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Interpretation of the value of red cultural heritage in Shanghai based on 3D visualization technology

Wei Ren[1], Xianhong Chen[2]*

[1] *School of Architecture and Urban Planning, Tongji University, Shanghai 200092, China.*
[2]* *School of Marxism, Tongji University, Shanghai 200092, China. E-mail: saoirse1314@hotmail.com*

ABSTRACT

Shanghai is the gathering place of the Red Cultural Heritage. Based on a questionnaire analysis of 1,047 respondents on the interpretation of the value of red cultural heritage in Shanghai, this study shows that people lack the impression of Shanghai's "red cultural heritage agglomeration" and the lack of red heritage value display and interpretation, which is mainly due to the lack of representative red IP in Shanghai. Based on the practice of a major virtual reality display project, fully relying on scientific and technological means to achieve three-dimensional visual value interpretation of red heritage is conducive to the transformation and upgrading of red tourism resources to red tourism bases, the development of red tourism products that are popular in the market, and ultimately promote the protection and utilization of red heritage sites. At the same time, talent training and mobilizing community participation enthusiasm are equally important for the display and interpretation of red cultural heritage.
Keywords: red cultural heritage; 3D visualization; display; interpretation

1. Introduction

"To pass on the red gene from generation to generation, we must use the top-level design to elevate the inheritance of the red gene to the soul project and the solid foundation project, continue the red blood, maintain the fine traditions and work styles such as arduous struggle, and strengthen political beliefs to always maintain the original intention." From 2018 to 2020, the state intensively issued a series of policies and plans for the protection and utilization of red cultural relics, including the "Opinions on the Implementation of the Project for the Protection and Utilization of Revolutionary Cultural Relics (2018–2022)", and in

2019, the theme of China's "Cultural and Natural Heritage Day" was "Protecting Revolutionary Cultural Relics and Inheriting Red Genes"; on July 1, 2020, the Central Propaganda Department, the Ministry of Finance, the Ministry of Culture and Tourism, and the State Administration of Cultural Relics announced the second batch of revolutionary cultural relics protection and utilization areas list of counties.

Under the impetus of the policy, all provinces and cities across the country have actively developed and transformed the local red cultural heritage, with a view to integrating the politics and culture of the red cultural heritage value is transformed into

economic value. Making good use of red resources and inheriting red culture is an urgent need to carry forward the spirit of martyrs, reproduce the glorious history, and inherit the red gene[1]. Inheriting the red gene and carrying forward the red tradition has also become the consensus of more and more people[2]. However, under the rising red culture learning boom of the people, in the face of the multi-level and diversified needs of the audience market, the shortcomings of the red cultural heritage display and utilization are becoming increasingly apparent. How to revitalize and utilize the red cultural heritage in depth and in multiple dimensions and enhance the social identity and market attractiveness of the red cultural heritage is an urgent problem to be solved at present.

Shanghai has rich red cultural heritage resources. In order to explore the methods of interpretive research on enhancing the value of red cultural heritage in Shanghai and verify the feasibility of 3D visualization technology in this field, this topic designed an online questionnaire entitled "Research on Improving the Interpretation of the Value of Red Cultural Heritage in Shanghai Based on 3D Visualization Technology" from July 7, 2020 to July 13, 2020. Based on the systematic sampling method, based on artificial attributes (such as gender, age, work experience, and academic qualifications, etc.), the questionnaire is distributed nationwide in China, and the respondents who are interested in cultural heritage tourism are screened and the questionnaire is pushed. Questionnaire setting is an effective system and manual processing and filling control methods (IP restrictions, same device restrictions, trap questions, time control, similarity detection and manual sampling). By the end of the study, a total of 1 047 valid questionnaires had been collected.

