

Research on the Problems and Solutions of Digitization of Chinese Paper-cut

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Abstract: Digitization has become an important means of safeguarding and inheriting intangible cultural heritage all over the world, while the development of digitization of Chinese paper-cut, which is a world-class intangible cultural heritage, is relatively slow. Based on empirical research, this paper comes out with the problems such as single technology, limited digital function, Inadequate standardization and lack of content in Chinese paper-cut digitization. By developing and operating the paper-cutting intelligent design system based on deep learning technology, a new Internet ecosystem has been formed in Chinese paper-cut industry. This case will provide an advisable example of the digitization of other intangible cultural heritage.

1. Introduction

In 1992, UNESCO launched the Memory of the World project, aiming to promote the digitization of intangible cultural heritage worldwide. On March 26, 2005, the Opinions on Strengthening the Safeguard of Intangible Cultural Heritage issued by General Office of the State Council of the People's Republic of China clearly stated: "We should make real, systematic and comprehensive records of intangible cultural heritage and establish archives and databases by means of text, audio, video and digital multimedia." Digitization has gradually become an effective means of intangible cultural heritage safeguarding[1]. Over the past 20 years, the digitization of cultural heritage has developed rapidly, and a lot of theoretical and practical researches have been carried out. Some scholars pointed out the problem of lack of awareness by carrying out an interview with five experts in intangible cultural heritage domain[2]. Moreover, technology such as virtual reality[3], motion capture[4] and automatic extraction of metadata[5] have been applied in cultural heritage preservation and proved to be effective.

Intangible cultural heritage digitization is defined by Chinese academia as: the digitization of intangible cultural heritage is to transform, reproduce and restore the intangible cultural heritage into a shareable and renewable digital form with digital acquisition, digital storage, digital processing, digital display, digital dissemination and other technologies, and interpret it from a new perspective, preserve it in a new way and utilize it with new needs[6] (Wang Yaoxi,2009). Some achievements have been made in digitization technologies such as virtual reality[7], mobile augmented reality[8], virtual museum and database[9]and in specific items such as Qi Tai Yngko[10] and Dong ethnic's songs[11].

The concept and principle of intangible cultural heritage safeguard have been clarified, and the research scope has been gradually expanded and deepened. However, there are still some problems in the application of technology and the construction of digitization system. The digital technologies generally focus on the preservation of cultural heritage itself, neglecting the cultural connotation, resulting in a cleavage of content and form. Moreover, many heritage items with handicraft skills such as Chinese paper-cut cannot be effectively protected in digital ways.

2. Problems of Digitization of Chinese Intangible Cultural Heritage

By researching the related websites of Chinese intangible cultural heritage, this paper analyzes

the problems of Chinese intangible cultural heritage. The top 20 related websites were ranked according to the number of views, and their contents were sorted and analyzed as shown in Table 1.

Table 1. An Analysis of the Websites of Intangible Cultural Heritage

Number	Website Name	Website Address	Main Content	Features
1	Intangible Cultural Heritage Website of China · Chinese Intangible Cultural Heritage Digital Museum	http://www.ihchina.cn/	The general introduction of Chinese intangible cultural heritage, including policies, institutions, lists, etc.	A relatively comprehensive national director of the Ministry of Culture and Tourism and a non-official website covering a wide range of items.
2	Intangible Cultural Heritage Website	https://www.feiyiw.cn/	Introduction of the worldwide representative cultural heritage items, including specific products.	Mainly based on sales, trading platform for intangible cultural heritage products worldwide.
3	China Plus - Intangible Cultural Heritage Channel	http://ich.cri.cn/	Introduction of the development and events of intangible cultural heritage events in the world.	With latest news
4	Sino Feiyi	http://www.sinofeiyi.com/	Sponsored by Chinese academy of intangible cultural heritage safeguarding, a product trading platform for Chinese intangible cultural heritage.	Official trading platform
5	Intangible cultural Heritage Big Data	http://www.diich.com/	Search and introduction platform for intangible cultural heritage.	A integrated website of cultural heritage data, with a column of animation.
6	Intangible Cultural Heritage Channel - Guangming Online	http://feiyi.gmw.cn/	Latest news of Chinese intangible cultural heritage.	Special reports of cultural heritage.
7	Intangible Cultural Heritage Website of Anhui Province	http://www.anhuiich.com/	Local intangible cultural heritage protection, policy and declaration in Anhui province.	Regional and detailed.
8	Intangible Cultural Heritage Website of Tianjin Province	http://www.ichtianjin.com/	Local intangible cultural heritage protection, policy and declaration in Tianjin province.	Regional and detailed.
9	Intangible Cultural Heritage Website of Ningbo	http://www.ihningbo.cn/	Introduction of intangible cultural heritage in Ningbo, including base, audio recordings and videos.	Regional and detailed.
10	Guangzhou Intangible Cultural Heritage Safeguarding Center	http://www.ichgz.com/	A brief introduction of cultural heritage in Guangzhou.	Including notifications of courses related to cultural heritage.
11	Feiyi Life	http://www.feiyilife.com/	Provide intangible cultural heritage product customization service.	Hosted by a company in Shenzhen. Individualized service.
12	Intangible Cultural Heritage Website of Fujian Province	http://www.fjfyw.net/	Local intangible cultural heritage news, policy and situation in Fujian province.	Official and regional
13	Intangible Cultural Heritage Website of Hangzhou Province	http://www.hangzhoufeiyi.cn/	A detailed introduction of intangible cultural heritage in Hangzhou.	Regional and comprehensive
14	Intangible Cultural Heritage Website of Suzhou	http://www.szfwzwh.gov.cn/	A detailed introduction of intangible cultural heritage in Suzhou.	Regional and comprehensive, including a special map of cultural heritage as well as some government information.
15	Chinese Wood Carving Art Website	http://www.zgmdysw.com/organization.html	A detailed introduction of Chinese wood carving art.	Information about trading platform and exhibition of Chinese wood carving handicrafts.
16	Intangible Cultural Heritage Website of Fenghuang	http://www.fhfyw.com/	A detailed introduction of intangible cultural heritage in Fenghuang.	Distinct cultural heritage of the Miao nationality. The content is relatively simple.
17	Intangible Cultural Heritage Website of Henan Province	http://www.henanfeiyi.com/	A detailed introduction of intangible cultural heritage in Henan province.	Regional, with a column of cultural heritage literature.
18	Intangible Cultural Heritage Website of Jiangxi Province	http://www.jxfwzwhycw.com/	A detailed introduction of intangible cultural heritage in Jiangxi province.	Regional, with a column of cultural heritage forum.
19	Intangible Cultural Heritage Research Center of Shandong Province	http://www.sdich.com/	A detailed introduction of intangible cultural heritage in Shandong province.	Relatively old, with links to other websites.
20	Intangible Cultural Heritage Safeguarding Center of Zhongshan	http://www.zssfeyi.com/	A detailed introduction of intangible cultural heritage in Zhongshan.	Special channel of multimedia publication.

