Exploration of Design Strategies and Methods of Epidemic Quarantine Sites on the Basis of Design Psychology Theory

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Abstract

At the beginning of an epidemic outbreak, due to the emergency needs of epidemic prevention, the design of quarantine sites often considers the basic functions without taking into account the psychological factors of the quarantined people. As the epidemic situation is altering, the psychological state of the quarantined people is also changing, so it is urgent to design quarantine sites from the perspective of the psychological state of the quarantined people. Therefore, in view of the current problem of quarantine sites neglecting the psychological state of the quarantined people, this article aims to explore the design strategies and methods of quarantine sites from four aspects, namely, location and environment, form and culture, interior design, and memorial significance of quarantine site on the basis of the design psychology theory, which is of practical and important significance to the successful implementation of the epidemic prevention battle in China.

Keywords

Design Psychology; Quarantine Sites; Design Method; Practice Exploration.

1. Introduction

The outbreak of COVID-19 has swept the world. Under the strong leadership of the Party and the unity of the Chinese people, the current epidemic in China is now generally under control, with small-scale cases suddenly appearing in some areas. In the whole fight against the epidemic, quarantine prevention and control play a key role, and quarantine sites come into being as important places for epidemic prevention. Quarantine sites refer to places where people returning from risky areas are safely isolated. At the beginning of the epidemic, quarantine sites are built quickly because of time constraints. However, in the post-epidemic era, the shortcomings of those quarantine sites are gradually exposed, especially the lack of humane design for the psychological conditions of the quarantined people. The hierarchy of needs theory proposed by Maslow is widely used. It has provided scientific theoretical support for the humanistic view of design in environmental design. Through the use of design psychology theory, people form memories and generate unique emotional experiences in the environment. This kind of space that can interact with human psychology can be called a creative and meaningful space. Nevertheless, theories should continue to develop with the changes of current affairs. How to use design psychology to investigate the relationship between environmental design and psychology to conceive the design strategies of quarantine sites is the top priority of this article. Moreover, the purpose and meaning of this article is to provide a place for the quarantined people to enjoy themselves physically and mentally, and also to explore the positive impact of the intersection of environmental design and other disciplines on social development and humanistic concepts.

2. Literature Review

2.1. The Influence of Design Psychology Theory on Environmental Design

Design psychology is a cross-discipline between design and psychology, and its application to the habitat environment is reflected in the guidance of human emotions and psychological needs for design practice. Environmental design is based on the design psychology theory, and provides innovative design methods for how to meet the different levels of human spiritual needs. Although different regions, time, etc. can have a differential impact on environmental design, design psychology has universal implications for environmental design. Take Maslow's hierarchy of needs theory as an example. Physiological needs require a space to provide basic living functions such as eating, sleeping and air circulation, and the space should be as comfortable as possible, so that people can obtain sensory well-being through design. Safety needs refer to obtaining the happiness of avoiding danger. The sense of order can give a person a sense of security. Whether it is as large as the relationship between people and the environment, or as small as the relationship between the human body and the furniture, it should let the person clearly know the self-situation, then to some extent to eliminate fear and anxiety. Love and belonging needs are the connections with others, which makes the design of the environment should provide an atmosphere that allows for easy social interaction. In order to meet the cognitive needs of people, a space may need to create a place with a strong learning atmosphere to evoke a desire to learn or a curious desire to explore. Esteem needs vary from person to person, and the differences are often due to variance in location, age, work, etc. Therefore, a full analysis of the clientele should be conducted before the design, so as to create an artistic expression that can make users feel happy. Self-actualization needs involve not only the space itself, but also requires designers to consider the background of the times, the environment in which they are located and so on to make the space have a sense of story through design, so that users can feel the significance of themselves to the space, the environment and even the times. Although Maslow's hierarchy of needs theory is only basic knowledge in design psychology, it provides clear design direction and goals for environmental design. Different types of environments need to incorporate different psychological theories, for example, a sense of security and belonging is particularly important for quarantine sites.

