Transformational Strategy of Community Library Related to Epidemiological Insights： A Case Study in China

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Abstracts

Throughout the previous epidemiological history, airborne transmission of viruses causing health problems has consistently posed a significant threat to public health and safety due to the high fatality and infectivity rates. This study focuses on addressing the issues faced by the Lu-yang Ju community in Zhongshan City through an epidemiological lens, employing a comprehensive approach that includes literature review, field research, case studies, and experimental methods. Additionally, an online questionnaire was conducted with 260 randomly selected participants (45% male and 55% female) across different age groups to assess community satisfaction levels. Satellite mapping and photography were utilized for observing the surrounding environment of the community in Guangdong province. The findings revealed that 67.31% of respondents expressed a desire for additional library space within the community, while only 22.69% reported being satisfied with their current living environment. Analysis of the Lu-yang Ju community's surroundings highlighted an abundance of commercial spaces but a lack of cultural exchange facilities, with the nearest library located at a distance of 2.2 kilometers away.

Therefore, this paper proposes redesigning part of the existing commercial space into a library within the Lu-yang Ju community as per epidemiological considerations. The layout plan for this redesigned space will strictly adhere to social distancing guidelines by maintaining at least one meter (or ideally between one to two meters) between individuals. The outcomes derived from this work can serve as practical and valuable references for similar urban community transformation projects aiming towards improvement.

Keywords: Interior Design; Community; Library; Transformation Design; Epidemiology

1. Introduction

Airborne virus transmissions cause very serious health problems (Shown in Figure 1).

Throughout the public health crisis, viral evolution has constantly existed in our lives and has afflicted humanity for thousands of years (Kelly, 2006). Epidemiologic studies mentioned that the Antonine Plague had caused the death of over 5 million in AD165-169, and the plague had spread to Gaul and the legions along the Rhine (Liu, 2020). The fourth-century historian Eutropius noted that a large proportion of the empire's population died from this outbreak (Fears, 2004). This was followed by the Great Plague of Athens in ancient Greece, which killed almost half of the people in Athens in 430-426 BC (Liu, 2020). And then the Plague of Justinian destroyed Byzantine ambitions as the Byzantines pursued a grand strategy to build up their own lands. The Plague of Justinian reunited the Roman Empire and killed twenty-five to fifty million people; Europe was in the Dark Ages in 541-542 AD (Peterson, 2020). In the past, people were weak and hopeless in the face of a public health crisis until we overcame the technical problem with vaccinations. In one successful case, smallpox, which is thought to be transmitted by airborne droplets more than any other disease, had killed a hundred million people before it was eradicated by a global vaccination campaign in 1980 (Berche, 2022). Amidst the joy of a better life after the vaccination campaign, it saved our lives. The Black Death, the most significant public health crisis in human history, was a devastating global public health crisis caused by the bubonic plague that killed about a quarter of the European and Asian population in the mid-13th century (Liu, 2020). The Black Death killed about 50 million people in Europe during the five year outbreak (Wagner & Reifegerste, 2022).

There are many reasons why a hundred million people have died from the public health crisis. One of the most important reasons for the severe public health crisis is the airborne transmission of respiratory viruses.

During the SARS pandemic (1993–2007), there were 2,500 cases of hantavirus with an overall mortality rate of 30% (Clement, Maes, Ducoffre, Van Loock, & Van Ranst, 2008). This viral pathogen was airborne and could spread widely, which was generally accepted. In addition, previous experience with public health crises suggested that H5N1 was airborne after modification, and H5N1 had killed up to 150 million people worldwide (Petsko, 2005). Tuberculosis transmission was thought to occur indoors and had occurred almost every year prior to the decline of tuberculosis in the UK from the mid-19th century (Hobday & Dancer, 2013). The literature also indicates that tuberculosis is mainly transmitted by airborne droplets (Hobday & Dancer, 2013), which kills approximately 2 million people annually (Fattorini, Piccaro, Mustazzolu, & Giannoni, 2013). SARS epidemic was not only a public health problem. On July 11, 2003, there were only 8437 SARS cases worldwide, resulting in 813 deaths. By early 2019, a novel coronavirus had infected the world with rapid speed and wide reach, leading to an unstoppable global public health crisis. According to global coronavirus data, the coronavirus pandemic led to an estimated 6.63 million deaths worldwide and infected 643 million people in December 2022 (Data, 2022). The main reason for the spread of the coronavirus is airborne droplets. Nevertheless, the public health crisis is linked to deaths and economic losses.

From another perspective, the spread of the virus has caused enormous economic damage as people have spent huge amounts of money on medical and psychological care. Some statistics from the US in 2002 put the healthcare costs of building-borne respiratory infections at 10 billion US dollars (Mendell et al., 2002). With no way to eliminate virus transmission, poor performance in public health risk detection and community prevention (Wu, Chen, & Chen, 2021) has led to a historic epidemic crisis. However, the public health crisis has also created opportunities to rethink critical issues related to public space design (Campioli & Peraboni, 2022). Begum, Roknuzzaman, and Shobhanee (2022) collected online data from 71 public libraries and conducted semi-structured interviews with eight librarians. He proposed guidelines for developing library infrastructure and showed that it is necessary to redesign public spaces (Begum, Roknuzzaman, & Shobhanee, 2022). The redesigned space increases public safety. There are some previous studies on redesigning spaces after a public health crisis. Based on standard epidemic prevention and control, Tao (2023) conducted a design study on the improvement of public space in old communities (Tao, 2023). It pays attention to the health of residents at the three levels of physiology, psychology, and society, and creates a vibrant community public space. Peng (2023) proposed three strategies for renovating old communities based on preventing and controlling infectious diseases, controlling the source of infection, interrupting the channel of infection, and protecting the end of infection. Integrate the critical points of landscape transformation into the design of healthy landscape transformation of old urban communities (Peng, 2023). Similar cases are based on the prevention and control of infectious diseases (Ying-ying Song, 2023).

