

Solving Consumer Psychological Problems in the Post-Epidemic Era Based on Survey Analysis and Device Modeling of Chinese and American Shopping Malls

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Abstract: Since the outbreak of the COVID-19 pandemic, both the global economy and mall business have been greatly affected. How to reduce the impact of the outbreak on daily life is an important topic. However, how to help the economic recovery of shopping malls in spatial planning is a weak link in the research. Therefore, this paper takes The MIXC in China and Beverly Center in United States as examples, and uses field research, questionnaire survey, data collection and analysis to explore the impact of COVID-19 on shopping malls and consumers' psychology at home and abroad, and to find suitable shopping mall space transformation methods during and after the epidemic. Finally, the author proposes to set up disinfection spaces and rest stations as solutions to reduce the economic impact of COVID-19 on malls. However, in this study, the number of samples and long-term research data are less, and the proposed model needs more experiments to confirm and improve.

Keywords: Post-pandemic Shopping Malls Design, COVID-19's Influences on Economic Activities, Consumer Psychological.

1. Introduction

1.1 Background

At present, every country in the world is in the midst of the COVID-19 epidemic, which has a great impact on all walks of life and even the national economy. COVID-19's unrelenting global reach has had a major impact on the spatial planning of markets and economic activities. Studying those aspects can be helpful for understanding the impact of the COVID-19 pandemic on people's lives. In the context of the COVID-19 pandemic, a time when consumers' purchasing power and desire to buy have decreased significantly and the operation of shopping malls has been affected, how shopping malls get out of the predicament determines whether shopping malls can be revitalized and revitalized. The redesign of shopping malls is an important element in the revival of the post-pandemic world.

According to the data from the Center for System Science and Engineering (CSSE) at Johns Hopkins University (JHU), as of the 6th of August 2022, the COVID-19 pandemic has infected over 583,073,536 people and killed over 6,416,463 lives worldwide [1]. It is obvious that the COVID-19 pandemic has had a very significant influence on the life of people all over the world, including Chinese and American people.

Because it can be hard to manage regions separately in large metropolitan, metropolitan areas encounter greater challenges in controlling the spreading of the COVID-19 virus compared to sites with lesser population density [2]. Among all the diverse and complex elements that form a metropolitan society, shopping malls play an important role in people's consumption and the control

of the virus in public spaces. Understanding the spread of the virus at post-pandemic malls can help to predict the development of public construction and entertainment activities in the post-pandemic time.

1.2 Research topic

This paper hopes to provide a new solution to the economic impact of COVID-19 in shopping malls under the influence of the overall global economic environment after the outbreak of COVID-19. People choose to reduce the number of times they go to the mall because they are afraid of being infected with the virus. This paper, from the perspective of setting up disinfection space, eliminates people's resistance to entering the mall, so as to alleviate the fundamental problem of reduced turnover caused by the outbreak of COVID-19 in the mall.

This paper takes COVID-19 as the background to explore the changes that shopping malls should make, and takes shopping malls as an example to explore the global economic environment. In further research, the themes in this paper will be continued and expanded to explore broader economic measures in the context of COVID-19.

1.3 COVID-19 Pandemic's impact on shopping malls

1.3.1 Impact of the pandemic on the real economy

The COVID-19 pandemic has hit the brick-and-mortar retail industry hard. In order to prevent the spread of the epidemic, shopping malls were sometimes closed during the COVID-19 pandemic. Even when they reopened after the pandemic slowed down, shopping malls experienced an inevitable decline in customer flow, making it difficult for department stores to return to their pre-pandemic status. Because of the repeated periods of the pandemic, all walks of life can face greater pressure, leading to the depression of the entire consumer market, shopping malls are also difficult to be immune to.

1.3.2 Insufficient innovation

When malls first enter the market, consumers are attracted to their innovative format. When the first department store was set up, it attracted the attention of countless consumers. Since then, shopping malls have created a new form of open-shelf sales and sparked a new wave of debate.

However, traditional malls often lack uniqueness and innovations, often designed with jewelry and cosmetic stores on the ground floor and clothing stores and dining on the upper floors, as in most malls. Brands in shopping malls are also similar. This can have negative effects on consumers' willingness to shop in malls, leading them to begin choosing online shopping instead. In the context of the economic downturn caused by the COVID-19 pandemic, innovative mall designs and management become even more important to boost consumer consumption in malls[3].

