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The Emotional Experience Dimensions of The Residents of Apartment Units During the Coronavirus Pandemic (Case Study: Tehran)

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Abstract

During pandemics, people are more susceptible to high stress, which is caused by the dread of disease, the consequences of home quarantine, the illness and death of family members, remote work activities, and virtual schooling. As this might not be the last outbreak, we need to be well-equipped with greater adaptability and resilience. The research purpose is to investigate and then rank the components affecting the user's emotional experience (increasing relaxation and reducing stress) in the communal space of residential apartments in Tehran during pandemics. The ranking was based on the extent and type of psychological effect. This research seeks to answer the main question: What architectural components of the communal space of the apartment houses (living room), during the period of the coronavirus pandemic have an impact on creating or enhancing relaxation and decreasing the stress levels of residents?. The research method is descriptive-analytical. Initially home-associated comforting components and recommended components for the pandemic era were scrutinized by reviewing the research literature. Moreover, components suggested by the authors were examined. The research components were classified into three categories: physical components, sensory components, and personal components. The components were evaluated through a qualitative interview with 10 architectural professors to confirm the validity of the research. Then, the data were collected and ranked through a qualitative questionnaire (including demographic information and Panas standard questions based on positive and negative emotional poles on a 10-point Likert scale) from a sample size of 405 people. The collected data were analyzed by SPSS using Shapiro-Wilk, Friedman, one-way ANOVA, unpaired t, Kruskal-Wallis, and Mann-Whitney U tests. The results show that the most important components affecting positive emotional experience include openable windows that facilitate the flow of fresh air, the entry of natural light, and a semi-open space (a terrace or balcony). However, partitioning and creating individual spaces and higher dimensions of proxemics to family members had the least priority on positive emotional experience.

Keywords: Architectural experience, stress and relaxation, residential unit, Coronavirus pandemic, quarantine

1. Introduction

Human experience in the built environment shows that the environment influences mental well-being, resulting in psychological, physiological, and emotional reactions (Ergan et al., 2019, 1). As one of the primary foundations of the built environment, architectural space elicits cognitive-emotional reactions (Higuera-Trujillo et al., 2021, 1; Tuszynska et al, 2020, 120), especially housing that is inextricably linked to its users. Unconscious emotional responses to architectural spaces can be negative (e.g., tension and anxiety, rage, loss of attention, etc.) or positive and well-being-oriented (e.g., concentration, relaxation, happiness, concentration, etc.). One of these prevalent mental health illnesses is stress, which is discussed in this article.

Stress is a person's reaction to external pressures or improper conditions (Sladek et al., 2016,9). Pandemics, including Corona, which the World Health Organization labeled an epidemic on March 12, 2020 (Ciotti et al., 2020, 365), have had a wide-ranging detrimental impact, including increased stress and associated diseases. The infection of a large number of people (770,778,396 people worldwide until March 28, 2023), many deaths (6,958,499 people worldwide until March 28, 2023) (URL1), hospitalization in medical centers and hospitals, long quarantine time, fear of disease contagion, despair, fatigue, low protective equipment, insufficient information, financial loss, rumors, negative beliefs about vaccination, and stigma are among the stressful factors of this period (Fathi Ashtiani et al., 2020, 1).

Belzunegui-Eraso and Erro-Garcés (2020, 5) stated that remote work can have detrimental consequences for employees, including reduced social connection and isolation, which can lower productivity and worsen health. The tension that was previously felt at work or school, particularly among employees and students, can also be transferred to the living environment through virtual schooling. In addition, those who have been in quarantine are more likely to experience mood swings, impatience, anger, fear, anxiety (Polizzi et al., 2020,59), insomnia, learning challenges, and acute and post-traumatic stress (Brooks et al., 2020,913). They also experience the worsening of non-communicable diseases, such as some chronic conditions including diabetes, depression, and cardiovascular diseases (Amerio et al., 2020,6); Quarantine is particularly difficult for people

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who reside in cramped, compact homes or without access to open spaces (Saada et al., 2020, 3).

Aside from these issues, most rural and urban residential units do not meet the health requirements of the living environment during the pandemic period (Hajjar, 2021, 10), and a new definition of housing, namely "housing for the pandemic period," has been added to the previous definitions. There are a lot of unsolved difficulties with high-stress user comfort scenarios. In this regard, no study has been conducted on the components that increase relaxation and stress relief for apartment residents during this period.

Identifying comforting and stress-reducing factors during this period will lead to modifications in house architectural design methods by addressing health and architectural needs. Moreover, architects can collaborate with doctors and healthcare experts to tackle the difficulties described effectively. We need to accept that COVID-19 will not be the last outbreak (Spennemann, 2021, 199) and the relevance of the restorative features of architecture can minimize stress and mood disorders, as well as the necessity for therapeutic and pharmacological techniques.

Purpose: Given that, in most societies, residents of residential apartments spend the majority of their time in the living room, bedroom, and balcony, respectively, during the coronavirus pandemic (Hajjar, 2021,10), the goal of this study is to investigate and then rank the components affecting the user's emotional experience (increasing relaxation and reducing stress) in the communal space of residential apartments (living room) during pandemics. The ranking is based on the amount and type of psychological effect. It is hoped that the results of the study will help experts and architectural designers come up with the best architectural design patterns.

Research question: What physical components of the architecture of the communal space of the house (living room), in the period of pandemics such as the COVID-19 virus, have an impact on creating or enhancing relaxation and decreasing the stress levels of users? Research hypothesis: some physical characteristics of the architecture of the communal space of the house (living room) affect the emotional experience (levels of relaxation and stress) of the residents during pandemics.

Components identified by reviewing the research literature and suggested by the authors were examined through a qualitative interview with 10 architectural professors and ranked through a qualitative questionnaire including demographic information and Panas standard questions based on positive and negative emotional poles on a 10-point Likert scale.

