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Exploration of Narrative Space Design of the Binyang Bamboo Weaving Exhibition Hall under the Background of Digital Intelligence

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Abstract. With the fast development of digital intelligence technologies like interactive media, virtual reality and digital twins, the display and communication methods of intangible cultural heritage (ICH) are experiencing significant changes. Taking the design of Binyang bamboo weaving exhibition hall as an example, this paper investigates the digital-intelligence improvement routes in the layout design of ICH exhibition halls. By comprehensively studying the development patterns, craftsmanship aesthetic features and current cultural status of Binyang bamboo weaving, the study suggests spatial narrative approaches based on three aspects: narrative logic, narrative sequence and narrative translation symbols. In addition, by combining digital technologies such as interactive projection, sensory interaction and immersive media, the paper builds three innovative models: cultural narrative, behavioral narrative and conscious narrative. The purpose of this research is to improve the emotional attraction and interactive feeling of ICH exhibition areas, promote the survival inheritance and multi-directional dissemination of ICH culture and offer theoretical support and practical advice for the design of similar ICH exhibition areas.

Keywords: spatial narrative, ICH exhibition hall space, digital intelligence, Binyang bamboo weaving

1. Introduction

As an important carrier of social development, intangible cultural heritage still faces many challenges in protection and inheritance. With the wide application of digital intelligence technology, ICH exhibition space has gradually shifted from traditional static display to dynamic, interactive and multi-dimensional narrative experience, showing a development trend of integration of "living state" and "digital intelligence". As an important ICH project in Guangxi, Binyang bamboo weaving has distinctive regional cultural characteristics and craft value. The design of its exhibition space concerns the effect of cultural communication, and also relates to the sustainable development of ICH skills.

The origin of narratology theory can be traced back to the 18th century, when literary and artistic works gradually divided into two art forms: one is time art based on temporal continuity, and the

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other is juxtaposition art based on spatial coexistence, such as painting, sculpture and architecture [1]. In a space, narrative design often carries the role of arousing the viewers' thinking, and this design logic based on story sequence can promote the emotional resonance between viewers and the space. Based on spatial narrative theory, combined with digital intelligence technology, and taking the Binyang bamboo weaving exhibition hall as an example, this paper explores the innovative design path of ICH exhibition space. By reconstructing narrative logic, optimizing spatial sequence and translating cultural symbols, combined with virtual-real combined interactive means, a display environment with emotional tension and cultural depth is constructed, aiming to improve the audience's sense of participation and cultural identity, and to provide new ideas and methods for the modern transformation of ICH exhibition space.

2. Inheritance and development status of ICH bamboo weaving

2.1. Characteristics of binyang ICH bamboo weaving

In 2022, the Ministry of Culture and Tourism and other departments jointly issued the Notice on Promoting the High-quality Inheritance and Development of Traditional Crafts, which provided policy guidance for the "two creations" development of traditional crafts [2], and it is a very important development opportunity for the birthplaces and inheritance units of ICH culture. The Binyang bamboo weaving exhibition hall is located in the bamboo weaving ICH inheritance base of Taishou Community, Silong Town, Binyang County, Nanning, Guangxi Zhuang Autonomous Region. The exhibition space is one of the main ways to publicize and sell bamboo weaving. Binyang bamboo weaving takes pragmatism as the core, and its product shapes are centered on daily life, mainly including bamboo lamps, bamboo hats, and festival bionic shapes such as dragons, lion dances and peacocks; it mainly uses the warp and weft weaving method, has uniform and dense texture characteristics, and its bamboo weaving patterns are mainly auspicious patterns. Binyang bamboo weaving has a mature production model and marketing route locally, and is closely connected with local culture (Pao Dragon Festival, Harvest Festival, etc.). Through the business model of cooperative + company + farmer, it drives local villagers to increase income and maintains the traditional cultural context. The uniqueness of Binyang bamboo weaving lies in that, under the dual influence of Lingnan culture and Zhuang culture, it has special customs and cultural symbols, and combines deep national heritage with the potential of large-scale production.

From the design point of view, the publicity and development mode of the bamboo weaving exhibition hall is relatively traditional, and the space of the exhibition hall needs relatively complete functional arrangement and clear exhibition red lines and interaction processes. Therefore, from the perspective of the living inheritance of bamboo weaving culture, through multi-level narrative design of the exhibition space, an interactive space with strong perception can be built, which can enhance the educational environment and publicity system of bamboo weaving culture, promote the living inheritance of ICH culture, and is also a multi-dimensional integration of traditional culture and modern technology, stimulating the birth and development of new culture.