According to the Analysis, although the digitization of intangible cultural heritage has been widely paid attention by society and a number of websites have been built in China, intangible cultural heritage digitization is still facing several problems.

Single Technology. Web development and database platform construction are still the main measure so far while the application of GIS system and AR technology is only at the theoretical level, and only a few research institutions use them to present intangible cultural heritage.

The singleness of digital means has resulted in redundant construction of the same type of websites, which is a waste of social resources. At the same time, because of the homogenization of websites, the audience has to spend more energy and time in order to get information that they really need, which reduces efficiency and quality of intangible cultural heritage safeguard and transmission.

Limited digital function. At present, by means of photography and scanning, the data and materials of cultural heritage are well recorded in databases. Cultural heritage item itself is protected though, its essence and core are prone to be neglected. The essence of a large number of Chinese intangible cultural heritage lies in their complex and dynamic manual skills, which cannot be accurately displayed, inherited, and developed only by video and picture. The digitization of intangible cultural heritage should not be limited at the stage of the database establishment, but should utilize digital technology to boost relevant industry, which is beneficial to its promotion and dissemination. Only in this way can traditional heritage culture develop sustainably.

Inadequate standardization. There are many categories and items in Chinese intangible cultural heritage, and different item requires different digital technologies. Among all the current websites of intangible heritage in China, most of the construction and management institutions are independent, and the databases and archives of intangible heritage are operated independently, lack of communication and cooperation. This situation may make the bulwark of information resources among different items and regions, reducing management efficiency. Moreover, even for a specific item, there is no unified standard for digital protection. For instance, questions, such as which step of handcraft should be protected, what technical means should be adopted, and what specification should be enforced have not been answered yet. As a matter of fact, inadequate digital standardization leads to errors and omissions in the protection of intangible heritage.

Lack of content. At present, lack of content is a common problem of Chinese intangible heritage digitization. Inheritors of Chinese intangible cultural heritage is generally aged, and there are obvious limitations in their creation, as they are prone to be influenced strongly by traditional aesthetic and lack of innovation ability. Moreover, a large number of intangible cultural heritage is relatively conservative in its subject matter. In Shu embroidery, paper-cut, Yunjin and other intangible cultural heritage items, the traditional Chinese elements, such as the zodiac, Chinese opera mask, landscape, flower, bird, fish and insect, is their main theme of creation, so the content is relatively limited. With the rapid development of digital culture, the traditional themes cannot meet the aesthetic needs of contemporary young people.

The lack of digital content and innovation ability prevent consumers from purchasing products of cultural heritage. Since the market of traditional heritage products is shrinking and promotion is becoming more difficult, it also demotivates inheritors and the younger generation is less likely to enter this industry. The creation and idea of older generation is out of contact with current market preferences, thus forming a closed loop and a vicious circle.