2. Research status of interpretation of the value of red cultural heritage in Shanghai judging

From the history of the development of China, Shanghai has now identified as many as 1,020 memorial sites for the Red Revolution in Shanghai, covering various historical periods such as China's revolution, construction, and reform. Today, Shanghai is one of China's financial centers and economic powerhouses. How to revitalize and utilize Shanghai's rich red cultural heritage in contemporary times is one of the important challenges in the new era[3].

2.1. Shanghai's image as a city among the people of the whole country and the people of Shanghai

According to the questionnaire survey, the image of Shanghai in the minds of most people is still "China's financial center" (76.4%) and "Sino-foreign economic and trade exchange center" (74.5%), while only 28.46 percent of the respondents chose the least of all the options. Fewer than half the people who chose the "financial center" and the "economic and trade center" were even less than the people who chose the "birthplace of Shanghai culture" option. It fully shows that Shanghai is not a holy place of red culture in people's hearts. For historical reasons, since the end of the 20th century, Shanghai has become one of the important centers of China's economy and an international metropolis that opening up to the outside world earlier, so people's impression of Shanghai is biased towards the economy. historically, Shanghai has had relatively few red cultural propaganda and interpretations, and when people talk about red cultural holy places, people often think of the well-known red revolution holy places such as Xibaipo and Zunyi Conference.

It is very regrettable that it was shown in a sampling survey of Shanghai natives. In terms of the degree of recognition of the "red cultural heritage agglomeration" by Shanghainese, it is only 10% more than that of the whole country, reaching 38.27%, and this data is still in a relatively low position among all images, second only to the

"cultural and artistic center" (34.57%). That is to say, at least 20% of Shanghainese do not consider their own city to be a "red cultural agglomeration", and Shanghainese generally lack the self-confidence of red culture (**Table 1**). However, the proportion of Shanghainese who choose the option of "the birthplace of Shanghai culture" is 30% higher than the national average, which means that Shanghainese are very confident in their traditional culture.

Table 1. Perceptions of Shanghai's urban image by national respondents and Shanghai respondents

Option	National subtotal	National proportion /%	Shanghai subtotal	Shanghai proportion /%
China Financial Center	800	76.41	65	80.25
Chinese Culture and Art Center	312	29.8	28	34.57
Sino-Foreign Economic and International Trade Exchange Center	780	74.5	61	75.31
The birthplace of Shanghai-style culture	344	32.86	55	67.90
The Red Cultural Heritage Cluster Place	298	28.46	31	38.27
The frontier position of reform and opening up	441	42.12	44	54.32
The history of the "ten miles" and "flower world"	416	39.73	46	56.79
Other	4	0.38	0	0

2.2. The understanding of Shanghai's cultural heritage is not clear

According to the reality of the survey of respondents' understanding of Shanghai's red heritage, vast majority of respondents are very unclear about which red heritage in Shanghai is very unclear (**Table 2**). The researchers listed some of the typical red heritage of Shanghai in the options, inviting respondents to choose the heritage that they consider to be in Shanghai. The proportion of red heritage options in Shanghai was relatively low, even if it is the famous memorial hall only more than half of the respondents believe that it is in Shanghai (53.58%), while less than 20% of the respondents who know the National Anthem Exhibition Hall, Zhang Wentian's Former Residence, the Former Site Exhibition Hall of the Secretariat of the China Labor Union, and the Four Major Memorial Halls in Shanghai are known, the Memorial Hall of the Former Site of the Central Organ of the Chinese Socialist Youth League, the Former Residence of Chen Yun and the Qingpu Revolutionary History Memorial Hall. Less than 30% of the People's Republic of China know that Honorary President Soong Ching Ling Mausoleum and Longhua Martyrs' Cemetery located in Shanghai. It also confirms that less than 30% (29.03%) of the residents of the country understand the geographical location of the above important Shanghai red heritage. To make good use of the red resources and inherit the red culture is an urgent need to carry forward the spirit of martyrs, reproduce the glorious history and inherit the red gene. Today, Shanghai is one of China's financial centers and economic centers. How to make active use of Shanghai's rich red cultural heritage is one of the important challenges in the new era. Shanghainese are very confident of their traditional culture.

