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Architectural space changes during covid-19 pandemic

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A B S T R A C T

The pandemic caused people to spend more time in quarantine spaces (living spaces) than ever before and continuously interact with that space. With the emphasis that architectural designs affect subjective human experiences, it has been revealed by scientific studies that people need spaces that are intertwined with nature with gardens and terraces during periods like this. While these studies refer to the spatial configurations that will make individuals feel good psychologically, they also mention the buildings' features such as their location, size, space quality, and comfort content. The main aim of running this paper is to identify the emotional state changes that occur in individuals during the quarantine period and to use these determinations in designs within the framework of the concept of "pandemic space," a concept that emerged after the pandemic started. Seven hypotheses have been developed in this context. As method, a questionnaire consisting of 39 items designed to measure individuals' emotional state changes was chosen. The meaningfulness of the hypotheses was questioned using the statistical values obtained as a result of the data analysis of the data collected from 1500 people. As a result of the study, several design approaches to pandemic spaces were put forward by trying to interpret this meaningfulness in terms of space.

Keywords: covid-19; pandemic space; architectural space; emotional state changes

Introduction

The world has faced various pandemics throughout history (Ebola, SARS, MERS). In early 2020, the Covid-19 pandemic that affects people's respiratory tract started. The first case was seen in Wuhan, China, and has spread widely around the world since it was first seen, leading to the coronavirus outbreak in 2019-2020. The outbreak of the virus, which is spreading rapidly all over the world, has been declared a pandemic by the World Health Organization (WHO) on March 11, 2020. Parmet et al. [1] state that the measures taken by governments such as travel bans, social isolation, and quarantine reduced the spread of Covid-19 virus worldwide; however the spread of the virus could not be prevented as a result of logistical developments. In the spread of the virus, people's ability to travel and social lifestyle have been effective in the globalized world. Countries that are most severely affected by

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the Covid-19 pandemic include the USA, Italy, Spain, and China. Quarantine periods have been initiated by governments because the increase in case numbers could not be prevented in these countries where health facilities were inadequate for the increasing number of cases. Quarantine is a set of measures taken to prevent people from infecting more people, and people must spend time in living spaces to comply with these quarantine decisions. Quarantine periods have also been implemented in many European countries, and especially in the USA and China. In addition to these sanctions, some countries have recommended voluntary quarantining to their citizens. The idea that the spread of the virus can be slowed down or even prevented with these practices is available in literature studies [2].

Considering the house quarantines during the pandemic, it is thought that there will be some behavioral changes when people spend the quarantine period at their homes. This situation can be considered as restricting the active movements of people in order to prevent the spread of the Covid-19 pandemic. Restriction can be defined as the spatial obligation of people to stay at their living spaces. People spend much more time in their living spaces during this quarantine period compared to before. Therefore, there is a need for improvement suggestions in spaces according to the needs of the individuals. It is thought that by providing multiple functions at the quarantine space, the satisfaction level of the individuals will be increased by meeting their needs and the time spent in that place will alleviate the pressure of the quarantine. It is predicted that the improving the space (without damaging the physical structure of the building) can be a solution so that individuals do not feel restricted in the space during the quarantine period and to reduce mental fatigue. Thus, it is thought that the desire of the individual to spend more time in that space will increase with the idea of "space within a space," which has different functions within the same space. In addition, it is expected that the space will have a positive effect on emotional state and psychological well-being. This change envisages increasing the functions of the space, thus minimizing the psychological disturbances that may occur after quarantine in the individual. Improving the space also indicates that it must meet the functions needed by the user. In other words, how the spatial features of the space are perceived also affects the psychological well-being of the individual. In the studies conducted [3-7] many factors that affect people's well-being have been revealed. These can be listed as personal characteristics, habits, and relationships with other individuals. In addition to these factors, how spatial characteristics are perceived also affects the psychological well-being of the individual [8].

As a result of this situation, it is expected that people will acquire new behaviors and they had in their lives before the quarantine period. However, the important point here is that the quarantine process is directly related to the space.

