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Study on digital protection and construction of characteristic landscape of SHANZHOU SILO-CAVE

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Abstract: *Under the strategic direction of rural revitalization, through the general analysis of digital protection and construction of traditional villages, the research progress of digital landscape is sorted out. Taking SHANZHOU SILO-CAVE as a case, the landscape status of SHANZHOU SILO-CAVE is investigated. According to the current problems, the digital protection and construction strategies are proposed for the characteristic landscape of SHANZHOU SILO-CAVE from three aspects: form, ecology and context. Digital reconstruction, digital collection of landscape genes, information management, virtual roam and Digital platform builds interactive space. Understanding the characteristic landscape of SHANZHOU SILO-CAVE from a new perspective provides feasible construction ideas for the digital development of rural areas.*

Keywords: *SHANZHOU SILO-CAVE; Digital landscape; Digital conservation*

1. Overview of digital protection and construction of traditional villages

Digital protection of traditional villages refers to the preservation, protection and inheritance of traditional villages and their culture by using computer technology, and the conversion of existing text, images and spatial data into digital documents, databases, still images and 3D dynamic images. The digital construction of traditional villages refers to the use of information technology means to improve the economic and social life in rural areas, improve the quality of life of farmers, and promote the digital development of rural areas. Digital village construction includes the following aspects: rural information construction, digital agriculture construction, rural e-commerce construction, digital culture and tourism construction, digital medical services.[1]

In 1992, UNESCO launched the "Memory of the World" project to select typical cultural heritage sites around the world for digital and information- based protection. China was a late starter, starting its practice from the 1980s to the end of the 1990s, but it has also made some important achievements. For example, Songyang County national traditional village digital system, Suzhou Shushan Smart Village platform builds three smart application systems: smart management, smart supervision and smart service, The embodiment of 5G+ digital village comprehensive application scenario in Gaotan Village, Lianhua County, Xingwen County in Sichuan Province promotes the co-construction and shared of digital infrastructure to build a smart application platform.

2. Overview of the landscape of SHANZHOU SILO-CAVE

2.1. Form

From the form (landscape environment image), the SHANZHOU SILO-CAVE has the following characteristics:

Concealment: the site of the SHANZHOU SILO-CAVE faces the southwest with high terrain. The construction terrain is located on the flat loess ground and gradually excavates 6m to 7m. No houses can be seen from the ground, and every household is hidden underground.

Harmony: the landscape environment of the SHANZHOU SILO-CAVE is a good expression of the state of harmonious coexistence between man and nature. The architectural style of the SHANZHOU SILO-CAVE is influenced by the architectural style of western Henan. The SHANZHOU SILO-CAVE

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is the living space excavated in the middle of the loess layer by "subtraction", which belongs to the "original ecological building". From the outside, the SHANZHOU SILO-CAVE and the surrounding environment are integrated and closely linked.

Environmental protection: The construction materials of the SHANZHOU SILO-CAVE are extremely environmentally friendly. The villagers use the least amount of building materials and the least project cost, and use local materials to dig holes in the loess soil layer with tight soil structure and deep accumulation to build the SHANZHOU SILO-CAVE. The processing of the earth building has low energy consumption and no pollution, which reduces the damage of construction waste to the environment.

2.2. Ecology

From the perspective of ecology (environment and ecological greening), the SHANZHOU SILO-CAVE follows the ecological principle of "harmony between nature and man". On the relatively flat Loess Plateau, the local villagers use the original terrain to build a living environment. Residents live underground and create a warm indoor environment in winter and cool in summer. It is integrated with the surrounding environment, and the land utilization rate is high. Because the climate in SHANZHOU SILO-CAVE area belongs to semi-arid climate, the climate is cool and dry with four seasons Ming. Residents in the SHANZHOU SILO-CAVE will dig a sunken pit in the courtyard for drainage, and a well will be set in the center of the SHANZHOU SILO-CAVE, which is deeper than the depth of the pit. When it rains, the water falls into the pit through the eaves and is finally collected in the drainage well. In terms of lighting, the design of the cave in the pit courtyard makes full use of natural light. The top of the entrance of each cave is usually designed with a daylighting port or small window, so as to let the natural light shine into the room, provide the basic lighting needs for the cave, reduce the dependence on electric lighting and reduce energy consumption.