2.2. Development status of ICH exhibition hall space

ICH display is a necessary carrier for the communication, development and presentation of ICH culture. Since ICH takes people as the core carrier and transmits spirit, experience and skills, it has a significant "immaterial" attribute. Therefore, the core value of ICH exhibition space is mainly reflected in four aspects: protection, innovation, living inheritance and interactive experience of ICH

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culture. Early ICH exhibition spaces mostly used the traditional display mode of "exhibits + explanation boards", and the display focus was also concentrated on the "form" level of ICH.

As society pays more and more attention to ICH protection, interactive elements such as touch screens, interactive games and skill experience have begun to be introduced into ICH exhibition spaces. These designs both enhance the audience's sense of participation and make the "non-form" characteristics of ICH more prominent. Nowadays, ICH exhibition spaces are gradually realizing multiple transformations: from traditional mode to modern form, from single function to diversified positioning, from static display to dynamic presentation, and from closed space to open scene. This series of transformations continuously injects impetus into the protection and inheritance of ICH culture.

3. Narrative strategies of the binyang ICH bamboo weaving exhibition hall space

The scope of spatial narrative design covers the analysis of spatial relations, functions, structural organization and systems, and also emphasizes the environmental characteristics of unique spaces [3]. The premise of narrative is the communication relationship between narrative media and receivers [4]. Narrative design frees designers from the previous awkward mode of displaying exhibits separately with graphic display boards, and cleverly intersperses "culture" in between, so that visitors are always in the visiting state guided by the designer [5]. Therefore, the design strategy of spatial narrative should take the characteristics of exhibits as the core, human activity habits as the support, and emotion as the carrier, and take local characteristics and special cultural stories as the narrative clues. The space is used as a medium to display the theme concept, so that the narrative content unfolds as visitors tour the space [6]. Therefore, narrative design should combine the characteristics of the exhibition space, build a multi-level logical structure, and then write concise and clear design language into the set logical structure as the medium of cultural communication, and finally form systematic memory symbols through the analysis orientation of the design language to viewers, so as to build the cultural communication system of the whole spatial narrative.

3.1. Constructing narrative logic from the perspective of space

The spatial layout in the exhibition space is influenced by the cultural characteristics of the narrative subject, and generally presents linear logical characteristics of multiple levels, multiple senses and multiple dimensions. Spatial narrative design focuses on the theme idea as the core, and strings together the different theme plots of each space through the narrative process. Corresponding to the plot development of literary novels, the space is divided into four scenes: opening, transition, climax and ending (see Figure 1). The mutual cooperation of spaces with different functions promotes the emotional changes of visitors.

In a bamboo weaving narrative space layout, each functional space carries a part of the story plot. The traditional exhibition way is reconstructed into multiple scene spaces working together. The opening space serves as the communication center for visitors and the premise for understanding the information of the whole main hall, the transition space shows the development history of bamboo weaving, the climax space is the experience of bamboo weaving and the study of bamboo weaving culture, and finally the ending space helps the emotional change through the external space. The four types of spaces are connected in multiple lines, producing multiple rich scene perceptions. Taking the experience and study of bamboo weaving as double climax narrative, with the narrative logic of multiple transitions, conforms to the long and narrow spatial characteristics of the bamboo

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weaving exhibition hall, takes the layout itself as the guiding line of the story, and lets visitors naturally "read" the whole story.