2.2. The Influence of Environment on Human Psychology

Habitat design is roughly divided into landscape design, architectural design and interior design from the outside to the inside. The three do not exist independently. An ideal space should be one in which the three echo and harmonize with each other. Urban landscape design, as "second nature", is a way for people living in cities to get in touch with nature quickly. Dr. B.P. Toknnh discovered in 1930 that plants contain a substance called phytoncide, which has "antibacterial, antimicrobial, air-purifying, and mind-clearing advantages, and has uplifting and soothing effects on the human spirit and mood".1 It can be seen that some plants are beneficial to human body and mind. "Curative landscape design" is produced for the psychological state of people, especially for those who suffer from diseases and sub-healthy people. Through the connections between landscape design and people's sense of sight, sound, taste, smell and touch, people are able to get close to nature at multiple levels and multiple angles. The forms of architecture are rich and varied according to the development of the times and the regions. Gestalt psychology points out some common principles that make people feel psychologically comfortable: symmetry, simplicity and stability, as well as exposed structures that bring a sense of security. For instance, materials close to nature such as wood, bamboo and stone bring a sense of intimacy to the human psychology. The contour, size and color of architecture are also important factors that affect the psychological feelings of people. As the most intimate space for human living, the room difference in details can cause significant psychological changes.

Generally speaking, interior space requires a sense of distance, privacy, domain and security. Clear space layout and flow will give people a sense of security. Private rooms that are too permeable will weaken the sense of privacy and domain. The placement and scale of furniture affects the perception of the safe distance of the environment. Factors such as color, lighting, materials, decorative details, etc. will have an impact on the human psychology. For example, research shows that a light green environment helps people enter a quiet and calm state.

This article focuses on the analysis of the psychological state of human beings in the post-epidemic era, based on which the psychological conditions of the quarantined people, which is neglected in the current quarantine sites, are discussed. Meanwhile, the new design strategies of quarantine sites are proposed from the perspective of design psychology.

3. Design Problems of Quarantine Sites in the Post-epidemic Era

3.1. The Certain Risks of Temporary Quarantine Methods

At present, there are three main ways to temporarily quarantine people returning home from high risky areas. First, home quarantine. This method relieves the emotional stress of the quarantined person because of the close communication with family members, but there is a risk of infection of family members. Second, the use of hotels, stadiums and other public facilities through renovation. Although it has made full use of resources, those facilities are often located in dense crowds, which contains a certain potential danger. In cities with a large number of population and high mobility, quarantine rooms are obviously insufficient. Moreover, under the normalization prevention of the epidemic, long-term occupation of public facilities will also bring a certain degree of interference and psychological and emotional impact on the life of urban residents. Third, the independent quarantine sites. Compared to the above two quarantine places, independent quarantine sites are exclusive buildings to quarantine people. From the beginning of the design, it can consider the basic function of quarantine sites and the psychological state of people, thus it is more flexible, safe and professional. Independent quarantine sites are the focus of this article.

3.2. Current Problems of Independent Quarantine Sites

The current locations of independent quarantine sites are often adjacent to communities, schools and enterprises. Although it is convenient for management, there is still a problem of proximity to dense crowds, which can bring tense feelings for those around. And because of the site limitations, it is difficult to exert the harmonious aesthetics of buildings and the surrounding environment. Meanwhile, due to the lack of landscape, it cannot provide a good view for the quarantined people inside, thus creating a cold atmosphere. At the beginning of the epidemic, because of the urgent need, a large number of movable panel houses are built up to fight against the epidemic, which has played a timely and important role. However, the shape of those movable panel houses is often simple and crude, ignoring the diversity of space forms and functions. As temporary structure, it will generate construction waste and increased costs when they are dismantled in the future. So, it is urgent to consider the sustainable use of quarantine sites.