3. Digital Exploration of Chinese Paper-cut

Chinese paper-cut is a collection of painting, carving and cutting, with scissors or carving knife cutting the paper into a handicraft with Yin and Yang lines. On May 20, 2006, the paper-cut art heritage was listed in the first batch of national intangible cultural heritage with the approval of the State Council of the People's Republic of China. On September 20, 2009, UNESCO officially accepted Chinese paper-cut as the world intangible cultural heritage.

Development bottleneck of Chinese paper-cut. As an important item of Chinese intangible

cultural heritage, Chinese paper-cut is a vessel of Chinese culture and history of more than five thousand years, which is considered to be protected integrally, authentically and lively. However, based on 6 years' experience of entrepreneurship and research in Chinese paper-cut industry, the author found that digitization of such a typical Chinese intangible cultural heritage item is grim. Severely limited by technology, resources, conditions and other factors, problems as above hindered its further development. Moreover, it is showed that the "design" step of paper-cut manufacture is the key bottleneck that leads to the emergence of these difficulties.

There are eight steps in traditional Chinese paper-cutting process, i.e., "drawing sample", "first carving", "matching sample", "smoking", "stapling", "second carving", "dyeing" and "sorting and mounting", among which the longest and most costly step is "drawing sample", that is, "design". Taking the design process of a 4-layer 4-color paper-cut with a size of 90cm×40cm as an example, it takes 1 month to finish the traditional design step, and design accounts for 57.1% of the total cost of this product, which means design has become the bottleneck of the innovation and development of Chinese paper-cut for hundreds of years. In addition, there are no more than 10 artists who have the ability to design samples of paper-cuts. Such a production status is not conducive to the promotion of the popularity of Chinese paper-cut, and it is difficult to expand the market, which greatly limits the further development and upgrading of Chinese paper-cut industry.

Breakthrough and Innovation of Paper-cut Industry. Sichuan Forest Deer Culture Communication Co.Ltd. took the lead in applying deep learning technology to the design step of Chinese paper-cut. During 6 years of entrepreneurship and program development, more than 10,000 sets of paper-cut models were learned by the program. After the repeated training of paper-cut model, a paper-cut intelligent design system was developed, and the deep learning technology was successfully applied to Chinese paper-cut design, announcing the next chapter of intangible cultural heritage digitization.

Through the application of deep learning technology, the design time of paper-cut design process was successfully reduced to one hour, and the cost was reduced to less than RMB 500. The design cost was greatly reduced, the production efficiency was improved, and the demand of market personalized customization was better met. It breaks through the design bottleneck of paper-cutting industry, and solves the key problems that restrict its development and promotion. In addition, paper-cut artists now have more time to optimize their craft and innovate. It promotes the upgrading of traditional Chinese paper-cut culture industry.

The above operation process can be summarized as a new Internet ecology of Chinese paper-cut digitization. In the Internet ecology, supported by university research team and students' entrepreneurship team, a paper-cut data network center is established by image processing system to save data of paper-cut. At the same time, the center directly connect customers and provide them with personalized service. With the technology of deep learning and AR, it can satisfy the customer's demand to the maximum extent and promote the development of Chinese paper-cut industry. Sichuan Forest Deer Culture Communication Co.Ltd. explores the path of the digitization of Chinese paper-cuts, which provides an advisable example of the digitization of other intangible cultural heritage.

4. Summary

According to the empirical research, the paper-cut intelligent design system contributes to the development and upgrading of Chinese paper-cut industry, and it's proved that the prospects of application of information technology such as deep learning is very broad in the field of intangible cultural heritage digitization. Other items of cultural heritage can also take this case as a reference, in order to expand their markets and extend the industrial chains. However, with the development of new technology, some new problems emerges.

Technical Popularization. The intelligent design system based on deep learning technology greatly contributes to the innovation and development of paper-cut, and it is feasible to popularize it in other heritage items. In order to further promote this technology, it is necessary to break the

barriers among items and regions, so that more intangible cultural heritage can benefit from it.

Public Acceptability. It is found that audiences' attitude towards the cultural heritage products manufactured by computer technology depends on their understanding of the intangible cultural heritage as well the education they received. The better they know about intangible cultural heritage, the more receptive they are to the heritage products manufactured by computer technology. In the future, more in-depth research for audience should be conducted to ascertain their acceptance of digitization of intangible cultural heritage, in order to smooth the path of technology application in cultural heritage safeguard.

Ethics of Technology. In this case, the intelligent design system of Chinese paper-cut is only applied in the step of "design" to optimize the flow of production, which did not impair the most essential "cutting" step. However, as such technologies are more widely applied, the core step of handicraft may be replaced and the authenticity and cultural characteristics of intangible cultural heritage may be threatened. Therefore, it is necessary to define the boundary of technology application, to eliminate the negative effect of technology application and ensure the sustainable development of cultural heritage.

In short, digitization is an inevitable trend of intangible cultural heritage safeguard. It is believed that in the near future, cutting-edge technology will be applied to more heritage items, even make a change to the whole industry chain. However, we must be vigilant and do not forget to protect the essence of cultural heritage and traditional spirits in the process of digitization.

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