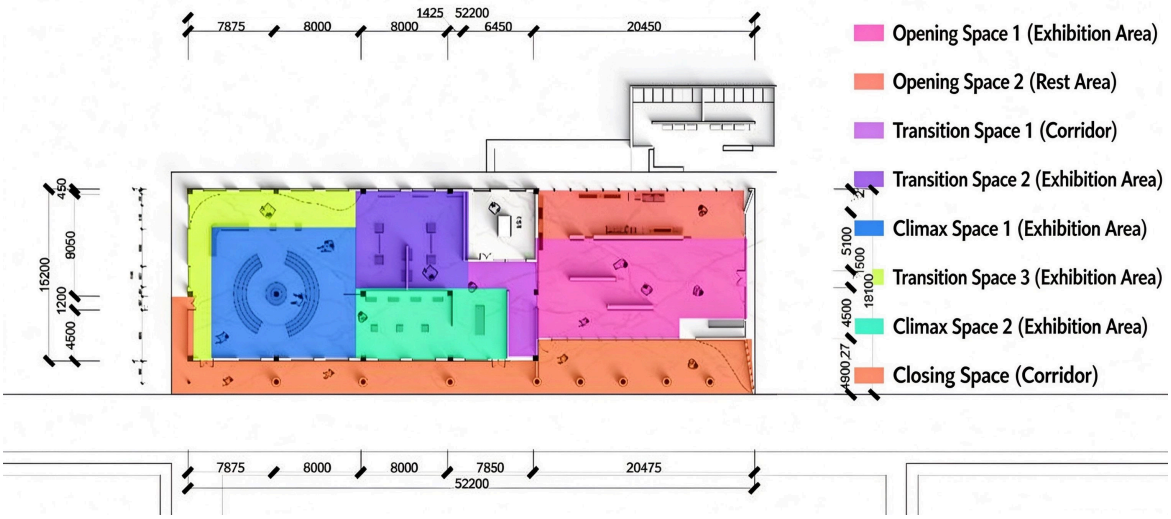

Figure 1. Spatial logic distribution map (source: drawn by the authors)

3.2. Constructing the narrative design sequence

The key to constructing the design sequence of narrative space is to combine the abstract story structure with concrete spatial carriers. A main melody is created for the story plot, and based on the cultural theme and exhibition line organization, the exhibits have specific presentation ways and orders [7]. By tapping the potential of narrative space and building carriers that fit the theme, the sensory expression of narrative elements is highlighted [8]. A complete narrative sequence is equivalent to the meridians of the whole space, ensuring the normal operation of the overall moving line and story rhythm. In design, it is mostly reflected in excellent moving line design, distinctive color perception, and immersive light and shadow effects, mainly embodied in the design of materials, lighting, soundscape devices, etc. Architectural space from the narrative perspective analyzes its construction logic from a literary perspective, and explores the relationship between spatial sequence, creation function and connotation attributes [9].

As the clue of the whole story, the narrative sequence is the key to advancing the plot. In the reconstruction of the narrative sequence, the bamboo weaving exhibition hall combines the characteristics of linear narrative and parallel narrative sequences, improves the structure of linear narrative (see Figure 2), and adopts a ring shape closing end to end on the overall tour line. It breaks the limitation of traditional narrative space with time or category as the narrative sequence, no longer arranges the craft of Binyang bamboo weaving (bamboo selection—splitting—weaving), culture (pattern meaning, folk custom connection) and craftsmen (skill inheritance stories) in a fixed order, but adopts a multi-line crossing narrative sequence, decomposing the three into interrelated interactive space modules, which enriches the selectivity of the tour line, improves the fun of space play, and enhances the feedback of emotional interactive experience.

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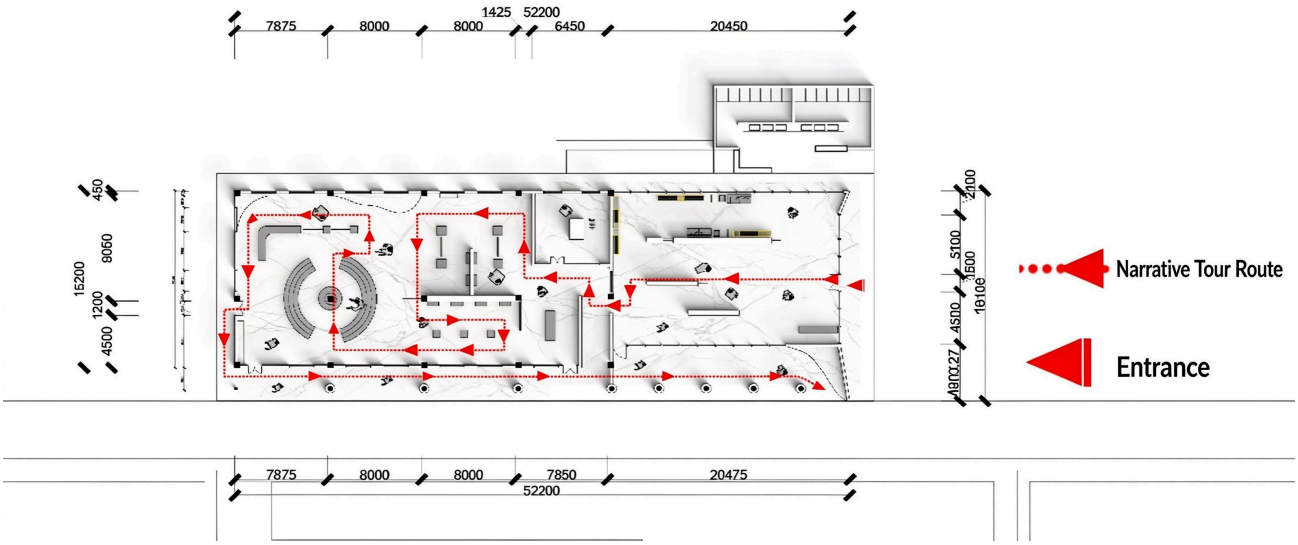

