A. (2019). Sustainable cities: The relationships between urban built forms and density indicators. *Cities,* 95, 1-15. https://doi.org/10.1016/j.cities.2019.06.013

Anastasiou, E., & Manika, S. (2020). Perceptions, determinants and residential satisfaction from urban open spaces. *Open Journal of Social Sciences,* 8(6), 1-18. https://doi.org/10.4236/jss.2020.86001

Aurand, A. (2010). Density, housing types and mixed land use: Smart tools for affordable housing?. *Urban Studies*, 47(5), 1015-1036. https://doi.org/10.1177/0042098009353076

Biddulph, M. (2007). *Introduction to Residential Layout*. Amsterdam: Architectural Press. ISBN: 1136392122

Bolton, L. T. (2021). Space ratio: A measure of density potentials in the built environment. sustainable *Cities and Society*, 75. 103356. https://doi.org/10.1016/j.scs.2021.103356

Boyko, C. T., & Cooper, R. (2011). Clarifying and re-conceptualising density. *Progress in Planning,* 76(1), 1-61. https://doi.org/10.1016/j.progress.2011.07.001

Cho, P., & Sawaki, M. (2007). Study on the neighborhood characteristics of high-density hillside areas through common space (A case study on an on-the-spot improvement program district of the housing environment amelioration program in Busan, Korea). *Journal of Asian Architecture and Building Engineering*, 6(1), 111-118. https://doi.org/10.3130/jaabe.6.111

Chokhachian, A., Perini, K., Giulini, S., & Auer, T. (2020). Urban performance and density: Generative study on interdependencies of urban form and environmental measures. *Sustainable Cities and Society,* 53, 1-20. https://doi.org/10.1016/j.scs.2019.101952

Crajé, C., Santello, M., & Gordon, A. M. (2013). Effects of visual cues of object density on perception and anticipatory control of dexterous manipulation. *PLOS ONE*, 8(10), 1-11. https://doi.org/10.1371/journal.pone.0076855

Csanady, P. (2019). Architectural space density – The effect of enclosure. *Symmetry Culture and Science*, 30(1): 43-58. https://doi.org/10.26830/symmetry_2019_1_043

Dave, S. (2010). High urban densities in developing countries: A sustainable solution. *Built Environment*, 36(1), 9-27. https://doi.org/10.2148/benv.36.1.9

Dave, S. (2011). Neighbourhood density and social sustainability in cities of developing countries. *Sustainable Development*, 19(3), 189-205. https://doi.org/10.1002/sd.433

Ellis, J. G. (2004). Explaining residential density (Research & Debate). *Places*, 16(2), 34-43.

Fisher-Gewirtzman, D. (2018). Perception of density by pedestrians on urban paths: an experiment in virtual reality. *Journal of Urban Design*, 23(5), 674-692. https://doi.org/10.1080/13574809.2018.1444471

Gibson, S., & Law, L. (2023). Barriers and opportunities for medium-density housing in small, regional cities: stakeholder perspectives from Cairns. *Australian Planner*, 58(3-4), 95-109. https://doi.org/10.1080/07293682.2023.2183225

Gifford, R. (2007). *Environmental Psychology: Principles and Practices* (4th Edition). Colville: Optimal books. ISBN: 0968854311

Godoy-Shimizu, D., Steadman, P., & Evans, S. (2021). Density and morphology: from the building scale to the city scale. *Buildings and Cities*, 2(1), 92–113. https://doi.org/10.5334/bc.83

Gomes, E. (2020). Sustainable population growth in low-density areas in a new technological era: Prospective thinking on how to support planning policies using complex spatial models. *Land,* 9(7), 1-14. https://doi.org/10.3390/land9070221

Hur, M., Nasar, J. L., & Chun, B. (2010). Neighborhood satisfaction, physical and perceived naturalness and openness. *Journal of Environmental Psychology,* 30(1). 52-59. https://doi.org/10.1016/j.jenvp.2009.05.005

Jacobs, M. M., & Burch, A. E. (2023). Disparities in perceived physical and mental wellness: Relationships between social vulnerability, cardiovascular risk factor prevalence, and health behaviors among elderly US residents. *Journal of Primary Care & Community Health*, 14, 1-13. https://doi.org/10.1177/21501319231163639