Figure 1 Histories of public health crisis.
Source: Researchers, 2023

Studies refer to the prevention measurement to enhance the spatial health of the library, and prolonged prevention is one of the effective transformational strategies. The Department of public services reported that normalization of prevention should focus on venue control to construct the health environment (Department of Public Services, 2011). Venue control is significant to ensure space safety. Spatial distance is one effective measurement of venue safety control when public spaces are designed. In related studies, these practices would minimize the risk of contact contamination, including limits on the number of people in the library, disinfecting floors/surfaces, keeping doors open, social distancing, digital services to library users and a dedicated quarantine space for the incoming documents (Jan, 2020). Begum et al. (2022) mentioned that spatial distancing is a practical non-pharmaceutical approach to limiting disease transmission. Bar-On, Flamholz, Phillips, and Milo (2020) proposed that the virus is roughly 0.1 mm (100 nm) in diameter. To characterize Droplet transmission by someone within 1 m or in "close contact" with someone with respiratory symptoms (Organization, 2020); (Bar-On, Flamholz, Phillips, & Milo, 2020). Recommend a 1 m distance in Hong Kong, Singapore, and Norway; In England, the recommended distance is now at least 1 m. In New Zealand, 1 m was recommended in schools and workplaces at high alert levels (Han et al., 2020). Nevertheless, evaluation criteria are different in many countries. For instance, 1.5 m is in Germany and Spain; and 2 m is in Japan and South Korea. 2 m distance between people is recommended in public spaces in New Zealand (Gray et al., 2021; Han et al., 2020). The guidance in the United States from November 2020 is six feet, or 1.8m (Schneider et al., 2023). Overall, Limited spatial distance became the prevention measurement that the required distance is better than keeping a distance from 1m to 2m, at least one meter, for reducing the risk of droplet transmission.

In addition, this study focuses on transformational design in the Lu-yang Ju community—the result of transformed strategy was considered as a reference for the upgrading design of another community library.

2. Objectives
1) To research the problem of the Lu-yang Ju community and propose transformational strategies ideas on community library related to epidemiological insight.
2) To utilize some design factors to achieve health and tranquility in the community library.
3) To propose a method of visualization design on the transformation of community library.

3. Materials and Methods
3.1 Literature review
3.1.1 Community library
The community library is an essential part of the public cultural service system, providing information guidance services, social education and recreational activities (G. Li, 2016). There is no hierarchy level in a community library, only different sizes compared to other standard libraries. A community library collects books compiled by the community (Liao, 1992) and serves all residents by selecting information, organizing, storing and sharing documents in a certain area (Huo & Guo, 1995). The relationship between the library and the community is remarkably close. Usherwood (2002) found that public libraries had a positive impact on communities through their social, educational, and cultural roles and by developing trust in individuals and communities (Usherwood, 2002). As the service function of community libraries has expanded and the cultural needs of community residents have been strengthened, the importance of community libraries has steadily increased. However, a common point regarding community libraries is based on the function of a community, which aims to enhance cultural exchange and community competitiveness through information exchange. Kretzman, and Rans (2005) found that public libraries have contributed to community development by providing free community space, technological resources, connections to the local economy, a sense of belonging to the community, and a high level of trust in the community (Aabø & Audunson, 2012; Kretzman & Rans, 2005). EA community library is a public space with a significant meaning. Usherwood (2002) alleged that public libraries positively impact communities through their social, educational, and cultural roles and developing confidence in individuals and communities (Usherwood, 2002). The relationship between the library and the community is intimate. Greenhalgh and Manjarrez stated that community Libraries supported stability, safety, and quality of life in neighborhoods (Aabø & Audunson, 2012). The benefit of a community library is obvious.

Moreover, the six characteristics of these new public reading spaces and compared them with the traditional public reading spaces. First, based on the population density of residents and the flow of people as the primary information for local distribution, which was closer and more attractive than traditional libraries. Second, although the area could have been more significant and all small libraries with the primary service function, the

new one is for ordinary book lending rather than ordinary book borrowing. Thirdly, the interior design of the new library was original, and the environment was elegant, which was more attractive than a traditional community library. Fourth, it integrated high-tech means such as wireless networks, automatic borrowing and returning, card processing, e-book scanning and downloading, automatic control of lighting and temperature, remote monitoring of cell phones, and comprehensive intelligent and digital services. Fifth, the main branch of the town library system was integrated, and a standardized management and service system was introduced. Sixth, various forces were brought together, such as libraries, enterprises and institutions, grassroots communities and volunteers, which included high social participation and sustainability (Tiao, 2019).

In principle, people should live in a balance of three circles, including family, work, and social circles. The American sociologist Oldenburg (1989) wrote in his book that the best place to combine snack bars and coffee is in the heart of the community (Oldenburg, 1989). In the book, he pointed out some places for restaurants, bookstores, bars, hairdressers, and other meeting places that modern citizens need for a healthy life. He called these places the third place. According to his induction, the third place must have iconic characteristics. Community library mentioned that the library is located in the community. Community libraries should consider the characteristics of the community and the library. Community libraries are cultural and educational institutions and that information exchange centers are established in communities and used by community residents.

As for the internal function of the community library, Chang Song Chen stated that the reading space includes a public space, a group space, and a personal space (Chen, 2009; Tiao, 2019). The theory of social space by American sociologists Erving Goffman and John Lofland analyzed and summarized that the personal reading space is private and not subject to outside control or interference, and that everyone has their own personal space. Therefore, the community library should consider the three parts of space design.

3.1.2 Case studies of spatial distance

The safety distance is closely related to the transmission of droplet viruses. In order to avoid the transmission of viruses, we should design physical distancing in public areas. There are some cases related to the physical distance in public space, for example, the outdoor restaurant in New York City designed by American designer, which transformed the streets of New York City into outdoor restaurants, thus creating social distance from the dining place, as shown in Figure 2. The expansion area of the restaurant was located near the sidewalk and streets. The design included the restaurant, sanitation station, sidewalk and landscape, complemented by lighting, umbrellas, fans, flowers and other amenities. The aim was to create a module that would adapt to the different parts of the city and provide potential revenue for the restaurant operators. At the same time, people had a sense of security as the restaurant met the requirements for social distancing in the allotted space.