2. Research Background

2.1 Residential space and pandemics

According to Figure 1, a relatively big pandemic has occurred across the world every 13 years on average over the previous 100 years, with each one lasting roughly 2 years on average. As a result, the architecture must be improved to deal with the epidemic. The research background shows that reforms have been made in architecture and living and working spaces by humans during epidemics in the world. For example, the fight against tuberculosis started in the 1830s and resulted in the health movement for a health-oriented architecture in sunlight and ventilation, or the Spanish flu pandemic in 1918, which improved ventilation standards and led to significant changes in open spaces and air circulation. This was achieved by a better knowledge of how contagious influenza spread and subsequent laws in the United States requiring hallways to be at least 0.90 meters wide with private toilets in apartments (Hajjar, 2021,6,7). Also Corona pandemic has a direct relationship with the theoretical and practical foundations of urban planning and architecture (Allam, Jones, 2020,1). As a result, each pandemic has introduced new requirements in the fields of building and user health. In this research, the scope has been limited to the Corona pandemic, since the death toll and the number of cases infected by COVID-19 have recently caused a very intense level of stress for the majority of people. To gather more reliable data, the questionnaires were also collected during the outbreak of the Corona pandemic from all samples, but this was not possible with other pandemics.

In his research titled "Residential Architecture in the Post-Pandemic World," Spenman (2021) put forward design strategies such as creating a space that can be isolated, separating the mostly uncontrollable external environment from the internal residential space, and separating residents' entertainment spaces from private sleeping spaces. In "Anti-Virus Built Environments: Lessons Learned from the COVID-19 Pandemic," Megahed et al. (2020) investigated the components of an anti-virus and health-oriented environment in this period.

Hajjar et al. (2021) also proposed a new home design concept for post-pandemic apartments in Lebanon. Furthermore, Zarrabi et al. (2021) in " COVID-19 and Healthy Home Preferences: The Case of Apartment Residents in Tehran" and keshtkar et al. (2022) “Functional Principles of Housing Design in Proportion to Lifestyle Changes during Pandemic (Case Study: Covid-19 Epidemic in Tehran)’ presented the housing design indicators of this period in Iran.

2.2 Residential space and levels of perceived relaxation and stress:

The suggested studies have frequently been undertaken on the issues of "general or functional design requirements of housing" during the Corona period**,** and no research has been conducted on the component boosting relaxation and lowering stress in the residential space during the pandemic period. However, some features have profound effects on the user's peace of mind in all periods, and by removing them, the validity of the research is not possible. These components are mentioned below:

Dimensions of space: A high ceiling enhances the sense of freedom (Meyers-Levy & Zhu, 2007,176) and the perception of beauty (Vartanian et al., 2015,10). In contrast, a lower ceiling causes a sense of confinement

((Meyers-Levy & Zhu, 2007,176). It is also vital to create bigger hallways, front entrances, entrances, and staircases during this era (Megahed & Ghoneim, 2020,4) and enhance living space area (Hajjar, 2021,11) since there is a direct association between depression during the Corona pandemic phase and the area of living space. There is a direct relationship between depression during the pandemic and the low area (less than 60 square meters) of residential units (Amerio et al., 2020, 5).

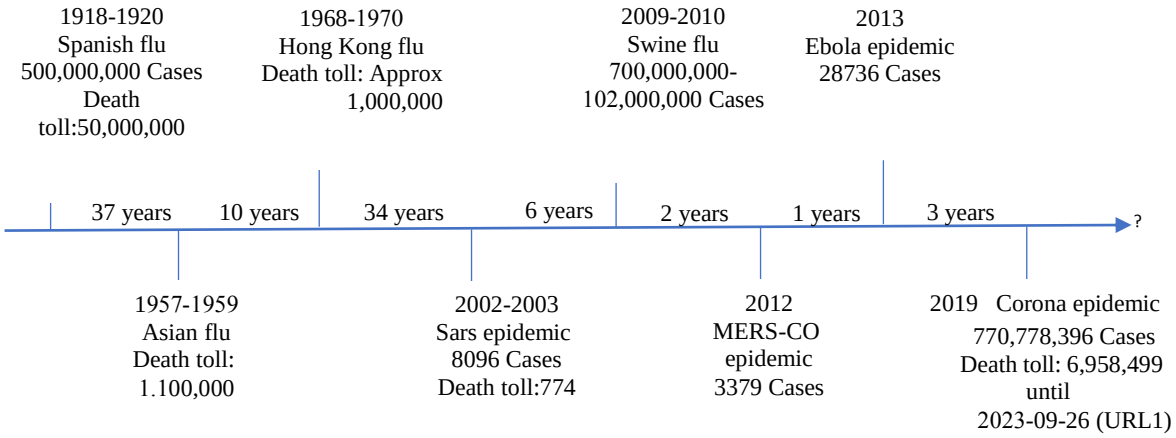

Fig. 1. Time diagram: infected population, death toll, and intervals.

Light: Several studies have underlined the increased penetration of sunlight (Megahed et al., 2020,5; Allen et al., 2020; Zarrabi et al. 2021,5). Ergan et al. (2018) demonstrated that increased light intensity in comparison to dark places decreased stress and that it may even influence the mental health of patients and minimize the usage of painkillers in hospital rooms (Walch et al., 2005,156). Blue light also hastens relaxation following stress (Minguillon al., 2017).