1.3.3 Impact of e-commerce

The COVID-19 pandemic has dealt a blow to the brick-and-mortar department store industry but brought development opportunities to e-commerce. Shopping at home became the norm. Shopping can happen with the clicks of a finger. Online shopping platforms have more commercials and allow consumers to easily compare prices. These are advantages offline shopping does not have. With the lack of innovative forms, lack of interest in consumers, lack of buzz, and impact of the Internet and new retail, department stores' competitiveness is shrinking year by year. In the context of the pandemic, customers reduce the frequency of visiting malls due to their concern about contracting the virus and lacking proper preventive measures in malls.

1.4 The importance of separate disinfection spaces for shopping malls

Disinfection is very important during an outbreak. COVID-19 virus is mainly transmitted through droplets and contact. Disinfection can kill the virus in the environment and cut off transmission routes, which plays an important role in epidemic prevention and control.

In the post-pandemic time, many consumers will still have psychological resistance to visiting indoor public spaces such as malls. Establishing sanitized spaces can help to reduce consumers' psychological resistance and increase consumer traffic in malls.

Pandemic prevention is important for shopping malls as it not only can dispel consumers' fear of the virus and promote shopping activities but also can avoid the indoor spaces of malls from becoming spaces for transmission and boost pandemic control in society. In the following questionnaires presented, respondents expressed their concerns about shopping in malls during the pandemic and emphasized the importance of disinfection in the eyes of the public for epidemic prevention and control. Therefore, starting from the establishment of disinfection space, pandemic prevention and control measures need to be established in shopping malls to cope with the pandemic's impact on economic activities.

2. Method

2.1 Questionnaire survey

2.1.1 Questionnaire design

During the research for this paper, questionnaires and field trips were used as the main research methods. One Chinese and one English questionnaire were designed to collect data. Questions in the two questionnaires are similar. The Chinese questionnaire used the WENJUANXING platform, and the English questionnaire used the Survey Monkey platform. The questions mainly asked about respondents' shopping behaviors and respondents' opinions of different aspects of the design of malls. Table 1 shows research themes, aspects, and questions. The answers to the questions can help to visualize consumers' opinions of post-pandemic shopping malls.

Table.1. Post-pandemic shopping mall development: research theme, aspects, and questions

Research Themes	Research Aspects	Research Questions
Shopping behaviors	Consumers	1. What is your age range?
Shopping behaviors	Consumers	2. What are your preferred pronouns?
Post-pandemic public spaces	Consumers, commercial developments of malls, and architectural design of malls	3. To what extent do you think the COVID-19 pandemic influences shopping malls overall?
Post-pandemic public spaces	Consumers and architectural design of malls	4. Do you think the special planning of shopping malls changes in post-pandemic time?
Post-pandemic commercial development	Consumers and commercial developments of malls	5. Do you think the promoting activities in shopping malls change in post-pandemic time? If so, why?
Post-pandemic public spaces and commercial development	Consumers and commercial developments of malls	6. In what aspect(s) do you think shopping malls are most influenced by the COVID-19 pandemic?
Shopping behaviors	Consumers and commercial developments of malls	7. Do the COVID-19 pandemic influences your willingness to shop at shopping malls?
Shopping behaviors	Consumers and commercial developments of malls	8. Do you think the COVID-19 pandemic influences your consumption patterns at shopping malls?

Shopping behaviors	Consumers and commercial developments of malls	9. What type(s) of goods do you usually shop at shopping malls?
Post-pandemic public spaces	Consumers	10. What COVID-19 prevention measure(s) do you think shopping malls should take?

2.1.2 Questionnaire result

There are 121 Chinese respondents. Most of the respondents are between 18-30 years old or over 50 years old, but respondents were relatively uniformly distributed in diverse age ranges, including 30-40 and 40-50 years old. There are 12 American respondents. Most American respondents are between 18-30 years old and are female. The data collected from the two questionnaires can lead to the following conclusions as shown in Table 2.

Firstly, most respondents to both questionnaires believe that the overall impact of the pandemic on shopping malls is moderate to large. Most of them think that this is reflected in the income and spatial planning of malls. In contrast, a smaller number of respondents believe that it is reflected in the management of shopping malls for tenants and customers.

Secondly, most respondents to both questionnaires believe that the pandemic led to a decrease in their frequency of visiting malls.

