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Exploring Digital Preservation of Audiovisual Intangible Cultural Heritage: The Case of Yunnan Province, China

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Abstract: Intangible cultural heritage (ICH) is a vital carrier of national culture and history. With the rapid development of digital technologies, the preservation of ICH is facing new opportunities and challenges. This study examines the current status and problems of digital preservation of audiovisual ICH in Yunnan Province, China. By analyzing typical cases, it explores the application strategies of digital technologies in preserving the "tangible" and "intangible" aspects of audiovisual ICH. Drawing upon the concept of digital ecology, this study proposes a framework for digital preservation of audiovisual ICH in Yunnan, which consists of three key components: digital resource platform, digital inheritance application, and digital dissemination promotion. It also provides suggestions for promoting digital preservation of audiovisual ICH in Yunnan, including top-level policy design, platform construction, talent cultivation, and technology empowerment. The findings enrich the research perspective of digital anthropology and offer practical insights for the preservation, inheritance, and development of ICH in the digital era. However, this study also has some limitations. Future research could conduct comparative analysis on the digital preservation of different categories of ICH, examine the cultural identity construction in digital inheritance, and evaluate the social impact of digital dissemination.

1. Introduction

Cultural heritage is the carrier of national spiritual civilization and national history and culture, the traditional cultural evolution of regional people from generation to generation, and the embodiment of Chinese long history and cultural diversity. The protection of intangible cultural heritage(ICH) is more difficult than that of tangible cultural heritage, and the protection of national intangible cultural heritage has received attention from all countries since 2001, when the United Nations declared the "Masterpieces of Oral and Intangible Cultural Heritage of Humanity".However, with the rapid science and technology development, the trend of intangible cultural heritage being "hard to pass on and weak in vitality" is becoming more and more starry, and it is urgent to implement comprehensive protection of intangible cultural heritage. Nowadays, digital ecology has become a common term in the era of digital China. Text, audio, video and digital multimedia technologies can provide authentic, systematic and comprehensive records of intangible cultural heritage, and inject fresh blood into intangible cultural heritage by establishing archives and databases.

Up to now, 43 projects have been recorded on the UNESCO Intangible Cultural Heritage List in China, and Yunnan has 6 selected. In addition, according to China News: In 2021, the State Council released the fifth batch of the national intangible cultural heritage representative projects list, Yunnan Province has 127 projects selected, ranking second in the country. Yunnan Province has also undertaken a series of preliminary audiovisual intangible cultural heritage protection deployments, with continuous exploration of digital technologies such as 3D animation, virtual reality and augmented reality, with the aim of discovering more intangible cultural heritage digitization concepts and development directions.

Although Yunnan's cultural ecological reserves and related departments have made good achievements in the protection of intangible cultural heritage, there are still a series of difficult to coordinate problems at this stage from the perspective of digital ecology, such as the backward construction of digital talent team, the serious aging of inheritors and the sharp decrease in the number of personnel, and the lack of cultural intellectual property rights and experience, therefore, how to make a digital ecological perspective on Yunnan's audiovisual intangible cultural heritage Therefore, it is especially important to make professional suggestions on the digital protection of Yunnan audiovisual intangible cultural heritage under the digital ecology.

Based on the digital ecological perspective, this paper takes the protection of intangible cultural heritage in Yunnan Province as a case study, applies the methods of literature research, case analysis and comparative research, focuses on the status quo and problems of the digital protection of audiovisual intangible heritage in Yunnan Province, discusses the application strategy of digital technology in the inheritance of intangible heritage of ‘materiality’ and ‘intangibility’, and proposes the path of promoting the digital protection of audiovisual intangible heritage in Yunnan Province. The text is divided into five parts: the first part is the introduction; the second part compiles the relationship between digital technology and audiovisual non-heritage protection and the current development situation at home and abroad; the third part discusses the application strategy of digital protection of audiovisual non-heritage; the fourth part analyses the promotion measures of digital protection of audiovisual non-heritage in Yunnan Province as an example; and the fifth part is the conclusion and discussion.