In this study, quarantine spaces (areas in which people go through the quarantine process in such an extraordinary period), which are also defined as spaces that restrict people's movements, are named "pandemic spaces." Some problems arise due to the restriction of the active movements of individuals and the increase in the spatial obligation to stay in living spaces. Sood [9] states that people who quarantine during the Covid-19 pandemic may go through significant psychological and psychiatric disturbances such as post-traumatic stress disorder, depression, and

anxiety, and the reasons for these may be factors such as staying away from family, loneliness, financial problems, and being stigmatized. What needs consideration here is that people may go through various stages in pandemic spaces where they spend the quarantine period, such as anxiety, worrying about the future, outbursts of anger, and not complying with quarantine rules. Even though it is not possible to suppress such behaviors completely, it is possible to restrain them by improving pandemic spaces. However, what matters at this point is not what the spaces are, but how people can get through this process with minimal psychological discomfort.

In this study, the aim is to improve the pandemic spaces using the analysis results of the data from the surveys conducted on the volunteers during the Covid-19 pandemic quarantine period. In this way, it is aimed to see the effects of spaces on people and to mitigate the negative effects stemming from spatial problems. For this reason, the goal is to design spaces at the optimum comfort level for people both during the quarantine period and after.

The importance of quarantine

Quarantine is a series of precautions taken in order to prevent the spread of the virus to more people. Scientific studies emphasize the importance of quarantining during a pandemic. Brug et al., [10] state in their study that in the early stages of a potential epidemic, compliance with the measures taken for the populations at risk prevents further spread of the disease. As a preventive measure to slow the spread of the disease in society, people were recommended to stay at their homes and curfews were imposed in many countries. In this context, as a result of the spread of Covid-19, 20 million people were quarantined in Wuhan [11].In addition, SteelFisher et al., [12] observed that people avoided crowded places on an urban scale such as shopping malls, places of worship, public transportation areas, gyms, markets, and restaurants in the early stages of the H1N1 epidemic. These attitudes of people towards these spaces show that they associate spread of the virus with space and perceive the importance of space at this point. All these situations are the reason for examining the relationship between human-space interaction and epidemics.

The importance of true application of the quarantine

The quarantine period must be implemented correctly in order to reduce the psychological effects of long-term pressure on the individual. Rubin et al., [11] state that quarantine may cause fear and the voluntary quarantine can be overcome with fewer psychological effects than mandatory quarantine. This situation indicates the necessity of individuals to have a positive relationship with the quarantine space. According to Parsons [13] this relationship between people and space is defined as spaces may have positive or negative effects on people. These effects are related to many factors that range from the plants grown in the space [14] to the sounds coming from the outside [15], from the functional design of the spaces [16] to the daylight received [17]. The argument of Kaplan and Kaplan [18] that the psychological fatigue and tension in people's daily lives can be reduced by natural environmental factors in the "attention restoration theory" shows that people are affected by their environment. Coburn et al., in the study they conducted in 2020 [19], reveal that the visual cortex is sensitive to certain

psychological variables when faced with architectural interiors. All these situations are cognitive evidence that the spaces affect the emotional state and psychological well-being of individuals.

The effect of quarantine space on human psychology

It is known that people spend more time in their living space during quarantine compared to before. This leads the person to be in constant interaction with the space and the space to affect human psychology. Moser & Uzzell [20] discussed the human-environment interaction in spatial terms. While talking about the importance of individual spaces, they also emphasized that they have an important function in ensuring and developing security, predictability, order and stability in one's life. In this study, the effects of houses that have turned into quarantine spaces on people's emotional states are discussed. The places where we spend time every day have a close connection with features such as being natural, personal, relaxing, and 'being home.' These living spaces affect people's perceptions and behaviors as well as their mental states. In this context, it should be taken into consideration that the living space can turn into a trigger or supportive element. Brooks et al., in their study in 2020 [21], underline this situation and discuss the necessity to take into account the negative mental consequences that may arise when evaluating the possible benefits of compulsory quarantine practices. Supporting this discourse, Laura et al. [22] conducted a lot of research on individuals who remained in quarantine during the SARS epidemic. They state that forced social inadequacy and lack of physical contact, especially with family members, cause negative emotional states and feelings of restraint at home, not being able to see friends, not meeting the basic needs of daily life, being away from the outside world are associated with post-traumatic stress disorder (PTSD) and depression symptoms. The negative psychological impact of quarantine on people can also affect the social behavior of people during this process. As Balinska & Caterina [23] identified the problems that will arise in future pandemics, they argued that factors such as disobedience to quarantine, panic, resistance to travel restrictions, and uneasiness will be the leading causes of these problems. It is stated in the literature that the reason for this is the pressure exerted on people by the feeling of being in quarantine [24]. In order to minimize this pressure, the psychological well-being of people in quarantine should be kept at a high level. As a result of all these studies that examine the psychological well-being of people during the quarantine period, psychological well-being becomes important. When this term is considered spatially, it is defined as people living a quality life in the environments with which they interact [25]. In the studies conducted [26-28] many factors that affect people's well-being have been identified. These can be grouped basically as "demographic characteristics" (gender, age, marital status, income status) and "external factors" (physical environment, perception, etc.). It is thought that the emotional state and mood, which can be affected by many factors, can also be affected by the living spaces and houses.

