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Examination and Analysis of Flexibility and Movement in Housing Design to Overcome Crowding

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ABSTRACT:
Following modernization and the Industrial Revolution, where structural columns replaced load-bearing walls, open plans emerged as a consequence of this structural paradigm. These fundamental changes provided an opportunity for social and psychological considerations to evolve the spatial structure towards enhancing the comfort and well-being of occupants by utilizing spatial flexibility. The growth of urban populations and the lack of preparedness for urban living have led to both micro (single residential unit) and macro (urban society) overcrowding. This phenomenon, rooted in psychological and physiological aspects of human life, results in decreased quality of life, monotony, and disarray. This research aims to provide practical solutions to improve the quality of life by utilizing library resources and previously conducted studies on this subject.In the contemporary era, characterized by the transition from the Industrial Revolution to the Information Revolution, dynamism and movement are among the most critical attributes. Consequently, contemporary architecture, housing, and urban planning must, willingly or unwillingly, align with these attributes. Given that architectural products must continually metamorphose and adapt throughout their lifespan, they must inherently incorporate the essential principle of flexibility (physical, contextual, and structural). It is evident that architectural spaces must be designed to enhance the creative potential of occupants within a given living unit over time, allowing for mobility and modifications within the space under their control. Therefore, by employing strategies such as modular design, movable walls, multipurpose spaces, and smart technologies, the topic at hand can be continually updated. Undoubtedly, adopting a design approach based on spatial flexibility will significantly impact economic efficiency, improve quality of life, ensure environmental sustainability, and foster social adaptability.

Keywords: Flexibility, Overcome crowding, Environment and Social Behavior, Dynamism

INTRODUCTION:

Change is an inevitable aspect of life, and the human mind continually adapts to new forms, as society's members constantly evolve with new lifestyles. The impacts of new technologies, environmental and climatic changes, transformations in social relationships, and shifts in cultural structures are all evident in housing. However, sometimes the extent of these changes becomes so vast that society cannot remain indifferent; otherwise, it will fail to meet the needs of its audience. The pace of these transformations in society is so rapid that homes must undergo continuous changes to align with new needs and developments (Ali Al-Hesabi and Borhani, 2006). Additionally, due to the high cost of land and housing, the design and production of smaller residential units have become more prevalent. These units are often designed and executed without consideration of architectural principles or analysis of the wide range of individual needs by non-specialists, resulting in reduced spatial quality. Consequently, many residential units, despite having large areas, lack appropriate functional spaces. As a result, long-term living in such environments can have detrimental effects on human psychology (Hosseini, 2018).One of the prominent issues in housing design worldwide is designing housing as a static commodity with fixed components. This is referred to as the inflexibility of housing, which involves designing residential buildings based on short-term needs and market demands, causing social, economic, and physical problems (Zandiyeh, Eghbali, and Hesari, 2011). Buildings must no longer be designed statically to achieve flexibility; they must incorporate characteristics such as transformability, dynamism, and movement to respond to the changing needs of residents and their surroundings (Shafighnia, Taghizadeh, and Asefi, 2013). Flexible and adaptable design in space reduces overcrowding and meets many needs of residents, particularly in small housing units, and also serves as a starting point for innovative development. This type of design can be seen as a capability to respond to the changing needs of families, creating a link between space and time, and fostering greater dynamism. Flexible or adaptable housing is designed to accommodate different uses, needs, and family structures over time. This approach not only increases the longevity and functionality of housing but also contributes to sustainable living by reducing the need for frequent renovations or relocations.Our

goal in this research, considering the aforementioned points and previous studies, is to identify flexibility in housing design, revisiting these criteria and evaluating the effectiveness and efficiency of various solutions in reducing overcrowding and improving living conditions for residents. The aim is to find appropriate responses to social conditions and identify architectural strategies and techniques capable of adjusting and adapting to the evolving needs of society.

Research Question

Given that the primary interaction of humans with architecture occurs in residential spaces, which remain the most extensive context for realizing this way of life, identifying factors that enhance environmental quality and ensure resident satisfaction, while also creating vibrant and dynamic spaces that overcome overcrowding, is one of the primary questions of this research. In examining housing, various issues are considered, among which spatial flexibility plays a crucial role. Flexibility significantly contributes to the creation of multipurpose or multifunctional spaces and is one of the key issues addressed in this study. Therefore, this article explores the following questions: "What is flexibility, and how does it manifest in architecture? Can the perception of overcrowding be reduced, and how do individuals respond to it?"