Figure 2 Outdoor restaurant scheme
Source: American designer, 2020

Another case is the studio named Curl la Tourelle Head in Great Britain. The classroom was to keep students safe when they return to school. They envisioned a creative temporary classroom in schools that increased social distancing for students to learn and reduced reliance on transportation. After the redesign, the detailed

spacing was changed from 600mm to 2m to create safe social distancing. The design can effectively protect students' health during a health crisis (Figure 3).
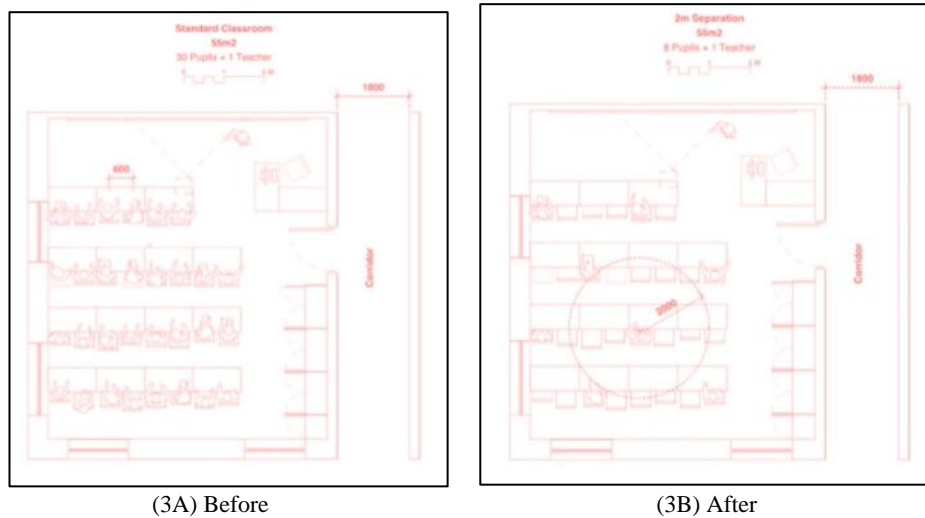

(3A) Before	(3B) After

Figure 3 Comparison of classroom
Source: Britain studio named Curl la Tourelle Head, 2022

3.2 Field research
3.2.1 Research framework

According to our observations, we inferred that community spaces are facing numerous challenges in meeting new demands. It is crucial for us to pay more attention as the correlation between social dynamics and the urban context has undergone significant changes. The research process is illustrated in Figure 4. Firstly, various issues identified through observation, such as residents' needs and surrounding factors, were addressed. Based on these problems, objectives for the transformational strategy of this study were formulated. Secondly, a comprehensive literature review provided essential theories and references for further investigation in order to develop a redesigned community space. Thirdly, data collection was conducted through three methods: situation analysis, field research, and questionnaires. Additionally, an online questionnaire was distributed across multiple cities including Zhong-Shan in Guangdong Province, China to capture residents' demands or satisfaction levels and gather insights for improving Lu-yang Ju community space through transformative strategies. Fourthly, an experiment on spatial distance was conducted to evaluate the effectiveness of associated design strategies aimed at transforming the community space.

Finally, after undergoing transformational changes guided by both modern art aesthetics and public health considerations, the community library now offers a more relaxing and enjoyable environment that enhances people's lives. This paper serves as a practical and valuable reference for upgrading other urban community libraries with public health aspects taken into account.
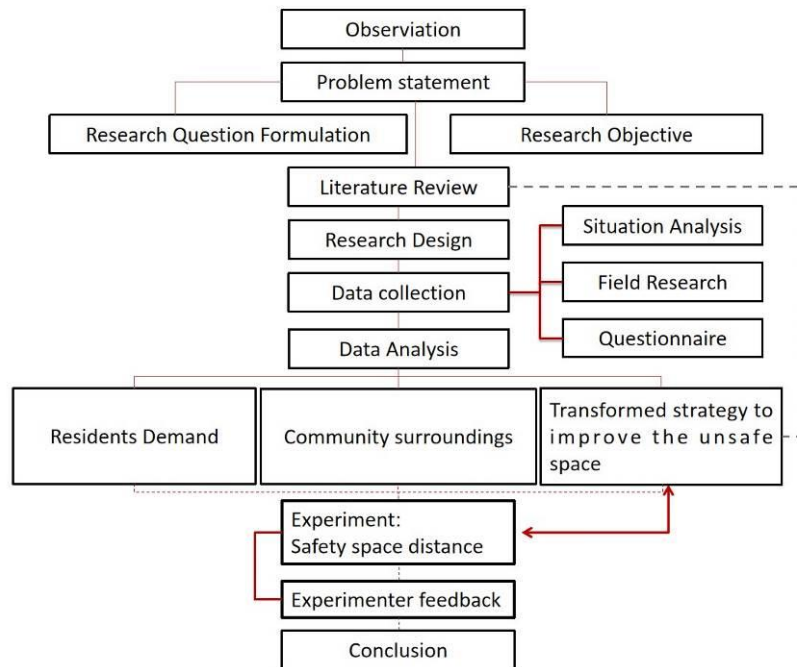
Figure 4 Research framework.
Source: Researchers, 2023

3.2.2 Research problem

The main internal problem of the community is the inadequate consideration of the needs of the residents. The survey found that the area surrounding the Lu-yang Ju community is full of commercial space. Cultural facilities such as libraries, museums, galleries, and other facilities related to spiritual pursuits and tranquility are far from the community. This situation has become common in many cities, especially second and third tier cities. The literature states that Baoding in Hebei Province has studied the range of 15-minute living circles of more than 1,000 communities by calculating the proportion of public service facilities in each district. The allocation of medical and commercial facilities in urban community life circles was relatively perfect, but the allocation of public cultural facilities was inadequate (Li, Zheng, & Zhang, 2019).