The effects of outbreaks on human psychology and behaviour

It has been observed in many scientific studies that epidemic diseases that negatively affect societies also

negatively affect the psychological well-being of individuals. In the study, behaviors such as not interacting with others, reducing contact with people outside their own living space, and avoiding physical contact with others during interaction were recorded. At the same time, in other scientific studies, it is seen that psychological health is negatively affected during epidemics. Ooesterhoff et al., in their study on adolescents in America in 2020 [29], encountered anxiety symptoms, depressive symptoms, indifference and burdenlessness symptoms during the pandemic process. Sprang et al., (2013) investigated the psychosocial responses of children and their parents during the pandemic and reached the conclusion of traumatic stress. Post-traumatic stress disorder has been detected in 30% of the children. This rate was found to be 25% for adults. Based on all these studies, it can be said that epidemics have negative effects on people's emotional states for various reasons.

Material and Methodology

As a result of the period of staying at home, which is one of the mandatory restrictions of the pandemic period, the relationship of individuals with the space has changed as well as increased. In the current study, a survey was conducted to obtain relevant data in order to identify how the emotional state and psychology of the space users are affected. The question content of this questionnaire is also based on obtaining data that will enable people to interpret emotional state findings in terms of space. Identifying the changes made by people in the pandemic spaces in different scales during this period has helped with this interpretation. With the evaluation of all these findings and the data obtained, the study has enabled people to get through this process with minimal psychological discomfort and to put forward suggestions that can alleviate the negative effects caused by spatial problems. The improvement of spaces will also support the design of spaces at the optimum comfort level for people both during the quarantine period and after.

Participants

Within the scope of the study, the surveys were applied on volunteers during the Covid-19 pandemic quarantine period. The general demographic characteristics of the participants are given in Table 1.

Questionnaire Procedure

39 questions were developed for the study. These survey questions were organized in certain categories and presented to the participants. The questions were sent to the participants by e-mail via Google-survey. Participants were randomly selected from across Turkey. As a result of the survey, which was delivered to a total of 1500 people, the answers given by each participant to the questionnaire were examined one by one. In line with the observational preliminary examinations made in the questionnaire items, as a result of detecting unsafe results, data from 1423 people were taken into account.

Table 1. Demographic characteristics of the participants

Features	Level	Frequency	Percent	Mean
Gender	Women	799	56	
	Man	624	44	
Age	<20	72	5	38,67
	21-30	407	28,6	
	31-40	278	19,5	
	41-50	430	30,2	
	51-60	157	11	
	61-70	65	4,5	
	71-80	6	0,5	
	81-90	8	0,7	
Marital Status	Married	878	61	
	Single	545	39	
Education Status	None	1	0,1	
	Primary School	13	1	
	Middle School	39	2,8	
	High School	186	13	
	University	916	64,4	
	Post Graduate	202	14,1	
	Doctorate	66	4,6	
City Population	0 - 500.000	662	46,6	3.022.839
	501.000 - 1.000.000	118	8,3	
	1.000.001 - 1.999.999	104	7,3	
	2.000.000 - 5.000.000	284	20	
	5.000.001 - 10.000.000	107	7,6	
	10.000.001 - 15.000.000	32	2,2	
	15.000.0001 - +	113	8	
Total Revenue (8 TL=1 $)	0-2500 TL	98	6,9	7687,105TL
	2501-5000 TL	350	24,6	
	5001-7500 TL	357	25	
	7501- 10000 TL	280	19,7	
	10001 TL - 12500 TL	133	9,3	
	12501 TL - 15000 TL	98	6,9	
	15001 TL- 17500 TL	35	2,5	
	17501 TL - 20.000 TL	24	1,7	
	20001 TL and up	48	3,4	

Result and Discussions

As a result of the survey studies and the literature review in the study, suggestions for “space improvement” are made. In the survey study, the demographic characteristics of the people, the information about the place where they live, their perception of the place before and after the quarantine, and the direct recording of the emotional state are included. Accordingly, various correlations were found in the survey results and analyzes were conducted. As a

result of the obtained data, some hypotheses were developed and individual answers were sought:

H1: There is a relationship between the size of the house in which individuals live and their frequency of going out.