Window: improving Increasing indoor air quality through increasing the ventilation rate and creating natural air circulation (Zarrabi et al., 2021,5) is the most important thing to do during quarantine, and residents should not make the mistake of keeping the windows closed (D'Alessandro et al., 2020, 6). Wider windows create a sense of openness and pleasantness, as opposed to a sense of gloom and confined space (Ergan et al., 2018; Ozdemir, 2010, 2275). sick building syndrome[1] may also disrupt serenity by causing headaches, burning eyes, nose, and throat, exhaustion, dizziness, and nausea (Spence, 2020, 8), which, given the big windows that can be opened by a person, allows natural light to enter. Rectangular, square, circular, and semi-circular arches have been identified as pleasing window forms, while triangular and centaur-shaped forms have been identified as unfavorable (Naghibi Rad et al., 2019,5).

Temperature and humidity levels: Not only are variables of visual perception useful in sustaining a person's serenity, but so are factors of multisensory experience of space such as temperature, air humidity, fragrance, and sound (Passe, 2009,2) (D'alessandro et al., 2020,8). Furthermore, the transmission of any airborne virus in the interior environment is affected by a variety of parameters, including population density, temperature, UV rays or antiviral chemical exposure, humidity, and ventilation rate (Allen et al., 2020, 1).

Semi-open spaces: Creating a semi-open space such as terrace or balcony is one of the most beneficial variables contributing to inhabitants' pleasant emotional well-being (Tarale et al., 2020, 1387; keshtkar et al., 2022,63). It also allows for mingling with neighbors and friends while maintaining social distance (Hajjar, 2021, 6). There is a direct relationship between depression during the pandemics and unusable terraces or balconies at homes (Amerio et al., 2020, 5).

Greenness: Stress recovery is one of the psychological impacts of incorporating nature's qualities into the design of built spaces or biophilic (Martnez-Soto et al., 2021,3). Natural visual impacts, as opposed to urban and built environments, promote psychological stress recovery and boost mood and attention (Alvarsson et al., 2010,1036; Van den Berg et al., 2003,144), especially access to green spaces can contribute to mental well-being (D'alessandro et al., 2020,62).

Soothing activities: There are a variety of factors contributing to maintaining a state of serenity and relaxation, for instance, meditation, breathing exercises, interacting with animals, social interaction (Nukarinen et al., 2022, 6), cooking, watching TV, and working on the Internet and using social networks virtually, remote work or virtual education (Hajjar, 2021,6-8-9; Mahdinejad et al., 2023, 4), sports, and gardening and cultivation at home (Hajjar, 2021, 8–9)

Flexible spaces for Remote work or virtual learning: During the coronavirus pandemic it is also advised to create flexible and multi-functional spaces (Megahed & Ghoneim, 2020,4), particularly spaces connected to

[1] SBS

remote work and education (D'alessandro et al., 2020,4) (Hajjar, 2021,6).

Antibacterial and washable materials: The use of hygienic, antibacterial, and antiviral materials has been recommended in building systems such as copper and surfaces that are easy to clean (D'alessandro et al., 2020, 9).

Proxemics: In his book, "The Hidden Dimension", Edward Hall (1966) introduced the concept of proxemics and four main areas of communication distance between people: "intimate space: between 0-0.45 meters" for close physical contacts such as spouses and family members; "personal space: 0.46-1.22 meters" for interaction between close friends and family members; "social space: 1.2-3.5 meters" for interaction with friends and colleagues; and "public space: more than 3 meters" for interaction with strangers. However, physical contact limits, "social distance" standards (such as the 1.5-meter rule), safety advice such as wearing a mask, and the increased risk of disease transmission in proximity resulted in a new idea of the proxemics (Gramigna, 2020, 100). Veronese's (2021) research found that with a suggested minimum distance of 1.5 meters among people during the pandemic, we are actually witnessing the crushing of intimate and personal space into one group, and the resurgence of "filter" spaces such as terraces or balconies is also due to maintaining the distance between people.

Form : Curved shapes elicit drive and pleasantness, while angular ones indicate avoidance (Vartanian et al., 2013,3). Sharp features, especially those oriented downward or human, may be viewed as menacing and elicit avoidance reactions (Salgado-Montejo et al., 2017, 512). Curved shapes in space furniture promote relaxation (Dazkir & Read, 2012, 722).

Color: Colors with great brightness and brilliance in the architectural space provide brilliant and vivid effects, while colors with low brightness produce peaceful and silent effects (Zhang, Li, Li, et al.). While cold colors are typically non-stimulating and soothing, warm colors can also arouse a sense of arousal, enthusiasm, and stimulation. cold, warm, and colorless, respectively, gives a better sense of relaxation. (Yildirim et al., 2011, 509–518)

Voice: Nature voices aid in the rehabilitation process following a psychological stressor (Alvarsson, Wiens, Nilsson, 1036). During the pandemic, the three primary sources of pleasant noises were birds chirping, running water, and the sound of a breeze or soft wind between the leaves of trees (Tarale et al., 2020). It is also advised to eliminate undesired ambient noises and to utilize sound insulation (Zarrabi et al., 2021,5).

Smell: The role of smell, hearing, and multisensory perception of place, as well as vision, in stress reduction, is clear (Higuera-Trujillo et al., 2020,269). Most individuals liked aromatic houseplants, the aroma of fresh coffee, and scented candles during the Corona epidemic (Tarale et al., 2020).

An open plan vs. partitioned and enclosed spaces: In contrast to enclosed places, open spaces promote a positive feeling (Ergan et al., 2018) and more sense of beauty (Vartanian et al., 2015,10). Post-pandemic housing is more likely to result in more partitions between sections and reduce open spaces (Megahed & Ghoneim, 2020, 4). This is in line with the suggestions of Hajjar (2021) for more partitions in the communal space of the house.

Outdoor view from the window: Compared to commercial centers and congested streets, urban green spaces and cafés make people feel more relaxed (Al-Barrak et al.,2017,15; Neale et al., 2017,878). Furthermore, looking at the constructed environment is preferable to looking at the sky (Masoudinejad & Hartig 2013, 23).