Thirdly, most respondents to both questionnaires believe that the promotional activities in shopping malls have increased after the pandemic.

Fourthly, food occupies the largest proportion of Chinese respondents' consumption patterns in malls, while clothing occupies the largest proportion of American respondents' consumption patterns in malls.

Fifthly, most Chinese respondents believe that the pandemic prevention measures that should be taken by shopping malls include setting up temperature measuring spots and COVID-19-related personal information checkpoints. But most American respondents believe that the pandemic prevention measures that should be taken include encouraging all staff and consumers to wear masks and providing free disinfection wipes and masks.

Table.2. Questionnaire results: data analysis of most (>/ 50%) Chinese and English respondents

Research Themes	Chinese Respondents	English Respondents
The overall impact of the pandemic on shopping malls	Moderate to large; reflected in income and spatial planning of malls	Moderate to large; reflected in income and spatial planning of malls
The pandemic's influences on people's frequency of visiting shopping malls	Leads to a decrease	Leads to a decrease
The pandemic's influences on shopping malls' promotional activities	Leads to an increase	Leads to an increase
Consumption patterns	Food occupies the largest proportion	Clothing occupies the largest proportion
The pandemic prevention measures that should be taken by shopping malls	Setting up temperature measuring spots and COVID-19-related personal information checkpoints	Encouraging all staff and consumers to wear masks and providing free disinfection wipes and masks

2.2 Field trip observations

Sometimes it is hard to spot infected individuals and avoid contacting them. People can be infected by the virus by contacting asymptomatic carriers or pre-symptomatic individuals [3]. The transition of the virus in public spaces can be fast. Therefore, new facilities and policies need to be added to prevent the spread of the virus in crowded places such as shopping malls. Information collected on site can help to reflect the real COVID-19 controlling situation at malls. Therefore, four field trips to shopping malls in China and the US are conducted.

2.2.1 Beverly Center

Beverly Center is an eight-story structure located at the edge of Beverly Hills and West Hollywood in the Los Angeles County in California in the US. One of its major characteristics is a six-story series of escalators that can offer visitors views of the Hollywood Hills, Downtown Los Angeles, and Los Angeles West. Another major characteristic can be the skylights with multiple layers allowing a great amount of sunlight to enter the building.

Inside the building, there are many COVID-19-related pictograms. Most of them were suggesting people wear masks, keep a safe distance, and wash hands. The pictograms were shown using boards, screens, and printed paper. They were shown at elevators, rest areas, restrooms, and the entrances of stores and restaurants. Figure 1 shows the COVID-19 related pictograms at Beverly Center.