Figure 2. Spatial sequence display map (source: drawn by the authors)

3.3. Constructing narrative translation symbols

Human narrative behavior can be traced back to primitive society. Before language was born, primitive people transmitted information through symbols, and this ancient narrative way can be regarded as the origin of narrative [10]. The narrative translation symbol of the exhibition space is equivalent to the way to achieve the display purpose. It is the emotional fluctuation produced through a series of viewing interactions, so as to generate thinking about the display subject and form a thinking symbol, and the "symbol" is the signal transmitted in the interaction. Through the effective design treatment of bamboo weaving theme elements, translation symbols often have a summary tendency and strong universality.



Figure 3. Narrative symbol rendering (source: drawn by the authors)

In the bamboo weaving exhibition space, the transformation of this symbol comes from abstract craft logic, bamboo culture connotation, inheritance emotion, etc., transforming text records into visible facade decorations and creating immersive scene atmosphere. The weaving lines of split bamboo are translated into the suspended bamboo silk device at the top of the exhibition hall, the warp and weft weaving structure is translated into the grid pattern of space partitions, and the pattern

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meaning is translated into ground interactive projection (see Figure 3). Using digital virtual technology, the narrative information originally attached to bamboo woven objects "comes alive" through symbols such as lines, light and shadow, materials and interactive behaviors in the space, so that the audience does not need to rely on text explanations, and the virtual-real combined interactive technique achieves multi-sensory interaction.

3.4. Summary of the narrative methods of exhibition hall space

The use of spatial narrative techniques is particularly common in exhibition spaces. The main purpose is to break the insensitive interaction of static display and create a vivid emotional scene, so the narrative design of the exhibition space should conform to the spatial characteristics. Under the positive influence of digital intelligence technology, the attraction of traditional exhibition spaces with "objects" as the display form has declined, so physical exhibition spaces must rely on the meaning and social function of cultural display. New brand exhibitions oriented by multi-sensory narrative, through the synergy of the two, are subverting the one-way communication logic of traditional brand display, and instead constructing a cross-cultural, cross-sensory "meaning symbiosis system". The practical essence of this theoretical system is to transform narrative value into diversified value through deep deconstruction of cultural symbols and precise coding of sensory experience [11]. Using the reconstruction of spatial narrative logic in space design enhances the emotional interactive experience of viewers and improves their interest in viewing, so as to better play the role of cultural communication and exchange.

Binyang bamboo weaving has unique technical craftsmanship and cultural connotation. In more than a hundred years of inheritance and development, it has created material innovation and development in the history of Guangxi bamboo weaving craft from scratch [12]. As an important part of Chinese culture, bamboo weaving culture has a relatively clear narrative logical structure, attached to the overall framework of traditional Chinese bamboo culture. The innovative ways of bamboo weaving exhibition space can develop in multiple dimensions, and are relatively rich in the overall narrative sequence of ICH culture.

4. Digital-intelligence innovative design paths of spatial narrative

The perspective of digital-intelligence empowerment is a new theoretical framework proposed in recent years alongside emerging technologies such as artificial intelligence, big data, cloud computing and the Internet of Things [13]. In narrative space, digital-intelligence design pays more attention to the efficiency of human-computer interaction, allowing visitors to participate in the interaction in more dimensions, achieving the purpose of rapid information transmission, and following the design principles of resource sharing, sustainability and visibility. In the narrative space of bamboo weaving, bamboo culture is integrated with digital entertainment to innovate the interaction mode and realize communication services based on ICH culture. The innovation of digital intelligence technology empowers the development and upgrading of various fields of society through innovative technical means and service modes, realizing the integration and coordination of digitization, intelligence and networking [14]. Through the digital deconstruction of Binyang bamboo weaving, viewing, experience and study are integrated, and the exhibition space is divided into three digital-intelligence innovative application modes: cultural narrative, behavioral narrative and consciousness narrative.