Each household in the pit courtyard will do a small amount of greening, planting one or two persimmon trees, pomegranate trees or pear trees. The meaning of these trees is linked with auspicious meanings, and they also have the role of shading in summer, and fresh and delicious fruits to eat in autumn. The ground yard is usually covered with vegetation, which not only ensures the moisture of the soil, but also helps improve the air quality of the ground yard. Looking down from the roof floor, you can see the village scene of "people walking on the ground and trees shaking under the feet". In addition to some animals in the original environment, every household will raise some basic livestock in the livestock kiln, so as to facilitate the owner's daily farming.

On the whole, the SHANZHOU SILO-CAVE is very good in terms of ecology, integrating with the surrounding environment and using the existing local resources to create a livable living environment.

2.3. Environmental culture

From the perspective of style (public behavior psychology), the villagers' behavior is closely related to the environment of the SHANZHOU SILO-CAVE. The villagers live and live according to the soil, and the SHANZHOU SILO-CAVE is the material embodiment of loess culture. The embryonic form of pit courtyard can be traced back to the Miaodigou culture period more than 6,000 years ago. "Tao Fu Tao Cave" is recorded in the Book of Songs.

The daily life of the villagers is closely related to the loess, and the villagers build the basic space and various facilities necessary for life around the loess resources to play their maximum role. When constructing the SHANZHOU SILO-CAVE, the villagers follow the traditional Chinese feng shui thought and the belief of supremacy and inferiority, and combine with the eight bagua to distribute the courtyard from the four directions of due east, due west, due south and due north. They are defined as "Dongzhen Residence, Xidui Residence, Nanli Residence and Beikan Residence", which are suitable for house owners of different life phases to live. "Dongzhen Residence" is the best place to live in the area, and is usually called "Fu House". In order to ensure the safety of their living environment, the villagers are keen to observe the weather conditions and the vegetation on the roof, prevent rain from washing the soil of the cave dwelling, and remove weeds on the roof to prevent plant roots from destroying the cave dwelling.[2]

The villagers of SHANZHOU SILO-CAVE also reflected the family ethical order of "orderliness of the elders and orderliness of the children" when distributing their family members. The caves were distributed according to the traditional ethical norm of "facing away from the main kiln and respecting

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the left side". The elders generally lived in the main kiln, and the children and grandchildren moved into other secondary kilns according to their seniority. On important dates such as festivals and happy events, in order to invite friends and relatives to come to the house for the feast, large stoves with 5 to 9 stoves will be temporarily repaired, which is called "mountain stoves". The materials of "mountain stoves" are derived from loess and will be dismantled after the feast, thus deriving the special food "Ten Bowls" of SHANZHOU SILO-CAVE. It can be seen that the loess shaped the simple life of the villagers, affected the social communication of the villagers, and derived the unique landscape and regional culture of the SHANZHOU SILO-CAVE.

3. The current situation of the underground SHANZHOU SILO-CAVE

3.1. The courtyard is hollowing out

In the 21st century, in response to the national policy of returning farmland to forest, Shanzhou District government of Sanmenxia City gave rich subsidies to the original residents of the courtyard, and moved most of the original residents to new model buildings, leaving only a small number of poor residents and the elderly. The imbalance of the age structure of the villagers in SHANZHOU SILO-CAVE and the massive population outflow led to a sharp decline in the number of the population in SHANZHOU SILO-CAVE, the decline of the population quality, the weakening of the social function of the village, and the hollowing out of the overall form of SHANZHOU SILO-CAVE.

3.2. Heritage damage

SHANZHOU SILO-CAVE was listed as China's intangible cultural heritage in 2011. In order to develop the tertiary industry, Shaanxi District government hired a professional tourism planning company to develop and design large-scale tourist attractions in Beiying Village SHANZHOU SILO-CAVE, connecting 22 SHANZHOU SILO-CAVEs, planning a tour route, and developing into a folk experience park. After the development, the original and rough old space of the SHANZHOU SILO-CAVE was renovated and designed into a space with strong commercial flavor.

In terms of architectural functions, the original spatial pattern of the pit courtyard was disrupted. The original pit courtyard had distinct functions, including main kiln, dwelling kiln, stove kiln, livestock kiln, latrines kiln and gate cave kiln, etc. In the updated pit courtyard, except the main kiln could be identified, other cave functions were weakened.