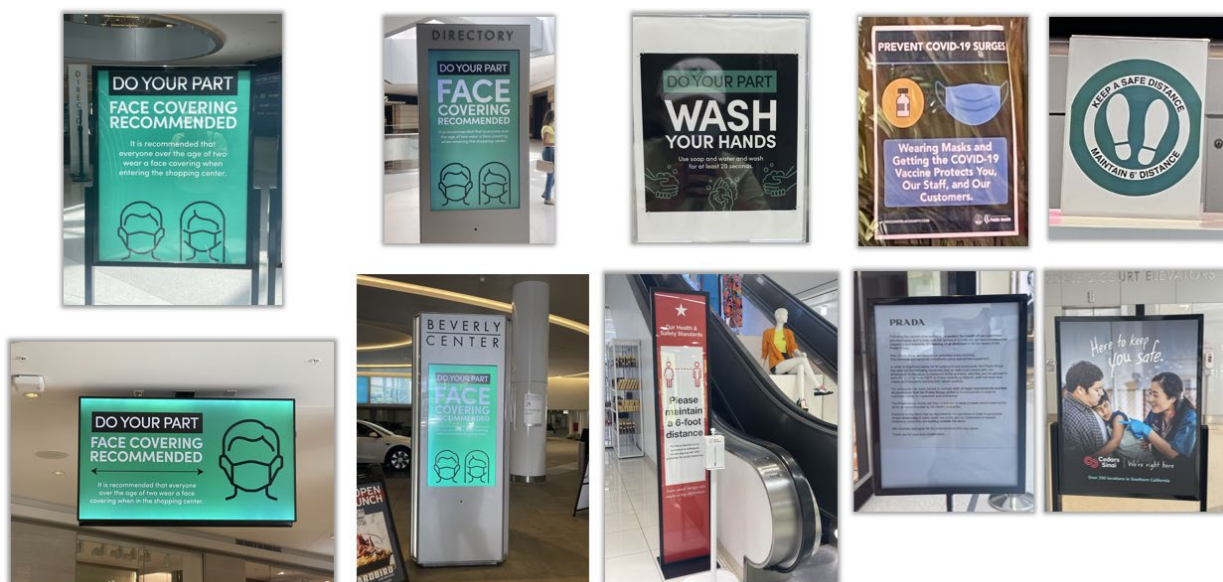


Figure 1. COVID-19 related pictograms at Beverly Center

There were COVID-19-related facilities inside and near the mall. Same as the pictograms do, hand sanitizers are distributed all around the mall: at elevators, at rest areas, and at the entrances of stores and restaurants. There is also a free COVID-19 testing spot near the mall. This facility can be helpful as it is in a busy commercial area and relatively near to residential areas.

Another creative characteristic is the vending machines in the mall. The mall not only has regular vending machines that sell drinks but also has a “Cupcake ATM” and a machine that sells frozen yogurts. This can be a good method of reducing the interaction between people during the pandemic. The machines may even promote the as people may want to see how machines make cupcakes and frozen yogurts. But on the other hand, the machines also lead to a reduction in employment.

The mall has a diverse group of consumers: from children to elderly people. The customer traffic at the mall is moderate. People wearing masks compared to people not wearing is approximately 50% to 50%, and some staff members were not wearing masks.

2.2.2 Beverly Connection

Beverly Connection is a large power center located in Beverly Hills, Los Angeles, California, US. Unlike the indoor shopping mall Beverly Center, Beverly Connection is a combination of indoor and outdoor commercial areas. Figure 11 shows a the birds-eye view of Beverly Connection.

There are many COVID-19-related facilities and pictograms at stores in the Beverly Connection, such as hand sanitizers and pictograms suggesting people keep a safe distance. There are also machines for checking prices and information, which reduce the interaction between people. Figure 2 shows the COVID-19 related pictograms and facilities at Beverly Connection.



Figure 2. COVID-19 related pictograms and facilities at Beverly Connection

Customers of Beverly Connection are diverse: from children to elderly people. The consumer traffic is moderate. People wearing masks compared to people not wearing is approximately 50% to 50%, and some staff members were not wearing masks.

2.2.3 The MIXC in Haikou

Haikou MIXC is a one-stop shopping mall located in Haikou, Hainan, China. The consumer traffic and consumer diversity in the mall are both high. Most consumers are wearing masks.

Luxury business in the mall is mainly not in a good condition. The first floor is reserved for luxury brands including Louis Vuitton and Chanel, but the pandemic causes the luxury brands unable to begin their business. In this case, the first floor is temporarily arranged as an art space. But gold is a special case. During the pandemic, gold became a hard currency, and many guests were willing to buy gold as another form of property reserve. Therefore, the consumer traffic to the gold stores in the mall during the pandemic is relatively stable.

Compared to other business, the dining services in the mall is in relatively better condition. The field research showed that even on weekdays, there are long streams of customers queuing up to eat in the dining area. Although consumers face potential infection risks while eating, the dining area takes disinfection measures and uses discount promotions and other activities to attract customers.

Same as Beverly Center and Qingdao MIXC do, Haikou MIXC also has a semi-open building structure with large skylights. The semi-open structure enables a large amount of sunlight to enter the indoor area during the day, making the shopping environment more comfortable and helping to sterilize the area.

2.2.4 The MIXC in Qingdao

Qingdao MIXC is a one-stop shopping mall located in Qingdao, Shangdong, China. The consumer traffic in the mall is moderate. The consumer diversity is low, and consumers are mainly young adults. Most people are wearing masks.

During the pandemic, Qingdao MIXC stopped cinema services and reduced the number of clothing stores. But the dining services, beauty stores, and electronic equipment stores were relatively less affected by the pandemic.

The mall has a creative appearance as an irregular cuboid, which retreats inward towards the main road. The building consists of six floors above ground and two underground floors, which are directly connected to the subway entrance. Qingdao MIXC has a semi-open structure with large skylights that allows natural light to come in directly, creating a special visual effect.