2. The relationship between digital technology and the preservation of audiovisual intangible cultural heritage and its current development

Scholars at home and abroad have carried out extensive research on the digital preservation of non-heritage.Carrozzino et al. proposed the use of digital technology for the virtual preservation of

handicraft non-heritage Shuai et al. discussed the application of computer digital technology in the preservation of non-heritage;Liu Shu et al. explored the silk non-heritage of mainland China from the perspectives of digital resources, digital inheritance, and digital dissemination as a digital conservation strategy. In terms of practice, developed countries in Europe and the United States started early in digital NRL protection, such as the implementation of the digital Michelangelo programme in the European Union.China is also actively promoting digital NRL protection, the Palace Museum, Dunhuang Academy and other institutions have carried out fruitful work.

Everyone's understanding of "digital" is different, but it is everywhere. Nowadays, most information has been digitized, and the dissemination of digital information has far surpassed traditional information dissemination methods because of its speed, flexibility, convenience and, more importantly, the freedom to choose how to use and recreate the information. Intangible cultural heritage is the inheritance of past information, which is now on the verge of disappearing. In the past, we always remember some lost civilizations, and what cannot be done by traditional conservation methods, digital technology means can make these civilizations that have disappeared or are disappearing continue their lives. Digital technologies such as digital collection and processing technology, digital storage and management technology, digital restoration and reproduction technology, and digital display and dissemination technology convert, reproduce, and restore intangible cultural heritage into shareable and renewable digital forms, and interpret them through new perspectives, preserve them in new ways, and use them for new needs. The integration and intersection of intangible cultural heritage and digital technology has not only changed the way intangible cultural heritage exists, but has also greatly changed the public's perception of cultural heritage. The digitization of intangible cultural heritage promotes the cultural survival of intangible cultural heritage skills introducing newer entertainment and cultural products, allowing the treasures of cultural heritage and Chinese history and culture to be passed on for a long time, and moreover deriving highly creative cultural and entertainment products.

Whether from past wars or natural disasters, historic buildings and cultural heritage are disappearing at an alarming rate, and no country in the world has been spared. In 1992, UNESCO launched the "Memory of the World" project to preserve cultural heritage permanently. Subsequently, the United States, Japan and other countries have started "Memory of America" and "Memory of Japan" projects, and the preservation of intangible cultural heritage has become the focus of attention of all countries. With the development of digital technology, the digital preservation of cultural heritage in foreign countries has spread from government to the private sector, including many commercial companies have invested a lot of money for this purpose, and they are more advanced in multimedia, virtual technology, graphics and so on. At the same time, many research institutions as well as universities have carried out many projects and courses on the digital conservation of cultural heritage. The European government, for example, offers special courses and training on digital preservation, establishes international organizations for digital preservation of cultural heritage, such as ICMOS2 and CIPA3, and holds large international conferences such as VAST4 and VSMM5 paintings. The 3D MURALE project, which started in 2000 and lasted for three years, proposed the reconstruction method of ancient sites, and realized the digital restoration and protection of cultural heritage through low-cost and easy-to-operate machines and equipment to complete the data collection of buildings and sculptures, and then the technicians transformed the collected data into 3D data, and realized the digital restoration and protection of cultural heritage through multimedia database, virtual reconstruction, and visualization of ancient site artifacts and other technologies. After the U.S. launched "American Memory", nearly 3.4 million collections have been digitally protected, and the "U.S. Digital Library Program" was subsequently launched. In addition, the most significant feature of the digital preservation of intangible cultural heritage in the United States is its commercial operation, such as the "Grand

Canyon of Yosemite Panorama Project" and the "eHeritage" thematic research project launched by Microsoft Asia Research Institute. They are run under commercial sponsorship, with no government involvement. The Digital Michelangelo Project at Stanford University and the Forma Urbis Romae Project have had a profound impact on the field of digital archaeology by applying 3D technology to the restoration of traditional cultural heritage, enabling the virtual mosaic of fragments. The National Research Center of Canada has also developed a high-precision 3D scanning digitizing system for the digital conservation of museums and sites, realized the 3D digitization of the Virgin Mary and the Holy Child with Padova University, and carried out digital conservation of ancient architectural sites of the Caesars era with Israel.

