Analysis on the Local Evaluation of the Micro Space of Public Toilet in Linpan Integrating Industry and Tourism

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Abstract. Under the upsurge of beautiful rural construction and "toilet revolution", the public toilets in rural areas have made remarkable achievements in environmental health, but it is still poor in micro space quality and aesthetic sense, and homogenization causes serious local deficiencies. Therefore, this paper selects Daoming bamboo art village in Chongzhou city and Chuanxi Music Linpan in Dujiangyan city of China as the research areas. Starting from the micro space of public toilet in Linpan integrating industry and tourism, On the basis of defining the concept of the micro space, this paper uses Likert scale method to acquire the local evaluation of local villagers, tourists and business operators on the micro space, and applies factor analysis method to verify the evaluation five-dimension of the micro space, including humanistic care, cultural heritage, landscape optimization, spatial design and functional innovation. The results show that the respondents have a high recognition of the local landscape of the micro space, but it is believed that there are still deficiencies in terms of humanistic care, functional innovation, spatial design and cultural heritage. It aims at providing a reference for the local evaluation and creation of the micro space of Linpan, so as to help the protection of Linpan in Western Sichuan.

1. Introduction

The toilet is not only a place for people to go to the toilet, but also a display window for the local image of a region. With the rise of rural tourism, more attention has been paid to the renovation of public toilet space in recent years. In 2015, president Xi Jinping made important instructions on "toilet revolution"\textsuperscript{[1]}. In addition, ecological civilization and the construction of beautiful villages have attracted much attention in recent years. For example, the general office of the provincial Party committee and the general office of the provincial government issued the promotion plan of "beautiful Sichuan, livable countryside" (2018-2020)\textsuperscript{[2]}. As far as the study of toilet reform in rural areas is concerned, most focus on environmental health control and technical discussion. However, due to the lack of deep thinking and excavation of local traditional culture in different regions, most of the public toilets in rural areas are lack of beauty, which is out of keeping with the local style. Especially in the West Sichuan Linpan dominated by the integration and development of local characteristic industries and tourism, the lack of unique feature of local industries and regional culture results in its weak local characteristics. Therefore, under the background of implementation of the strategy of rural revitalization in China and promotion of the protection of Linpan in Western Sichuan province\textsuperscript{[3]}, two typical
micro space of public toilets in Linpan in Western Sichuan were selected as the survey objects in this study. Combined with questionnaire, interview and quantitative analysis, the paper discusses the local evaluation of the micro space of public toilet in Linpan.

2. Research objects and methods

2.1. Research objects
Linpan in Western Sichuan is a special form of village settlement in Chengdu plain, it has unique local culture, economy, history and aesthetic value[4]. Linpan integrating industry and tourism refers to relying on its favorable natural and cultural resources and economic development conditions, through continuous implantation and agglomeration of related tourism industrial chains such as complementary extension and periphery formats[5], which makes Linpan cross and combine with other industries such as humanistic ecological sightseeing tourism, characteristic agriculture and agricultural product processing industry to form a forest tray of integrated industrial chain in western Sichuan Linpan[6]. The micro space of public toilet in Linpan is the sum of its the internal and external micro public spaces related to public life of public toilets[7]. Luranraison once said: "when considering the design of the whole land as a building, it can be said that this is the beginning of external space design[8]. “ It can be seen that the construction of the micro space in Linpan is closely related to the surrounding environment.

2.2. Research district
In this study, two Linpan of western Sichuan with strong local characteristics, beautiful landscape environment and better development of industry and tourism were selected. One is Daoming bamboo art village with bamboo art as its characteristics in Chongzhou city. The other one is Western Sichuan Music Linpan with musical romance in Dujiangyan city. Both of them are rated as 3A level scenic spots in Sichuan province, and now they have become a model in Western Sichuan, which has a high value of local evaluation and research.

Daoming bamboo art village is located in the area of group 9, 11 and 13, longhuang village, Chongzhou city, covering an area of about 123 mu. As a national intangible cultural heritage, Daoming bamboo weaving culture has been deeply integrated into the village project and space construction.

Western Sichuan music Linpan is located in Hongxiong community, LiuJie Town, Dujiangyan city. It is adjacent to is adjacent to the Chengqing tourism expressway, covering an area of about 130 mu. With music as its theme, it has become a one-stop rural tourism complex and a hot place for tourism.