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4.1. Digital-intelligence innovation path of cultural narrative

At present, the recording and development of ICH culture need to pay attention to the needs of users and handicraftsmen. Facing multi-dimensional needs, the exhibition space requires attention to the application of digital technology. This bamboo weaving narrative space adopts the virtual-real combined design technique, establishes a digital library of bamboo weaving development archives and integrates digital entertainment, dynamically visualizes the development history of bamboo weaving, builds a new bamboo weaving cultural space, and combines virtual ways such as digital exhibition and digital reading with real bamboo weaving exhibits (see Figure 4), realizing the synchronized development of theory and practice and helping the rapid development of bamboo weaving culture education. Bamboo weaving is used as a part of the space facade material, shaping a narrative space where the space itself is the exhibit, and the virtual-real combined narrative purpose is achieved through the rolling display of bamboo weaving culture.

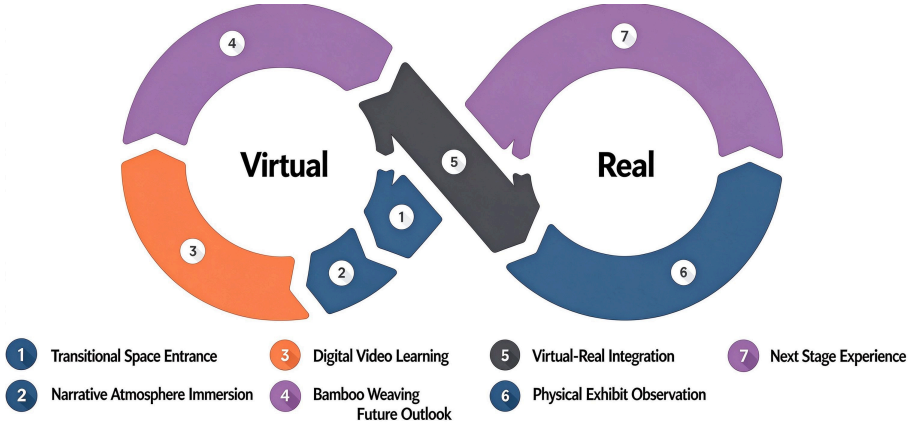

Figure 4. Mind map of cultural narrative (source: drawn by the authors)

4.2. Digital-intelligence innovation path of behavioral narrative

The reasonable use and effective combination of digital intelligence technology can give the exhibition space a viewing effect with great ornamental value and visual impact. Behavioral narrative is based on the learning results of visitors in the cultural narrative mode. After fully understanding the art of bamboo weaving culture, digital technology is used to realize images, sounds and atmosphere creation and other interactive ways to integrate experience and study, pushing the whole bamboo weaving story to the climax. In the narrative logic, the experience and study are set as two adjacent climax spaces. In the scene space of experience, by comparing digital patterns with physical patterns, digital weaving can be carried out on the interactive screen. Visitors try innovative creation on the original bamboo weaving patterns, and the works are entered into the digital sharing library of bamboo weaving pattern works, and the bamboo weaving digital patterns are displayed in the study space. In the study space, visitors can try hand-making according to the digital patterns obtained in the experience space, and a handmade works sharing platform is built. Learners in the space can fully exchange their work experience by scanning QR codes (see Figure 5). Compared with the traditional spatial narrative logic, the learning double-climax space in the transition space has longer and more stable emotional fluctuation, and digital intelligence technology helps the story advance rapidly, making up for the defect that traditional narrative has low controllability of viewing emotions.