Table 2. The red sites in Shanghai considered by the respondents

Option	National subtotal	National proportion /%	Shanghai subtotal	Shanghai proportion /%
The Memorial Hall of the National Congress of the CPC	561	53.58	58	71.60
The Memorial Hall of the Second National Congress of the CPC	272	25.98	34	41.98
Historical Memorial Hall of the Third Major Central Bureau of the CPC	221	21.11	19	23.46
The Fourth Major memorials of the Communist Party of China	178	17	14	17.28
Memorial Hall of the former Central Committee of the Socialist Youth League of China	277	26.46	37	45.68
Exhibition Hall of the former Department of China Labor Group	153	14.61	16	19.75
Chen Yun's Former residence and Qingpu Revolutionary History Memorial Hall	267	25.5	32	39.51
Zhang Wentian's former residence	182	17.38	28	34.57
Soong Ching Ling Cemetery, Honorary Chairman of the People's Republic of China	287	27.41	35	43.21
Longke Martyrs' Cemetery	222	21.2	44	54.32
The Memorial Hall of the Founding Conference Site of the Chinese Left-Wing Writers' Alliance	154	14.71	24	29.63
National Anthem Exhibition Hall	102	9.74	17	20.99
Shanghai Songhu Anti-Japanese War Memorial Hall	704	67.24	64	79.01
Former Changsheng Liu Residence of the History of the Communist Party of China	421	40.21	29	35.80
Shanghai Pudong Exhibition Hall (Pudong Development and Opening-up Exhibition)	559	53.39	45	55.56
Other	6	0.57	1	1.23

We have done some explorations in the study of cultural heritage interpretation[4]. However, there are still some problems in the field of red heritage, and although the various options of Shanghai residents for Shanghai's red cultural heritage are 10% to 15% higher than the national average, it still shows that the understanding of Shanghai's local red heritage still needs to be improved. Among the selected items, the residents of Shanghai, whose location located in Shanghai, are only 40.82%. The research data fully shows that the people of the whole country are generally unclear about what red heritage sites shanghai has, because it is not clear what red heritage there is in Shanghai, so it is more difficult to define Shanghai as a red cultural heritage gathering place.

Combined with the above two echoing survey results, the respondents lack sufficient understanding of the distribution and current status of red heritage in Shanghai, so they did not believe that Shanghai could be used as a red cultural heritage gathering place. In fact, Shanghai's red cultural heritage is very rich, and one of the main reasons why the public knows little about it is that Shanghai's red cultural heritage is insufficient in the field of value display and interpretation. The wonderful field of value display and interpretation is one of the important ways to revitalize and utilize, and it is also an important channel for promoting heritage and publicizing heritage. According to the results of the questionnaire survey, up to 93.31% of the respondents agreed that although the red heritage resources in Shanghai are abundant, they still lack effective activation and utilization.

2.3. At present, the main issues in the interpretation and display of values of Shanghai's red cultural heritage

First, the survey shows that more than 60% of the respondents believe that Shanghai's "lack of deep excavation of the information context of the value of red heritage and the lack of red IP" is the main problem at present (**Table 3**). Further, what is the core of Shanghai's red heritage, what is the dragon head, the pulse and main line of culture are not clear, and propaganda naturally cannot be concentrated. There is a lack of a main theme of red propaganda. Second, 50 percent of respondents believed that issues included "the party spirit of the Red Historic Site". The monotony of educational content is untargeted, "the display of red heritage values is homogeneous, and the information is lengthy and repetitive", "the red heritage propaganda and display methods are traditional, lack of scientific and technological sense", the lack of interest in red heritage propaganda makes the respondents prone to aesthetic fatigue when feeling the red heritage of Shanghai, which is also one of the common problems faced by the national red heritage.