Research Methodology

The selection of the research method depends on the objective, the nature of the research topic, and the available resources. Considering the data collection approach, this research falls under applied studies and aims to identify the most effective strategies and actions for enhancing the flexibility of buildings. Therefore, the research will be conducted using library resources and existing research projects in this field, followed by the organization and thematic categorization of the obtained information.

Analysis of Flexibility

Flexibility in architecture refers to the design of spaces and buildings that can quickly and easily adapt to changing user needs and environmental conditions. This approach helps optimize space utilization, reduce costs, and improve the quality of life for residents. Flexibility depends on functional, social, psychological, and economic factors and becomes increasingly important over time with changes in family residence patterns, seasonal and daily needs, and the activities of family members (Ainifar, 2003). In architecture, it addresses many changing needs in the interior and exterior spaces of residential environments. However, to evaluate a residential space, it is necessary to provide the conditions for the personal growth of each family member, young and old. Each family member should be able to find the appropriate space and privacy needed for their activities and to achieve psychological and physical comfort according to their mental and emotional needs and interests (Zabihi, Habib, Rahbarimanesh, 2011).

Table 1 - Definitions of the Concept of Flexibility from the Perspective of Theorists (Source: Altman, 2016)

Theorists	Definitions of the concept of flexibility
Peter Cook	Architecture is not merely a process; rather, it involves the introduction of change and flexibility within a process.
Gilles Deleuze	The philosopher is the creator of the concept, and architecture cannot simply synchronize its space and place with static conditions beyond this.
Daniel Libeskind	Architecture can only thrive within a democratic space.
Grok	Flexibility is the capacity of a building to accommodate various physical arrangements.
Herman Hertzberger	In the design of flexibility, there is no solution that prioritizes over other solutions.
John Habraken	Spatial flexibility can be achieved through active user participation and raising awareness among them.
Greg Lynn	Using innovative tools, techniques, and concepts, it is possible to create dynamic, flexible, and vibrant spaces.

In the midst of the 20th century, reactions to functionalism initially centered on flexibility. Flexibility was a crucial modernist term, especially in the post-1950s era, which introduced the hope of liberating functionalism from excessive determinism by incorporating time and uncertainty. Flexibility, in contrast to the assumption that all parts of a building must be predetermined for specific uses, emerged as a desirable feature in architecture with the recognition that not all functions need to be predetermined at the moment of design.The aim of flexibility in the discourse of modern architecture was to provide a way

to address the existing contradiction between expectations of architecture. An important concern in architectural design is the function of the building and human occupation, the reality being that human engagement with a building ceases the moment occupancy begins. Combining flexibility with design allows architects to nurture aspirations and anticipations for future control over the building beyond their actual period of responsibility (Hill, 2017).

The Three Types of Architectural Flexibility

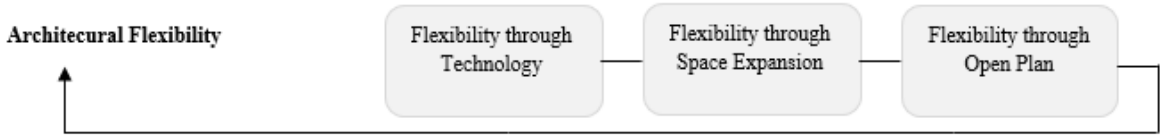

Chart 1: Types of Flexibility (Source: Author, 2024)

1- Flexibility through Technology: This type of flexibility involves a complex design with a fixed space and a limited spectrum of configurations. The second type is a conventional structure with lightweight and uniform panels that can be assembled on the floor, walls, and ceiling. Flexibility through increased utilization of technology is also a combination of biotechnology, cyber sciences, and architectural technologies.

2- Flexibility through Space Expansion: In this type of flexibility, the environment is so extensive that it can accommodate various uses, even though these uses are not defined at the time of construction.

3- Flexibility through Open Plan: Open plan, by offering a broad balance between space and function, is similar to flexibility through space expansion. Unlike flexibility through technological tools, it is less dependent on physical changes in the building. By combining flexibility and movement in architecture, designers present a new dimension to inhabitants, allowing them more interaction with the environment. Flexible architecture, due to its impactful influence on the environment, creates a new level of awareness and mindfulness in space users, resulting in a balance between interior and exterior awareness (Hill, 2017).