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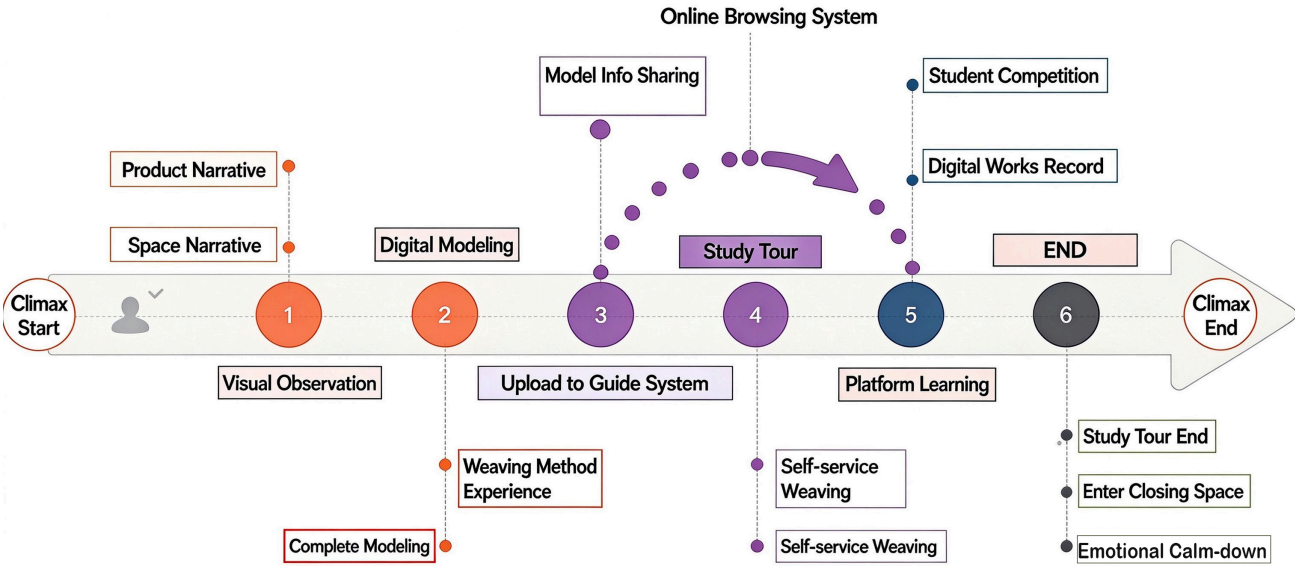

Figure 5. Mind map of behavioral narrative (source: drawn by the authors)

4.3. Digital-intelligence innovation path of consciousness narrative

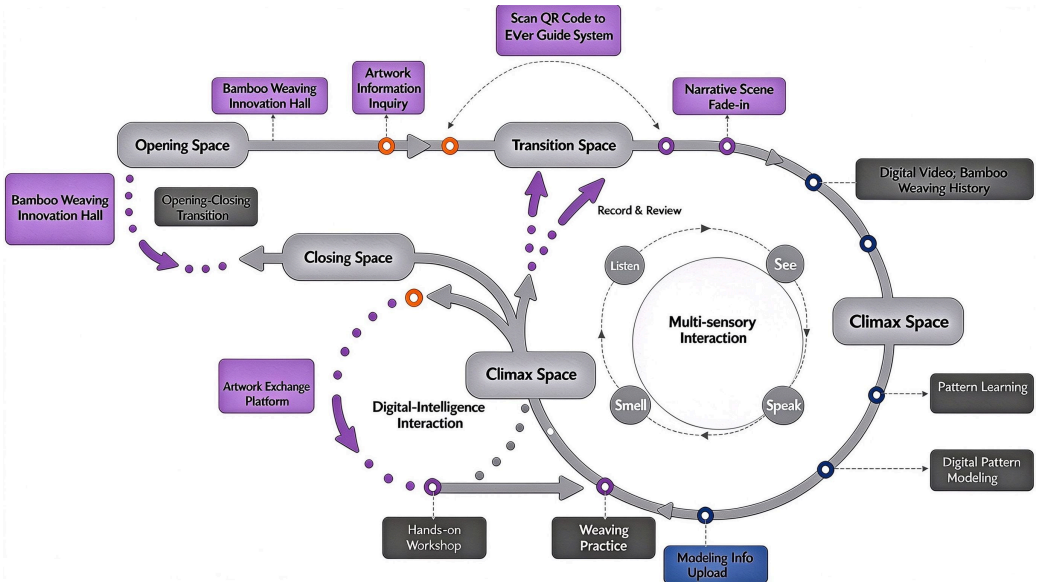

Figure 6. Mind map of consciousness narrative (source: drawn by the authors)

Consciousness narrative is the review and continuation of the whole viewing process, and is the key to perfecting the whole narrative system. It is mainly concentrated in the ending space and the entrance space. The innovation of this bamboo weaving exhibition space adopts a circular narrative sequence. After the climax of the bamboo weaving story, visitors follow the set tour route through the external bamboo forest corridor back to the opening part of the entrance space. This space mainly displays innovative bamboo weaving works that can be sold. Visitors can freely choose how to handle them according to the characteristics of their own works. The displayed works are accompanied by QR code information of the residence time and experience content in each space, and serve as the intelligent guide system for the next visitor (see Figure 6). From an overall point of

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view, the circular narrative sequence can be described as the end of one narrative story being the beginning of the next story. Digital intelligence technology ensures the information accuracy of the whole viewing process, ensures the reliability of visitor-to-visitor guidance, and optimizes the tour line through real-time data synchronization.