3.3. Lack of Consideration for the Psychological Conditions of the Quarantined People

The interior space is the only place a quarantined person is exposed to during quarantine and is the most important factor influencing the psychological changes of the quarantined person. However, current interior quarantine sites are simple and confined, meeting only the basic functional needs and lacking consideration for the psychological conditions of the quarantined person. According to a study at the beginning of the epidemic, "45.3% of the general quarantined population (non-healthcare or other high-risk occupationally exposed populations)

had moderate to severe depressive symptoms, and the main factors affecting the psychology of isolated persons were prolonged isolation, fear of being infected, frustration and boredom, inadequate supplies, and insufficient information".2 However, it is also worth noting that some isolated people may also feel relaxed because they are separated from work and school and have less useless social life. Therefore, for the interior design of quarantine sites, in addition to ensuring that the basic functions are reasonable and the information equipment is advanced, it should also give full consideration to how to reduce the negative emotions that the isolated people may have, and improve the positive emotions that may be generated in the isolation, such as adding new and diverse functional activity spaces, providing places where an isolated person can independently arrange time for activities or study, for the increased sense of control over life will somewhat weaken the sense of anxiety and boredom when being isolated. Depression or anxiety can have a detrimental effect on sleep, and poor sleep is equally counterproductive to a person's negative emotions, so the indoor sleeping space should be fully studied for the state of sleep to help the isolated person be able to fall asleep quickly and get a comfortable deep sleep. A study on the effect of physical exercise on the mental health of isolated people shows that "whether or not to exercise during isolation contributes more to the mental health of isolated people than high-intensity exercise and frequent exercise."3 It indicates that creating indoor exercise areas with open views and comfort for isolated people contributes to physical and mental health.

In the post-epidemic era, acute stress moments shift to periods of chronic stress, and "epidemic fatigue" is now characteristic. Prolonged and constant epidemic information may cause fatigue, confusion, and impatience in the general public due to the chronic need to maintain attention, which may be more obvious among the quarantine people. It can be concluded that paying attention to mental health and quarantine site construction in the post-epidemic era is a design concept that reflects humanistic care and human orientation. In addition, studies have shown that individual compliance with isolation measures is negatively correlated with anxiety levels. So, the design of isolation stations from a psychological care perspective is an important safeguard to provide a psychological dimension to the long-term battle against the epidemic.

4. Design Strategies and Methods for Epidemic Quarantine Sites on the Basis of Design Psychology Theory

4.1. Location Selection and Landscape of Quarantine Sites

From the realistic need to stay away from dense crowds, ideal quarantine sites should have ecological greenery as a natural separation zone, for example, in a suburban area that is far from the city center, has a large site, and is easily accessible. Such a location has two main benefits: first, it keeps the quarantined people away from the hustle and bustle of the city while also facilitating the transportation of supplies, and the natural scenery will give the quarantined people a relaxing impression; second, when it is necessary to artificially increase the landscape, if plant species that have the sterilizing are chosen, and the terrain, humanities and artistic aesthetics for landscape design are fully considered, it will not only help to prevent and fight against the epidemic, but also promote the design and development of the suburban landscape, which is helpful for the ecological stability of the whole city. Even if the ideal location cannot be chosen in reality, the relationship between the building and the landscape should be fully considered. The landscape design should be increased as much as possible under the premise of meeting the required area of the building, so as to take the opportunity to promote the repair and improvement of the area. The vertical design combined with the landscape makes quarantine sites not completely exposed to human view. Through this design method, the isolated people can feel the nature indoors, and at the same time dissipate the insecurity of nearby residents to a certain extent.

From the relationship between landscape design and interiors, the direction and size of windows at quarantine sites are particularly important. For example, designing large areas of glass in living rooms, yoga rooms and other relaxation spaces can provide an open view for those being isolated and provide ways for them to get as close to nature as possible. Another example is that the design of a separate balcony with plants in quarantine sites allows the isolated people to breathe fresh air and at the same time dispel the feeling of being confined in the room, and encourages them to have a hands-on plant cultivation experience, making the use of the "curative garden" concept personal. The ecological balcony designed by Farming Architect in Vietnam has some implications for the design of quarantine sites. By using a steel truss tree system and adopting a hydroponic system, fish and aquatic plants can be raised while also allowing people to experience a different way of being close to nature (Figures 1, 2, 3, 4). Since the isolated people cannot get close to the outdoor scenery, designers need to give extra thought and design to the "visual" aspect of the landscape, which is different from the previous emphasis on the "experience" of people in the landscape. The impact of restorative natural environments on attention proposed by Stephen Kaplan is generally accepted, which mentions that a good landscape should have a sense of distance, extension, charm and compatibility. Those four qualities have certain inspirations for the landscape design of quarantine sites. The design of quarantine sites should try to shield unpleasant and cluttered scenes to give the viewer a sense of experience away from the trivial and mundane; the landscape cannot be viewed at only a glance. Instead, it should stimulate the viewer's association with the unseen scenery. Designing the visual focus of the nodes can increase the charm of the landscape. Compatibility refers to the ability to naturally perform certain activities in the environment to achieve a curative effect. For those in isolation, the interior decoration and furniture should also be harmonious and functionally sound with the outdoor scenery, so that when they adapt to the environment and the pleasant exterior, they may be inspired to read by the window, do yoga, photography and other activities that can be relaxing and enjoyable, thus reducing the state of inactivity when in isolation. In addition, adding landscape vignettes that can change with time and temperature or can be changed artificially can also alleviate the tedium of seeing the same landscape every day.