Table 3. The main problems in the value interpretation and display of Shanghai's red cultural heritage in the opinion of interviewees

Option	Subtotal	Proportion /%
Red heritage value information context mining is not deep enough, the lack of positive red IP	682	65.14
The monotony of party spirit education content in red historical sites	595	56.83
The Red heritage value display is homogeneous, and the information is lengthy and repetitive	581	55.49
Red heritage publicity and display methods are traditional, and they lack of a sense of science and technology	502	47.95
The protection situation of the Red selection site in Shanghai is still serious	311	29.7
Other	4	0.38

3. Emerging technologies such as artificial intelligence and the revitalization and utilization of red cultural heritage

In order to "do a good job in the inheritance and dissemination of red genes", the interpretation and display of Shanghai's red cultural heritage needs to fully rely on the power of science and technology. The survey results found that up to 95.99% of the respondents agreed with the view that "artificial intelligence, three-dimensional visualization, light and shadow vision and other emerging technology services red cultural heritage display and interpretation is one of the important attempts to promote sustainable tourism of cultural heritage".

Promoting the value of cultural heritage based on emerging technologies is not only an important development direction in the field of Chinese heritage, but also a region that the International Council on Heritage is highly respected. In China, demonstrating the interactivity of communication in the digitization of cultural heritage has an important and positive effect on the interpretation of the value of cultural heritage[5]. For example, at present, there are very few in-depth studies in the academic community on the application of emerging technologies to red heritage, and the results of combining red heritage and emerging technologies in Shanghai are even rarer. The Shanghai Municipal Government has a far-sighted vision, and on the occasion of the centenary of the founding of the CPC, the Shanghai Municipal Philosophy and Social Science Planning Youth Project "Research on the Interpretation Model of the Value of Red Ruins in Shanghai Based on Three-dimensional Visualization" (No. 2018EGL002) was established in 2018, and some basic research was done in exploring this field. Several scholars have also

proposed to revitalize Shanghai's red heritage based on a variety of emerging technologies[6].

Among the many new technologies that can be used for the interpretation and display of cultural heritage values, the new technologies that are more commonly used include the panoramic display and interpretation tour system based on panoramic technology, the three-dimensional digital model based on point cloud technology, the light and shadow engraving based on the combination of sound and photoelectricity, and the immersive heritage tour system developed based on virtual reality, augmented reality and mixed reality technology.

According to the questionnaire survey, respondents believe that emerging technologies are far better than traditional technologies in terms of interpretation and display value and experience of red heritage (**Table 4**). The proportion of the four emerging technologies selected is the mobile phone panoramic heritage tour system (22.54%), the cultural heritage three-dimensional digital model tour display platform (25.79%), the cultural heritage sound and photoelectric light and shadow display technology (11.56%) and the cultural heritage virtual reality technology (17.86%), while the traditional technology selection is the exhibition board and paper brochure of the cultural heritage scenic spot (9.46%) and the cultural heritage tour guide or audio guide system (12.8%). The average (19.44%) of respondents who chose emerging technologies was 8.31% higher than the average of respondents who chose traditional technologies (11.13%).

Table 4. Respondents' acceptance of emerging and traditional technologies in the field of heritage display

Option	Subtotal	Proportion /%
Exhibition boards and paper brochures of cultural heritage site scenic spots	99	9.46
Cultural heritage guide or audio tour system	134	12.8
Mobile phone panoramic heritage guide system	236	22.54
Cultural heritage 3D digital model guide and display platform	270	25.79
Cultural heritage, sound, photoelectric, light and shadow display technology	121	11.56
Cultural heritage virtual reality technology	187	17.86

The 3D model is the basis of advanced 3D vision technology such as virtual reality. Considering that vast majority of respondents do not have virtual reality equipment, some of the 3D virtual reality images that can be implemented on the computer or mobile side were used in this survey. All respondents were invited to rate this chart group on a 10-point overall score, with an average of 1,047 people scoring a score of 17.45 points. The highest percentage of people selected for 8 points was 29.7 percent; 0 points were selected the lowest percentage of people at 0.1 percent.