5. Innovative design exploration of the binyang ICH bamboo weaving exhibition hall space

After modular disassembly of Binyang bamboo weaving culture, digital intelligence technology is used to reconstruct its narrative structure, and relatively rich and coherent combinations of narrative logical space modules can be obtained in the exhibition space. This digital-intelligence narrative space module breaks the limitation of traditional space in time-space scale and realizes cross-space narrative fusion. In addition, the digital-intelligence processing of ICH bamboo weaving culture can realize efficient processing of cultural records, speed up the display and communication, share cultural achievements from multiple dimensions, and improve the acquisition and interaction ways of such humanistic resources, which has a positive impact on the inheritance and development of traditional culture.

5.1. Digital-intelligence innovation exploration of transition space

As the connecting space in the narrative space, the transition space has the function of information recording and transmission, and mainly displays the development history and cultural publicity of bamboo weaving. This space uses a large amount of bamboo weaving texture in the hard decoration part, and uses bamboo weaving elements as space guidance signs. In terms of exhibition methods, multiple digital screens are combined into a digital display panel array to dynamically display bamboo weaving culture, bamboo weaving history and future prospects, and the design purpose of combining virtual and real is realized through simultaneous observation of digital display and physical objects. This space is the medium for visitors to understand bamboo weaving and provides an emotional foundation for the subsequent interactive experience.

5.2. Digital-intelligence innovation exploration of climax space

The climax space mainly has two interactive scenes: digital modeling of bamboo weaving and study experience, and the color atmosphere of the whole space is close to natural wood color. The two narrative scenes share real-time guide information through the digital-intelligence platform, with rolling prompts on the connected central digital plane. In the narrative scene of shared digital modeling, 5 digital screens are set up. After learning bamboo weaving, visitors can create new bamboo weaving digital patterns through interactive operations in the digital-intelligence customization platform. In the study scene, a circular digital operation platform is set up, which shares information with the scene in digital modeling, providing visitors with hand-made experience of self-created bamboo weaving works. The two scenes jointly promote the change of story rhythm and effectively control the visitor flow line.

5.3. Digital-intelligence innovation exploration of combining the opening and closing spaces

This narrative scene combines the opening with the narrative. Different from the interior space of the exhibition hall, the entrance space adopts a modern design style. In terms of exhibition, an exhibition array composed of bamboo display walls echoes the skylight on the top, forming a spatial atmosphere with strong light and shadow. The facade is decorated with digital light strips with a

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strong sense of technology, and bamboo-patterned entrance guidance signs are set on the ground, which also serve as partitions of the visitor rest area. In terms of digital intelligence, there are mainly digital explanations beside the display walls and the exhibition hall guide information screen in the center of the space, providing real-time information of the exhibition hall interior and visitors' study results. Through the digital-intelligence processing of the guide information, the transformation from the ending to the opening is realized.

6. Conclusion

This research takes the Binyang bamboo weaving exhibition space as the empirical carrier. On the issue of the inheritance and development of ICH culture, digital intelligence technology is used to strengthen the emotional appeal of narrative design and explore the innovative design path of ICH exhibition space. First, digital intelligence technology is used to reconstruct the framework of narrative logic, sequence and translation symbols in spatial narrative, which is deeply adapted to the cultural characteristics of ICH exhibition, breaks the traditional linear narrative rhythm, realizes the layered presentation of the multi-dimensional connotation of ICH culture, constructs a multi-sensory interwoven narrative mode, promotes the living inheritance of ICH culture, and enriches the practical dimension of spatial narrative theory in the ICH field. Although there are still some challenges at present, such as data privacy protection and technical costs, with the progress of technology and the improvement of social acceptance, digital intelligence technology will undoubtedly play an increasingly important role in future exhibition hall design. In addition, this paper still has certain limitations. This research only focuses on a single ICH culture, and few cultural categories are covered, which may have a certain degree of deviation for regional cultures covering multiple ICH items.

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