Development and Evaluation of a Digital Museum of a National Intangible Cultural Heritage from China

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Abstract. Intangible cultural heritage (ICH) such as traditional craftsmanship lacks a physical form and often originates from minority groups with little documentation. Digital technologies can be leveraged for documenting and archiving these assets of humanity. In particular, digital museums are established for promoting public understanding and appreciation of cultural heritage. Despite the richness of ICH in China, the development of digital museums of ICH is still in an early stage and mostly from government endeavours. As part of an inter-disciplinary collaborative project involving academic researchers, information professionals, and a private not-for-profit museum, this paper described the development of Gifts from Lanmama, a digital museum of Miao embroidery as a unique ICH from Guizhou ethnic minorities in China. This paper also reported a preliminary evaluation of the digital museum with 78 users, in terms of its usability and affordance for learning about cultural heritage. Results revealed the strengths of the digital museum in terms of the rigor of metadata and its impact on improving users' understanding and appreciation of Miao embroidery. Some issues and challenges were also identified, such as the lack of channels for user-system communication. These evaluation results offer insights for further improving the digital museum and other end-user oriented digital presentations of similar ICH.

Keywords: Digital museum · Intangible cultural heritage · User evaluation

1 Introduction

Cultural heritage is a group of invaluable assets that inherit and embody human activities passed down from previous generations. It is a responsibility in our citizenship to safeguard cultural heritage for ourselves and future generations [1]. However, intangible cultural heritage (ICH) such as traditional craftsmanship lacks a physical form and often originates from minority groups whose languages may not have written scripts. These make it very challenging to preserve and promote these ICHs [2]. Digital technologies have been leveraged for documenting and archiving ICH [3]. China is well-recognized for its rich history and culture yet digitizing ICH in China is at an initial stage and is mostly through government endeavours [4]. Guizhou province in southwest China houses multiple ethnic minorities, among which the traditional craft of artisan embroidery of Miao

people was listed in the inaugural register of the National Intangible Cultural Heritage of China in 2006 [5]. With a long history of migration, the Miao are skillful at documenting their socio-cultural history and folk customs through their clothing, creating a vibrant cultural heritage [6]. For instance, the needlework of Miao women in history was emphasized as they produced various festival and daily live items with highly detailed patterns, including costumes, purses, baby-carrying belts, hats, bibs, and so on. Many of these exquisite traditional crafts that have ever emerged in Chinese history are intactly preserved by Miao embroidery techniques, including weaving, embroidering, and dyeing. They are of exceptionally high value in historical, anthropological, artistic, aesthetic, iconic and inspirational terms.

ICH is mostly rooted in people's traditions and daily lives. Therefore, effective conservation and preservation of ICH cannot only rely on government efforts. Grass-root initiatives and collaboration across sectors are desirable for improving the effectiveness, efficiency, and sustainability of ICH preservation [2]. As part of an inter-disciplinary collaborative project involving academic researchers, library professionals, and a private not-for-profit museum, a digital museum was built for digitizing, exhibiting, and preserving these unique ICH of Guizhou ethnic minorities. The ultimate goal is to facilitate access of a global audience, enhancing their understanding and appreciation of Chinese cultural heritage. As one of the first collaborative efforts between academia, information professionals and the private not-for-profit sector in China, it is essential to evaluate the usability of the digital museum and its affordance for facilitating the audience to learn about the Miao embroidery as a cultural heritage. The evaluation can also help us understand users' interactions with the digital museum and areas needing improvement from users' perspectives. This paper reports the development and evaluation of the 'Gifts from Lanmama' digital museum[1] (Fig. 1). Preliminary evaluation results will offer insights for further improving the digital museum, as well as other end-user oriented digital presentations of similar ICH, such as interactive multimedia exhibitions.

2 Related Work

2.1 Digital Museums of Cultural Heritage

To embrace the evolving potential of digital environments and multimedia in creating and distributing cultural content, more and more digital museums have been established worldwide to exhibit collections of digitized cultural heritage [7]. Over the recent two decades, intangible cultural heritage (ICH) has been receiving increasing attention after the UNESCO acknowledged its significance via the Convention for the Safeguarding of the Intangible Cultural Heritage in 2003 [8]. While people living in modern cities may have limited opportunities of experiencing ICH due to the often small numbers of its successors, digital museums help not only make institutionalized documentation of ICH but also promote public understanding and appreciation [9]. Despite the richness of cultural heritage in China, the development of digital museums in China is still in an early stage [10]. Xiong (2020) [11] conducted a review of 466 digital museum related articles published and indexed in the China National Knowledge Infrastructure, concluding that

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[1] https://lanmama.lib.hku.hk/.

there were insufficient collaborations between universities and museums as well as a lack of evaluation of digital museums in China.