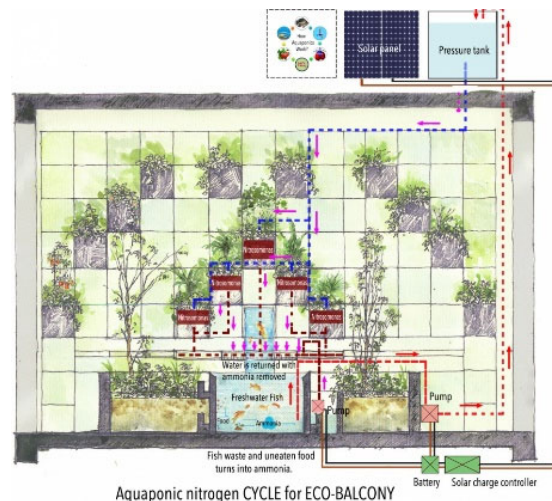**Figure 1.** Ecological Balcony Design Concept

Figure 2. Ecological Balcony with Hydroponic System

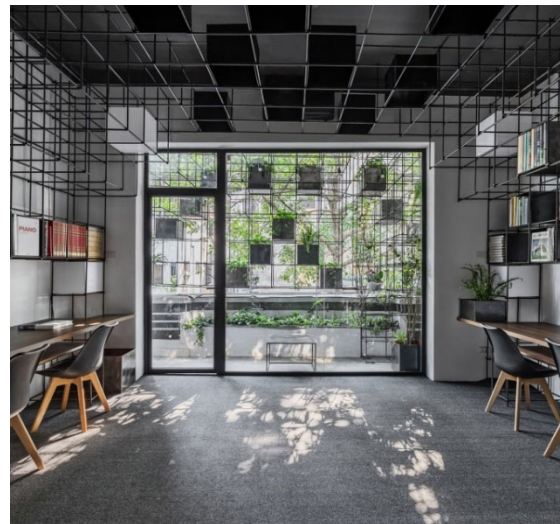**Figure 3.** Detail of Ecological Balcony

Figure 4. Renderings of Ecological Balcony

4.2. Architectural Form and Culture of Quarantine Sites

The exterior of a building is often the first impression people have of a building, and the same is true for quarantine sites for the isolated people, where the impression of the interior space is associated with the sight of the exterior. Its outline, shape, lines, and color are all important factors that constitute the psychological impact on the isolated people. The overall style cannot be generalized. However, it should not be too simple, boring and uniform, nor should it overly pursue novelty. It should be based on local architectural characteristics and culture, and properly integrate into the environment, so that the construction principles will not only make the isolated people feel respected and relaxed, but also show a city and a country's attitude and humanistic care for the fight against the epidemic.

