An Overview of Trends in Architectural Space After COVID-19

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Abstract. In the aftermath of the COVID-19 epidemic, most countries responded to the spread of the epidemic by adopting a closed management approach, with changes in living spaces being the most discussed in the field of architecture. This paper briefly organizes the research related to the spatial changes of buildings after COVID-19, and presents people's needs for buildings in the post-COVID-19 period. The method used in our study is known as a qualitative analysis approach, mainly through the collation and analysis of the literature following the epidemic. In summing up, it may be concluded in three aspects: firstly, there is a clear increase in the demand for quality in the built space, especially in the physical environment (landscape, lighting, ventilation); secondly, there is an increase in the demand for flexibility in space, both from architects and users, who want to meet the demand for the use of space by flexibly transforming its function or flexibly dividing it, i.e., flexible space; and thirdly, although changes in space can be an effective response to epidemics, changes are not necessary.

Keywords: COVID-19 · Architecture · Housing · Space · Resilience

1 Introduction

After the COVID-19 epidemic, there was a complete change in the way people lived [1]. Most areas responded to the spread of the epidemic by adopting a closed management approach [2]. Houses become the buildings where people live for the longest time. As a result, the changes in residential spaces following the epidemic are most discussed in the field of architecture. Existing research suggests that housing becomes indispensable for the treatment and isolation of positively diagnosed people [3], while housing should also be adapted to the epidemic [4]. The design of apartments after the epidemic should pay attention to landscaping, lighting, bedroom design, air quality, balconies and a reasonable scale of units. As the epidemic developed, discussion of other building types began to increase, such as restaurants [5], hotel spaces [6], and libraries [7]. In addition, some scholars argue that the use of flexible space in architecture should be rethought after the epidemic [8]. The increase in the amount of literature provides more references to study the changes in space before and after the epidemic. However, there is a lack of collation of articles in related fields in academia, which is the aim of this thesis. This

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paper sorts out the research related to the spatial changes of buildings after COVID-19. A critical analysis of the literature can reveal some important factors that contributed to the improvement of the epidemic situation, as well as some useless attempts. The research will provide valid recommendations for architects, planners and related practitioners in post-epidemic architectural practice. The study uses a qualitative analysis approach, mainly through the collation and analysis of the literature following the epidemic. The research questions are used as a basis for a fundamental understanding of spatial changes in buildings. This paper sorts out the changes in architectural space after the epidemic and provides a clear reference for future research and practice. The research will provide valid recommendations for architects, planners and related practitioners in post-epidemic architectural practice.

2 Analysis of Architectural Design Needs After COVID-19

The outbreak has restricted people's outdoor activities and increased the amount of time spent inside buildings. The immediate impact of this shift has been an increase in the demand for quality interior spaces. Each epidemic outbreak in the world has led to changes in architectural design strategies [4]. This is partly due to the changing needs of people and partly because design strategies can play an important role in the prevention and control of epidemics [9]. Yu & Fujii's [10] research demonstrates that psychological factors largely influence building design. More than ever, people need open spaces, large window openings, soft colors and continuity between indoor and outdoor spaces to alleviate the mental health effects caused by the epidemic (Fig. 1). Torres et al., [11] found by means of a survey that people are generally satisfied with their homes, but they would like to have a better view or outdoor space, and this is also supported by the research of Amerio et al. A good view not only compensates for the lack of access to the outdoors and keeps people in a good mood, but also contributes to their physical health. A well-orientated balcony or window can therefore effectively increase the quality of indoor life [12].

With the development of digital technology, many activities can be carried out from home, such as remote working. As an alternative, remote working can indeed cope with the shift in working patterns after the epidemic. Research has shown that the built environment has an indirect effect on both remote work satisfaction and productivity, with the most important influencing factors being comfortable spaces and ergonomic furniture [14]. When the living environment is transformed into a working environment,

Fig. 1. Detail of the balcony at Qiyi Urban Forest Garden, Chengdu [13]

the demands on the quality of the space are further increased. Torresin et al., [15] argue that the same type of space may be comfortable when used for relaxation but requires a better acoustical environment when used as an office. As many companies began to return to work and production, people began to return to their former workspaces. Conversations are more effective in person, people are more active, and a lack of ergonomics at home are all motivating factors for a return to the office. It has become clear that for many, our homes weren't meant for this lifestyle, and that home should be home and work should be work. In summary, high-quality space is the first element to be considered by architects and stakeholders in future architectural design strategies.

