Renewal Design of Urban "Gray Space" Based on Sustainable Development in The Post-epidemic Period

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Abstract. By discussing the importance of the mobile individual economy and renewing urban "gray space" to cities in the sustainable development of cities in the post-epidemic period, it leads to a view that combines the protection of urban mobile individual economy and renewing urban "gray space". Taking the renewal and reconstruction of the "gray space" under the Juzizhou Bridge in Changsha City as a design case, the feasibility of the viewpoint is verified by establishing a model to restore the site.

1. Introduction
In the post-epidemic period, the liquidity individual economy has suddenly developed at a high speed. In the survey, it was found that there are long-term individual economic households in the space under the Orange Island Bridge in Kaifu District, Changsha. This phenomenon has triggered the thinking of urban "gray space" and mobile individual economy under sustainable urban development. Exploring the problem space in the city-"gray space", combining the mobile individual economy with the urban "gray space". It provides innovative ideas and an effective experience for the renewal and transformation of urban "gray space" based on the concept of sustainable development.

2. Analysis of the elements of the mobile individual economy and urban "gray space" renewal in the post-epidemic period

2.1. The development status of the liquid individual economy in the post-epidemic period
In May 2020, the people of Shenzhen set up a street stall when the epidemic eased. In this way, they relieved the economic pressure and relieved the long-depressed and longing for the social mood in people's hearts. After the report, it caused widespread concern in society. On June 1, 2020, Premier Keqiang Li also stated: The stalled economy and the small shop economy are fireworks in the world, and the same as "Gao Da Shang" is a business opportunity for China. In this way, this old down-to-earth trading method regained people's vision. The liquidity of the individual economy has also ushered in a period of rapid development.

The stalled economy has extremely strong vitality. Because of its small business model cost, strong liquidity, and time flexibility, we can see their existence in every corner of the city, and they can always find the best choice. In places with high population density and convenient and fast operation, the stalled economy has become an indelible part of the city. Even when the epidemic has seriously affected the urban economic development this year, the stalled economy has become a powerful hand to promote the urban economy. But for a long time, the street stalls have formed their dirty and messy
bad labels due to their lack of management, which affects traffic order and city appearance, and other negative labels. With the continuous update and iteration of commercial trade in the process of urban development, the stalled economy has gradually retreated to the fringe of the city, becoming the existence of "urban fringe".[1] It is very necessary to protect the urban stall economy, regulate and benignly guide the stalled economy to a healthy and reasonable development model, and solve the contradiction between the economic development of the stalled economy and the modern development of the city, so it is necessary to find a suitable urban space to guide and regulate the stall economic development.

2.2. The benefits of updating the "gray space" to the city

The term "gray space" first came from the concept of the transitional space between the internal space of the building and the external environment space proposed by the Japanese architect Kisho Kurokawa. The concept of "gray space" comes from the field of architecture, but this concept has also been extended to the field of landscape design in recent years, so this concept naturally covers new content in the landscape direction. The concept of urban "gray space" mentioned in this article refers to a space that exists reasonably in urban space, but its functional attributes are not clearly defined and not valued by people, but it has a variety of possibilities and plasticity.[2]

The urban renewal policy and continuous economic demand have caused the urban structure of the city to become disorganized and separated, thereby creating a space of social and economic inefficiency. These spaces are increasing, unoccupied, and have no purpose, although they have so much potential in location, size, and history. [3] But it is not just because it arises from urban problems that "gray space" is defined as a bad element in the city. Renovation and renewal of the "gray space" that cater to the surrounding urban space or combined with urban culture are likely to produce unexpected effects, such as the reconstruction of the Nakameguro viaduct in Japan. [4] This proves that the renewal and transformation of urban “gray space” can remedy the meaningless incidental space after urban development planning, attract people to rejuvenate the space, and even have a positive impact on the urban economy and culture. The lack of small and medium-scale boundary public space is a common problem in cities, but this type of space is the most direct and convenient public space for people to enjoy. [5] In some cities, the "gray space" has the most lacking small-scale public space in the city, and it also exists in the living space that urban people can see everywhere. The possibility and plasticity of "grey space" also make this space extremely flexible in the renewal and transformation. It can be renovated and transformed into parks, green spaces, and shops according to the needs of urban populations, urban planning, or the integration of the surrounding urban environment. And other diverse forms of space. While meeting the needs of the urban population and improving the comfort of the urban living environment, it can also reduce part of the pressure on urban space resource utilization.