2.2 Evaluation of Cultural Heritage Digital Museums

Prior studies on evaluating cultural heritage digital museums often focus on usability. Usability of a digital resource refers to the extent to which the resource meets the users' needs [12], also reflecting the quality of user experience [13]. Usability evaluation is one of the most frequently used tools for assessing how a digital museum supports its users' needs [7], offering designers and developers insights into the usefulness of the digital museum and revealing design problems and erroneous elements [14]. As one of the purposes of memory institutions is educating visitors, it is important to evaluate to what extent a cultural heritage digital museum helps visitors understand this cultural heritage and arouse their interests. Online questionnaire surveys are one of the most common methods of digital museum evaluation [15], while other methods include direct observation and log analysis [16]. There have been numerous studies on evaluating the usability of cultural heritage digital museums. For instance, Pallas et al. [15] evaluated the websites of 210 art museums worldwide in terms of usability and other aspects such as content and presentation. Their findings suggest that easy and simple navigation, return-to-Home and Help buttons, and absence of page errors are essential features for visitors' perceived ease of use. In a more recent study, Hu et al. [17] involved fourteen professional and layman users for evaluating the digital museum of cultural heritage in Dunhuang, China, yielding that introductions to the cultural heritage materials can be added for users with little background knowledge, and more communication channels such as a forum can be established for enhancing user-to-user interactions.

3 The Digital Museum: *Gifts from Lanmama*

Our collaborator, the Lanmama Ethnic Minority Apparel Museum, is a private, not-for-profit museum located in Guizhou, China. It houses about 2,000 pieces of apparels from ethnic minorities in Guizhou province, including Miao, Dong, Buyi, and those with small populations yet rich histories. The embroidery of Miao people contributes to a significant portion of the collections in the museum, with a diversity of items from festival dresses to daily household items such as aprons and bags. The dates of these items span from late Qing dynasty to the 1960s, reflecting the lives and traditions of ethnic minority people in a systematic and comprehensive manner. To ensure the quality of the digital museum, the items to be digitized was selected by this museum given their expertise, such that selected items cover all representative techniques of weaving, dyeing and embroidery, from various branches of major Guizhou Miao tribes. A total of 109 items were photographed by a professional photographer, resulting in 668 high-resolution digital images. Together with the photos were detailed descriptions of the items. To serve an international audience, the descriptions, originally in Chinese, was carefully translated into English. The translation process referred to a detailed monograph on Miao embroidery from Guizhou, whose content is aligned in Chinese and English [18].

Dublin Core (DC) was adopted as the metadata schema [19], with the following elements chosen for describing each item: *Title*, *Subject*, *Description*, *Creator*, *Date*, *Rights*, *Identifier* and *Coverage*. After reviewing the available software for implementing the digital museum, Omeka.org, the open-source online exhibit tool for memory institutions (i.e., galleries, libraries, archives, museums), was utilized for its core functionality of publishing collections and exhibits, ease of use and flexibility, and extensibility and scalability enabled by a suite of plug-ins [9]. Users of the 'Gifts from Lanmama' digital museum can freely browse the 109 items individually, three collections organized based on the procedure of making the crafts ("Weaving", "Dyeing", "Embroidery"), 28 exhibits of different embroidery techniques (e.g., "Knot stitch", "Counted thread stitch"), or browse items on a map, i.e., according to the geographic locations of their origins (e.g., Qianxi county in Guizhou). The digital museum also supports searching by metadata and full-text, where users can apply different query types such as Boolean search and phrase search. Notably, the interface has a responsive web design that is compatible with both computers and mobile devices, entailing a browsing experience with minimal resizing and optimal scrolling.

Fig. 1. Homepage of the Gifts from Lanmama digital museum

4   Research Method

A questionnaire survey in both English and Chinese versions was carried out to collect users' responses. It includes evaluation criteria adapted from the usability evaluation model devised by Jeng [16], the scale of a website's interactivity with users proposed by Liu [20], and those related to the ultimate purpose of the digital museum: facilitating 'learning about cultural heritage' [21]. Hence, the framework of evaluation criteria in this study (Table 1) comprises dimensions including effectiveness for learning about cultural heritage, user satisfaction (ease of use, organization, labeling, visual appearance,

content), and user-system interactivity (active control, two-way communication). It is noteworthy that effectiveness of the digital museum on 'learning about cultural heritage' was operationalized as its impact on users' understanding of, interest, and engagement in the exhibited ICH [21]. In the questionnaire, participants were asked to rate the digital museum against these criteria on a 6-point Likert scale from 1 (Strongly Disagree) to 6 (Strongly Agree). They were also asked, though not obligatory, to provide relevant comments and suggestions in an open-ended question. Participation in this study was voluntary without any remuneration.

Participants were recruited by a mix of convenience and snowball sampling of the researchers' networks and official dissemination channels of the hosting institution (e.g., websites, mailing lists). Besides descriptive statistics, Spearman's rank-order correlation analyses were conducted to reveal possible inter-relationships between these evaluation criteria [24]. Participants' free-text comments were analyzed thematically and quoted to supplement quantitative results.

5   Evaluation Results

78 valid responses were collected, with 77% (n = 59) from female participants. The ages of participants ranged from 18 to 64 (mean = 30.6). All of them were native Chinese speakers. More than half (61%) were students in higher education institutions. A considerable portion (80%) of the participants reported their studies or work were not relevant with cultural heritage, whereas the remaining (20%) deemed the opposite. The majority of them (87%) were interested in intangible cultural heritage. 71 (91%) respondents provided free-text comments and suggestions.