The formal beauty of architecture is an abstract feeling that comes from the strong or subtle emotional changes that occur when people see the buildings. Although there are differences in people's perception, there are still rules about judging the beauty of architectural forms: such as harmony, unity, change, rhythm, color, etc. The metaphors and symbols of architectural forms are also important ways to arouse the psychological resonance of the masses because they require designers to fully consider the relationship between social context, culture and architecture. From a geometric point of view, if the form of quarantine sites follows a certain pattern, it conveys a sense of psychological security and control while brings a sense of overall order, and those feigns are very important for the quarantined people. The sense of scale is to

perceive the relationship between the surrounding things and oneself from the human view. The volume of quarantine sites should be controlled to avoid causing a sense of oppression. Even if the volume of quarantine sites cannot be controlled because of the functional needs, some methods should be used to increase the intimacy of quarantine sites from the psychological perspective, such as using natural materials and adjusting the proportion of the building form to influence the human vision.
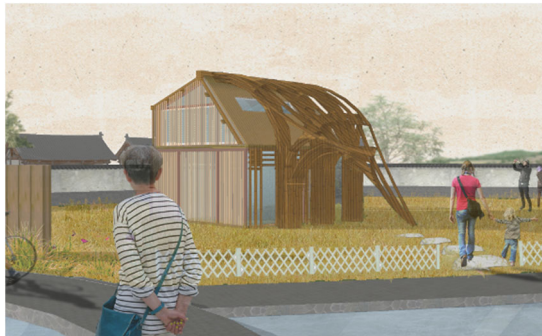

Figure 5. North Side of the Building

Figure 6. South Side of the Building

With the development of modern technology, there are more and more successful cases of innovative use of materials and structures, which are also inspiring for temporary buildings such as quarantine sites. The use of prefabricated assemblies allows for quick transportation, installation and disassembly, making them a natural and common form of temporary construction. However, extra attention needs to be paid to the fact that it often results in uniformity and lack of humane consequences, and that the main materials now commonly used in movable panel houses are metal sandwich panels and plastic, both of which are difficult to degrade and have weak environmental benefits. Therefore, the design of quarantine sites should consider both the actual needs and how to use material and structural innovations to create new spaces. For example, bamboo is a naturally renewable and easily degradable material with high environmental value. It can not only meet the needs of rapid lap and disassembly, but also has a high artistic modeling space due to its high toughness and flexibility. The author has studied the use of bamboo materials in the subject of designing a single quarantine station for the Qianmen community in Beijing. By adopting an external umbrella structure and an internal frame structure, the use of bamboo in the interior can also create a natural and relaxing atmosphere (Figures 5, 6, 7, 8, 9, 10). In addition to bamboo, there are also materials such as wood, paper and crop fibers. Owing to their more natural properties, the innovative use of these ecological materials can bring a more intimate and relaxing feeling to the occupants than man-made materials.
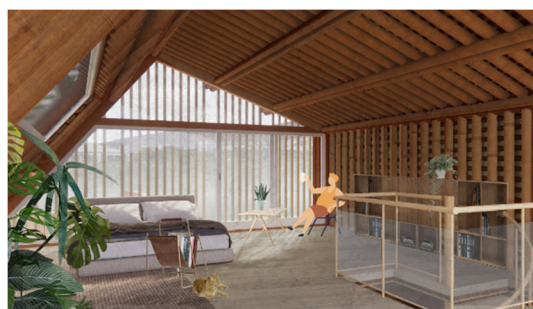

Figure 7. Renderings of the Second Floor Bedroom of the Bamboo Quarantine Station

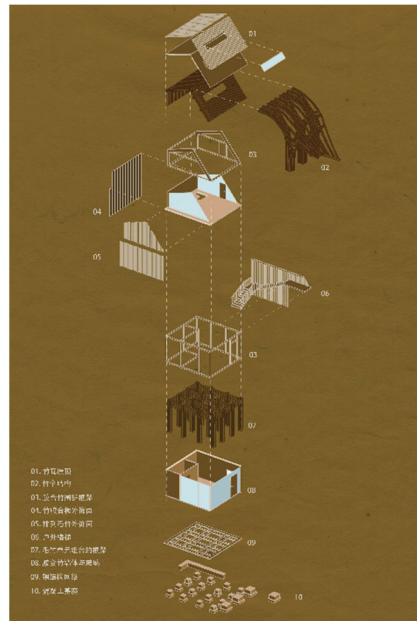**Figure 8.** Renderings of the First Floor Living of the Bamboo Quarantine Station