From the perspective of the overall structure, in order to facilitate the passage of tourists, 22 originally unrelated SHANZHOU SILO-CAVEs were opened up, which destroyed the original design structure of the SHANZHOU SILO-CAVE. Originally, the entrance of each household cave kiln had to be entered through the Mendong kiln, which was the door face of the household owner and the dividing line between the inside and outside the pit. After the opening of 22 SHANZHOU SILO-CAVEs, the Mendong kiln was weakened. The original independent structure of each household courtyard was reconnected underground. The surrounding landscape environment has also been redesigned, and the original yellow soil on the ground has been paved with blue brick or stone roads for the convenience of visitors, losing the original sense of simplicity.

From the perspective of architectural use, in order to promote different folk characteristics, the park has designed SHANZHOU SILO-CAVEs with different themes according to different folk customs, such as marriage customs exhibition yard, farming yard, intangible cultural heritage exhibition yard, Chengmud inkstone yard, etc. For each courtyard with different themes, only the main kiln is carefully designed, while other secondary kilns are only renovated or left idle, with low utilization rate.

3.3. Lagging behind in updating

With the continuous development of tourism, the experience value of tourism consumers is also improving. The public service facilities in scenic spots also affect the experience value of tourists to a great extent. In addition to protecting and displaying the original cultural heritage of the SHANZHOU SILO-CAVE to tourists, the infrastructure development in the tour process is not perfect. The directions for entering the SHANZHOU SILO-CAVE are not clear, and it is easy to get lost when visiting alone without the guidance of a guide. There are also no rest facilities for tourists in the 22 underground pits, so they have to rest on seats on the ground, which interrupts the tour route. The interactive landscape pieces at the entrance of the Folk Culture Park are backward and lack of interest. The playing facilities

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of the ground physical park have varying degrees of damage, and there are hidden dangers to play.

3.4. Backward inheritance

Although the construction techniques of the SHANZHOU SILO-CAVE have been included in the national intangible cultural Heritage protection list, in the actual situation, more funds, policies and traditional skills are still needed to ensure the sustainable development of this traditional architecture and traditional skills. Some of the traditional skills in pit courtyard, such as Shanzhou paper-cutting, Chengmud inkstone and hammer grass printing, require a long time of study and practice to master, and there are only a small number of young people in modern society who are willing to devote themselves to learning these traditional skills. The old masters who master these skills in the pit courtyard cannot stay in the pit courtyard for a long time due to physical reasons. The teaching space is also selected in the intangible cultural heritage exhibition courtyard, where the works of the old masters are displayed and sold. The space for people to learn the skills is less than 5 square meters. The shortage of funds, the difficulty of skill inheritance, and the narrow learning space have all led to the backwardness and loss of traditional skills in the SHANZHOU SILO-CAVE.

3.5. Current situation of digitalization

The development of digital technology also provides new technical means for the protection and construction of SHANZHOU SILO-CAVEs. In 2016, the courtyard cooperated with Tencent to introduce e-commerce thinking and jointly launched China's first "Internet +" smart rural tourism scenic spot. The public can buy tickets online on wechat, and the display signs in the courtyard can also be scanned to listen to the online explanation. The official website of the courtyard has the introduction of special scenic spots and the 720° view of real scenery. However, the digitization of the courtyard has not been updated in real time, and the information displayed on the official website of the scenic spots is not comprehensive enough, only twelve scenic spots are introduced, and some of the characteristics of the courtyard are missing. The recent information of the SHANZHOU SILO-CAVE was only updated to December 31, 2018, resulting in tourists not being able to timely understand the latest information of the SHANZHOU SILO-CAVE. Most of the information is presented in the form of a single text and picture, which fails to fully mobilize the five senses of tourists and lacks the sense of experience. It can be seen that the current update progress of the digitization status in the SHANZHOU SILO-CAVE is relatively backward, there is no clear and unified digital plan, the actual information of the SHANZHOU SILO-CAVE is not updated in time, and the experience mode of the scenic spot is single and insufficient.