Based on the conclusions of the above questionnaire, this study believes that the immersive 3D virtual reality technology of the 1st CPC site based on this research can be used as a new attempt to show the spirit of the Shanghai Sea Red, and up to 97.99% of the respondents indicated that if they have the equipment or conditions to use virtual reality technology, they will be willing to try the immersive 3D virtual reality technology of the 1st CPC site. In addition, as many as 95.89% of the respondents agreed with the view that "the results of the three-dimensional visualization of red heritage value interpretation will help to serve the transformation and upgrading of red tourism resources to red tourism bases, develop red tourism products that are popular in the market, and ultimately promote the protection and utilization of red heritage sites in Shanghai".

4. Suggestions for the interpretation and development of the value of red

cultural heritage in Shanghai

In the digital age of rapid technological change, the interpretation of the value of red cultural heritage must consider the audience's sense of participation and experience. The inheritance of the red spirit combined with intelligent technology is more conducive to promoting the wisdom construction of the red heritage[7]. The introduction of cutting-edge digital media broadcast control technology in the multimedia exhibition and the comprehensive embrace of the new forms of perception created by science and technology can not only bring the audience a special experience beyond the senses, greatly accelerate the speed of communication and interaction, and even make the audience a part of the exhibition, and many of the results presented are also different due to the different reactions and operations of the participants, which has established a more realistic image for the red cultural heritage for past events, places, and character exhibition projects, and the truth of history will have a more positive embodiment. In view of the current situation of red heritage in Shanghai and the results of the questionnaire survey, this study puts forward the following suggestions[8].

4.1. Select diversified means of activation and utilization of red cultural heritage according to local characteristics

The Red Cultural Heritage serves not only as a tourist attraction, but also as a wider social function. Explaining how the media and heritage sites are managed is an important part of this informal learning experience. The formation of the exhibition design concept stems from the understanding of the exhibition content, which is a reasonable and comprehensive grasp of the exhibition content, audience psychology, exhibition hall environment and other factors. The design and implementation of multimedia exhibitions must be guided by the confirmed exhibition concept, and in the process of narrative display and display design of relevant cultural heritage, it is necessary to dissolve fragmented information clues and

reconstruct to form an organic narrative frame through layered and progressive cultural cores, rich and diverse design elements, and clear and clear main theme clues. On this basis, based on the unified platform of digital media, the cultural heritage information in various forms of media is integrated together, and with the help of multimedia integration, digital photography, virtual reality and other technologies, under the condition that there will be no harm to the cultural heritage itself, through the network environment, the restrictions of specific time and places have been broken, and the utilization and sharing of resources have been realized to the greatest extent, so that the display, dissemination and interpretation of red cultural heritage are extremely convenient and sufficient. Getting rid of the value display that is bound by the visit time, interpretation and interpretation level of the traditional red cultural heritage visit, can provide sufficient information and capture the diversified, multi-level historical facts and value display of the interests of people of all ages, which can effectively stimulate the awareness of attention of different tourist groups and greatly help to improve the satisfaction and experience of tourists. For example, based on the advantages of Shanghai's red resources, the Longhua Martyrs Cemetery has created a high-quality curriculum for party education with different pertinence[9]. Rich, accurate and convenient access to information makes the audience's informal learning experience better, and will also prompt people to enjoy their travel more, so that tourists can respect attractions more and spread positive evaluation of tourist destinations, so that tourists can have a memorable, educational, spiritual, nostalgic, and transparent red cultural heritage experience, thus bringing about revisiting.