On the other hand, when the public health crisis occurred, people suffered from fear, anxiety, stress, and depression, while the related kinds of literature facilities can alleviate these matters (Alnazly, Khraisat, Al-Bashaireh, & Bryant, 2021; Fitzpatrick, Harris, & Drawve, 2020). Public cultural institutions, such as churches, sometimes influence the mood and purify the mind. Therefore, the transformation strategy of the redesigned community should consider the needs of residents, including mental health and surrounding environmental amenities. Moreover, a community library, an important public space within the community, is a great choice.

3.2.3 Questionnaires

The quantitative research was to conduct online data collection. Online questionnaires were constructed on a Chinese online survey website, "Wen Juan Xing" (www.wjx.cn) (Jiang et al., 2020). In order to understand people's demands, the questionnaires (n = 260) were mainly responsible for collecting data about the community's satisfaction. There are 143 women and 117 men, respectively, in the questionnaire. Four age grades in the questionnaire include those below 18 years old, between 18 and 35 years old, between 36 and 50 years old, and above 50 years old. Among these groups, one hundred seventy-three are all young people aged between 18 and 35—moreover, questionnaire questions set up an evaluation, single and multiple-choice items. The highest score is 5 points, and the lowest is 1 point among the evaluation answers. The multiple-choice question includes at least two answers to understand their demand accurately. Some questions to ask can include, but are not limited to:

Question 1. Your sex?
Question 2. Your age?
Question 3. Are you satisfied with the public space in your community? (Maximum score is 5)

Question 4. Do you agree that the environment of your community is poor and public health is weak? (Maximum score is 5)

Question 5. Which space function would you like to add to your community?

Question 6. Do you agree that your community's public space lacks vitality, indifference between people? (Maximum score is 5)

Question 7. Which public space do you prefer to go to?

3.2.4 Situational Analysis

The data on the location of the Lu-yang Ju community was collected through direct observation using photographs and satellite maps. According to the traditional neighborhood concept (TND), parks are within three minutes walking distance and public areas and other necessary facilities are within five minutes. The satellite map was used to measure the scale of the floor plan of the original building, which allowed the distribution characteristics of the functional space to be quickly understood and provided primary data for the redesign. Photographs of the community were also used to analyze the issues of the original building. Figure 5 shows the natural environment of the Lu-yang Ju community. Site A is the original trading place to be remodeled.
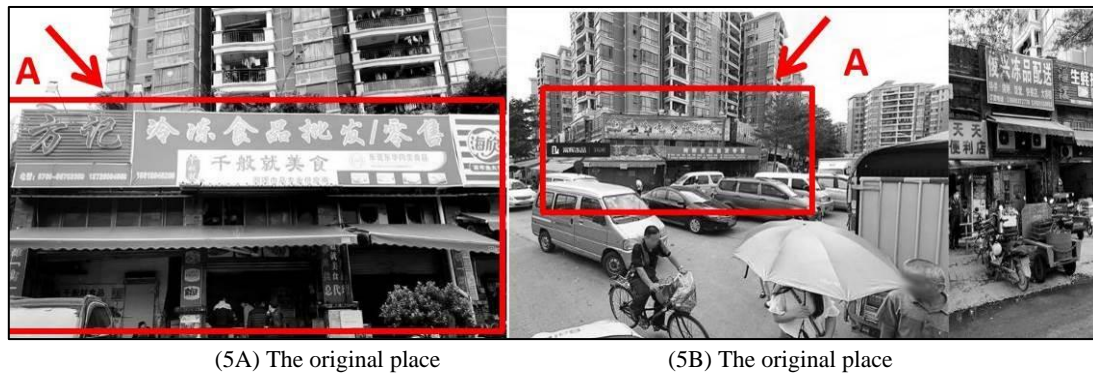

(5A) The original place   (5B) The original place

Figure 5 Circumstances of Lu-yang Ju community.
Source: Researchers, 2023

Other data came from the nearest spaces around the Lu-yang Ju community, where we have thoroughly scrutinized the commercial establishments in the living circle. The place has a mixed pedestrian and vehicular access system and a hectic and unsafe environment. The preliminary collection of the life circles in the satellite map revealed that there are about 30 restaurants and food wholesalers around the Lu-yang Ju community, the number of hotels and condominiums is about 4. The number of hospitals, salons and express services is about 6, as shown in Figure 6b. The nearest library is about 2.2 kilometers or 22 minutes away by car, which is inconvenient for residents, as shown in Figure 6a.
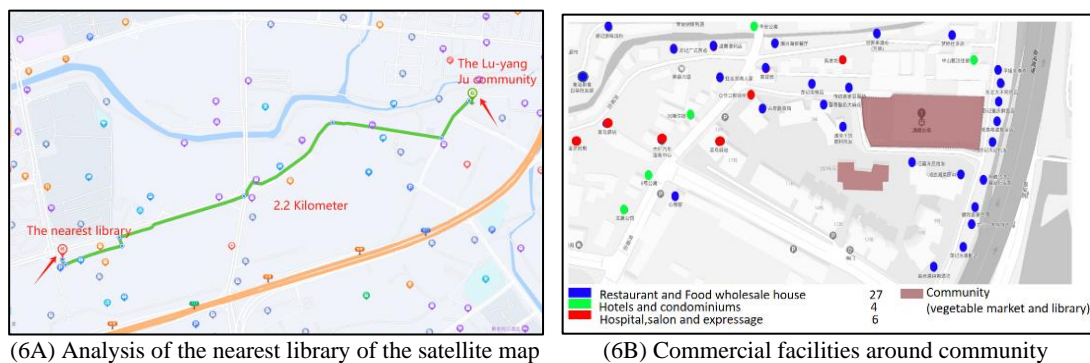

(6A) Analysis of the nearest library of the satellite map   (6B) Commercial facilities around community

Figure 6 The satellite map in Lu-yang Ju community.
Source: Researchers, 2023

3.3 Experiment: Safety space distance
3.3.1 Material Type
Organic polymer material (plastic baffle), metal material (measuring tape), school table and school chair. Further information can be found in Table 1.

3.3.2 Description of the test model
Table: 1300 mm x 750 mm x 750 mm, Chair: 420 mm x 500 mm x 900 mm.
Baffle: 600 x450 mm.
The distance between the front and rear table is 1000 mm and 1500 mm respectively.