4. Digital protection and construction strategy

The research on the digital protection and construction of the characteristic landscape of SHANZHOU SILO-CAVE needs to keep up with the development of current science and technology and make good use of it do a good job of digital protection with digital technology, follow the scientific, objective and systematic construction strategy, and show visitors the most comprehensive, most real and diversified SHANZHOU SILO-CAVE. According to the current situation of the SHANZHOU SILO-CAVE, this paper will put forward corresponding protection and construction strategies for the SHANZHOU SILO-CAVE from three aspects: form (landscape environmental image), ecology (environmental ecological greening) and context (public behavioral psychology) .

4.1. Landscape environment image

Firstly, the SHANZHOU SILO-CAVE is reconstructed digitally from the aspect of morphology: The characteristics of the underground cave courtyard lie in the construction form of the underground cave, traditional intangible cultural heritage technology and human customs. 3D scanning technology can be used to comprehensively and accurately record the architectural forms, folk culture and other landscape elements of the underground cave courtyard, so as to obtain all aspects of landscape information of the underground cave courtyard, and provide detailed basic data for the subsequent digital protection of the underground cave courtyard. Secondly, the damaged part of the SHANZHOU SILO-CAVE can also be digitally reconstructed, and a 3D digital model can be built to supplement the damaged part. Establish a 3D construction database to standardize and classify the construction of SHANZHOU SILO-CAVE, allowing tourists to more intuitively and conveniently understand their methods and architectural styles. Alternatively, use 3D printing technology to present the original appearance of these houses in miniature

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scale before visitors.At the same time, the addition of digital technology can also improve the work efficiency of the restoration and maintenance personnel of the SHANZHOU SILO-CAVE[3].

4.2. Environmental ecological greening

Secondly, the digital collection of landscape genes and information management of the SHANZHOU SILO-CAVE are carried out from the ecological aspect:

At present, after the construction of the SHANZHOU SILO-CAVE scenic area, some of the buildings in the courtyard have also suffered varying degrees of damage. The traditional manual care, camera supervision and traditional manual data collection have low efficiency and poor accuracy, and it is difficult to avoid visual blind areas or artificial subjectivity. Digital technology can provide more comprehensive and accurate information to help us understand the real-time situation of the SHANZHOU SILO-CAVE, analyze its landscape status, and prevent possible disasters in the future. Through the application of satellite remote sensing and aerial images, we can obtain the information of land cover, landform, vegetation greening, climate, hydrology and other aspects of the SHANZHOU SILO-CAVE, so as to provide detailed and solid basic data for subsequent protection work. At the same time, the addition of digital technology can also improve the work efficiency of the restoration and maintenance personnel of the SHANZHOU SILO-CAVE. With the gradual maturity of big data acquisition and processing technology, the accuracy of landscape gene collection is also gradually improved. Technicians can also use these data to prevent and predict the disasters that the SHANZHOU SILO-CAVE will face, and maximize the prediction information to protect the SHANZHOU SILO-CAVE.

Information collection includes two parts: characteristic landscape and intangible cultural information, and scanning, storage and classified management of the real scene part of the pit; For the virtual information of the intangible culture, the information can be stored and managed by means of text editing, recording, image, audio and video. After collecting the information data, through analysis and collation, the information is optimized and explained, and then all kinds of information are classified, so that the staff can query the information more convenient and the tourists can query more clearly. It can also be used for the generation of related virtual information, so that the tourists can understand the characteristics of the SHANZHOU SILO-CAVE through various ways. For example, at the entrance of the park, the display screen can be used to make the construction background and history of the pit courtyard into a display animation. In the folk culture Park, icon identification is set up, and VR technology and icon identification are used to map different intangible cultural heritage one by one, so that more tourists can experience the intangible cultural heritage such as hammer grass printing, Shanzhou paper-cut, and Cheng Ni inkstone.

4.3. The public acts of psychological

Finally, from the aspect of text, the virtual browsing and interactive space design of digital platform construction are carried out:

Digital technology can provide diversified display methods and increase the dissemination breadth of the characteristic landscape of the SHANZHOU SILO-CAVE. The application of technologies such as virtual browsing and interactive space design built by digital platform, VR technology based on the 3D modeling of the pit courtyard, can allow visitors to truly feel the characteristics and culture of the pit courtyard through multi-angle, multi-mode and high-definition scenes, and make the dissemination of the characteristic landscape and culture of the pit courtyard more extensive and in-depth through diversified display methods. AR technology can also be used to superimpose virtual information on the real scene, visually present the originally invisible digital cultural content through mobile phones, and expand the cultural carrying space of the characteristic landscape of the SHANZHOU SILO-CAVE.