The Importance of Flexibility for Users: Architecture cannot create a flexible space without users, and to have a suitable and flexible space in architecture, the design approach must be geared towards enabling users to have more interactions with the space and transform from neutral performance to creative usability. Examples of passive users include residents who are accustomed and habituated, leading to the devaluation of both the user and the architect. Architects often assign a user with conventional habits, such as unpaid work, as there is no longer a distinct and recognized field for them to claim in architecture. In contrast, the concentrated thinking of an individual who becomes enthralled by an artistic work creates an unsettled crowd that absorbs the artistic work. This phenomenon is more evident in buildings. Architecture always offers an interpretation before encountering an artwork, which ends with a kind of distraction. In other words, three types of users are suggested:

Table No. 2 - Types of Users in the Environment (Source: Author, 1403)

Three Types of Users	Passive User	Predictability and incapacity in transforming the spatial function and meaning.
	Reactive User	It alters the physical attribute of space based on the need but within the limited spatial scope defined by the architect.
	Creative User	It creates a new space and imparts new meaning and function to the existing space.

Strategies for transforming reactive and passive users into creative users

Flexibility through technological tools suggests replacing a passive user with a reactive one and creates strategies to transform a reactive user into a creative user.

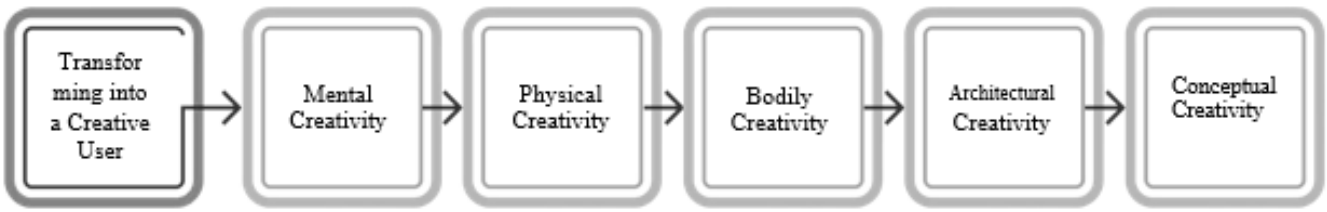

Diagram 2 - Strategies for Transforming Passive Users into Creative Users (Source: Author, 2024)

Mental Creativity: It involves a change in the perception of space, such as renaming a space or associating it with a particular memory.
Physical Creativity: It entails rearranging a space or the objects within it.
Bodily Creativity: It includes a movement or a series of independent movements within or adjacent to a space.
Architectural Creativity: It pertains to the creation of a new spatial form or the physical expression of a space or existing object.
Conceptual Creativity: It involves conceptualizing a spatial form or object based on a particular concept.
To stimulate users to engage in the transformation of buildings, strategies are proposed, which initially involve creating multi-functional spaces and then leaving them incomplete and implementing a partially constructed building design, in which everyone can complete it according to their needs and desires. Because providing opportunities for user participation in the design process increases their motivation for creativity and self-expression in design, facilities such as shared spaces, simple and user-friendly design tools encourage users to participate in the design process and enable them to identify the strengths and weaknesses of the design, thus helping to improve the design process. By adopting these strategies, users can be transformed from passive consumers to active and creative participants in the design process and the flexibility of housing (Hill, 2017).

Movement and Flexibility in Space and Elements

In architectural design, the term "flexibility" refers to organizing human-made space and making changes to it to meet new conditions and needs. The concept of flexibility requires proper organization and planning, appropriate dimensions and sizes, spatial arrangements, and strategies, all of which, when observed, enable the design to be flexible in nature; otherwise, the organization of interior spaces becomes chaotic and crowded (Albostan, 2009). The subdivision of plans plays a significant role in the architectural structure of a building. Designing space with high flexibility in terms of layout and surface arrangement can create various functions (Ainifar, 2002). Features such as lightweight and portable dividers, transparency, color schemes tailored to existing needs, material diversity, and attention to the arrangement and interaction between different spaces are elements that can enrich architectural plans. Flexibility, dynamism, and the use of indoor space according to our need to create security, ownership, and identity contribute to moving towards life. Flexible interior space leads to creative and dynamic quality, and in other words, moving from one place to another creates diversity, attractiveness, and departure from rigidity, and the multipurpose use of a space according to new needs (Asafi & Ahmadnejad Karimi, 2016). The ability to change usage is one of the most important features of flexibility and is the most fundamental level, which is specifically addressed. The aim of this design approach is to create rooms with predetermined dimensions and sizes that can accommodate various functions (Friedman, 2000). For form, space, time, and movement in architecture in the modern era and using new tools, techniques, and innovative thinking, architectural form and space can be defined as dynamic, flexible, and vibrant. By using new philosophical approaches and concepts of movement, force, or evolution in time, flexibility can be maximized. In this regard, the discussion of stability, steadiness, and stasis in architecture is challenged in the hope that architecture can move from lifelessness to dynamism and movement (Lynn, 2017). Flexibility and construction in architecture can be classified into these three categories:

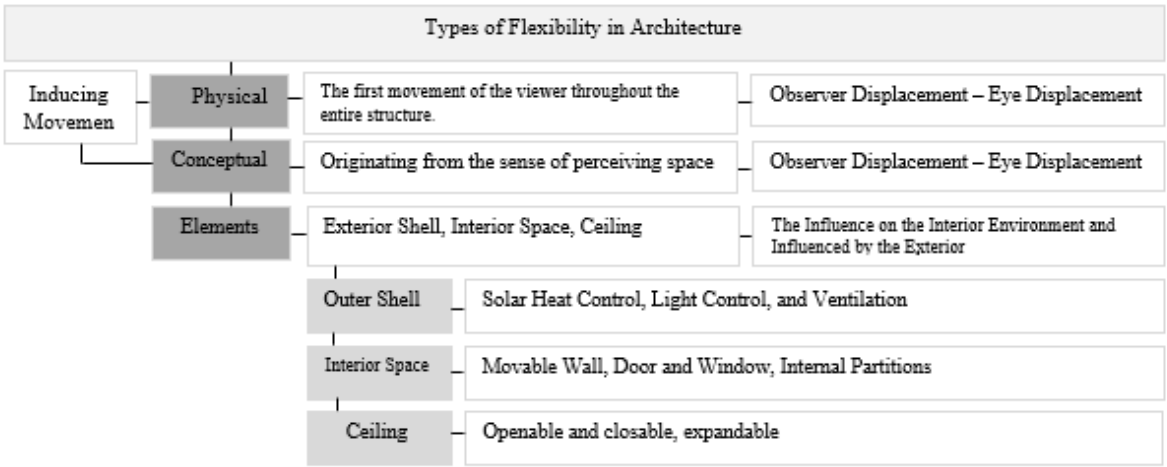

Diagram 3 - Types of Flexibility and Movement in Space and Architectural Elements (Source:Asafi,Ahmadnejad Karimi, 2016)

Crowding

Crowding and overpopulation are social issues today that are as important as energy crises and environmental pollution. Some believe that crowding leads to physical, physiological, and psychological impairments and manifests as diseases and other social damages. In summary, crowding occurs when secluded mechanisms fail to function successfully, meaning the achieved seclusion is less than desired. When these mechanisms lead to less than the desired relationship, the individual experiences social isolation, and when the relationship exceeds the desired level, crowding occurs. Crowding is a personal and mental reaction, not a physical variable. Crowding is a motivational state that often leads to purposeful behavior to alleviate discomfort resulting from the feeling of space insufficiency. According to Stokols' observations, the feeling of crowding is always associated with psychological or physiological pressure, where psychological pressure includes a sense of cognitive instability (the discrepancy between an individual's inclination towards space and the actual space available). Crowding is not a simple concept; it applies to large populations such as cities where population density is high, as well as relatively small groups like families. Therefore, understanding the concept of crowding requires clarification of its dimensions and acceptance of its complexity (Shahcheraghi,Bandarabad,1402). When individuals require more physical space, when their path towards the desired goal is blocked, when others encroach upon their territory, and when they spend long or short periods in high-density situations, these examples all refer to various dimensions of crowding such as access to space, access to resources, and invasion of the duration of contact with others (Altman, 2016). Some researchers have defined crowding as the perception of excessive stimulation from social resources in the environment. Crowding is associated with a sense of lack of control over the environment and is influenced by an individual's perception of the level of control others have over their intrusions. Therefore, the sound of a radio or the transportation of furniture imposes more interference than the sound of vehicle traffic. This is because the sound of the radio is controllable, and household items can be moved at a more appropriate time (Leng, 2004). In some instances, you may not feel crowded in a gathering of forty friends and acquaintances at a celebration, but you may feel very uncomfortable in a group of only four strangers. In fact, an individual can be with a group of friends and not feel crowded, but may feel that the same number of strangers makes the surroundings crowded or congested (Altman, 2016).