3.3.3 The experimental group
Number: six people (undergraduate).
Experimenters 1, 2: Shan-Shan Teng, Yan-ting Luo
Experimenters 3, 4: Ying-Zhang Li, Shanni Li
Experimenters 5, 6: Xi Diao, Yong-Yi Liang
The table was set up at a distance of 1000 mm and a clear divider was placed in the middle of the table. Experimenters 1 and 2 performed the experiment with the spatial distance, and the researcher took photos and recorded the course of the experiment. After the recordings of subjects 1 and 2 were made, the same procedure was repeated with the other experimenters.
The spatial distance was set to 1500 mm between the front and back desks, and the experimental procedure and recordings were repeated.
All experimenters described their feelings and drew their conclusions from the two experiments. At the end of the experiment, the researcher summarized the results (Figure 7).
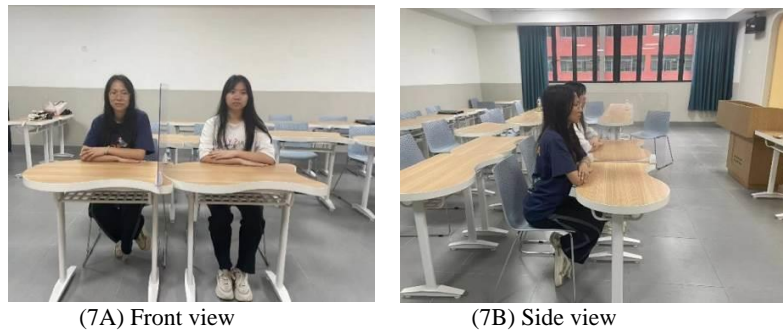

(7A) Front view   (7B) Side view

Figure 7 The Experiment: Safety space distance
Source: Photography by Researchers, 2023

3.4 Experimenter feedback
3.4.1 Summarizing the feedback and keywords (spatial distance).
Feedback Summary: If the distance is 1000 mm, the room is small, narrow, and uncomfortable and the air circulation is poor. After the distance was adjusted to 1500 mm, the room was spacious, the seating position was more comfortable, and the air circulation was adequate (Table 1).
Keywords: comfortable, spacious, air circulation, pleasant mood

Table 1 The feedback of spatial distance experiment (Source: Researchers, 2023)

| Experimenters	Summary of opinions
1	The larger room was less crowded than the smaller room when it was overcrowded.
2	The distance of 1500 mm would be more comfortable.
3	Experimenters felt less pressured at the 1500mm distance than at the 1000 mm distance.
4	The distance between the seat and the table has been extended and will be even more spacious once the distance has been increased.
5	People got more ventilation when they had more distance.
6	The 1500m space would not be depressing and became more comfortable

## 4. Results and Discussion
4.1 Data Analysis

Data were collected randomly through online surveys (n=260) in various cities in Guangdong province, including residents of Lu-yang Ju community, as shown in Figure 8. The purpose of the questionnaire was to find out the residents' satisfaction with the current situation in the community and the majority's demands for the transformation of the community. Judging from Question Three, the average satisfaction with the community they live in was 3.55 points among the 260 questionnaires. The percentage of 22.69 indicated a high level of satisfaction with their community. A percentage of 32.69 had a moderate attitude. Only 7.69% were very dissatisfied with the environment in their community. The result shows that few people were satisfied with their surroundings, which means that the community still has a lot of room for change.

In terms of facilities and public health, 13.85% of the respondents in Question Four fully agreed that the facilities and public health in their community are dirty and weak and 26.54% of the population held a moderate attitude and gave a satisfaction level of 3 points. Only 23.46% disagreed at all that the environment and public health in their community are poor, but the average score in question Four was 2.89, indicating that some communities in Guangdong have specific problems, including poor facilities and weak public health. The results of Question Five showed interest in the different functional spaces. The highest percentage of 67% was for community libraries, indicating that most people wanted to establish a community library in their community. This was followed by the gym and art gallery. Thus, the primary remodeling strategy was to convert a portion of the original commercial space into a library to enrich the community's diversity function. Question Six explains that only 23.46% of the respondents disagreed and gave 1 point, but still have 26.54% of people held a moderate attitude, 20.38% gave 4 points and 13.85% totally agreed, which means that most people agree community lacking of vitality, and indifference between people. The community library will serve as a space for fostering connections among neighbors. The line graph in Question Seven explains that 87% of the respondents preferred an excellent natural environment in the community and the percentage 71 chose proximity to home.