Artificial intelligence: If necessary, it is advised to use smart systems to control and manage indoor air quality, temperature and relative humidity, air change rate, window opening and closing, and control systems for the elderly or patients without the need to touch building components like knobs, switches, etc. (D'alessandro et al., 2020,11).

Personal characteristics: The effect of environmental stimuli depends on the person's sensitivity to them, their capacity to detect them (Dijkstra et al., 2008,268) also their psychosocial context, personality, self-confidence, and mental health (Lara-Moreno et al., 2021,4). People with a low ability to screen stimuli can be much more affected by reducing or stimulating stress via the color of the environment compared to their counterparts who can effectively reduce the complexities of the environment (Dijkstra et al., 2008, 268). People with higher levels of stress have a greater tendency to choose restorative environments with positive qualities (Van den Berg et al., 2003, 136).

The components provided by the authors of the current study, such as Neo-proxemics and stress levels relative to the illness, which were not in the literature, were incorporated into the model. To explain and rank the components, first, the research components were divided into three categories: physical components, sensory components, and personal components, which can be seen in Table 1.

2.3 Literature review on research methods:

The evaluation of the components affecting people's emotional status in the architectural environment is frequently done in two ways: experimental measurement, including biometric measurement tools such as electroencephalograms, heart rate sensors, electrodermal measurement, and FMRI, etc.; and non-experimental measurement, including questionnaires and interviews, etc. For example, Ergen et al. (2019), in "Quantifying Human Experience in Architectural Spaces with Integrated Virtual Reality and Body Sensor Networks," investigated the effect of architectural design features on stress and anxiety. In the first stage, the issue was experimentally examined using virtual reality and a network of body sensors, and in the second stage, they non-experimentally examined stress and anxiety using the Panas questionnaire. Yin et al. (2022) employed biometric measurement tools to assess the environment's biophilic

qualities. The descriptive-analytical method was also employed by Azadeh, Mohammadi, and Neshat Doost (2019) to examine the elements influencing stress in the urban environment.

Table 1
Research components

Macro component	Micro components	Component representation in architecture
Physical-spatial components	Space proportions	Ceiling height/designing wider hallway, front entry/area of the living room
	Form	Curved or angular and sharp-edged
	Materials	Can be washed or sterilized/antibacterial material
	functions and proximity of spaces	Flexible design for spaces and the possibility of integrating various functions into the living room, including space for watching TV and activity in virtual social networks/ remote work/ virtual education/ exercise and meditation/ cooking/ growing plants/ balcony and terrace adjacent to the living room/ disinfection space/Indoor green space
	Open plan or creating personal spaces	Furniture distance to maintain social distance
		Open plan or separation of spaces with partitions/creation of personal spaces instead /of collective
	Smart home control systems	Smart home control systems/non-touch technologies
Sensory components	Light	Natural or artificial light/light color/light intensity
	sound	Pleasant or unpleasant sounds/loudness
	Smell and scent	Pleasant/unpleasant smell
	Color	Cold or warm/dark or light
	View	View natural or urban landscapes, greenery, or sky
	Temperature and airflow	comfort temperature
		The natural airflow inside the house
Personal components		Age/Gender
		People with higher or lower stress levels (authors' suggestion)
		Proxemic zones between family members during the pandemic (authors' suggestion)

In the present study, the non-experimental method of measurement was used to measure the independent variables. For this purpose, an interview was conducted with the experts, and sample questionnaires were used to measure the quality of emotions. The rationale behind this method is to gather the data relatively quickly. Moreover, it is affordable to measure the components in 405 samples, and it can be done virtually in the conditions of the Corona outbreak. The direct observation method was not used due to the large number of components and the inability to modify them in the built architectural environment. Emotional status and people's understanding of space have been measured through positive and negative bipolar scales (see Ergan et al. 2018, 12) and Dias et al. (2014,747). In the present study, the Panas standard questionnaire and semantic bipolar scales were also used. The conceptual model of research can be seen in Figure 2.

3. Theoretical Framework

The mutual impacts of the environment and humans are explored through the lens of different. Some perspectives focus on the effects that enhance the user's well-being.

The process of recovering or regenerating resources or human physical, mental, and social capacities is referred to as restoration theory, and the quality of the restoration environment encourages psychological rehabilitation. Since the 1980s, social-ecological theories have explored many elements of the built environment as stress triggers influencing mental health and individual performance (Amerio et al., 2020,2), such as Ulrich's (1983) functional-evolutionary approach, Ulrich's and others' (1991) stress reduction theory, Kaplan's attention restoration theory (1995), the biophilia hypothesis (Kellert & Wilson, 1993). conditioned restoration theory (Egner, et al., 2020), and collective restoration theory are more recent approaches to restoration (Nukarinen et al., 2022, 2).

Among the reviewed strategies, the following ones are more pertinent to the subject of the current study: Functional-evolutionary viewpoints (Ulrich, 1983) show that exposure to landscapes with natural environments and greenery can evoke positive emotions, maintain non-conscious attention, limit negativity, minimize negative thoughts, and reduce stress while promoting restorative effects (Yin et al., 2022,2). Stress reduction theory (Ulrich et al., 1991) suggests that certain natural environments, such as diverse habitats containing water or vegetation, can reduce sympathetic nervous system activity levels and stress. Joy-Vandenberg's theory suggests that patterns and information derived from nature have a restorative effect since they are processed smoothly, for example, fractal patterns.

The biophilic hypothesis also states that humans have an innate tendency to focus on nature and natural processes (Nukarinen et al., 2022,2-3). With his pioneering book, Health, Stress, and Coping (1979), Antonovsky demonstrated that the salutogenic approach is based on the identification of health factors and can inspire designers toward a healthy society (Yeang & Dilani, 2022,16), and his research served as the foundation for future methods such as the health promotion model, the resource margins model, the Positive Deviance Approach, and the the Self Tuning Model of Self-Care (Mittelmark et al., 2022).