Figure 9. Exploded View of the Structure of the Bamboo Quarantine Station
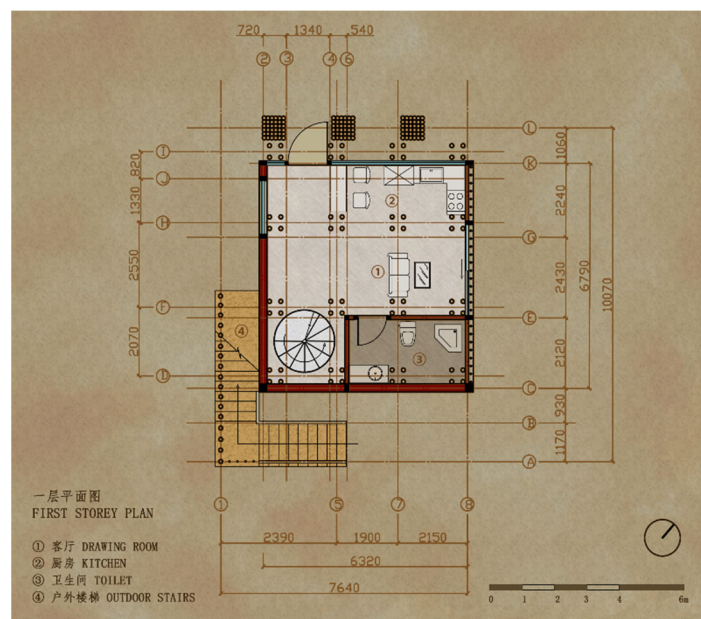

Figure 10. First Floor Plan of Bamboo Quarantine Station

4.3. Interior Design of Quarantine Sites

The interior of quarantine sites should first have facilities to meet the basic requirements of epidemic prevention, such as air conditioning, ventilation facilities and disinfection equipment

that can introduce more filtered outdoor air. In the past, the isolated space only satisfied the basic functions such as sleeping and eating, but lacked the functional space for activities that could regulate the mood. The following paragraphs will propose some additional functional spaces. It should be noted that these functional spaces should not be "stuffed" into quarantine sites; instead, the space that can take these functions are "flexible space", so that the space has a flexible layout form. Then, according to the different age groups, gender, work, etc., a few basic types of space are listed for the quarantined people to choose freely.

Studies at the beginning of the outbreak have shown whether exercise is more significant than the intensity and length of exercise on mental health. Doing exercise can effectively relieve anxiety, unrest and other emotions. In quarantine sites, the area for personal physical exercise may not need much space, but it should have a good view of the outdoors, lively colors, text and graphic guidance to create the exercise atmosphere. This will stimulate mire usual isolated people without exercise habits to physical exercise compared to just putting a few fitness equipment. As mentioned above, some isolated people will feel relaxed because they are free from work and study, but long periods of inactivity will also be accompanied by anxiety, and the lack of supervision will lead to a loss of self-control and easy distraction. Therefore, the work and study environment of quarantine sites needs to have a sense of "immersion". The separated and independent space, pure and uniform color can try to block the clutter that interferes with vision. Ergonomic chairs and books are also essential to create the atmosphere. According to Maslow's "cognitive needs" and "self-actualization needs", it is particularly important to add new things to quarantine sites, such as providing places for dessert making, coffee making, yoga learning, floral art, and so on. With intimate text or electronic guidance, it can actively guide the isolated people to participate in skills during the isolation period that they seldom involve and learn because of their busy lives, and to find joy. In addition, some studies have shown that the lack of social interaction during isolation can bring a certain degree of loneliness. Although online social interaction provides isolated people with the possibility of communicating with family members and friends, they are missing the opportunity to make new friends and communicate with others face to face. Therefore, designing public spaces where isolated people can see or communicate with each other without contact can be considered. For example, the white translucent film structure designed by Japanese architect Sosuke Fujimoto in "Watari - International Emergency Architectural Design Exhibition" provides the possibility for the isolated person to communicate with the outside world through touch (Figures 11 and 12).
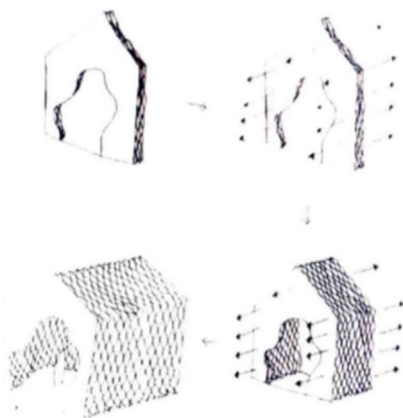