Compared with the protection measures of foreign countries, China has been relatively late in attaching importance to the construction of digital protection of intangible cultural heritage. In 1997, the State Key Laboratory of CAD&CG of Zhejiang University proposed the fresco copying technology and fresco color gradient technology to restore many Dunhuang arts. 1998, Professor Zhou Mingquan of Beijing Normal University used the 3D rigid object restoration technology to virtually restore the Terracotta Warriors. In 2006, the State Council announced the first batch of intangible cultural heritage lists with national qualifications, marking the official launch of research on the digital preservation of intangible cultural heritage within China. With the progress of the times, domestic research institutes carry out conservation work with the help of professional digital cameras or scanners if they are flat cultural relics, like calligraphic works, paper cuttings, paintings, etc. If they encounter three-dimensional cultural relics, such as sculptures, ceramics and other precious objects, they need to be protected with the help of three-dimensional technology. Therefore, digital archiving is widely recognized by the society. Although many intangible cultural heritages have been protected in recent years, factors such as the lack of special technology and immature domestic development are still not optimistic.

In recent years, cultural ecological reserves in Yunnan Province have been established and corresponding digital protection measures for intangible cultural heritage have been carried out, including laws and regulations, organizational systems, facility utilization, and development of the ICH+ model for audiovisual intangible cultural heritage protection in the reserves. At the same time, the government is also committed to expanding the database of the Experimental Ecological Protection Zone in Yunnan Province and uploading as many documentaries as possible to the database. In terms of inheritors, the reserve will organize inheritors to participate in live broadcasts or exchanges, in addition to regular training and granting subsidies. In terms of the spatial experience of intangible cultural heritage, regional museums in Dali, Kunming and Jianshui County use high-definition digital screens, touch screens and projection equipment to increase the experience. Based on the limitations of digital technology, many intangible cultural heritage conservation projects in Yunnan Province at this stage are cooperating with foreign countries, and it is easy to have the problem of poor connection between cultural connotation and technology. The following problems are apparent in the current protection work:

(1) Although the organization and management system of the protected area has been established, the workers concerned have weak knowledge of the digital protection of audiovisual intangible cultural heritage and lack scientific response-ability, especially in the area of digital archiving, digital talents are lacking, and filming video archiving is still the main form of protection.

(2) The problem of "aging" and insufficient number of inheritors and craftsmen of intangible cultural heritage in Yunnan Province, with the majority of the 50-70 year-old group and the number of inheritors in the generation 80s, generation 90 and generation Z "precipitously decreasing, and the form of heritage culture protection is relatively backward.

(3) Intangible cultural heritage inheritors uploading their craft works to the Internet are highly susceptible to misappropriation and infringement problems, and it is difficult to reconcile economic

interests and intellectual rights. Moreover, there are many local pavilions that still maintain the traditional model, and the digital infrastructure is still unable to meet the core cultural dissemination and continuity.

From the perspective of the real challenges faced by the audiovisual intangible cultural heritage in Yunnan Province, it is inevitable to vigorously promote digital transformation, which requires not only fruitful theoretical results as support, but also efficient practical actions as guarantee. Compared with the traditional protection methods, the advantageous necessity of digital protection lies in: first, storage flexibility. Technology continues to develop, storage data formats, carriers and capacities have made great progress, and the storage of resources of intangible cultural heritage relies on electronic records to become the main storage method, which further liberates the space required for traditional storage methods, reduces storage costs and facilitates the advantages of management; second, rapid dissemination. The resources recorded by digitization technology have greater advantages in data collation as well as network transmission in terms of work efficiency; third, wide application prospects. Digital technology records a large amount of data, covering a lot of content, so that the flexible use of data is possible. It has been proved that at present, digital means have played an important role in various work links in the protection of audiovisual intangible cultural heritage in Yunnan Province by virtue of the advantages of the above three aspects.

3. Application strategies for digital preservation of audiovisual intangible cultural heritage

Intangible cultural heritage has two attributes: "materiality" and "immateriality". Traditional conservation methods have problems such as high cost, large space occupation, difficulty in organizing and low storage capacity, etc. Digital technology provides a starting point for solving these problems. At present, many intangible cultural heritages in Yunnan Province are facing the plight of endangerment. Using advanced digital technology to digitally extract information, contents and materials of intangible cultural heritages with historical and cultural values, record them in all aspects, process digital images and establish an audio-visual database, we can realize the permanent preservation of audiovisual intangible cultural heritages. For intangible cultural heritage that has been damaged or has died out, digital technology can realize virtual reproduction, which is also an important means of digital preservation of audiovisual intangible cultural heritage.

3.1 "Material" conservation of audiovisual intangible cultural heritage

The "material" conservation of audiovisual intangible cultural heritage is the most direct and efficient way to digitally conserve intangible cultural heritage works, props, materials and other material items, including data archiving and restoration and virtual reproduction of damaged artifacts.