Using the salutogenic theory, which has a more complete perspective of all health-enhancing variables (relaxation and stress), the authors of this study attempted to extract the components that impact the emotional experience of the user in the architectural environment to contribute to the promotion of the restoration of health.

4. Research Methodology

Initially, components identified in the research background and those suggested by the authors were placed into three groups. Subsequently, the components were evaluated through interviews with ten prominent architecture professors to establish the questionnaire's validity. At the suggestion of experts, the components

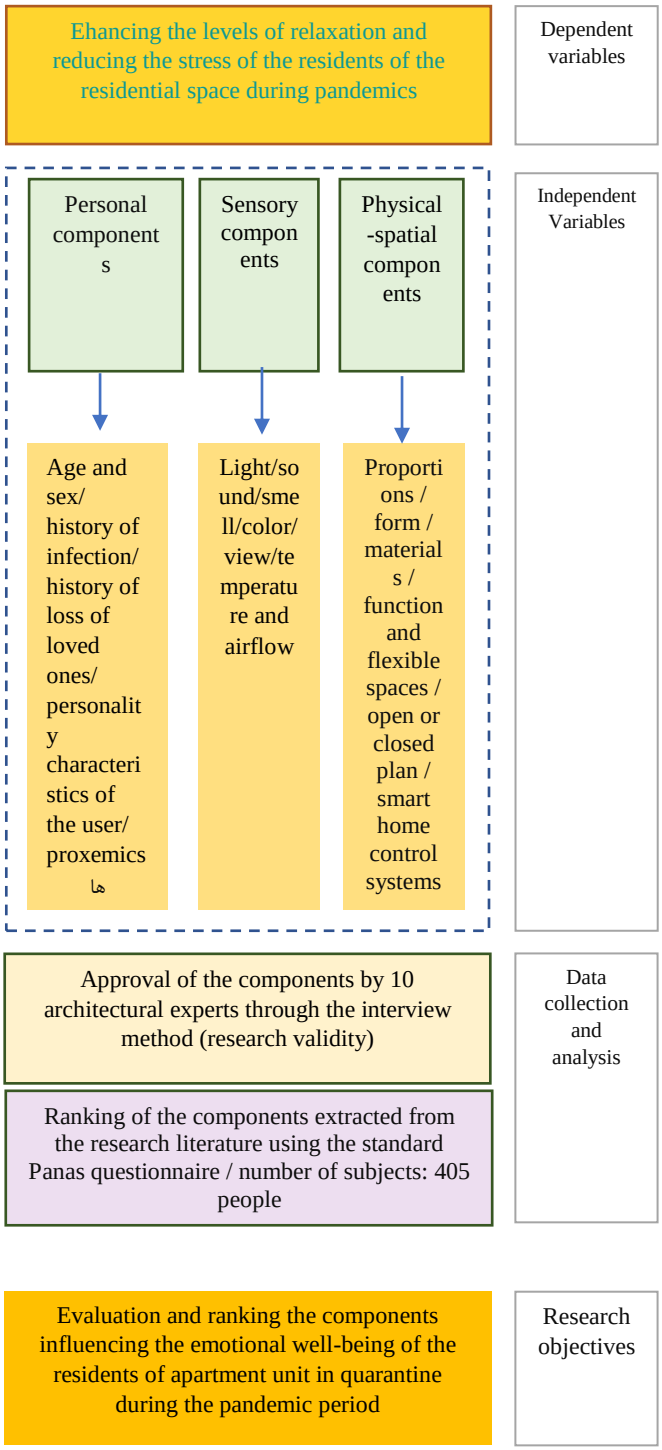

Fig. 2. Conceptual model of research

related to smell and sound were deleted from the list. The reason was associated with the inherent difficulty of accurately measuring these aspects.

As the coronavirus is a pandemic, it spreads widely across all regions of the world, including Iran, Tehran, and all its districts. For this reason, to maintain the validity and generalizability of the current research, the samples were not only selected from a specific area or district but randomly from all districts of Tehran. According to the

above reasons, and Since almost 80% of Tehran's population lives in flats, 5–6 story apartment units which were widespread and scattered in most areas of Tehran, were selected, and not high-rises fall in the scope of our research. These units often have openings from one (north or south) side or two sides. the design features of the communal space of the house (the living room, where most people spend the majority of their time during this period) were focused.

Table 2
demographic information of participants

Employment status	percentage	Average monthly income (Rials)	Percentage	Marital status	Percentage	Age	Percentage	Education	Percentage
House Wife	13.81	50.000.000 or less	19.61	Single	34.44	15-18	20.22	Student	21.39
Employed	57.18	50.000.001-100.000.000	43.65	Married without children	25.62	18-24	9.70	High school graduate	10.83
						25-34	10.25	Bachelor	35.56
						35-44	30.19	Master	28.61
Student	29.01	100.000.001 or more	36.74	Married with children	39.94	45-54	19.94	PhD or Higher	3.61
						55-64	7.76		
						65 or more	1.94		

The questionnaire was used to gather data for three major reasons: it was cost-effective to ask 405 samples. Moreover, it was easy to communicate with the samples online during the Corona pandemic, and the subjects were familiar with it. the first section contained 14 demographic questions: (gender, age, education, income, marriage, history of contracting the coronavirus, history of Corona infection, history of losing loved ones as a result of Corona infection, employment, level of fear of Corona infection, level of stress change during the Corona period, level of self-care during this period, use of masks at home, house floor, the dominant use of home spaces for remote work or leisure during the Corona period), and the second part of the evaluation of the research components included 19 questions about research architectural components.