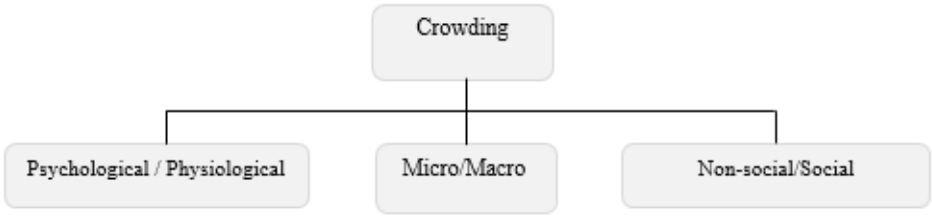

Image 1: The individual does not feel congested with a group of friends (Source: Author, 2024)
Image 2: The person feels crowded with the same number, but strangers (Source: Author, 2024)

Researchers have defined two types of congestion: social congestion, which primarily results from the excessive presence of individuals in a space, and non-social congestion, where only physical factors create a sense of space shortage. Congestion is also discussed on both small and large scales. This means that the feeling of congestion can be related to urban populations on a large scale as well as to individuals, small groups, and interpersonal events.

Diagram 4 - Categorizations of the concept of congestion in environmental psychology(Source:Shahcheraghi,Bandarabad,2023)

In summary, congestion results from the disorder at the boundary between oneself and others, arising from situational factors such as high density and disorder, individual factors such as lack of experience, and a range of organic and psychological factors such as psychological pressure, restlessness, and fatigue (Shahcheraghi,Bandarabad,2023).

Image 3 - Someone does not feel crowded in the presence of physical orde .(Source: Author, 1403)

Image 4 - When order is disrupted, the feeling of crowding increases (Source: Author, 1403).

Today, numerous studies have been conducted to control crowding. For example, in a high-rise building, residents on higher floors experience less crowding compared to those on lower floors (Nasar & Min, 1984). It has been found that increasing the ceiling height reduces the sense of crowding in the environment for men (Savina, 1975). Furthermore, rooms with defined corners induce less crowding sensation compared to rooms with curved walls (Rotton, 1987). Research has shown that rectangular rooms induce less crowding sensation than square rooms. Also, rooms with a view and multiple openings induce less crowding sensation compared to rooms without openings and views. By utilizing walls, partitions, and other architectural features of the building, the sense of crowding can be altered. The more flexible the space, the less crowded a person feels. If an individual remains in a highly congested and undivided environment for a long time, excessive crowding is experienced (Desor, 1972).Some researchers believe that Japanese society is one of those that has managed to devise skillful strategies to cope with life in crowded environments. Therefore, for preventing physical and psychological costs and social damages, especially in the long term, flexible design in building spaces and urban environments should be used to overcome crowding and congestion (Altman, 1395).With the provided explanations, the sense of crowding in the environment should be controlled and restricted. Efforts should always be made to control

the feeling of crowding. Moreover, in the design of the environment at various scales, crowding can be reduced or eliminated.