Digital information extraction and processing technology. Traditional technology for the collection of intangible cultural heritage information resources is mainly realized through video or photography, etc., but it is very easy to have problems such as image aging and damage. With the improvement of digital technology, 3D scanning technology, high-definition digital photography technology, and image processing technology can extract and process the information of intangible cultural heritage and store it permanently in the network database. (Figure 1). For precious works of calligraphy and painting, high-precision information reading technology can achieve 1:1 restoration, or infinite enlargement or reduction, presenting a more realistic visual effect, providing relevant experts and scholars with clearer information on cultural relics, and also facilitating resource sharing and research. According to the different cultural forms of intangible cultural heritage, different means of information extraction are needed, like for flat cultural relics, 2D code scanning

or camera technology can be used to generate pictures, and for three-dimensional cultural relics, 3D scanning technology can be used for all-round data extraction to generate corresponding graphics.

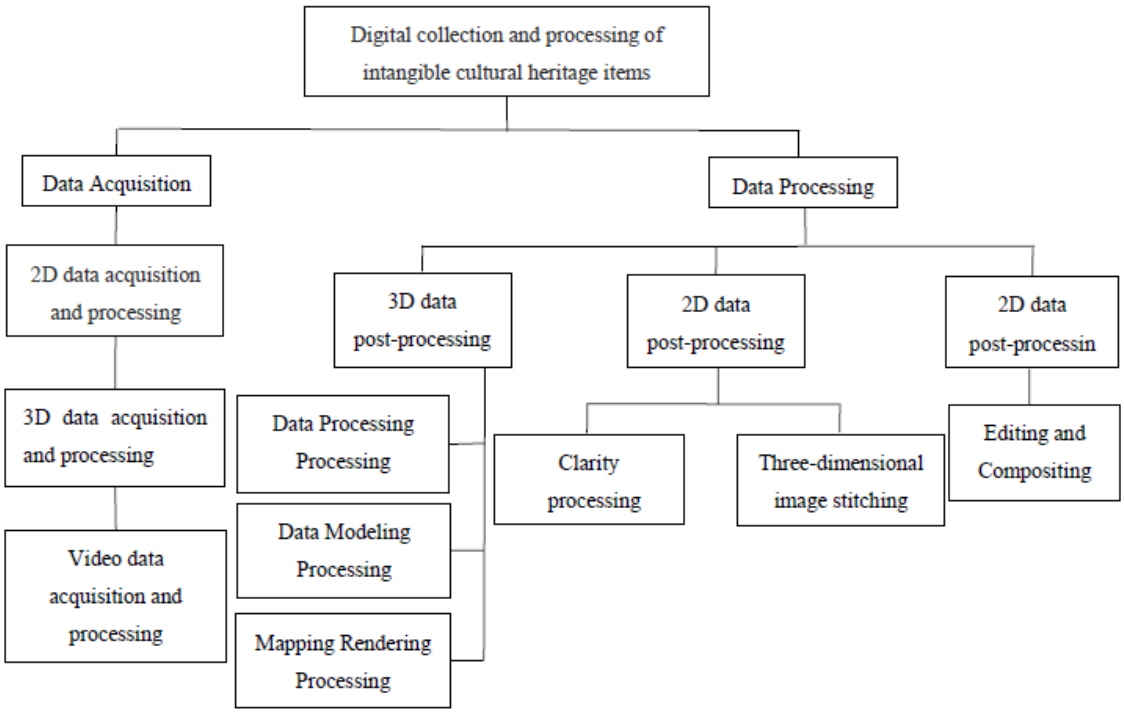

Figure 1:Digital collection and processing of intangible cultural heritage items

Heritage restoration and simulation techniques. Audiovisual intangible cultural heritage is subject to different degrees of damage due to seasonal climate, preservation time, objective conditions, and other factors. Digital technology to repair and restore them will be safer than traditional manual restoration. Especially, the relic buildings that have disappeared can be restored and reproduced through relevant textual information and data, which is convenient for future generations to study. The restoration and simulation of intangible cultural heritage is not only the reproduction of the relics themselves, but also the restoration and recovery of the images and data of the past intangible cultural heritage. Academician Pan Yunhe of Zhejiang University has carried out digital restoration of Dunhuang murals, which is the restoration of textual data, video sound effects, and scene space through digital sweeping technology, and the use of computer technology to simulate reality, which is a very successful case of digital preservation in China.