2.3. Research methods
In this study, Likert scale method was used to design the questionnaire[9]. Through questionnaires and in-depth interviews, the micro space of public toilets in the above two Linpan were investigated on the spot. Referring to the research of other scholars on the deconstruction of local intention[10], this paper will carry out preliminary investigation and research from local landscape, local culture and local spatial, and select 14 influencing factors of the micro space for key evaluation and investigation as Table 1. The local evaluation data of micro space by villagers and outsiders were obtained.

In this paper, the method of factor analysis in dimension reduction of multivariate statistical analysis is adopted[11]. Through the investigation and interview with local villagers of all ages, tourists and business personnel inside and outside the province, the evaluation scores of three main groups on the local measurement factors of the micro space of public toilet in Linpan were collected. SPSS software is used to process and analyze the data, to analyze the local measurement factors of the micro space, and then to summarize and explain the nature of the local influencing factors of the micro space with simple and accurate dimensions.

| Table 1. Local survey and evaluation items and description of public toilets in Linpan |
|-------------------------------------|------------------------|------------------------------------------------------|
| Survey dimensions                  | Influencing factors    | Corresponding description                           |
|-------------------------------------|------------------------|------------------------------------------------------|
Local landscape  
- Beauty of landscape: The surrounding landscape has a harmonious aesthetic feeling adapted to the environment.
- Landscape horizon: The field of vision is wide enough to show the complete local landscape.
- Vernacular landscape: The surrounding landscape has local regional characteristics.
- Site paving: The texture of the ground matches the local style.
- Indoor greening: The interior is well landscaped and matched with the outdoor rural landscape.

Local culture  
- Appearance: Building appearance can reflect strong local culture or characteristic industrial culture.
- Local materials: Materials used in public toilets show regional cultural color and characteristic industrial elements.
- Interactive place: There are participating and interactive places for local cultural leisure activities in the place.

Local spatial  
- Space interest: The interior space of the building is interesting with paths.
- Path reachable: There are accessible paths in the site in line with local cultural activities.
- Night lighting: The interior and exterior lighting at night with regional culture.
- Degree of privacy: The interior layout of toilet combined with local material and style.
- Natural ventilation and lighting: The natural ventilation and lighting of public toilets are combined with local characteristics and well handled.
- Additional features: There are other diversified functions in the site for the convenience of local residents or outsiders.

3. Questionnaire design
By using the standardized answers of different emotional levels, the questionnaire can transform the evaluation of objective factors and subjective feelings of the respondents into a quantitative evaluation scale of the micro space, and then carry out a quantitative analysis of local sensuality. The survey adopts the combination of on-site interview and questionnaire survey, and the respondents mainly include local residents of all ages in the two Linpan, tourists and business personnel inside and outside the province, etc. The subjective evaluation level is 7, which is described by "highly agree", "very agree", "relatively agree", "neutral", "relatively disagree", "very disagree" and "highly disagree". The scores are +3, +2, +1, 0, -1, -2, -3 respectively from left to right, so as to obtain quantitative analysis data.

4. Investigation and result analysis

4.1. Analysis of characteristics of respondents
In this study, 200 questionnaires were sent out from November to December 2019, with a recovery rate of 100%. After removing the invalid questionnaires, there were 193 including 101 in Daoming bamboo art village and 92 in Western Sichuan musical Linpan. Among the respondents of Daoming bamboo art village, 21 were young (15-25 years old), 32 were middle-aged (26-50 years old), and 48 were old (51-80 years old); male accounted for 44.6%, female 55.4%; local residents 52.5%, local employees 13.8%, provincial tourists 24.8%, and foreign tourists 8.9%; there are 22 young people (15-25 years old), 38 middle-aged people (26-50 years old) and 32 old people (51-80 years old) in the questionnaire survey of musical Linpan in Western Sichuan; men accounted for 56.5%, women 43.5%; local residents 52.2%, local employees 14.1%, provincial tourists 28.3%, and foreign tourists 5.4%.

4.2. Overall analysis of questionnaire results
After sorting out the factors of the two valid questionnaires, the minimum, maximum, total score, average and standard deviation of each single factor are obtained as Table 2. Each index of the two copies is similar, especially the minimum and the maximum are completely overlapped, which shows that the two selected research sites are similar, which can be analyzed in a unified way later.
In terms of the minimum, the minimum of degree of privacy, night lighting, space interest and indoor greening of the two Linpan is -3; the minimum value of additional function, interactive place, appearance and local material is also low. For the maximum, only the indoor greening is lower than 3 points. For the total score, landscape aesthetics, landscape horizon and local landscape are the highest, while local materials and indoor greening are significantly lower. For the average, it is the same as the total score. For standard deviation, indoor greening and space interest are greater than 1.25, and people have clear different opinions on these two items.