In contrast, only 13.85% preferred other population areas. It was easy to see that most people placed more value on the natural environment. The community should pay more attention to the creative natural environment during reconstruction. In addition, according to the questionnaire, residents wanted a community close to home, an excellent natural environment and a community library
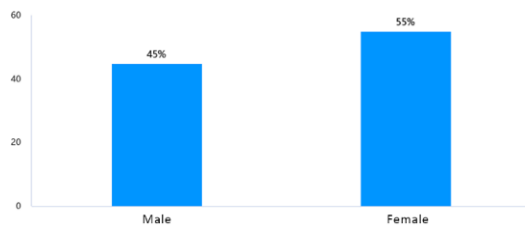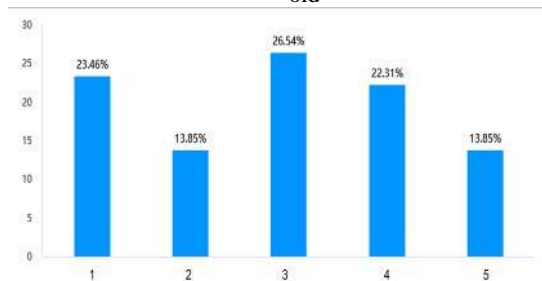
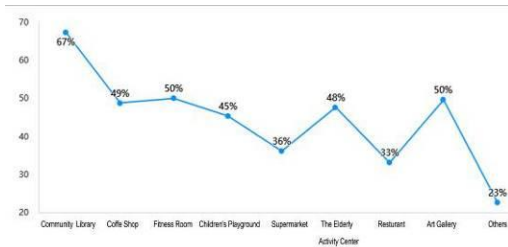(8A) Question 1 Result: Male 45%, Female 55%
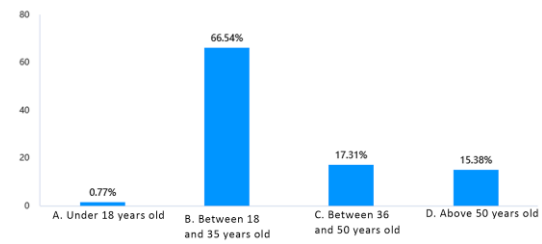
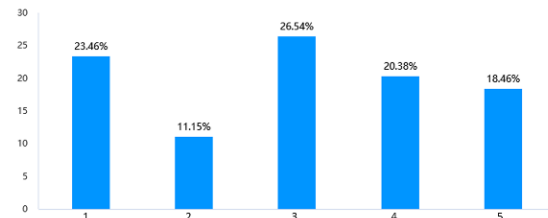(8B) Question 2 Result: 66.54% are between 18 and 35 years old
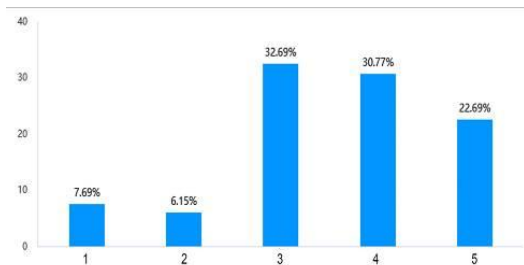
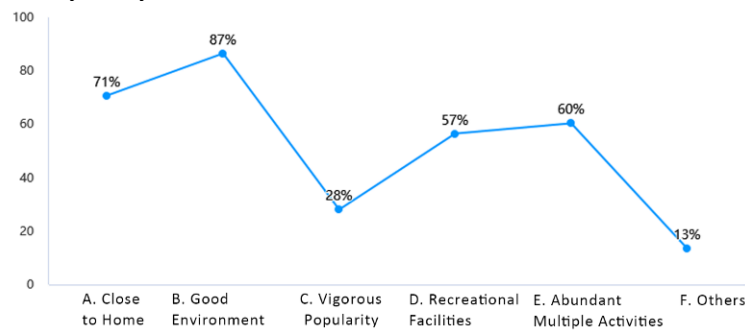(8C) Question 3 Result: the average score is 3.55.

(8D) Question 4 Result: the average score is 2.89.

(8E) Question 5 Result: the highest percentage is 67% of community library.

(8F) Question 6 Result: the average score is 3.17.

(8G) Question 7 Result: 87% of people choose public space with good environment

Figure 8 The results of online questionnaire.
Source: Researchers, 2023

4.2 Case study: community library
4.2.1 Design concept

The transformational strategy of the Lu-yang Ju community was to transform part of the commercial space into a community library. The original commercial building would keep the framed structure. For instance, concrete columns, beams, load-bearing walls, and ceilings should be retained. The shape of the original space is a rectangle, and with more columns, sufficient lighting, and no trivial space, the entrance position faces north.

The "scroll" as a new element was extracted from the books and simplified. In the design, the thin gauze of a curtain was used to imitate the scroll hanging from the ceiling. The ceiling and interior were elegantly fitted with soft lighting. The whole design aims to create a vibrant cultural atmosphere.

The functional space was to reasonably divide combining with different human behavior to enhance different reading experiences. The public reading area has several combined ways of reading: single high seats, single room seats, two opposite seats, and three or four people in a group. The high seat and desk design linked with the unique perspective through the window made the reading experience different. Single-room seating was designed for one-person, separate spaces were protected from disturbance and better isolated from virus transmission. Two opposite seats with the plants and windows integrated with the bookshelf, sometimes people could change posture lying instead of sitting, taking a nap when tired. This design considered privacy when they sat opposite each other. Three or four people in a group, the desk kept sitting apart, and the middle desks were all boarded up, to avoid air transmission caused by droplets (Figure 9).
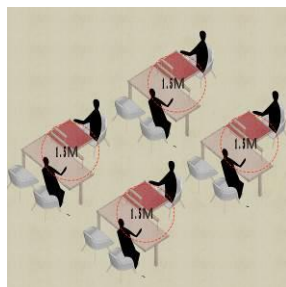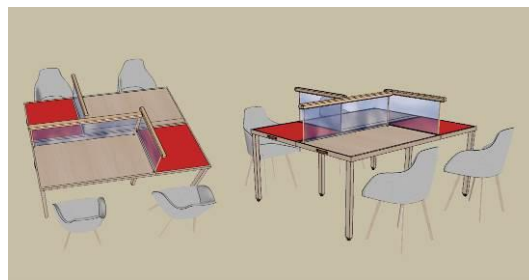
(9A) Single high seats

(9B) Two opposite seats

(9C) Two opposite seats

(9D) Three people in a group

(9E) Four people in a group

(9F) Independent study room

(9G) Independent study room

(9H) Public study hall

(9I) Public study hall

Figure 9 Library furniture with different behaviors.
Source: Researchers, 2023

People feel very vulnerable when they unexpectedly face a public health crisis. In the literature, the pandemic has resulted in a large increased number of depressed patients (Zhou et al., 2020).In order to alleviate this negative emotion, a self-healed yoga room was designed and added to the community library. The style of the yoga room was Chinoiserie, and stillness and Zen were used to decorate the interior space. The community library, including the yoga room, used light and warm colors. Using the Buddha statues and plants in a Chinese style to decorate this yoga room, providing a pure land to our spirit, and the atmosphere allowed people to escape anxiety for a short time. People practiced yoga and meditation as another way of relieving stress (Figure 10).