3.2 The "intangible" form of preservation of audiovisual intangible cultural heritage

The "intangible" protection of audiovisual intangible cultural heritage is to pass on the historical values and cultural spirit contained in intangible cultural heritage, which is the most fundamental content of cultural protection.

Virtual Reality (VR). A surreal experience that perceives the real world from sensory experiences such as vision, touch, hearing, and taste, is a virtualization of the real world image with conceptualization, multi-perception, immersion, and interactivity. VR technology involves a wide range of industries, and in recent years, China has used it in the field of intangible cultural heritage protection, and it has received widespread attention, with virtual museums, virtual restoration of cultural relics, and virtual reproduction of cultural relic sites all achieving better results. Especially the ancient and extinct intangible cultural heritage virtual reproduction, lamenting the powerful

digital technology at the same time, but also to show the world the origin of Chinese culture and unique charm.

Virtual Museum. Firstly, the image information data is scanned in the computer system through digital scanning technology, and then the information is processed and imported into the virtual reality scene, and the user can enter the simulation environment at the cell phone terminal or computer terminal, and can watch the cultural relics collection in the museum by tapping the screen or mouse, and can also visit and participate interactively. (Figure 2). The virtual museum also takes into account the dynamic environment modeling, first extracting the three-dimensional data of intangible cultural heritage, and then restoring the modeling space and realistic scenes 1:1, through the high-fidelity virtual environment technology, realizing the real effect of immersive viewers. The virtual museum further complements the real museum in time and space, not only satisfying the viewers' demand for viewing intangible cultural heritage, but also promoting the communication between the viewers and intangible cultural heritage. Whether in text, sound or image, the historical and cultural values of intangible cultural heritage can be fully displayed, and through resource sharing, this data and information also provides a certain reference for archaeological research.