2.3. The necessity of combining the liquidity individual economy with the renewal of the urban "gray space"

Judging from the situation that the protection of the urban stall economy requires urban space, the existence of urban "gray space" provides the possibility to protect the urban space needed by the stalled economy when urban space resources are tight. Moreover, the lack of suitable renewal and transformation design of urban "gray space" has become a problem that many cities must solve in the process of optimizing urban "gray space". Therefore, if the stall elements are integrated into the urban "gray space", the urban "gray space" will be effectively updated based on the characteristics of the urban mobility and individual economy, while protecting the urban stall economy, it also obtains the updated urban “gray space” Benefits to the city. It can be seen that there is a complementary relationship between urban stall economy and urban "gray space", and the combination of the two can bring maximum benefits to the city. From the perspective of urban population acceptance, the combination of the selection of stall elements and the renewal and transformation of the urban "gray space" is based on the fact that stalls have been integrated into the city's bloodline, have become an
integral part of the urban structure and are closely related to the urban population, so they are more easily accepted. Its universality also provides an effective formula for the renewal and transformation of various "gray spaces" in cities.

3. Research on renewal design of "gray space" under Juzizhou bridge to Wuyi Avenue Bridge in Changsha City

3.1. Project background

3.1.1. Geographical location and the surrounding environment. The project is located under the bridge from Juzizhou bridge to Wuyi Avenue in Kaifu District, Changsha City, Hunan Province. It is an important channel connecting the two green spaces separated by the bridge. It is located on the main road to May 1 square, Wanda Square, and Taiping old street.

![Figure 1. District analysis](image)

3.1.2. Generation of "gray space" under the bridge approach bridge. This space is located under the approach bridge of the Juzizhou bridge. Because of the need to connect the main bridge and embankment, and reduce the gravity of the car parallel to the downward component of the bridge deck, so most of the bridges need to build approach bridges. The construction of the approach bridge divides this area into two parts, so the bridge opening is set here for the convenience of traffic. Therefore, the main purpose of this space is to undertake the traffic function.

3.2. Investigation and analysis of regional status

3.2.1. Analysis of the location and surrounding environment of the survey area. The research on the "gray space" here mainly focuses on the interior of the space and its southern path area. Effective information was collected and recorded by observing the environment, facial perception, delayed photography, and so on.

First of all, one exit of the trail is the pedestrian center of the intersection, while the other exit is connected with the pedestrian footpaths of other streets, so barriers are placed to block the passage of motor vehicles, but a small number of vehicles will still pass on this road. Therefore, cars are parked on one side of the road, and the original area of the road is not rich occupied about 1/2 of the space. Some sections of the road also store abandoned shared electric bicycles.

Secondly, this is a bridge opening about 2.1 meters high, 16 meters long, and 8 meters wide. The whole space is dark and dilapidated, and the environment is bad. Due to the surrounding tall buildings and their terrain factors, the area in the space that sunlight can shine is insufficient. So, the interior of the space has always been in a dark situation, only close to the opening can receive light. Because of
the dark environment, it is hard to avoid people's fear. After entering the hole, it was found that there were abandoned cars on both sides of the bridge, which could be seen that the abandoned cars had been placed for a long time, which also occupied most of the space.

Figure 2. The left shows the interior of the bridge opening, and the right shows the exterior of the bridge opening

3.2.2. Analysis of population and flow in the survey area. The population in this area can be divided into old people, young men and women, functional vehicles group, electric bicycle group, street vendors, and people staying. Among them, the electric bicycle group, functional vehicle group, and the elderly population account for a large proportion. Occasionally, pedestrians who ask for directions, escape from the rain, and scan the code for abandoned electric bicycles stop here for a short time. Due to its geographical location in a traffic artery and many places and scenic spots around, although this is a small road, the flow of people is also relatively large.

3.2.3. Analysis of users. In this space, there are five street barber stalls, all of whom make a living and have worked there for more than ten years. They use their creativity to make this space more suitable for the work environment. The utility model combines the sewer pipe with the washbasin to form a convenient tool for sitting and washing hair, to make customers enjoy the best enjoyment, make use of abandoned cars, place working tools on the wall, etc. They mainly use the way of greeting to attract guests, the guests are mostly old men, and most of them are familiar guests. Occasionally, mobile vendors will stop here and exchange change or chat with each other. There are also many peddlers around here, such as shoeshine, jelly drinks, fruit lotus seeds, and so on. They are all people who use this space for a long time, and the passers-by are the people who use this space for a short time.

3.2.4. Problems in space. There are three main problems in space, the first is the lighting problem mentioned above. The "gray space" under the bridge can receive less sunlight and only exists at the two entrances of the space. As shown in Figure 3. The lighting problem is the main problem to be solved. Secondly, the environment is dirty and messy. The vendors under the bridge will produce certain sewage in the process of operation. Their solution is that the sewage is directly poured on the ground, and the dirt after the haircut is sorted out at the final stall closing. This will have a certain impact on the entire space environment. The third problem is the use of bridge space. Most of the space in bridge opening is occupied by abandoned cars except traffic space, which leads to a low utilization rate and waste of space resources.