Kearney, A. R. (2006). Residential development patterns and neighborhood satisfaction: Impacts of density and nearby nature, *Journal of Environment and Behavior,* 38(1), 112-139. https://doi.org/10.1177/0013916505277607

Kline, B. (2010). Principles and practice of equation modeling. 3th Ed. New York: Guilford Press. ISBN: 1606238760

Kuddus, M. A., Tynan, E., & McBryde, E. (2020). Urbanization: A problem for the rich and the poor?. *Public Health Reviews,* 41(1), 1-4. https://doi.org/10.1186/s40985-019-0116-0

Mangrio, E., & Zdravkovic, S. (2018). Crowded living and its association with mental ill-health among recently-arrived migrants in Sweden: A quantitative study. *BMC Research Notes*, 11(1), 1-5. https://doi.org/10.1186/s13104-018-3718-6

Mellen, H. & Short, M. (2023). Designing for social interaction in high-density housing: A multiple case analysis of recently completed design-led developments in London. *Frontiers in Sustainable Cities*, 4, 1-56. https://doi.org/10.3389/frsc.2022.1043701

Milanovi, D., & Vasilevska, L. (2018). Influence of private open spaces on the quality of living in low-rise high density housing. *Facta Universitatis-Series: Architecture and Civil Engineering*, 16, 293-305. https://api.semanticscholar.org/CorpusID:115749699

Montgomery, C. (2013). *Happy City: Transforming Our Lives Through Urban Design* (Kindle Edition). New York: Farrar, Straus and Giroux. ISBN: 0374168237

Parra, D. C., Gomez, L. F., Pinzon, J. D., Brownson, R. C., & Millett, C. (2018). Equity in cycle lane networks: examination of the distribution of the cycle lane network by socioeconomic index in Bogotá, Colombia, *Cities & Health*, 2(1), 60-68. https://doi.org/10.1080/23748834.2018.1507068

Plane, D. A., & Mu, W. (2021). A people-based density perspective on physical/virtual world spaces in the microcosmic city. *Land Use Policy,* 111, 1-11. https://doi.org/10.1016/j.landusepol.2020.104462

Pons, F., Giroux, M., Mourali, M., & Zins, M. (2016). The relationship between density perceptions and satisfaction in the retail setting: Mediation and moderation effects. *Journal of Business Research*, 69(2), 1000-1007. https://doi.org/10.1016/j.jbusres.2015.09.005

Pont, M. B., & Haupt, P. (2007). The relation between urban form and density. *Urban Morphology*, 11(1), 62-65. https://www.researchgate.net/publication/289714646

Raman, S. (2010). Designing a liveable compact city: Physical forms of city and social life in urban neighbourhoods. *Built Environment*, 36(1), 63-80. https://www.jstor.org/stable/23289984

Sivam, A., Karuppannan, S., & Davis, M.C. (2012). Stakeholder's perception of residential density-a case study of Adelaide- Australia. *Journal of Housing and the Built Environment*, 27(4), 473-494. https://doi.org/10.1007/s10901-011-9265-2

Tahvonen, O., & Airaksinen, M. (2018). Low-density housing in sustainable urban planning – Scaling down to private gardens by using the green infrastructure concept. *Land Use Policy*, 75, 478-485. https://doi.org/10.1016/j.landusepol.2018.04.017

Tu, K. J., & Lin, L. T. (2008). Evaluative structure of perceived residential environment quality in high-density and mixed-use urban settings: An exploratory study on Taipei City. *Landscape and Urban Planning,* 87(3). 157-171. https://doi.org/10.1016/j.landurbplan.2008.05.009

Wen, L., Kenworthy, J., & Marinova, D. (2020). Higher density environments and the critical role of city streets as public open spaces. *Sustainability,* 12(21), 1-34. https://doi.org/10.3390/su12218896

Zacharias, J., & Stamps, A. (2004). Perceived building density as a function of layout. *Perceptual and Motor Skills*, 98(3), 777-784. https://doi.org/10.2466/pms.98.3.777-784

Zhang, K., & Yan, D. (2023). Exploring indoor and outdoor residential factors of high-density communities for promoting the housing development. *Sustainability,* 15(5), 1-18. https://doi.org/10.3390/su15054452