The Panas standard questionnaire (Watson, 1988, 1063) was used in the second section to quantify the amount of positive and negative emotions on a 10-point Likert scale (5 positives and 5 negatives), where 0 denotes highly positive emotions and 9 represents highly negative emotions. The emotional bipolar scales were used to assess stress and relaxation levels related to each component using the following alternatives: "pleasant vs. unpleasant; relaxed vs. anxious and; concentrated vs. distracted (Ergan et al., 2019,7)(figure 3). The Collected data were analyzed by IBM SPSS.

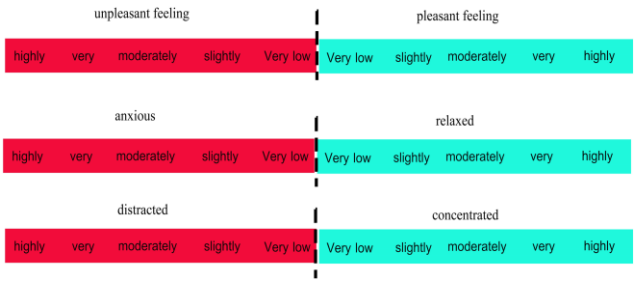

Fig. 3. Measuring research components with emotional bipolar scales on a 10-point Likert scale

4.1 Demographic characteristics

About 104 (28.65%) of the respondents were male and 259 (71.35%) were female; most of them had bachelor's degrees (35.56%) and master's degrees (28.61%). 57.18% were employed whereas the rest were housewives or students. The income level of most of the samples (43.05%) was about 5 to 10 million Tomans. (Table 2). About (16.02%) had experienced the death of at least one member of their family due to Corona. Often (44.35%) had a moderate level of fear and stress regarding Corona, but the stress of more than half of the population (55.56%) during the Corona period increased moderately or strongly compared to the previous periods, and 38.75% had self-care. 85.95% of them (312 people) did not use masks at home, except when one of the people living in the house was infected with Corona disease.

Table 3
Areas and spaces for leisure time, remote work, and virtual study at home

Space for remote work or studying at home	Percentage	The space for spending leisure time at home	Percentage	House floor area (square meter)	Percentage
The common space of the house	48.34	The common space of the house	64.74	75 or less	5.79
Bedroom	40.61	Bedroom	31.40	76-100	22.31
Kitchen	1.66	Kitchen	1.38	101-120	23.69
Study room	9.39	Terrace, balcony, yard, or roof	2.48	121-150	19.83
				151-200	20.66
				+200	7.71

4.2 Emotional experience component ranking based on improved relaxation

After calculating the average answers to the three emotional poles indicated for each component, the Shapiro-Wilk test revealed that the distribution of the answers for all 19 questions is abnormal, thus the Friedman test was used to prioritize the components. Table 4 lists the components that are most beneficial in lowering stress and enhancing relaxation, ranked from most effective to least effective. The statistical significance of the discrepancies is also indicated by the P-value of 5.202e-193.

The mean and Friedman tests were used in three income groups, according to Table 5, and the statistical difference in the findings of all three groups was significant. The Shapiro-Wilk test indicated that the distribution of data in each of the income categories is normal, thus the one-way ANOVA test was used to compare the findings of the groups with each other. An unpaired t-test on the answers of three income groups reveals that there is no significant difference between the answers of the middle and high-income groups (P-value: 0.763), but there is a significant difference between the answers of the low and high-income groups (P-value: 0.001), and low and medium (P-value: 0.001).

Means and the Friedman test were used to rank the components in three groups with varying stress levels concerning Corona throughout the epidemic period (Table 6), and there was a significant difference in the prioritizing of the components in each group. To determine the significance of the difference between the groups, the Shapiro-Wilk test was used. The result revealed that the data distribution in the moderate stress group was not normal, thus the Kruskal-Wallis test revealed no significant difference between them. The unpaired t-test revealed a significant difference (0.03) between the groups with low and high stress, which both had normal data distribution, and the Mann-Whitney U test revealed a significant difference (0.704) between the medium-high (0.704) and high (0.704).

Table 4
Ranking of research components

Priority	Component	Mean	Std	Mean Rank
1	Windows to facilitate natural air flow	1.08	1.74	6.67
2	Entry of natural light	1.09	1.77	6.97
3	Terrace or balcony (semi-open space)	1.27	1.72	8.92
4	Outdoor views	1.28	2.11	9.45
5	Space for watching TV and using social networks	1.31	1.63	9.71
6	Space for growing flowers and plants	1.34	1.79	9.18
7	Light versus dark colors	1.5	2.1	8.66
8	Greater light intensity	1.58	2.25	7.66
9	The living room of a country house versus that of one of a city house	1.62	2.06	8.87
10	The use of artificial intelligence in the building	1.79	2.11	9.38
11	Greater area (of space) and wider corridors	1.83	1.9	11.58
12	Sports and warm-up space	1.91	1.99	10.91
13	Space for remote work or virtual study in the living room	1.94	2.29	10.73
14	The greater height of the ceiling	2.14	2.06	9.82
15	Furniture and materials that can be washed and disinfected	2.24	2.19	12.29
16	Spending sickness in the living room compared to the bedroom	2.68	2.78	12.39
17	Curved forms versus linear forms	2.73	2.09	13.26
18	Personal space or partitioned versus open plan	3.08	2.66	11.74
19	More intimate distance versus less intimate distance with family members/more distance of living furniture	3.5	2.87	11.78

Table 5
Ranking of research components by income based on the highest impact on relaxation to the lowest