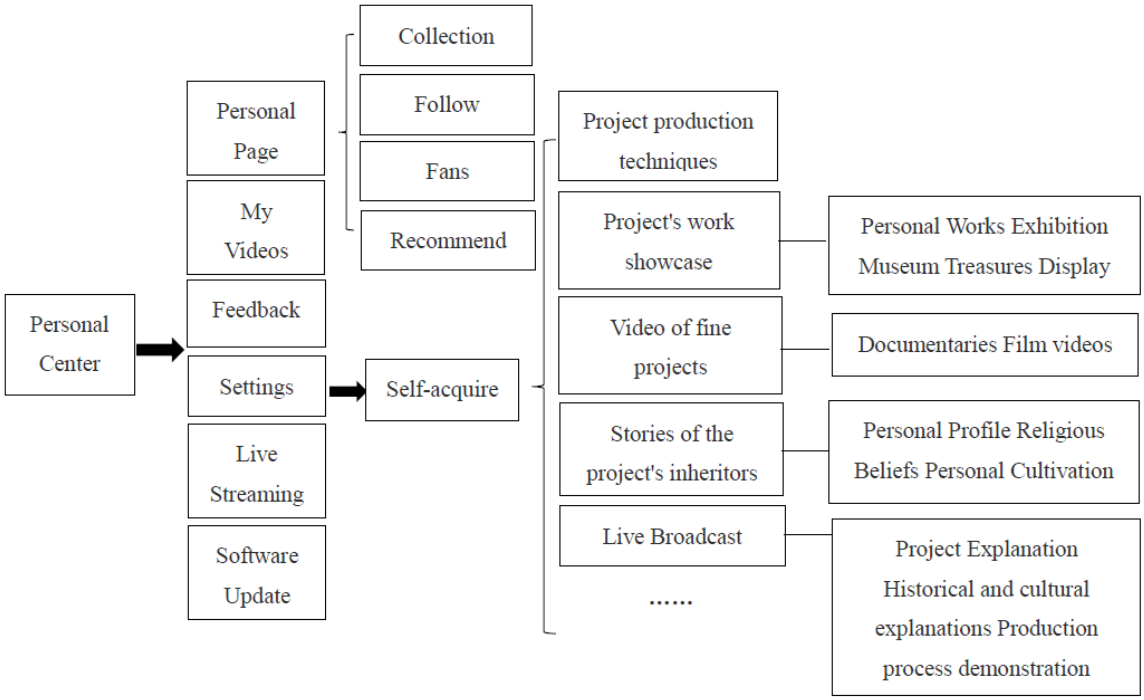

Figure 2: Online planning of the virtual museum

4. Application measures for digital protection of audiovisual intangible cultural heritage in Yunnan Province

Take the digital protection of Dali Bai tie-dye technique as an example. Firstly, using high-definition digital photography, image processing and other technologies, the pattern, colour and process of Bai tie-dye products are digitally captured and archived. Secondly, it develops online virtual exhibition halls to reproduce the production scenes and non-heritage elements of Bai tie-dye through 3D modelling, VR and other technologies. Thirdly, cooperate with universities to develop creative cultural and creative products with Bai Tie-Dye elements to spread the non-heritage culture and drive the development of the industry. Finally, support for Bai tie-dye inheritors to open live classrooms, online workshops, and cultivate the new generation of inheritors. This series of

initiatives for the white tie-dyeing techniques inserted digital wings.

As an important part of digital capacity, digital talents are also the core support force for digital preservation of audiovisual intangible cultural heritage in Yunnan Province. To actively supplement digital talents, improve digital technology, and innovate the development of "ICH+ mode", we can further improve and optimize the digital capacity. First of all, protected areas and institutions should establish or increase digital departments, introduce more digital technology and talents, and hold regular training on intangible cultural heritage protection, so as to improve the knowledge of relevant personnel and alleviate the current situation of "focus on technology but not culture". In view of the actual situation of each protected area in Yunnan Province, a set of modern digital talent training model is built by combining multiple disciplines such as anthropology, ethnology, design, digital media technology and digital media art. Then, with the new digital technology to enrich the archival information, the current intangible cultural heritage in each protected area in Yunnan Province is relatively single, in addition to text, pictures, video and other forms, but also should continue to increase the 3D, VR, 3D scanning and other digital technology archival attempts. For example, in recent years, Jianshui County, Yunnan Province, launched the "digital purple pottery" project, through a comprehensive digital technology, so that consumers not only see the pottery products will "move", but also present the audience with purple pottery products "past life and present life ", this bold attempt to achieve the intangible cultural heritage protection and regional brand building of Jianshui purple pottery. Finally, the digital protection of intangible cultural heritage should also respond to the preferences of young people, "ICH + games", "ICH + animation", "ICH + tourism" are all innovative ways to expand intangible. The digital preservation of intangible cultural heritage should also respond to the preferences of young people. For example, the animation production of Bai tie-dyeing technique uses 3D technology to virtualize, deform and exaggerate the animated images to guide the audience's sense of responsibility to protect the audiovisual intangible cultural heritage, thus achieving the effect of communication for conservation.

The digital protection of intangible cultural heritage in Yunnan Province is "aging" and understaffed, many young people are not interested in inheriting cultural heritage, and an intangible cultural heritage can easily be lost. The use of digital technology to alleviate intangible cultural heritage heritage has also become a problem. Yunnan Province has 127 national-level intangible heritage projects and 125 inheritors, and there is an urgent need to improve the way of protecting inheritors and intangible cultural heritage projects. First of all, the inheritors' knowledge of digitalization should be deepened. The inheritors are the core strength of digital protection of audiovisual intangible cultural heritage, which is characterized by the continuation through word and word of mouth, and the serious aging and shortage of personnel, it is necessary to find ways to inject more fresh blood so that young people are also willing to do the job. Then, the inheritance of intangible cultural heritage in Yunnan province is carried out by family, master and apprentice forms, the government needs to increase the investment in education in protected areas, increase the subsidy for the successors, reward the excellent successors with living honor, improve the efficiency of the protection of audiovisual intangible cultural heritage in protected areas, and indirectly provide better protection for the successors of intangible cultural heritage. Finally, the protection methods of different intangible cultural heritage items are optimized, such as folklore category: Dai Water Festival, Yi Torch Festival, Bai Round Three Spirits, etc., which can be recorded and archived by aerial photography, big data technology, etc. via the real photograph of the event condition. Traditional skills: Bai tie-dyeing techniques, Dai hand papermaking techniques, Jianshui purple pottery paper burning techniques, etc., can be recorded in an all-round way through virtual reality technology, allowing the audience to participate in the production process and ensuring the transmission of cultural core. Music and dance: Canyuan Wa wood drum dance, Dai

peacock dance, Lisu folk songs, etc. can be captured, tracked and recorded through artificial intelligence image recognition sensors, and the public can imitate and learn based on gesture movements, experiencing the novelty of intelligent interactive technology and the charm of intangible cultural heritage. Traditional fine arts: Bai resident painting, Dali paper-tying techniques, Dai paper-cutting, etc. can be restored using data collection, 3D scanning and 3D printing technologies to restore precious artworks, and can also be innovatively designed in conjunction with games and animation brands to enhance the modernized dissemination of traditional intangible cultural heritage.