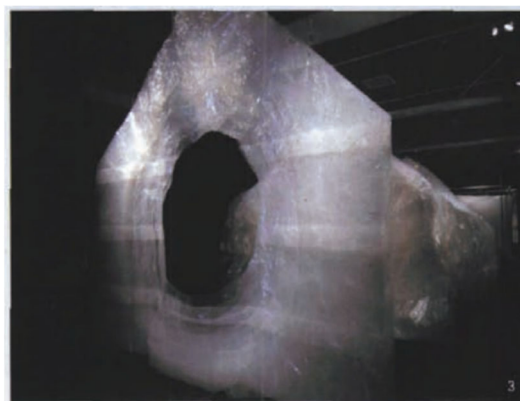
Figure 11. Air Tension House Structure   **Figure 12.** Physical Form of Air Tension House

In interior design, color as the first sensory impression, its impression on people is more intense than that of material and texture. So, the full use of color psychology requires designers to match appropriate colors according to the needs of human activities and psychology in different places, so as to provide a pleasant color environment for the isolated people. Relevant studies have listed the relationship between color and psychological feeling. Color has a sense of cold and warm, light and heavy, bright and melancholy, quiet and melancholy, etc. In the interior of quarantine sites, the use of cool colors such as blue and green grass or intermediate colors with white flavor, such as cream, light green will bring a soft and quiet feeling, and will help the isolated people quiet and become peaceful.

4.4. Monumental Significance

In the post-epidemic era, human reflection on the epidemic is linked to the "need for self-realization and self-transcendence," and design psychology can unlock people's memories of visual images, particular objects, experiences, and patterns and messages, offering the opportunity to create spaces that are meaningful to them, forming a new design paradigm of "liberating role". Considering the historical and contemporary nature of architecture, the author believes that the quarantine sites can not only meet the current needs of epidemic prevention, but also create a collective memory by humanizing the design of quarantine sites while satisfying the self-actualization needs of those isolated today. Current quarantine sites can be transformed into memorial sites for the epidemic in the future, paying tribute to every citizen who have cooperated with the epidemic prevention during the epidemic while reflecting on the ecological and social implications of the epidemic. And in this way, the quarantine sites are given a social and memorial significance.

Figure 13. Overall Renderings of Guangzhou International Health Site

Figure 14. Interior Design

In 2021, Guangzhou has already started to design and build the International Health Site. As the first International Health Site in China, it will replace the original quarantine site. It has considered different people and designed different room types, with a style that draws on the

traditional folk architecture of Lingnan region. The Health Site also provides humanistic care. The intelligent system helps the communication between occupants and residents, health management, etc. American public health experts have praised this initiative and stressed that it will be the most advanced quarantine center in the world, because it is very high-tech and sophisticated. When the Health Site becomes more professional, humane and international, it will be a collective warning to future generations and a symbol of hope that humanity can withstand and overcome any obstacle. The existence itself will be monumental (Figures 11 and 12).

5. Conclusion

In the post-epidemic era, although we are familiar with the COVID-19 and its prevention has been effective, the trauma brought by the epidemic has not yet disappeared. Only by designing from the perspective of human psychology is it possible to create works that are curative to the human soul in this era. The future quarantine sites should not only meet the basic requirements of epidemic prevention, but also flexibly use new techniques, materials and technologies. It should abandon the uniform practice of "temporary buildings" in the past, and not ignore people as the real users for the sake of saving time and effort. It cannot be neglected at present to explore a set of people-oriented, scientific and effective construction theory and design psychological system for quarantine sites. As the Party and the state advocate to be prepared for a long-term battle against the epidemic, the design of quarantine sites should keep pace with the times. In addition to the psychological level, designers should also timely find and analyze other problems during epidemic prevention, and flexibly solve problems with the development of current affairs to contribute to public health and wellness.

Annotations

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