Rating scores on the various criteria of effectiveness, satisfaction and interactivity were aggregated across participants and are presented in Table 1. Among all criteria and variables, the consistency of information presented in the digital museum received the highest rating (mean = 5.19, on a six-point Likert scale), echoed by the comment that the "style of [information] presentation was uniform and made sense" (Participant#46). This indicates the rigor of metadata displayed to the audience, attributable to the adoption of the Dublin Core metadata standard which is well-known for its compatibility with cultural heritage information [22]. The lowest rated criterion was two-way communication, likely due to the lack of any explicit functions in the digital museum for users to air their feedback. The decision of not having such interactive features stemmed from our past experience in developing digital exhibitions which attracted spam comments resulting in disrupted operations of our server. Similar issues were also reported in the literature [23]. Focusing on the effectiveness of the digital museum on 'learning about cultural heritage', the perceived impacts of the digital museum on improving participants' understanding of (mean = 4.97) and interest in Miao embroidery (mean = 4.83) were rated higher than their engagement with this ICH (mean = 4.69). This might be due to the fact that only static images were included as visual surrogates of the embroidery items. Being described as "delicate" (Participant#15), "having spirituality" (Participant#68) and "lively" (Participant#34), these high-resolution images work well in demonstrating the items and the craftsmanship. However, they may not be sufficient in providing an engaging *experience*. Virtual reality (VR), being an immersive technology, can deliver

the virtual experience for users to engage and interact with the ICH [8]. In fact, a mul-
timodal exhibition for this project involving the display of Miao embroidery items in a
physical venue, the launch of this digital museum, and a station for an immersive VR
experience of the exhibits were planned to be conducted in Spring 2020. These were
unfortunately cancelled due to the COVID-19 pandemic. In addition, the making of the
embroidery items (i.e., craftsmanship) is a process which would be better captured by
media with temporal information such as videos [6]. In this regard, we have noted partic-
ipants' suggestions on presenting "videos that show how the [embroidery] work is done"
(Participant #2), catering to users' interests in the "making process" of the embroidery
techniques (Participant #76).

Spearman's correlation analysis revealed that the better participants' understanding
of Miao embroidery was, the higher rating they gave on the visual appearance of the
digital museum (correlation coefficient $r = 0.500$; $p = 0.000$). This seems to confirm the
relationship between understanding and appreciation of ICH [25]. Similarly, as expected,
the more participants were interested in the cultural heritage, the more positive the rating
they gave on their browsing experience ($r = 0.593$; $p = 0.000$). Besides, there was also
a significant correlation between participants' engagement in the Miao embroidery and
their rating on the searching functionality of the digital museum ($r = 0.609$; $p = 0.000$).
This seems to suggest that users who were more engaged with the ICH would prefer
using the search function to locate specific items in their mind [26]. Last but not least,
participants' perceived two-way communication with the digital museum also quite
strongly correlated with their rating on searching experience ($r = 0.713$; $p = 0.000$).
This is not surprising as searching is an interactive process [27].

Table 1. Evaluation criteria and participants' ratings (N = 78)

Criterion	Variable	Rating mean (SD)
Learning about cultural heritage	Understanding of the cultural heritage	4.97 (1.04)
	Interest in the cultural heritage	4.83 (1.05)
	Engagement in the cultural heritage	4.69 (1.14)
Ease of use	Navigation	4.96 (0.99)
	Browsing of items	4.81 (1.13)
	Searching of items	4.85 (0.99)
Organization	Organization of information	4.91 (0.96)
	Organization of items through collections	5.10 (0.82)
	Organization of items through exhibitions	5.00 (0.95)

Table 1. (*continued*)

Criterion	Variable	Rating mean (SD)
Labeling	Comprehensibility of information	5.08 (0.85)
	Consistency of information	5.19 (0.74)
Visual appearance		4.74 (1.16)
Content	Accuracy of information	5.09 (0.79)
	Comprehensiveness of information	4.99 (0.90)
Interactivity	Active control	4.86 (1.07)
	Two-way communication	4.47 (1.21)

There were other noteworthy suggestions extracted from the open-ended comments of the participants. For instance, one specifically expressed his/her expectation on a "warmer lighting" of the photos that could "simulate a virtual visit" to a physical museum (Participant #19), which denotes the importance of considering not only the quality of photos [28] but also visitors' hedonic or affective experience during the digitization process [29].

6 Conclusion and Future Work

In this study, we presented the development and user evaluation of a digital museum of Miao embroidery as a unique intangible cultural heritage of ethnic minorities in Guizhou, China. Evaluation results have helped us identify the strengths of this digital museum (e.g., rigor of metadata), elements of weakness (e.g., two-way communication), and suggestions for further improvement. Further additions of the digital museum may include videos of the craftsmanship and VR scenes of the physical museum. This study is exploratory in nature and the participant sample was limited to the Chinese population. Towards the goal of promoting the Miao embroidery to an international audience, our ongoing work involves recruiting non-Chinese participants for the evaluation. Future research will also include more comprehensive evaluation methods such as usability testing and system log analysis.

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