Figure 3. Analysis chart of monthly sunshine area change

3.3. Concepts and ideas
The ground stall is produced in the urban space, also contains a city's historical culture and memory. The design is mainly aimed at the barber and other vendors under the bridge hole, combined with the "ground stall culture", to update the "gray space" under the bridge, so that these people can gather and
work in the area at the same time. It also pays attention to the preservation and embodiment of humanistic feelings in "ground stall culture". It is hoped that the design can provide a haven for vendors and optimize the "gray space" here. At the same time, it can also make use of the "ground stall culture" elements to build the "gray space" under the bridge into a space-time tunnel and arouse people's memory of old Changsha. Mainly through the transformation of existing problems and the creation of environmental atmosphere two aspects of design.

3.4. Concepts and ideas

3.4.1. Spatial division. Space is mainly divided into two areas, the hawker activity area on both sides and the traffic area in the middle. In the case of long-term occupation of space by abandoned cars in the bridge opening, it is proved that the current traffic space is sufficient. So, the space on both sides of the bridge after removing the abandoned cars can be used by street vendors.

3.4.2. Illumination. After comparing diffuse reflection and indoor lighting, indoor lighting is adopted. The cost of a light pipe daylighting system with a light guide tube is too high, and it is easy to make the environment in the bridge-tunnel dim again in bad weather. The use of light bulbs and other indoor lighting, low cost, and stable, in line with the needs of this space.

3.4.3. Design of sewage facilities. The blowdown box is mainly combined with the design language combination of terrain and rasterization. The lowest point of the terrain of the bridge opening is located at the entrance, and there is a sewer. Therefore, the sewage can flow into the sewer naturally along the terrain, and the grid ground can make the sewage produced by the street vendors flow into the sewage box directly through the gap, and then discharged into the sewer by the sewage box.
3.4.4. Modular design and combination. Design mainly through the modular form to create the possibility of space, mainly use the grid form language to form modules of different sizes and shapes, giving each module the basic function. Through the form language of rasterization, the modules can be moved and combined, and new functions can be generated through the will of users, which can give users the ability to transform the space freely and make space reach the ideal state through the use of users.
3.4.5. Integrating historical and cultural elements. To reflect and retain the humanistic feelings of the "ground stall culture" of the old times and create the feeling of "time and space tunnel", some retroelements are integrated into the design. Such as reed curtain, chandelier, signboard, signboard, etc. It is hoped that through these elements, people can create an atmosphere of being in old Changsha in the old times so that people passing by will have the illusion of crossing time when they stay here for a short time.

3.5. Presentation of final results

Figure 7. Effect picture

4. Conclusion

Based on the issue of urban sustainable development in the post-epidemic period, taking the "gray space" under the Juzizhou Bridge in Changsha City as an example, a conceptual design plan for renewal and transformation is proposed. The plan proposes the use of stall elements to create a spatial atmosphere and create a "temporal tunnel" design idea. Through the design plan and the discussion and research analysis on the renewal and transformation of the urban "gray space", the bridge-tunnel "gray space" is optimized while protecting the sustainable development of the city and has carried out a benign development of the urban mobile individual economy. guide. "Gray space" is a major pain point in urban development, which not only wastes urban space resources but also affects the urban appearance and urban environment. To create a more dynamic and warm urban space, in the future urban development, the combination of urban mobility and individual economic development and the renewal of urban "gray space" will also become the trend of sustainable urban development in the future.

References

[1] Shouqiang, W. (2020) From "hiding in the market" to "marginal culture" -- a look at the fireworks of "stall economy". Chinese times, 62-64.
[2] Yue, Y. (2015) Urban "gray space" - Research on the transformation and utilization of the space under the viaduct. Zhejiang University, MA thesis.
[3] Nehad S. Abd El Gawad, Khalid S. Al-Hagla, Dina M. Nassar. (2019) Placemaking as an approach to revitalize Neglected Urban Open Spaces (NUOS): A case study on Rod El Farag Flyover in Shoubra, Cairo[J]. Alexandria Engineering Journal, 58(3).
[4] Zhou, L. (2018) From "gray space" under abandoned bridges to dynamic "Community Complex". China Urban Planning Society, Hangzhou Municipal People's government. Sharing and quality: Proceedings of 2018 China urban planning annual meeting (02 urban renewal). China Urban Planning Society, Hangzhou Municipal People's Government: China Urban Planning Society, 2018:11.
[5] Haofan, Y. (2016) discussion on the relationship between regional culture and public space: Taking Longzhou Cultural Industrial Park as an example.