Table 2. Statistics of single-factor evaluation results of local measures of the Daoming bamboo art village and Western Sichuan Music Forest

| Evaluation factors | Single factor evaluation results of measurement in Daoming bamboo art village | Single factor evaluation results of musical Linpan in Western Sichuan |
|--------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------|
|                    | Minimum | Maximum | Total score | Average | Standard deviation | Minimum | Maximum | Total score | Average | Standard deviation |
| Appearance         | -2      | 3       | 180        | 1.78    | 0.820             | -2      | 3       | 164        | 1.78    | 0.836             |
| Local materials    | -2      | 3       | 82         | 0.81    | 1.155             | -2      | 3       | 34         | 0.37    | 1.174             |
| Beauty of landscape| 0       | 3       | 194        | 1.92    | 0.956             | 0       | 3       | 195        | 2.12    | 0.823             |
| Landscape horizon  | -1      | 3       | 193        | 1.91    | 0.981             | -1      | 3       | 182        | 1.98    | 1.038             |
| Vernacular landscape| -1    | 3       | 197        | 1.95    | 0.942             | -1      | 3       | 196        | 2.13    | 0.916             |
| Site paving        | -1      | 3       | 164        | 1.62    | 1.008             | -1      | 3       | 163        | 1.77    | 0.996             |
| Indoor greening    | -3      | 2       | -22        | 0.22    | 1.736             | -3      | 2       | -39        | 0.42    | 1.737             |
| Space interest     | -3      | 3       | 108        | 1.07    | 1.336             | -3      | 3       | 97         | 1.05    | 1.485             |
| Path reachable     | -1      | 3       | 170        | 1.68    | 1.019             | -1      | 3       | 175        | 1.90    | 0.973             |
| Night lighting     | -3      | 3       | 130        | 1.29    | 1.143             | -3      | 3       | 91         | 0.99    | 1.227             |
| Degree of privacy  | -3      | 3       | 132        | 1.31    | 1.138             | -3      | 3       | 66         | 0.72    | 1.049             |
| Natural lighting and ventilation | -1    | 3       | 161        | 1.59    | 1.060             | -1      | 3       | 109        | 1.18    | 1.138             |
| Additional function| -2      | 3       | 150        | 1.49    | 1.293             | -2      | 3       | 167        | 1.84    | 1.176             |
| Interactive place  | -2      | 3       | 150        | 1.49    | 1.278             | -2      | 3       | 168        | 1.85    | 1.154             |

4.3. Factor analysis of local measurement of Linpan
In order to more accurately and clearly explain the nature of the local influencing factors of the micro space of public toilet in Linpan integrating industry and tourism, all factors were extracted and renamed. Selecting the principal component method to extract factors and the maximum variance rotation method (varimax) to rotate factors, kmo is 0.766, greater than 0.6, which meets the prerequisite requirements of factor analysis, which means that the data can be used for factor analysis. At the same time, the data were tested by Bartlett's sphericity test (P < 0.05), which showed that there was correlation between the variables, and factor analysis was effective.

Through factor analysis, the cumulative contribution rate and load coefficient of 14 main factors of Linpan locality measurement are obtained. Based on the above data, the original 14 factors are extracted as 5 main factors, and the cumulative contribution rate of variance of these 5 main factors is 75.485% as Table 3. According to the meaning and category of the sub-factors under the five main factors, this paper learns lessons from the influencing factors of rural public toilets design in foreign countries[12], such as night lighting, participation in interaction, cultural experience, landscape utilization, practical functions, etc. Combining with the five dimensions of Shanghai most beautiful tourist toilet in 2019, which includes humanistic care beauty, green environmental protection beauty, appearance design beauty, civilization promotion beauty and function innovation beauty[13]. Finally, five local quantization factors are concluded and named, including five dimensions of humanistic care, cultural inheritance, landscape optimization, spatial design and functional innovation.
5. Discussion
The results show that local creation of the micro space of public toilet in Linpan integrating industry and tourism should focus on function innovation, space design and cultural inheritance to build and optimize. In order to make further supplement and discussion, the following three aspects will be further supplemented and discussed.