In addition, as a representative of intangible cultural heritage, the inheritance and development of SHANZHOU SILO-CAVEis also facing many challenges. Problems such as the shortage of funds and the difficulty of inheriting traditional skills restrict the development of SHANZHOU SILO-CAVE. The survey found that the official website of the SHANZHOU SILO-CAVE is 720°The panoramic tour scene is only an overall aerial view of the site, and there are no more detailed pictures of the underground gallery. Therefore, we need to develop a virtual tourism industry on a digital platform to promote the inheritance and development of traditional skills in the SHANZHOU SILO-CAVE through online communication and activities. At the same time, we should also integrate digital technology into the interactive space design, which can capture the scene in the pit courtyard from the perspective of tourists,

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and increase the real experience of tourists. It can also facilitate visitors to have a preliminary understanding of the SHANZHOU SILO-CAVE online through 5G live tour, and show the history and culture of the SHANZHOU SILO-CAVE in a vivid and interesting way.

The construction of the digital platform of SHANZHOU SILO-CAVE plays an important role in its digital protection and later construction. The Palace Museum has established a digital Palace Museum platform to present historical information about the Palace Museum through animation, games and lectures. Shanzhou Underground Gallery can also integrate digital technologies into the interactive space to compare the past and present of the underground gallery. Users can learn about the past and present of the underground gallery through interactive games on the digital platform. Visitors can also create a virtual identity on the digital platform to log in to the digital platform, participate in the supplement of other information of the SHANZHOU SILO-CAVE, exchange sightseeing experience and experience with other users, develop the virtual tourism industry, and hold online meetings, virtual business entertainment or teaching and research activities on the digital platform of the SHANZHOU SILO-CAVE. It can also create movies, animation and games for the prototype of the underground pit Institute, and jointly build the digital platform of the underground pit Institute.

In a word, the development of digital technology provides a new technical means for the protection and construction of SHANZHOU SILO-CAVE. Through the research on the protection and construction of the SHANZHOU SILO-CAVE by digital technology, the characteristic landscape and regional culture of the SHANZHOU SILO-CAVE can be better displayed, and the tourist experience and satisfaction can be improved. At the same time, the digital technology can also provide new ideas and directions for the future development of the SHANZHOU SILO-CAVE.

5. Conclusion

In summary: under the background of the vigorous promotion of the rural revitalization strategy, strengthening digital construction is the strategic direction of rural revitalization. SHANZHOU SILO-CAVE represents the rich historical and cultural heritage of the Loess Plateau region, as well as the local strong regional characteristics and customs. At present, SHANZHOU SILO-CAVE is facing the dilemma of protection and inheritance. In the era of continuous development of digital technology, how to combine digital technology with the protection and construction of the characteristic landscape of SHANZHOU SILO-CAVE is the key issue discussed in this paper.

The protection strategy needs us to keep up with the development of current science and technology, and make good use of digital technology to do a good job of digital protection. In terms of logical reasoning, we need to systematically analyze the current situation and problems of the SHANZHOU SILO-CAVE, and put forward targeted solutions. In the argumentation process, we need to pay attention to academicality and rigor to ensure that the proposed protection strategy is scientific and feasible.

Through the landscape overview and analysis of the current situation of the SHANZHOU SILO-CAVE, it is understood that the rural vitality of the SHANZHOU SILO-CAVE is declining, and the regional characteristics of the landscape are also slowly losing. Traditional landscape protection and construction methods are difficult to systematically and comprehensively control the landscape of the SHANZHOU SILO-CAVE. However, through the auxiliary means of digital technology, real-time information of the SHANZHOU SILO-CAVE can be more comprehensively and accurately understood. Analyze the current situation of the landscape of the SHANZHOU SILO-CAVE, prevent future disasters, understand the tourist dynamics and preferences through big data, and make targeted rectification of the characteristic landscape of the SHANZHOU SILO-CAVE. Let the digital technology play a full role in the characteristic landscape of the pit courtyard, make the pit courtyard have a variety of display ways, and increase the dissemination breadth of the pit courtyard's characteristic landscape and culture.

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