No	With an income of 3-5 million tomans		With an income of 5-10 million tomans		With an income above 10 million tomans	
Priority	Components	Mean	Components	Mean	Components	Mean
1	Space for watching TV and using social networks	1.44	Natural light	0.86	Window	.82
2	Space for growing flowers and plants	1.65	Windows	0.87	Terrace or balcony	.83
3	Natural light	1.79	Light Colors	1.17	Outdoor view	.89
4	Terrace or balcony)	2.02	Outdoor view	1.18	Natural light	.91
5-16	...	2.02-3.25	...	1.18-2.2	...	-1.16 2.47
17	Curved forms versus linear forms	3.34	Curved forms versus linear forms	2.63	Spending sickness in the living room compared to the bedroom	2.51
18	Spending sickness in the living room compared to the bedroom	3.74	Personal space or partitioned versus open plan	3.26	Personal space or partitioned versus open plan	2.62
19	More intimate distance/more distance of living furniture	3.91	More intimate distance/more distance of living furniture	3.4	More intimate distance/more distance of living furniture	3.62

Table 6
Ranking of research components by the levels of people's fear and stress of being infected with Corona, from the highest priority to the lowest

No	**Low level of stress and fear**		**Medium level of stress and fear**		**High level of stress and fear**	
Priority	Components	Mean	Components	Mean	Components	Mean
1	Space for watching TV	1.33	Natural Light	.92	Natural Light	.79
2	Window	1.37	Window	1.00	Window	0.87
3	Terrace or balcony	1.49	Terrace or balcony	1.08	Outdoor View	1.01
4-16	...	1.5-2.82	...	1.13-2.68	...	1.09-2.47
17	Curved forms versus sharped-edged forms	3	Spending sickness in the living room compared to the bedroom	2.87	Curved forms versus sharped-edged forms	2.51
18	Personal space or partitioned versus open plan	3.24	Personal space or partitioned versus open plan	3.17	Personal space or partitioned versus open plan	2.9
19	More intimate distance/more distance of living furniture	3.66	More intimate distance/more distance of living furniture	3.21	More intimate distance/more distance of living furniture	3.47

According to Figure 4, the majority of people prefer to maintain a physical distance of (1-0.5) meters from other family members. In the following rank, 83% of the samples, with a significant difference compared to the others, tended to have a view of green spaces and plants and a view of the sky from windows (Figure 5).

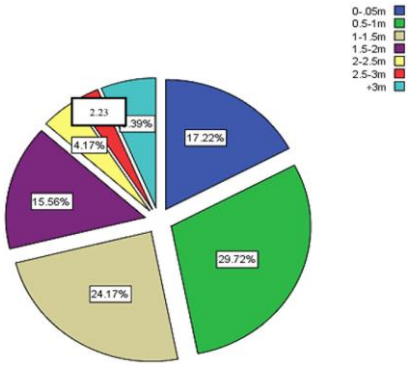

Fig. 4. Preference for maintaining distance from family members in the communal space of the house

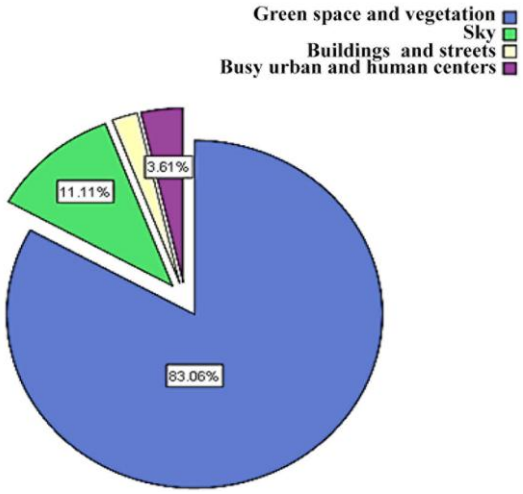

Fig. 5. tendency to look kinds of outdoor view

The amount of perceived stress or relaxation

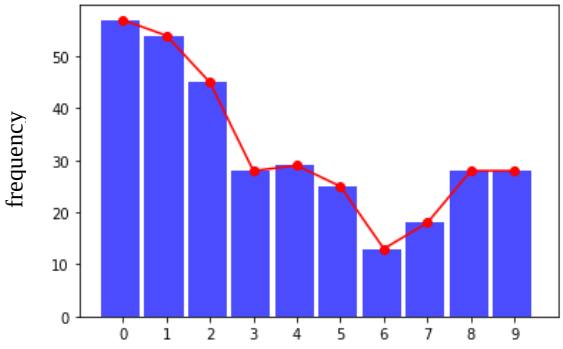

Fig. 6. The effect of larger proxemics distance from family members in the living room compared to a smaller distance on relaxation or stress (respectively, (0) indicates feeling very relaxed and (9) indicates feeling very stressed).

The amount of perceived stress or relaxation.

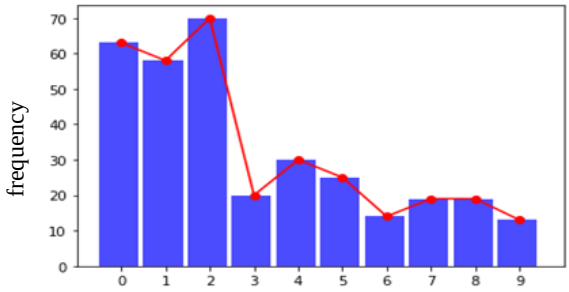

Fig. 7. The effect of personal space and living room partitioning in comparison with an open plan on relaxation or stress (respectively, (0) indicates feeling very relaxed and (9) indicates feeling very stressed).

5. Results and Discussion

According to Table 3, the majority of respondents chose the communal living spaces of the house to undertake personal duties that demand focus, such as studying, teleworking, or virtual schooling (48.34%), or to spend leisure time (64.74%). The bedroom was ranked second. These results lend support to those that exist in the literature (Hajjar, 2021, 10). This problem might have been caused by the emotional impacts of quarantine at home, such as a sudden drop in social connection with coworkers or friends outside the house. This justifies why individuals had more interaction with family members. The respondents preferred to spend just the period of illness in the room, which could have been due to the fear of infecting other family members with Corona. Therefore, it is advisable to allocate more space to the living room or reception area of the house. Similarly, research by Hajjar 2021 showed that it is necessary to consider flexible spaces for relaxing activities. As can be seen in Table 4, the impact of such spaces on residents' relaxation has been proven. Following this component, the spaces for watching TV and using social networks, growing flowers and plants, and working out were ranked, respectively, in terms of their effects.