Encourage audiovisual intangible cultural heritage heirs to broadcast and sell original products on online platforms, while also safeguarding the integration of the digital economy and intellectual property rights. Since Yunnan Province has responded to the national call for digital protection of intangible cultural heritage, legal documents such as "The Regulations on the Protection of Intangible Cultural Heritage in Yunnan", "The Implementation Opinions on Further Strengthening the Protection of Intangible Cultural Heritage", and "The Measures for the Protection and Management of Representative Projects of Intangible Cultural Heritage at Provincial Level in Yunnan Province (for Trial Implementation)" aim to protect intangible cultural heritage projects and the intellectual achievements of inheritors in legal form. At the same time, protected areas and local governments should also protect audiovisual intangible cultural heritage items and the works of inheritors through intellectual property rights systems such as trademarks, writings and geographical indications, and meet the reasonable needs of inheritors as much as possible. In the digital ecology, digital collections have become a hot thing in the new era. By making unique digital certificates of texts, pictures, audios, 3D models, etc. through block chain technology, we can inject technological elements into the digital protection of traditional intangible cultural heritage in Yunnan.

It is suggested to systematically promote the digital protection of audio-visual non-heritage in Yunnan Province in terms of top-level design, platform construction, talent cultivation and scientific and technological empowerment. Firstly, it should be incorporated into the construction plan of 'Digital Yunnan', and formulate a special action plan for digital protection of audio-visual non-heritage. Secondly, integrating non-heritage lists at all levels, building a big data platform for audio-visual non-heritage in Yunnan Province, and promoting cross-regional and cross-sectoral data sharing and utilisation. Third, relying on colleges and universities, scientific research institutions to establish a digital non-heritage protection talent training base, to cultivate a group of composite talents who understand both technology and non-heritage. Fourthly, it will support the application of cutting-edge technologies such as artificial intelligence, blockchain and meta-universe in the digital protection of non-heritage, and encourage colleges and universities, enterprises and scientific research institutions to carry out collaborative innovation.

5. Conclusion and Discussion

Based on the concept of digital ecology, this study explores the effective path of digital protection of audiovisual non-folklore in Yunnan Province, and the conclusions of the study have certain theoretical value and practical significance in promoting the digital protection, inheritance and development of non-folklore in China. At the theoretical level, this study builds a framework of digital protection of audiovisual intangible heritage in Yunnan Province, which is 'digital resource platform + digital inheritance application + digital dissemination and promotion', which enriches the research perspective of digital anthropology and provides a reference for the subsequent research. At the practical level, the countermeasures proposed in this study, such as talent cultivation, platform construction, and technological empowerment, can provide decision-making

references for the digital preservation of audiovisual intangible heritage in Yunnan Province and other regions. In the future, it is recommended that in-depth research be carried out on the similarities and differences in the digital preservation of different types of NRH, the construction of cultural identity in digital heritage, and the evaluation of the social effects of digital communication.

Today, with the diversification of global information, culture has become an important part of communication and cooperation among countries. China has a long history and culture, and intangible cultural heritage passed down from generation to generation has become a unique national memory, and the protection of history and culture is the protection of national security. The development of digital preservation technology is based on computer-aided system, using the world's leading information technology such as multimedia, virtual reality, broadband network, artificial intelligence and database to recreate the information of intangible cultural heritage such as image, text and three-dimensional data to achieve the purpose of digital organization, preservation and query and retrieval. Its advantages of flexible storage, rapid dissemination and wide application prospects allow intangible cultural heritage and digital technology to merge into one, providing a fuller guarantee for cultural preservation.

Intangible cultural heritage is the cultural wealth created by all ethnic groups through the vicissitudes of time, and together they form the Chinese national culture. For the digital protection of intangible cultural heritage in Yunnan Province, it is necessary to increase the complement of digital talents, innovate the development of "ICH + mode", and further accelerate the integration of digital economy and intellectual property.

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