(10A) The yoga room A

(10B) The yoga room B

(10C) The yoga room C

(10D) The yoga room D

Figure 10 The yoga room in community library.
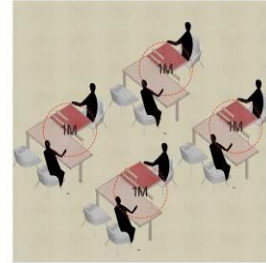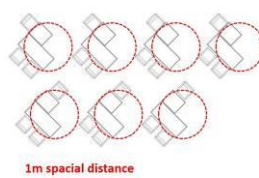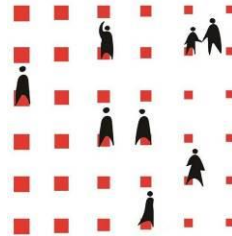**Source:** Researchers, 2023

4.2.2 Two-dimensional construction drawing

Adobe AutoCAD can be used for interior design (You, Liu, & Liu, 2022), and is capable of producing accurate two-dimensional drawings, especially for construction. Therefore, Adobe AutoCAD version 2023 software was used for the design of the community library. To achieve a better visual perception, a two-dimensional drawing drawn with the CAD software was imported into Adobe Photoshop version 2011 to design a colorful floor plan with additional materials, colors, plants, furniture, and accessories.

In this paper, part of the original commercial space was to transform into a community library. The interior space of the community library is located on the first floor, and the height is 4920mm. The floor plan dimensions are 38622mm (length)*29940mm (width). The space layout to divide into several areas, including a public reading area, single study rooms, a yoga room, a small academic conference room, and lounges, see Figure 12(b). The principle of the layout of floor plan combined with epidemiology that the display of furniture in the community library, including the public reading area, should be ordered strictly by keeping a distance from 1m to 2m, at least one meter (Figure 11) so that the layout of space has prolonged prevention avoiding virus transmission.

(11A)1.5/1.8m Spatial
distance

(11B) 1m Spatial distance
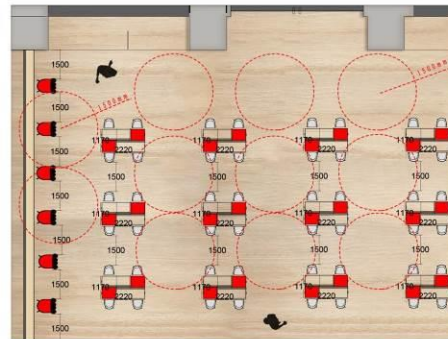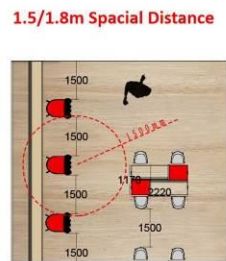
(11C) 1.5/1.8m Spatial distance

Figure 11 Safety spatial distance.
Source: Researchers, 2023
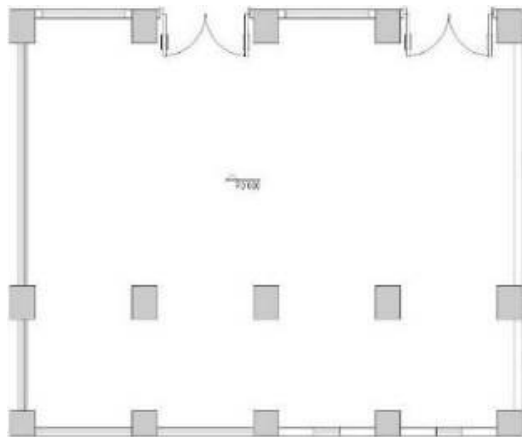
(12a) Original floor plan
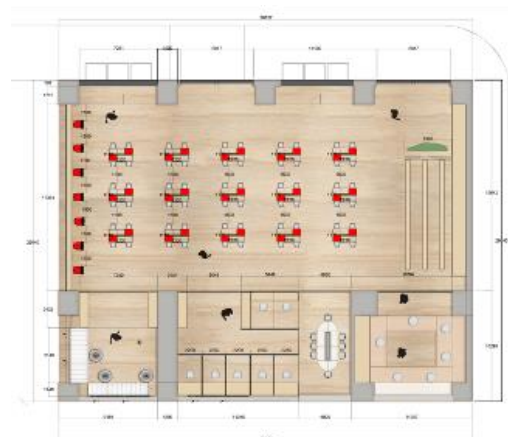
(12b) Redesigned floor plan

Figure 12 Floor plan of community library.
Source: Researchers, 2023

There are two ways of presenting elevation drawings. One is CAD-drawn, uncolored construction paper, as is common in interior design, however, the drawback is poor esthetics. Another way is to use SketchUp or other 3D software tools to cut the surface and create the elevation drawing. This visual esthetic of the elevation is faster and more beautiful, as shown in Figure 13.

(13A) Elevation A

(13B) Elevation B

(13C) Elevation C

(13D) Elevation D

Figure 13 Community library elevation
Source: Researchers, 2023

4.2.3 Three-dimensional design sketch
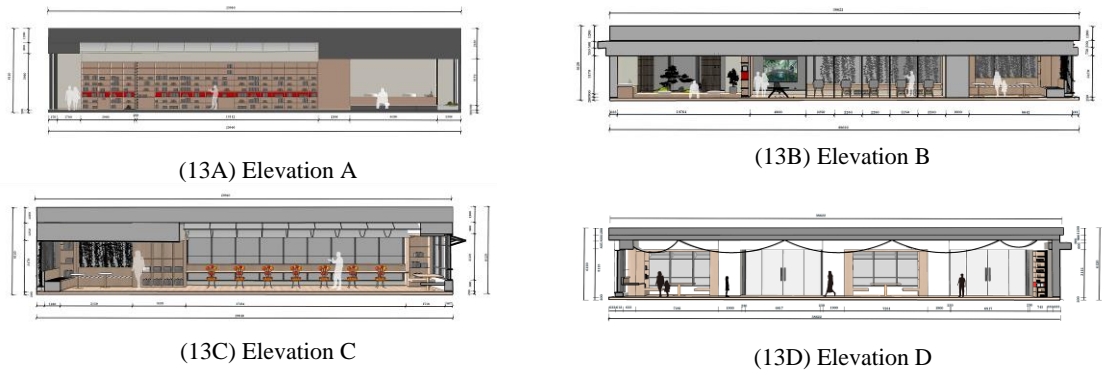
This article utilized the standard software, SketchUp Pro (version 2021), along with the Enscape plug-in (version 3.1), to generate three-dimensional images of a community library (Figure 14). The key advantage of SketchUp lies in its user-friendly interface and extensive range of plug-ins, enabling faster and superior image production. The floor plan was imported into SketchUp to create walls, floors, ceilings, columns, and other architectural structures. Additionally, furniture pieces, decorative plants, and various ornaments were incorporated into the design using SketchUp. By carefully selecting camera angles, optimal shooting images were obtained. Subsequently, the Enscape plug-in (version 3.1) was employed to introduce relevant materials such as wooden flooring, gauze curtains, transparent glass panels etc., while also setting up essential lighting elements including spotlights and simulated daylight, or indoor incandescent lamps as required by the community library's ambiance. Finally, the rendering process involved testing low-pixel images to evaluate overall design effects; continuous adjustments were made to lighting parameters until achieving desired final results.