Crowding and Density

Density is an objective description, whereas crowding is a phenomenon dependent on individual experience. Although population density plays a fundamental role in the emergence of the feeling of crowding, this feeling is a mental phenomenon influenced by psychological factors on the one hand and environmental and cultural factors on the other (Mortazavi, 1380). In this regard, Altman, based on Stokols' findings (1972), writes that density is a necessary condition for the feeling of crowding but not a sufficient condition. The effects of crowding on humans can be divided into physiological, behavioral, and psychological effects. Physiological effects include consequences such as increased blood pressure and other biochemical changes. These changes intensify physiological activity and also manifest other behavioral effects. For example, when density increases, we walk faster. Antisocial behaviors, ranging from avoidance to aggression, are among the other behavioral outcomes of crowding. In fact, when our goals remain unfulfilled and we are under pressure, our reactions become more intense and severe, reflecting a tendency to preserve or regain our freedom of choice. Finally, crowding may also have psychological effects. These psychological effects are mainly due to the pressure of sensory information exceeding a certain threshold. Gifford, in this regard, refers to the desensitization of individuals to disorder. For example, he explains that in the streets of large cities, many poor individuals exist; most citizens, unable to attend to the needs of each individual they encounter, cannot manage their lives in a balanced manner (Altman, 1395). Humans' reactions to crowding range from arousal to changeable cognitive impairment reactions. However, since residents of crowded environments are usually affected by other disabilities such as low income, low education, and poor-quality housing, the negative reaction cannot solely be attributed to crowding. When other factors are controlled, apparently, crowding has no negative consequences (Fargas, 1399). Some urban planners and architects believe that individuals are entirely subject to their surrounding environment and behave according to environmental stimuli. In other words, it is believed that by merely beautifying and designing the physical structure, citizen satisfaction and qualities such as happiness, sense of belonging, etc., can be achieved. However, contrary experiences have proven otherwise. Many urban and architectural spaces, designed and implemented with appropriate physical qualities, are poor in terms of functional and conceptual qualities. Many local parks or other urban areas have fully equipped urban furniture, but people are not inclined to stay in these spaces. Therefore, they have become soulless and unsafe spaces. The biggest mistake of designers who adhere to the physical determinism is that they summarize the environment and its effects on citizens in the body, especially the observable (visual) part, and forget about other environmental aspects (Pakzad, Bozorg, 1400).

Crowding in the Environment

Crowding refers to conditions in which the number of individuals residing in a space exceeds its standard capacity. These conditions can lead to problems such as stress, reduced privacy, decreased air quality, and increased noise levels. Crowding results in a reduction in the quality of life and an increase in health and psychological problems (Smith, S. K. 2000).

Density in the Environment

Density refers to the degree of compactness of buildings and individuals in a geographic area. This concept can be examined from two aspects: population density and building density. Population density refers to the number of individuals living in a residential unit

or area, while building density refers to the ratio of built area to land area (Churchman, A. 199).Crowding and density in the environment pose challenges for residents and urban managers. Through appropriate design solutions, smart technologies, and balanced urban planning, better management of these challenges and improvement in the quality of life for residents can be achieved.

Overcoming overcrowding with consideration of flexibility

With the passage of time and the increasing densification of urban spaces, alongside the greater adjacency of city buildings, the need for different and flexible spaces, as well as open spaces, considering the restricted urban space and regional culture, is considered one of the necessities of the new era. In cities with high density and the resulting crowding, there is still insistence on segregating spaces in design. However, flexibility should replace rigidity. By creating "undefined spaces," in terms of functionality, occupants may have more intervention in defining and changing their activities within the space.On the other hand, leaving a large portion of space unused during certain times of the year and maintaining it warm or cool is not only economical but also captures vitality and dynamism from that environment. In addition to flexible and metabolic design, another solution to overcoming the feeling of crowding is personal solutions by individuals, as humans naturally monitor the boundary between themselves and others by creating territory and choosing seclusion in the environment. However, concerning flexibility, some architects, including contemporary Japanese architects, have adhered to the principles of flexibility in the past architecture of their country and have modernized this idea.In Japan, where there has always been a serious shortage of land, despite the increase in population in this country, Japanese society demonstrates skillful adaptation to life in crowded environments. Japanese people make their homes flexible and use one part of the house for multiple purposes with the help of movable walls.While in most modern urban homes, usually one room serves more than one function, in Japan, one room can serve as a dining room, a children's playroom, and occasionally a bedroom within the same unit. Some have termed this utilization of home space as a metabolic approach to design, indicating change and growth. Additionally, the Japanese employ the art of miniaturization (bonsai) in their gardening. They create distance by precisely defining the location of their homes with the help of walls and arranging and adjusting interior spaces between themselves and the neighborhood and city, which are often crowded and noisy. In this way, they create a physical barrier around the family to avoid unintended interactions. (Shahcheraghi, Bandar Abbas, 1402). Designing such spaces requires approaches and solutions that, utilizing movable walls and partitions, multi-purpose areas, public and shared spaces, and smart technologies, can create greater dynamism and flexibility in the environment. Therefore, flexibility and mobility in architectural design mean the readiness and ability of spaces and buildings to dynamically adapt and adjust based on changing needs and conditions. In this regard, architects, by employing flexible tools and methods, can design spaces that are adaptable to the variable needs of society, thus helping to reduce and manage overcrowding and improve the quality of life for citizens.To overcome overcrowding through flexible architectural design, several creative and effective strategies can be employed. These solutions not only help improve the residents' quality of life but also lead to optimal use of space and reduction of population pressure. Below, key methods for utilizing flexibility in architectural design to overcome housing overcrowding are outlined:

Table 3: Flexible Design Methods for Overcoming Housing Overcrowding (Source: Author, 1403)

Definitions	Methodology
Apartments with modular units that can be added or removed, allowing residents to expand or reduce their living space.	Modular Design
Folding or collapsible walls that can create larger spaces or separate rooms and allow residents to modify the interior space according to their needs.	Movable walls
It aids in optimizing the use of available space and includes rooms that can function as a home office, guest bedroom, or children's play area.	Multifunctional Spaces
Multifunctional furniture allows residents to use their space flexibly. Foldable beds that can also be used as desks or sofas, and extendable tables that can expand, are examples.	Multifunctional furniture
Utilizing vertical spaces can contribute to optimizing the efficient use of available space. Mezzanine floors can be employed to create additional rooms. Utilizing walls for storage and organization of items.	Vertical Space Optimization
Creating public and communal spaces in residential complexes helps distribute population pressure. These spaces may include community halls, playrooms, shared recreational areas, gardens, and communal green spaces for the use of all residents.	Public and Shared Spaces
Integration of smart technologies in housing can assist in the optimal management of space and resources. Smart energy and ventilation management systems help reduce energy consumption and enhance residents'	Smart Technology
Designing spaces that can adapt to the variable needs of residents contributes to improving efficiency and reducing congestion. Versatile residential units that can be used as living, working, or commercial spaces.	Adaptability to Variable Needs
Designing spaces that can adapt to the variable needs of residents contributes to improving efficiency and reducing congestion. Versatile residential units that can be used as living, working, or commercial spaces.	Utilizing Outdoor Space
Resident engagement in the design process can contribute to creating spaces that better meet their needs. Holding consultation sessions and collaborating with residents to better understand their requirements in space design.	Resident Engagement in Design

By employing these strategies, it is possible to effectively address the challenges associated with housing overcrowding and design living spaces in a way that is responsive to the variable and dynamic needs of society. These approaches not only contribute to improving the quality of life for residents but also lead to greater sustainability and efficiency in residential environments.

CONCLUSION

Identifying and prioritizing flexible typologies in housing qualitative planning accompanies designers. The flexible typologies identified in this study indicate that flexibility assists the adaptability of spaces and buildings to the diverse and variable needs of users. This approach aims to create environments that can quickly and easily change to meet various needs and the growing demands of society. Versatility is one of the most important and appropriate solutions to meet the needs of residents, which has been investigated from various aspects, including the design of multipurpose spaces, the use of innovative technologies, and the deployment of adaptable structures that can anticipate specific spatial needs. Among these, flexibility, with the ability to create compatibility or change in the structure and space for various uses, is one of the fundamental concepts that leads to the improvement of the quality of living space. Flexibility can regulate changes in social and technological aspects, including the potential for pre-occupancy adjustments and the ability to adjust flexible housing throughout life, even after occupancy. Such an approach gives users the option to choose in the housing design before occupation and enables people to use housing for various purposes after occupation. Flexible housing has benefits in housing that reduce renovation and relocation costs, allowing residents to adapt their homes to their needs over time and prevent the need for buying new property or major construction work.

Table 4 - Flexible Design Approaches to Address Housing Density (Source:Author,1403).

Benefits of Flexible Housing	
Flexible housing reduces the costs of renovations and relocations, allowing residents to adapt their homes to their changing needs over time and avoid the purchase of new properties or undertaking major construction work.	Economic Efficiency
Through adaptability, flexible housing enhances residents' quality of life. It allows them to create spaces that reflect their personal preferences and lifestyles, leading to greater satisfaction and contentment.	Enhancing Quality of Life
Flexible housing contributes to sustainability by minimizing waste and resource consumption. The ability to adapt spaces instead of demolishing and rebuilding reduces the carbon footprint associated with construction and demolition activities.	Environmental Sustainability
Flexible housing supports diverse family structures and evolving social norms. This type of housing can accommodate single individuals, nuclear families, multigenerational households, and co-living arrangements, thereby fostering inclusive communities.	Social Flexibility

While flexible design in buildings can contribute to improving the quality of life and space efficiency, it also presents its own challenges that need to be carefully examined and managed. High initial costs, the need for specialized maintenance and repairs, complexity in design and construction, design constraints, resistance to changes, and legal and regulatory challenges are among these challenges. For the success of flexible project implementations, the need for careful planning, appropriate technical knowledge, and collaboration among all stakeholders must be taken into account to bring the project to an optimal and quality conclusion. The use of the obtained results provides the creation of residential units tailored to the needs of residents. The types of flexibility resulting from this research will effectively enhance the quality of living space in apartment residential units by overcoming overcrowding.