This hypothesis was tested in the SPSS program using the chi-square test, and the results are shown in Table 2.

As P=0.367 > 0.05, the hypothesis is rejected. In other words, there is no statistically significant relationship between the size of the house in which individuals live and their frequency of going out.

H2: There is a relationship between the individuals' frequency of going out and their emotional state score averages.

This hypothesis was analyzed in SPSS program with t-test and the results obtained are as in Table 3.

As indicated in Table 3, as a result of the Independent groups test conducted to identify whether the average emotional state scores show a significant difference according to the individuals' frequency of going out, and the

Table 2. The relationship between the size of the house in which individuals live and their frequency of going out

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	5,416a	5	,367
Likelihood Ratio	5,916	5	,315
Linear-by-Linear Association	2,414	1	,120
N of Valid Cases	739		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,43.

Table 3. The relationship between the individuals' frequency of going out and their emotional state score averages

	N	Avg	SD	P value
Not going out	234	34,5171	6,90973	
Once a month	41	33,4146	6,88831	
Once a week	182	34,9176	6,48831	
One in three days	85	33,6235	6,38446	
One in two days	95	35,6000	7,44969	.312
Every day	102	34,1373	6,51736	
Total	739	34,5386	6,77210	

Table 4. The relationship between gender and emotional state scores

Group Statistics	2. Gender	N	Avg	SD	P value
Emotional-state	M	624	35,1218	7,15913	,0000
	F	799	33,4631	6,87087	

Table 5. The relationship between the emotional state and square meters

Group Statistics	m²	N	Avg	SD	P value
Emotional-state	100 m² and less	298	33,4463	7,28349	,040
	100 m² and more	1125	34,3876	6,96988	

Table 6. The relationship between the size of the places where people live and the residence type and their emotional state

	Paired Samples Statistics	Avg	N	SD	P value
Pair 1	Q-36. Are you satisfied with the square meter of your house? [Before Quarantine]	3,4350	1423	1,14114	,000
	36. Are you satisfied with the square meter of your house? [In Quarantine Period]	3,2565	1423	1,28318	
Pair 2	Q-37. Are you satisfied with the location of your home? [Before Quarantine]	3,6486	1423	1,14808	,0000
	37. Are you satisfied with the location of your home? [In Quarantine Period]	3,5784	1423	1,25761	
Pair 3	Q-38. Are you satisfied with the number of rooms available in your home? [Before Quarantine]	3,4413	1423	1,19506	,0000
	38. Are you satisfied with the number of rooms available in your home? [Quarantine Period]	3,2832	1423	1,30854	

difference was not found to be statistically significant (p =.312 > 0.05).

H3: There is a significant relationship between gender and emotional state scores.

The result of analysis for H3 is given in Table 4.

As can be seen from Table 4, the difference between the emotional state score averages of men and women was found to be statistically significant according to the Independent groups t-test (p = 0.0 < 0.05).

H4: During the quarantine period, individuals who are not satisfied with the number and size of the rooms in their house go out more often.

The result of analysis for H4 is given in Table 5.

As can be seen from Table 5, the difference between the size of the house they live in and their emotional state score averages was found to be statistically significant according to the Independent groups t-test (p = 0.040 < 0.05)

H5: People's satisfaction with the square meters of their house is directly correlated to the type of residence and square meters they live in.

The result of analysis for H5 is given in Table 6.

As can be understood from Table 6, the difference between the averages of the individuals' satisfaction levels before and after quarantine was found to be statistically significant according to the Independent groups t-test (p = 0.0 < 0.05).

H6: Individuals who are in negative emotional states have a greater tendency to go out during the quarantine period.

As can be seen from Table 6, the difference between the individuals' average scores of satisfaction with the location of their houses before and after the quarantine period was found to be statistically significant according to the Independent groups t-test (p = 0.0 <0.05).

H7: There has been no change in favorite spaces at home before and after the quarantine period. There have been changes in the time spent in spaces.