The mall has an outdoor area with several outdoor basketball courts, but their uses decreased during the pandemic. Therefore, people change their moving pattern: lesser people enter the LG floor (where the basketball courts are located) and more of them directly enter the F1 floor (the first floor inside the mall).

2.2.5 Field trip results analysis

There are some interesting differences and similarities between the two Chinese and two American shopping malls.

The first difference is that Chinese and American malls utilize different methods of controlling the virus. Chinese malls often have strict disinfection requirements as the government believes those are essential to protect the safety of citizens [4] and hire staff members to supervise the implementation. However, the American malls mainly rely on people's self-management, and pictograms and signs are used more often. Both Chinese and American malls utilize technologies to assist in the control of the virus. But Chinese malls mainly use technologies to check the health condition of visitors, while American malls use machines to replace staff members for relatively simple tasks.

The second difference is that Chinese and American shopping malls run in different modes. Different malls can have different compositions of store types and spacial plannings, which are highly influenced by cultural backgrounds and people's lifestyles. The pandemic promotes the development of shopping and thus accelerates the elimination of shopping malls that are without a successful mode. Destination centers and retail centers can be two successful modes that will help shopping malls survive. The two Chinese malls in the field trips have destination center characteristics, while the two American malls have retail center characteristics.

Destination centers focus on one-stop shopping and can have very diverse services and facilities other than stores. Many Chinese shopping malls have gyms, cinemas, restaurants, bookstores, photo studios, and clothing stores. By contrast, retail centers mainly target specific consumer groups with their needs. The two American shopping malls only have retail services and only have clothing stores and restaurants. Because the two American malls targeted very different consumer groups, Beverly Center has much more luxury stores, while Beverly Connection only has common prices stores.

Public transportation, including buses and subways, are often very well-developed in big cities in China. Therefore, many people Chinese people choose public transportation over private cars as the former is more economical. Because taking public transportation is less convenient than using private cars, Chinese people often prefer one-stop shopping as it can save transportation time. However, American people often do not have access to well-developed public transportation. Due to the lack of access, sanitation problems, and safety concerns, many American people prefer private cars over public transportation. The preference for driving cars changes the planning of urban areas and allows retail centers to be developed. Both two models will continue to be used in China and the US after the pandemic, as they are suitable for the lifestyle of local people, which will not change significantly.

There are also some similarities between the Chinese and American malls. Both the two Chinese malls and the Beverly Center mall have large skylights indoors and have creative exterior appearances. Those features can show that the malls value architectural design and it influences the consumers' experiences. This trend will continue to be present in China and the US after the pandemic, as the competition between online shopping platforms and shopping malls will be more severe, and shopping malls need to use good shopping experiences to attract consumers.

2.3 The future of post-pandemic shopping malls

Customers of Beverly Connection are diverse: from children to elderly people. The consumer traffic is moderate. People wearing masks compared to people not wearing is approximately 50% to 50%, and some staff members were not wearing masks.

In the post-pandemic time, shopping malls need to make changes in many aspects to meet the newly emerged needs and requirements. It can be a complex process to improve a shopping mall's ability to reduce the spread of the virus, as many factors need to be taken into consideration. Among them, there can be several important factors.

The first one is the improvement of ventilation. According to World Health Organization (WHO), the COVID-19 virus can spread in poorly ventilated indoor spaces for a longer period, as aerosols will remain suspended in the air in this situation or travel faster than conversational distance [5]. Improving ventilation can help to reduce virus particles indoors and keep COVID-19 from spreading. Post-pandemic malls maybe can have more windows or ventilators.

The second one is artificial intelligence and touchless technologies. Post-pandemic shopping malls can use artificial intelligence to complete tasks that staff members originally did, such as selling food, to reduce the interaction between people. Disinfection doors are an example of touchless technology used in the pandemic. It sprays disinfectants on users walking through. Users do not need to touch anything in this process. Malls can set up sanitization areas with disinfection doors and free masks at the entrances. Figure 3 shows the design of a sanitation area for post-pandemic shopping malls.



Figure 3. Sanitation areas refectation

The third one is refocusing on green spaces. Shopping malls are often in big cities, so often there are not enough green spaces around commercial areas. Adding more plants is beneficial for improving air quality and people's health. Although often there is no space on the ground for additional plants, adding a sky park on the top of a building can be an option.