(14A) 3D model

(14B) 3D model

(14C) Rest zone

(14D) Academic meeting room
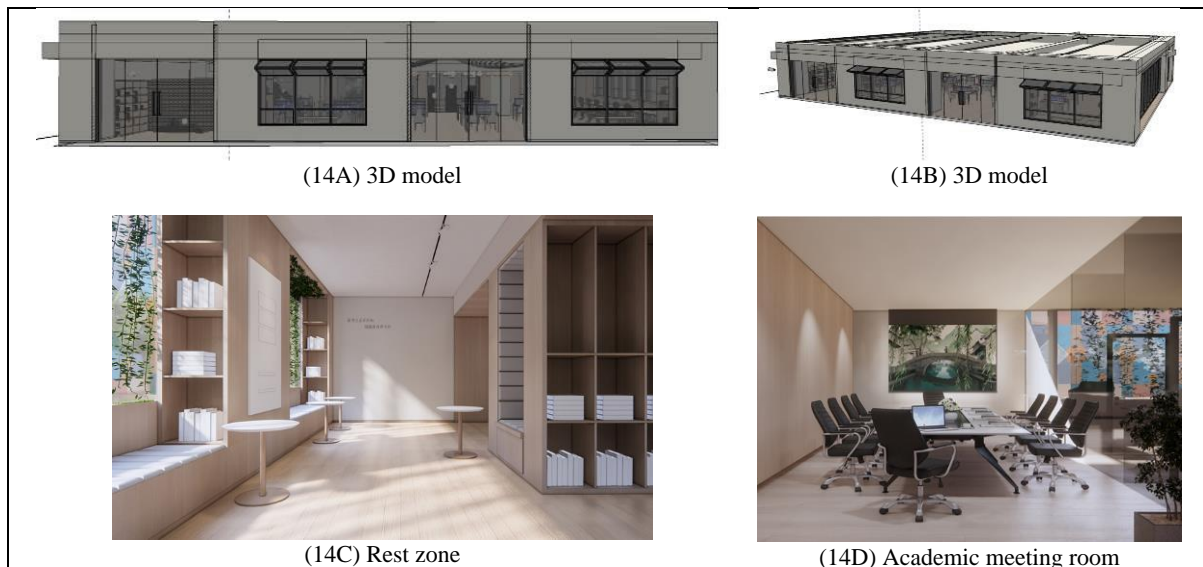
Figure 14 3D model in SketchUp (2021) software.
Source: Researchers, 2023

5. Conclusion

Community libraries play an essential role in the daily life of many residents. Many old communities were remodeled to meet the development of modern society with improved functions.

When we look at the history of the public health crisis, we realize that the danger of virus transmission is hidden in public spaces. In order to avoid large-scale virus transmission, the design of public spaces, including

community libraries, should be based on long-term prevention. In this paper, firstly, a large amount of data about the community environment was first collected through observation, photography, and satellite maps. The online questionnaire was randomly distributed to the residents in Guangdong province, and the data (n=260) were investigated. Analysis of the data showed that 67.31% of respondents wanted a library in their community, and only 22.69% of the respondents related their community satisfaction as high, indicating that there is still much room for improvement in the community. The satellite map explained that the neighborhood was surrounded by commercial space, and the nearest library was far away. Therefore, in this paper, part of the commercial space in the Lu-yang Ju community was transformed into a community library and related to the principles of epidemiology. Secondly, a new spatial layout was designed, including a public reading area, a single study room, a yoga room for self-healing, a small academic conference room, and lounges. The overall layout of the floor plan provided for limited social distancing of 1 m to 2 m, but at least one meter, to prevent virus transmission. The Chinese element and Zen culture were considered in the design of the community library, especially in the yoga room. People can find solace in the community library. The ceilings in the public reading area were decorated with scroll elements, and the space was filled with a lively cultural atmosphere. The spatial layout combines with different human behaviors, the public reading area set up different types of tables and chairs and has a variable combination and kept at a certain distance, such as single high seat, single room seat, two opposite seats, three or four people in a group. The independent reading room can maintain privacy and play the role of virus isolation. To better understand the transformative effect of the community library, 2D and 3D software such as CAD, Photoshop, and Sketchup were used to draw floor plans, elevations, and 3D renderings.

Moreover, the literature review of the community library revealed that certain articles addressed the constructional strategies and significance of community libraries, which are limited in ensuring that they effectively meet the growing and diverse cultural needs of residents. For instance, GELLERUP community library (Ning, 2017) was mentioned. Some scholars have incorporated relevant theories on emotional design into the internal environment of community libraries to analyze and summarize its expanded application scope. In countries like the United States, Denmark, and Japan, various community libraries have successfully engaged surrounding residents in their design process through innovative spatial models, new technologies, activities, and well-developed facilities (Ning, 2017). Many domestic community libraries face similar challenges. However, this paper presents a distinct perspective. Specifically focusing on epidemiological principles for spatial layouts can contribute to enhancing safety measures within these libraries by reducing individual virus transmission rates while also addressing residents' emotional needs.

Ultimately, transformative designs play a crucial role in ensuring safety within community libraries by minimizing specific virus spread rates and fulfilling residents' emotional requirements.

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