As can be seen from Table 6, the difference between the individuals' average scores of satisfaction with the number of rooms in their houses before and after the quarantine period was found to be statistically significant according to the Independent groups t-test ($p = 0.0 < 0.05$).

Studies have attempted to show the impact of the pandemic COVID -19 on humans. They range from travel behavior [30], effects of urban living [31], changes in environmental factors [32], psychological effects [33, 34], and future expectations in spaces [35]. Although Chashchina et al [36] take a new approach, it is necessary to consider the space needs after a pandemic from different perspectives. Thus, it is clear that the pandemic COVID -19 changed people's lives. This study aimed to look at this change in terms of spaces and analyze how the space changes may be related to staying at home.

In the study, the evaluation of 7 hypotheses was performed using the SPSS program. This evaluation was done for the individual hypotheses and for all hypotheses together. The statistical results of the hypotheses were evaluated based on the room and then design proposals for the pandemic rooms were presented.

Hypothesis 1 was found to be statistically insignificant, indicating that the quality of the space is more important than the size of the residential buildings in which people live. Therefore, it was found that light, ventilation, comfort, etc., which increase the quality of space, are important design components.

The evaluation of hypothesis 2 revealed that people do not need to leave their living spaces due to mood changes. It can be said that people prefer other places because they want to leave their own living space. During the quarantine process, where there are curfews, architectural solutions can be offered to meet the need for spatial change. Creating "flexible spaces" in living quarters would be a good solution. The concept of pandemic space design offers the possibility of presenting people with places with different physical and visual characteristics in the same space. Movable partitions, sliding elements, special designs in interior design, hybrid furniture solutions, etc. can be cited as examples for this group.

When evaluating hypothesis 3, it can be said that individual arrangements should be made to increase the comfort and taste of users of different gender. Color changes, replacement of furnishing elements, etc. in architectural spaces that can have a positive impact on mood can be cited as an example.

As a result of evaluating the numerical results of hypothesis 4, it was found that room size and number of rooms are important in living spaces. For this reason, when designing pandemic rooms, it is important to consider rooms with sufficient size and comfort to accommodate the number of users in the house. This concern can be achieved by limiting the use of space, changing design preferences, moving architectural elements, and flexible design principles.

According to the statistical results of hypothesis 5, it can be said that housing type and square footage are important. It can be seen that the number of hours spent by the user in comfortable and high quality spaces is directly proportional to his preference for living spaces. For this reason, the number of users in a house and the characteristics of social life should be important criteria for the designer.

Alternative architectural solutions can be offered for the case of "people with negative mood swings are more

inclined to go out", which results from hypothesis 6. In addition to the architectural solutions presented in the evaluation of the other hypotheses above, areas (sports areas, hobby areas, etc.) should be designed or functional preferences changed to perform activities that increase people's happiness levels.

When evaluating the data of hypothesis 7, the fact that there is no difference between the spatial preferences of users in their normal social life and the pandemic process shows that there is no differentiation in spatial function. In this case, for the satisfaction and happiness of the users, it is necessary to increase the comfort characteristics of the spaces used over a very long period of time. This requirement can be implemented architecturally at different levels.

Conclusions

This study aims to investigate the effects of changes in people's mood state on architectural spaces during the quarantine period during the pandemic. 7 hypotheses proposed in the study were interpreted by analyzing 1423 survey results. For each hypothesis, separate architectural outcomes and solutions can be proposed. A joint evaluation of the hypotheses was made to show the relationship between mood changes and space, the main objective of the study, during the Covid 19 pandemic.

Places where long time is spent due to curfew during the pandemic should be improved in quality and made more comfortable, according to the researchers. To achieve this improvement, the criteria of light, ventilation, color, etc. need to be considered more in the design. In the pandemic process that causes a change in the mood of users, design criteria and elements should be selected to redesign the same space so that this change is positive. Flexible understanding of space, hybrid furniture solutions, movable partitions and mobile architectural elements can be mentioned as examples of these solutions. The number of users and their socio-cultural characteristics should be directly proportional to the size of the living spaces and the number of rooms. The room size is important because it creates personal space and also provides spaces where personal hobbies and health needs can be realized despite the curfew. In creating pandemic spaces, one can benefit from solutions in different architectural/interior design scales to change the housing type, size, quality and comfort of the place and to change the mood in a positive direction.

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