The fourth one is the planned routes for consumers to avoid gathering. The gathering of many people can be dangerous as it provides the condition that allows the virus to transmit fast among people. WHO believes that the virus mainly spreads among people in close contact, and people contact the virus after inhaling infectious particles in the air [6]. Instructions, signs, or temporary walls can be used by malls according to planned routes for consumers to follow. This may reduce consumers' unnecessary visits to crowded spaces.

The fifth one is to help consumers to maintain a safe distance indoors. It is recommended by the Center for Disease Control and Prevention (CDC) in the US to stay at least 6 feet away from other people indoors in public [7]. Chinese authorities also have similar recommendations. Clearly, helping

users to maintain a safe distance is essential in designing post-pandemic shopping malls. There should be enough spaces in hallways, in elevators, and between tables.

3. Important features for post-pandemic shopping malls

3.1 Disinfection space

3.1.1 Design concept

To address the issue of disinfecting mall entrances during and after the pandemic, a disinfection space is designed, the front half is for people to wash their hands, the middle is separated by a transparent curtain, and the back is a spray disinfection space. This disinfection space is designed to be 3 meters wide and 3 meters high and 12 meters long. The specific size and height can be designed according to the size of the mall entrance.

3.1.2 Model is introduced

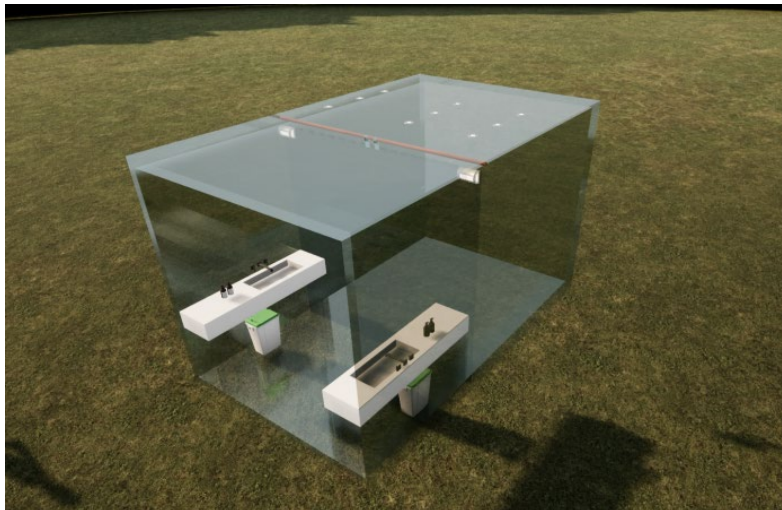


Figure 4. Model overview

The whole material of this entrance space is made of transparent glass or transparent solid plastic, which is intended to be tightly integrated into the entrance space of the mall and to be easy to manufacture and reduce weight [8]. Figure 4 provides a visualization of whole model.

The first half is a space for people to clean their hands, with sinks and hand sanitizer as needed. Function divided the middle section, separated by a transparent curtain, part for people's body after disinfection, with containing 9 to 12 nozzles at the top are emitting gas, such as rubbing alcohol, is used to people body and the clothing disinfection, people would stay in the bottom half of the 30 seconds to 1 minute to ensure the disinfection effect of a foundation. We also extended the length of this sanitized space to avoid fog affecting the surrounding shops.

3.1.3 Before and after placement

A comparison of mall entrances before and after the pandemic is conducted, comparing the difference between putting in this disinfection space and not putting in this disinfection space. The entrance of the mall has not changed much after the disinfection space is put into the entrance of the mall. The disinfection space is tightly combined with the entrance of the mall, and the normal use space of the entrance is also left. This space can be used as a disinfection space during the COVID-19 period, but in the post-pandemic era, this space can also be used as a regular protection. It has the value of long-term use, not only for a short period of time, but also does not need to be dismantled after use.

3.2 Rest stations

3.2.1 Design concept

The covid-19 virus is transmitted among people in various ways and transited faster in indoor environments, causing many people to have concerned about being exposed to the virus in indoor public spaces. This fear can cause anxiety. Thus, providing consumers with relatively safe indoor environments is important in the design of post-pandemic shopping malls. Take the shopping mall Shanghai SWEET7 as an example. Through the setting of a U-shaped aluminum screen around the indoor space and the use of a cylindrical aluminum screen as a cover for the bar, the building includes a high- and low-level layout of booths to help consumers maintain safe distances and for adding greenery to the construction, which is also helpful for improving the air quality. This design helps to ease the consumers in their shopping experiences.