REFERENCES

1.Asafi, Maziar; Ahmadi Nejad Karimi, Majid (2016). Mobile Architecture Technology: Theoretical and Practical Principles, Transformable Architecture. Tehran: Parham Naghsh.

2.Altmann, Erwin (2016). Environment and Social Behavior: Solitude, Personal Space, Territory, Crowding, translated by Ali Namazian, edited by Javaher Afsar, Printing and Publishing Center, Shahid Beheshti University, Tehran.

3.Pakzad, Jahanshah;Bozorg, Hamideh (2021). The Alphabet of Environmental Psychology for Designers, Samin Publications.

4.Hosseini, Seyyed Hadi (2018). A Review of Global Policies on Affordable Housing and Presentation of Proposed Framework for Housing Planning in Iran. Architecture and Urbanism Monthly, No. 1, 1-11.

5.Zabihi, Hossein; Habib, Farah; Rahbarimanesh, Kamal. (2011). Investigating the Relationship Between Satisfaction with Residential Complexes and the Effect of Residential Complex on Human Relationships. In Urban Identity Journal, Issue 8 (Spring and Summer 2011), pp. 103-118.

6.Zandieh, Mehdi; Aghabali, Seyed Rahman; Hasari, Pedram (2011). Flexible Housing Design Methods, Role of the World, Number One, Autumn and Winter.6

7.Shahcheraghi, Azadeh; Bandarabad, Alireza (2023). “Enclosure in the Environment," Tehran University Press.

8.Shafiee Nia, Mahsa; Taghizadeh, Katiyon; Asafi, Maziar (2013). "Investigating the Role of Mobile and Openable/Closable Structures in Achieving Flexible Architecture," International Conference on Sustainable Architecture and Urban Development, Iran.

9.Ali Al-Hasabi, Mehran; Borhani Darian, Farnaz (2006). Flexible Housing, Housing and Revolution Journal, No. 117, Indexed in the Office of Islamic Research Studies of Astan Quds Razavi.

10.A'inee Far, Alireza (2003). A Model for Analyzing Flexibility in Traditional Housing of Iran. Fine Arts Magazine.

11.Fargas, Joseph (2020). Social Interaction Psychology (Interpersonal Behavior), translated by Mehrdad Firouzbakht, Khoshyar Bigi, Abjad Publishing Center.

12.Lang, John (2004). Creating Architectural Theory (The Role of Behavioral Sciences in Environmental Design), translated by Alireza A'ineh Far, Tehran University Press, Second Edition, 2004.

13.Mortazavi, Shahnaz (2001). Environmental Psychology and Its Application, Shahid Beheshti University Press.

14.Lynn, Greg (2017). Form as Dynamic Display, translated by Yahya Eslami, Sadeghe Mirgazdar Langroudi, Kassra Book Publishing Center.

15.Hill, Jonathan (2017). Architectural Events (Architects and Creative Audiences), translated by Mahshid Moatamed, Kasra Book Publishing Center.

16.Albostan , D. “Flexibility”, in Multi-residential Housing Projects: Three Innovative Cases from Turkey, July 2009.

18. Churchman, A. (1999). Disentangling the concept of density. Journal of Planning Literature, 13(4), 389-411.

19. Desor,J.A.(1972):Toward a Psychological theory of crowding , Journal of Personality and social psychology,21.

20. Friedman, A. The Adaptable House: Designing Homes for Change, New York: McGraw-Hill, 2002.

21. Nasar,J.L,& Min , M ,S .(1984):Modifiers of perceived spaciousness and crowding ,A cross Cultural study,paper presentedat the annual meeting of the American psychological Association , Toronto , Canada.

22. Savinar, J. (1975): The effect of ceiling height on personal space,Man-Environment systems,5.

23. Smith, S. K. (2000). Urban overcrowding: An analysis of its causes, consequences, and solutions. Journal of Urban Planning and Development, 126(2), 47-56.

24.Rotton,J .& Kelly,I.W.(1987):Comment on : The lunar-hunacy relationship More ado about the full moon,Psychological Bulletin,97.