The components such as a window and creating air flow, natural light entry, and a balcony or terrace are listed in (Table 4). Access to a window to facilitate airflow was one of the primary strategies for maintaining health during the outbreak. Windows were reported to improve the conditions through the ventilation of stuffy air and replacing it with fresh ones, thereby increasing a sense of relaxation while reducing stress. In line with the research background, natural light was found to have a restorative effect (Walch, Rabin, Day, Williams, Choi, & Kang, 2005, p. 156). Balconies and terraces were widely used during the Corona period for meeting or talking with neighbors and acquaintances and establishing social interactions. In countries such as Italy, it was a place to play music and have some kind of social communication. The importance of greenery and vegetation for the majority of people (83.06%) was also consistent with the results of studies on the urban green space restoration effect (Neale et al., 2017, 878). During the pandemic period, designing the space for watching TV and using virtual social networks in the living space of the house can have a better restoration effect than staying in a completely separate TV room. This issue will be more effective for those who have high levels of stress or are housewives.

Zarrabi, Yazdanfar, and Hosseini (2021) investigated the factors of mental health (not just the feeling of stress and relaxation) during the Corona period on the general scale of the interior of the house, including the components of natural light, view of the open space, and acoustics. The open space (terrace) as a general desire of residents demonstrates that there is a direct link between preferences and relaxing aspects (proven in the current study), although it has a different ranking from the results of the current study. Creating a remote working or learning environment is graded higher (13) for working and student persons (average 1.98), but lower (15) for housewives.

Compared to the open plan with a close distance between family members in the living room, spaces with a curved form, individual spaces, and a partitioned living room were less effective. Such spaces ranked last in Table 4. The lack of a distinct role in protection against the spread of Corona in the component of the curved shape is most likely a cause for its low importance. However, the last

two components of Table 4 were stressful for a substantial percentage of people. This might have been attributed to the desire for increased engagement with family members during a period when there were fewer interactions among community members.

During the pandemic, the Iranian Ministry of Health recommended numerous things, including opening windows for natural air, wearing a mask, and keeping a greater distance from people. The first component is likewise first in Table 4, indicating the profound influence of health advice on individuals; however, 85.95% of people at home did not use masks, except when one of the people living in the house developed coronavirus. Furthermore, adhering to the suggested distance of 1.5 to 2 meters (Qian and Jiang, 2020, 2) under the label of social distance, which was seen in many public areas such as administrative and educational facilities, etc., was ranked lowest in the current study. According to Figure 4, keeping a distance of (0.5-1.5 meters) was a priority for the majority of individuals (54.19%) to feel relaxed. the distances obtained in the study are close to Hall's suggestion about the proxemics of family members (1.22-0.46 m) in non-chronic conditions.

This shows that although many people were aware of the risk of coronavirus transmission, they had little desire to keep much physical distance at home, and keeping intimate human interactions in the family is sometimes preferable to medical prescriptions, and other health suggestions are only applicable in communal and public areas. That might explain why partitioning and establishing distinct spaces and a large distance among furniture is not advised. There are proposals to build fewer open spaces, individual spaces, and more walls in the house's communal rooms (Hajjar, 2021, 11). However, according to the existing study, it is unlikely to be restorative for a wide variety of people, and on the contrary, it may even be stressful (Figures 6 and 7).

The results of this study support the hypothesis that the design components of the living space of residential flats can effectively reduce stress and increase relaxation among the residents during Corona time.

6. Conclusion

In conclusion, the findings of this study reveal the factors influencing the degrees of stress and relaxation of apartment residents in Tehran (an Iranian city with high infection rates) throughout the Corona period, as well as their ranking. It is worth mentioning that the Corona epidemic might reoccur in the future. That is why architectural specialists should consider the essential precautions to design comfortable houses for people.

Initially, by studying the research literature and scrutinizing the components suggested by the authors, the general comforting components of the house were identified, and then the recommended components of the pandemic age were grouped into three categories: sensory, physical, and individual components. The components were then reviewed via a qualitative interview with ten architectural professors to establish the validity of the research. In the next step, data was collected and ranked through a qualitative questionnaire including demographic information and the Panas standard questionnaire, which examines positive and negative emotional poles on a 10-point Likert scale.

The results showed that the most important components affecting the sense of relaxation are openable windows, which allow the flow of fresh air, provide a view of greenery and natural light, and a semi-open space (a terrace or balcony). However, partitioning and creating personal spaces and dimensions of proxemics for family members had the least priority for a sense of relaxation. For many people, they increased stress, which indicates a preference for maintaining close human relationships with family members over physical health recommendations. The design solution could be to use more windows with larger areas to have a better view of the green landscape and the sky. Based on the results of the study, it is recommended that the buildings be equipped with openable windows that facilitate airflow and create a flexible and green terrace and balcony, allocating spaces to exercise and grow plants, providing a flexible space for watching TV, as well as a space for remote work or virtual study in the living room.

In the current research, the focus has been on the communal space of the house (living room and reception). It is suggested that future studies focus on other spaces of the house, and larger samples in the big and high-risk cities of Iran should also be evaluated in terms of the pandemic rate. In addition, simulating the common types of communal space in contemporary Iranian apartments, designing alternatives, and measuring samples can also be very effective in verifying the results.

Conflicts of interest statement: There was no conflict of interest in conducting this research.

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