In addition, indoor seats also require attention. Usually, the walking radius of young consumers in commercial space is 180m ~ 210m every 30 minutes, and the walking radius of elderly consumers is 60 ~ 100m every 20 minutes [9]. The reasonable arrangement of a sufficient number of seats and other rest facilities in the space is very important in maintaining safe distances and alleviating consumers' fatigue, which helps to prolong the shopping time and explore the potential consumption motivation of consumers.

Therefore, variable modularization can be a beneficial element in post-pandemic shopping malls. Semi-open spaces with a reasonable arrangement of seats and booths can be an option to consider.

3.1.2 Model overview

The main node of the semi-open space is atrium spaces, which are distributed every 100 meters along the moving line. In the field investigation of MIXC shopping malls in China and the Beverly Center and Beverly Connection shopping malls in the United States, atrium spaces are found to be an important part of the multi-functional shopping malls, as atrium spaces enrich the spatial levels and form the transportation hub. Atrium spaces have the characteristics of being large in scale, being weak in directivity, and having multiple moving routes for users. However, under normal circumstances, the simple use of atrium spaces without proper design can result in the waste of space resources. At the convergence point of most moving routes in atrium spaces, large-scale resting areas should be added.

Walkway spaces are the lifeblood of the commercial space, where small sitting areas are set at 100 meters in spacing. The sitting areas can be used as waiting areas for restaurants, resting spaces, etc. Disinfectants and other safety precaution measures should be included in walkways. In the form of consumer resistance due to the pandemic, the creative design of indoor space modules can help to attract consumers and offer consumers a sense of security from the virus.

Each semi-open space consists of several single modules with a side length of 1.8 m and a height of 2.2 m. The module provides two seats facing the outside and a sterile hand sanitizer hanging on the inner wall. Units are arranged in corridor space with a width of less than 3.8 m, while the corridor space has a width of more than 3.8 m that can be appropriately extended and combined. The ' barrier ' formed by the combination separates the space to control the flow of people and provide privacy to consumers.

The resting space of the atrium is composed of a sinking space with a side of 3.6 m and several small resting stations at the edge. The sinking space also forms a gathering space and the central green space. Figure 5 shows a clearer view of a semi-open space for post-pandemic shopping malls.