First, in terms of space design, besides ensuring the rationality and convenience of space layout and path accessibility, it can appropriately enrich space interest. This will enhance the interaction between users and space environment, and finally realize the micro space construction mode of "living and traveling interaction"[14]. Second, in terms of cultural heritage, we should pay more attention to regional characteristics to create symbols that can show the local characteristics of the micro space[15], such as the residential stream forest field system of Linpan in Western Sichuan, the pattern of traditional residential courtyard and bamboo and wood local materials, etc. Third, in the aspect of landscape optimization, landscape sketch and ground pavement also adopt the elements full of local emotion. Besides, the internal and external micro space should be constructed in coordination, so as to enhance the local identity of local residents and foreign groups to the local landscape of Linpan[16]. In particular, it is urgent to improve the relatively weak indoor greening.

6. Conclusions
Based on the local investigation and evaluation analysis of the above two typical micro space of public toilets in Linpan integrating industry and tourism, this paper uses Likert scale method and factor analysis method to verify and summarize five dimensions of local evaluation of the micro space, including landscape optimization, humanistic concern, functional innovation, spatial design, cultural heritage. Among them, the landscape optimization is better overall, while the other four aspects are still insufficient, which is also the common problem of rural public toilet micro space in China. In the future, we need to pay more attention to spiritual and cultural experience and humanistic care.

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References
[1] Bai, L. (2020) Research on the coordinated governance path of "toilet revolution" in rural areas. J. Party & Government Forum. , (06): 33-35.
[2] Sichuan Daily. (2018) The general office of the provincial Party committee and the general office of the provincial government printed and distributed the promotion plan of "beautiful Sichuan, livable countryside" (2018-2020). http://www.sc.gov.cn/10462/10464/10797/2018/11/16/10463134.shtml?cid=303%EF%BC%8C2018-11-16.

[3] Li, S. Q. (2009) Introduction to the construction of villages and towns in Chengdu. Southwest Jiaotong University Press, Chengdu.

[4] Cai, X. Y. (2009) An analysis of the value of rural traditional dwellings—a case study of Linpan in western Sichuan. J. Theory and Reform., (4): 151-153.

[5] Gao, P., Xi, J. C. (2017) Tourism industry agglomeration and mechanisms for rural settlements of Gouge Village in Yesanpo, Hebei Province. J. Resources Science., 39(08): 1535-1544.

[6] He, J. M. (2011) The form, motivation, path, obstacle and mechanism of the integrated development of China's tourism industry. J. Tourism Tribune., (04): 9-10.

[7] Weng, Z., Yang, X. L., Lei, H. L., Fang, F. R., Long, J. Y. (2019) Investigation and analysis of the "micro space" public activity facilities in the old residential area of Changchun City. J. Sichuan Building Materials., 45(03): 45-46.

[8] Luranraison. (1985) Exterior design in architecture. Yin, P. T., translate. China. Architecture & Building Press, Beijing.

[9] Li, H., Liang, H. P., Huan, Z. L., Chen, B., Wang, B. (2019) Study on the evaluation of the present situation of the use of urban micro public space—Taking Hefei as an example. J. Intelligent City., 5(14): 23-26.

[10] Zhang, Z. H. (2015) Study on Strategy of Local Image Deconstruction and Planning Design of Ancient Town in Qinling Mountainous Area in Southern Shannxi. J. Urban Development Studies, 22(06): 17-21.

[11] Zhang, C. J., Feng, X. J., Sheng, M. (2013) Factor Analysis Development Steps and Realization of R Language. J. Journal of Anqing Teachers College (Natural Science Edition)., (2): 28-31.

[12] Surging News. (2018) The high beauty value public toilet tells you that it's nice to travel in such a micro public building. https://baijiahao.baidu.com/s?id=1591827551700572013&wfr=spider&for=pc&issFailFlag=1

[13] Shanghai Administration of afforestation and city appearance (SFA). (2019) It remains to be seen who will visit Hualuo's house after the "most beautiful toilet" selection in Shanghai. http://www.shanghai.gov.cn/nw2/nw2314/nw2315/nw31406/u21law1411280.html.

[14] Gui, Q., Shao, X.H. (2007) On humanistic care in Landscape Architecture. J. Movie Review., (08): 66-67.

[15] Yao, X. Y., Xu, M., Jacobs, S., Tian, T. (2017) Research on innovative approaches and guidance for urban public space design. J. Landscape Architecture Frontiers., 5(03): 18-31.

[16] Wu, W. L. (2018) Interactive Public Space Construction Practice in Tourism Villages: Taking HeJia Village for Example. J. Art & Design., (06): 94-96.