The spread of epidemics and outbreaks is often very rapid. In such cases, the introduction of flexible spaces can allow buildings to meet the needs of everyday life as well as respond to emergency situations. Increasing the flexibility of how buildings are used can be a better response to an epidemic [8]. As mentioned earlier, due to the impact of the epidemic and technological advances, many activities can be carried out at home. This means that some of the space inside the house needs to be transformed into other functions to support new activities, and what was originally a leisure space may be used as an office or a school, and this flex space is known as resilient space [15]. The result of this transformation in housing is a blurring of the boundaries between public and private space [12]. The flexible handling of boundaries is also one of the tendencies of future design strategies. In practice, flexible spaces are used in a wider range of applications. Phapant et al., [16] argue that more resilient office space and factory buildings are needed to ensure the safety of workers during an epidemic. Hospitals are challenged by the epidemic in many ways, for example, by the far greater number of patients than usual. To deal with this situation, a convertible unit option could be implemented within the hospital [17]. These units can be used as office space or treatment space during weekdays, and as isolation wards during times of epidemics (Fig. 2).

This type of spatial treatment has even been used in public buildings. China, for example, transformed many stadiums and hotels into treatment and isolation spaces during the epidemic, to good effect (Fig. 3). The transformation of large public buildings into healthcare spaces, as described above, can increase the medical capacity of cities [19]. The design of flexible spaces is not just about functional transformations but may also be about meeting different uses through flexible mobile partitions [20]. In addition to its use in architecture, flexible space also influences spatial change in the city. Lekić Glavan et al., [21] show that the prerequisites for achieving resilient urban spaces are

Fig. 2. Isolation Ward, Wuhan Lei Shen Shan Hospital [18]

Fig. 3. Wuhan Sports Centre Square Cabin Hospital [23]

adaptability, flexibility and convertibility. In addition, a resilient approach can be used on the one hand for the handling of space and on the other hand for the management model in the event of an epidemic. A resilient management approach improves the ability of managers to respond to unexpected risks [22], while also reducing wasted resources during non-epidemic periods. During the COVID-19 pandemic, resilient space will be used as the primary space response strategy to meet the varying needs of people in a limited space environment.

Many studies are emphasizing the use of spatial changes in response to the COVID-19 epidemic. However, there are still some spaces that have not changed and are still adaptable to the outbreak. This suggests that some traditional space design strategies are still applicable. [24] argues that the use of traditional concepts in modern urban housing can still reduce the spread of viruses. This illustrates that spatial change is not the only way to respond to an epidemic. The fact that outbreaks are rapid and response strategies lag means that traditional strategies still play a role until new ones are created. Marichela [25] found, through an analysis of 30 public buildings, that their spaces did not change during the COVID-19 epidemic blockade and that people used them successfully. Furthermore, flexible space is not a product of modern urban architecture, as similar concepts exist in some traditional buildings, such as the Threshold space used in traditional buildings in the Rumoh Aceh area of Bali, which can reduce the threat of viruses through five mechanisms [3]. Although, there are many studies that demonstrate the role of building-related practitioners during an epidemic [1], the role of building-related practitioners is not necessarily to respond to changes in the epidemic by changing the traditional spatial paradigm. Hamidi, Sabouri and Ewing [26] showed that there was no direct relationship between urban density and the development of the epidemic, and even the survey found that some cities had lower mortality rates in high-density areas than in suburban areas. Therefore, instead of advocating for low density areas to stop the epidemic, the building stakeholders are working with the government to advocate for some epidemic prevention measures or to add some specific services, such as additional medical services to areas with weak medical facilities. In general, spatial variation is an effective but not always necessary measure in response to the COVID-19 epidemic. Spatial patterns prior to the epidemic still have some value, and therefore one needs to be more flexible in dealing with space.

3 Conclusion

This study was a qualitative analysis of the available information, drawn mainly from existing literature and research. Three findings emerged from the above analysis. Firstly, due to the increased amount of time spent indoors, there is an increased demand for space quality. Although this demand is largely influenced by the type of building. Secondly, the introduction of flexible spaces helped the building better adapt to the changes in the epidemic. Because many activities were forced to take place at home, people needed to convert parts of their former homes into office or study spaces. In some large public buildings, the transformation of public spaces into medical spaces has been effective in relieving the pressure on medical buildings during times of epidemics. Thirdly, spatial change is an effective, but not necessary, element of the response to the epidemic. Some pre-epidemic architectural spaces still showed some value during the epidemic, meaning that architects may have to be more flexible in their design strategies in times of epidemics.

There are two main limitations to the study. Firstly, it is discipline-specific; the spatial changes following the epidemic studied in this thesis are mainly based on the perspective of the field of architecture. Secondly, the study is mainly based on analysis at the theoretical level and involves fewer practical cases.

This thesis is a brief overview of existing research and offers some insights. Future research directions could look at changes in built spaces from a broader perspective, in disciplines such as environmental health, epidemiology and sociology. In addition, with the increase in practical projects, researchers could make greater use of real-life examples to analyze changes in built space in the post-epidemic period.

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