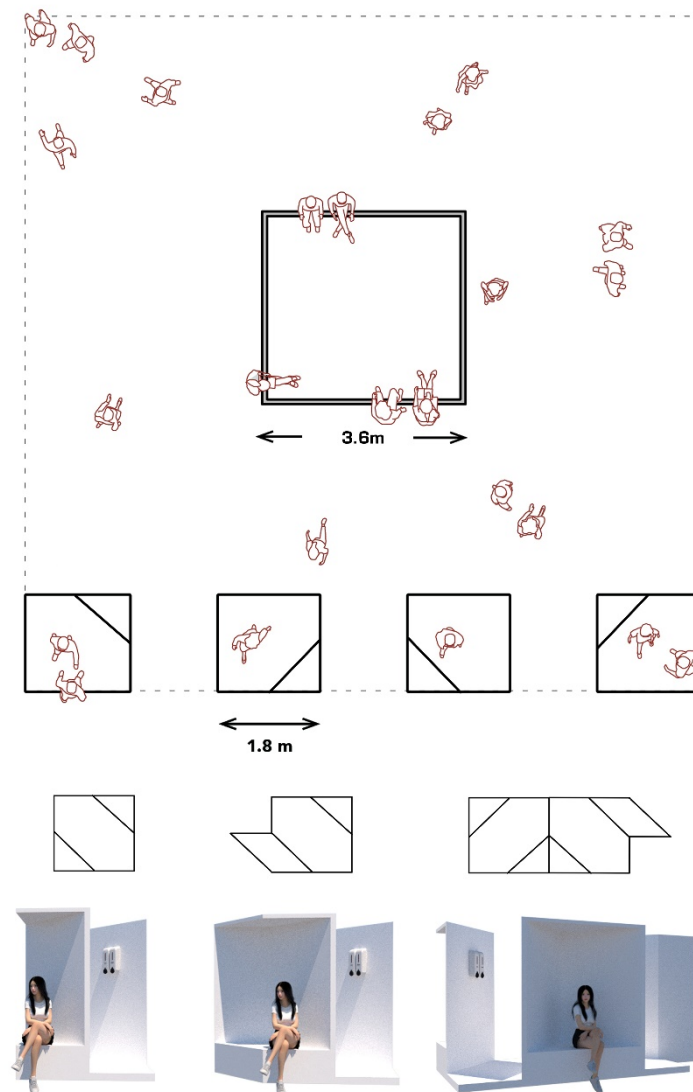


Figure 5. Resting space monomer, deformation, and nodes at an atrium

3.1.3 Disinfection hand sanitizer settings

Not all nodes need to be equipped with disinfection hand sanitizer, which will increase the cost of shopping centers. Before the epidemic, hand sanitizer was usually configured in the toilet. People looking for toilets for cleaning their hands were concentrated on the floors of snack streets and restaurants with dietary needs [10]. Parents with children have more demand for hand cleaning. Under the premise of meeting the basic disinfection needs, in the catering, infant supplies, cinemas, gyms, i.e. will be close to the skin floor disinfection hand sanitizer set the best.

4. Conclusions

This paper found a clear difference between the virus prevention methods of American and Chinese shopping malls. Disinfection measures are often not required but recommended in American malls as the government believes that the COVID-19 pandemic is under control locally. The main research result is that disinfection spaces and semi-open designs can be beneficial elements of post-pandemic shopping malls for easing customers' concerns about the virus and promoting sales. Disinfection spaces and semi-open spaces are two beneficial and creative features in the design of post-pandemic shopping malls. Architectural models were created to present the ideas. Due to time limitations, the sampling of malls was not sufficient. Long-term research and data collection are needed to determine whether disinfection spaces and semi-open designs benefit post-pandemic shopping malls significantly.

More experiments are needed to be carried out in various countries and times. The COVID-19 pandemic has led to an improvement in people's hygiene awareness. More research and design projects related to virus prevention in public spaces, such as shopping malls, will and need to be done in the future to meet this need of people. This research can be a small but essential attempt.

References

- [1] Cheng Qiyun, Sun Caixin, Zhang Xiaoxing, et al. Short-Term load forecasting model and method for power system based on complementation of neural network and fuzzy logic [J]. Transactions of China Electrotechnical Society, 2004, 19(10): 53-58.
- [2] He Lisi, Yu Shuxian. Resilience in brick-and-mortar business China 's brick-and-mortar shopping mall sales bucked the trend after the pandemic [J]. Shanghai Business, 2021 (03): 22-33.
- [3] World Health Organization. (2020, May). Coronavirus disease (covid-19): How is it transmitted? World Health Organization. Retrieved August 19, 2022, from <https://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-how-is-it-transmitted>
- [4] YE Dan, WANG Jiao, PAN Lijun, LI Tao. Health Protection Guidelines in Shopping Malls during COVID-19 Outbreak[J]. Journal of Environmental Hygiene, 2020, 10(2): 117-118, 121.
- [5] World Health Organization. (2021, December 23). Coronavirus disease (covid-19): How is it transmitted? World Health Organization. Retrieved August 20, 2022, from <http://www.who.int/news-room/questions-and-answers/item/coronavirus-disease-covid-19-how-is-it-transmitted>
- [6] Tao Liu, Dexin Gong, Jianpeng Xiao, Jianxiang Hu, Guan hao He, Zuhua Rong, Wenjun Ma, Cluster infections play important roles in the rapid evolution of COVID-19 transmission: A systematic review, International Journal of Infectious Diseases, Volume 99,2020,Pages 374-380.
- [7] Centers for Disease Control and Prevention. (2022, February 25). How to protect yourself and others. Centers for Disease Control and Prevention. Retrieved August 20, 2022, from <http://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html>
- [8] Wang Xiting. Biodegradable polycarbonate from sucrose and carbon dioxide [J]. Natural Gas Chemicals (C1 Chemistry & Chemicals), 2017, 42 (03): 102.
- [9] WANG Qiannan. Research on Shopping Mall Space Experience Design Based on Consumer Behavior Theory [D]. Qingdao Technological University, 2019. DOI: 10.27263 / d. cnki. gqudc.2019.000133.
- [10] Fan Huiyan, Jiang Xiao, Huang Yaoting, Dai Chengyu. Design of independent hand cleaning device in public places based on design thinking theory [J]. Design, 2022,35 (09): 113-115.