4.2. Strengthen the construction of talent teams based on the authenticity of red cultural heritage

The protection, display and utilization of red cultural heritage must be based on scientific research, and scientific research must be in the

forefront of practice, and the latest scientific research results must be used to guide the protection and revitalization of red cultural heritage. Multimedia Exhibition The real display is the exhibits themselves rather than technical means, and the digital interpretation and diversity of red cultural heritage is built on the in-depth excavation of the intrinsic value of each red cultural heritage. As a cultural symbol with Chinese characteristics, the red cultural heritage faces many contradictions and its unique value in the process of development. Whether it is the history spanned by the red cultural heritage, or the representative figures and typical events that have appeared in various periods, behind it is the profound Chinese communists and Chinese people at different stages of the revolutionary period to display different spiritual styles and revolutionary spirits, which requires the red cultural heritage to extract values from multiple levels such as historical facts, brands, and ecology, and to build a multi-dimensional network to achieve in-depth experience for the audience. Let people fully understand that the red culture and the spirit of the Long March forged by the Chinese Workers' and Peasants' Red Army are an important part of China's cultural soft power[10]. Talent is the core and key of the research team. Whether from theoretical research A lot of work needs to be done to cultivate talents in practice and operation, from the cultivation of administrative management talents to the cultivation of technical service talents.

4.3. Mobilize the enthusiasm of the community to participate in the revitalization and utilization of red cultural heritage

It is difficult to achieve sustainable protection and utilization by relying solely on the government, and it is necessary to fully mobilize the enthusiasm of the communities where the heritage is located, promote the participation of stakeholders in the protection and utilization of the red cultural heritage, realize the development of tourism-related enterprises to support the development of the

community, and promote the protection of the heritage site. Fully study the relationship between the value of red heritage and the residents of the community[11]. Form a positive interaction, so as to realize the harmonious protection and utilization model of red cultural heritage. Where the Red Cultural Heritage is located. The residents of the community improve their ability to make a living by participating in various trainings held by the government or operating companies on tourism reception, tourism commodity production, and operation, and while receiving tourists to obtain income, they encourage residents to take the initiative to participate, improve themselves, and enhance their confidence in independent development, so as to improve the ability of the community to develop themselves and the motivation of the community residents to protect and display their heritage. It is necessary to combine the protection and revitalization of red cultural heritage with poverty alleviation and rural revitalization, with cultural construction and tourism development, with economic and social development, and with the improvement of people's livelihood and well-being, so as to finally realize the continuous enhancement of the vitality and influence of red cultural heritage.

5. Conclusions

In the context of the digital age, science and technology empowering the display and interpretation of cultural heritage values is the research focus and development direction of cultural heritage value research and practice. The three-dimensional visualization survey and pilot of red cultural heritage carried out on the pilot basis of shanghai red cultural heritage can be used as a breakthrough to solve the common problem of value interpretation faced by China's red cultural heritage. However, there is no publicly published study on the interpretation of the value of Shanghai's red heritage based on questionnaires or first-hand data, and the results of this questionnaire survey show that the perception of Shanghai's red

cultural heritage is very vague and lacking, whether it is a nationwide or only Shanghai municipality, which is in stark contrast to the reality that Shanghai has extremely rich red cultural heritage resources. The data of the questionnaire survey shows that the solution to this contradiction lies in making full use of three-dimensional visualization technology to increase the sense of experience of the interpretation of the value of red cultural heritage, so that the audience can form an intuitive impression of red cultural heritage in interaction, which is not only conducive to the transmission and acceptance of red cultural heritage value, but also can form a unique Shanghai red cultural IP.

Due to the limitations of time and space, this questionnaire survey did not allow each respondent to conduct a field red heritage VR demonstration, and guide and collect qualitative data at the user's side. The application of 3D visualization technology to the interpretation of the red cultural heritage is still in its infancy and experimental stage, and there are still many problems to be solved by further research to promote 3D visualization technology in red. The maturity of application in the interpretation of cultural heritage values, such as the creation of three-dimensional standards for red heritage, the development of distinctive three-dimensional visualization of red cultural products, the lack of data on the acceptance preference of red heritage values in online red museums and different audiences.

Conflict of interest

The authors declare no conflict of interest.

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