



MUSEUM DIGITIZATION



EDITED BY

Beijing Union University & Beijing Association for the
Popularization of Digital Science and Technology

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— *Books Beyond Boundaries* —

R O Y A L C O L L I N S

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Edited by Beijing Union University and Beijing Association for the Popularization of Digital Science and Technology

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Preface

In the rapidly developing “Internet+” era, the application of digital technology in science and technology museums is becoming increasingly mature, especially in the implementation of strategies that support culture through science and technology, bringing new opportunities to the construction and development of science and technology museums. Science and technology museums of all levels throughout the world not only actively promote the application of information technology, but also make use of the Internet, mobile communication, Big Data, and other technology to make museums more open, inclusive, and dynamic, and to serve as public cultural and educational institutions serving the all-round development of human beings. A number of digital display projects are being launched, such as the immersive digital audio-visual program “Stepping into the Riverside scene at Qingming Festival,” the large-scale virtual reality show “The Forbidden City – Juanqinzhai and Turret Tower,” “Digital Yuanmingyuan,” “Digital Three Mountains Five Gardens,” and “Roaming the Dajue Temple.” The application of WiFi technology to experience the micro Palace Museum, micro navigation, and micro video has been implemented in many science and technology museums. Facing a new situation of deepening reform and accelerating the prosperity of science, technology, and culture in China, what will the future development direction of museum digitization be? How can science and technology museums make full use of the advantages of new technology to showcase culture and services? How can they tell a positive story? How can they bring cultural relics to life? How can they increase, strengthen, and accelerate the dissemination of information in science and technology museums and improve the level of public services with the help of new media? How can they make it easier for the public to access and enjoy museums? These and other important topics created the need for the Beijing Digital Museum seminar.

Under the guidance of the Beijing Association for Science and Technology, the Beijing Municipal Bureau of Cultural Relics, and the Beijing Municipal Bureau of Economy and Information Technology, on June 14–15, 2015, the 2015 Beijing Digital Museum seminar took place at Beijing Union University and the Software Park of the Chinese Academy of

Sciences. It was jointly hosted by the Beijing Association for the Popularization of Digital Science and Technology, the Capital Museum Alliance, the Beijing Museum Society, the Museum Digitization Committee of the Chinese Museum Association, the Cultural Relics Photography Committee of the China Cultural Relics Academy, Beijing Union University, and the Computer Network Information Center of the Chinese Academy of Sciences.

The theme of the symposium was Promoting Public Cultural Services — Museum Informatization. The five topics in this book, (“Letting Cultural Relics Live — The Creative Digitization of the Museum,” “Remembering Nostalgia — The Digitization and Conservation of Cultural Heritage,” “Sharing and Utilization as the New Status Quo — Digital Development and the Sharing of Museum Resources,” “Mobile Navigation for the Thousands — How Emerging Media can Boost Communications and Services for Museums,” and “Entering the Museum — Excavating and Utilizing the Cultural Tourism Value of the Museum”) lead this exploration of the digitization of museums.

The seminar received widespread attention. It was attended by than 300 professionals and scholars in fields such as technology, culture and museology, the popularization of science, education, design, art and the Internet came from the Beijing Museum (Science and Technology department), the University Museum, the Chinese Academy of Sciences Museum, the science popularization base, colleges and universities, scientific research institutes, and Zhongguancun science and technology innovation enterprises in Shanghai, Zhejiang, Yunnan, Shandong, Fujian, Hubei, and other areas. More than 90 papers were received, and nearly 50 people gave speeches.

This seminar introduced the most forward-looking technological developments and the most innovative demonstration cases, promoting the most pragmatic approaches and serving as a good reference for the present and future of the digitization of science and technology museums. The organizing committee set up an editorial board, which collated and collected 70 papers, and published them based on the five topics discussed in the seminar. These papers focus on the museum’s realization of its own social functions and their responsibility in social and cultural development, and also discuss the important role that science and technology museums and other regional cultural resources can play in the public service system. They analyze development opportunities and application cases brought by new media to museums, and also discuss museum data processing and the management and standardized operation of digital resource utilization of cultural relics. Moreover, they expound the reform and innovation of the museum in adapting to new situations, and the planning and vision for the construction of future museums.

This book is the fifth in a series of papers on the development of Beijing’s digital museums since 2005. It is suitable for those who are engaged in public cultural services in facilities such as science and technology museums and libraries, and personnel involved in cultural creativity, exhibition, science popularization, and research and development. It can also be used as a reference for people in the field of digitization or science

communications, and for enthusiasts who are interested in the development of science and technology museums. Readers are welcome to contact us by e-mail (bjszkpxh@163.com) to exchange experience, offer their opinions, and make suggestions. If you encounter any problems with the compilation, please comment with corrections.

In the process of editing this book, Zhao Hong, Li Fengyang and their colleagues from the Beijing Association for the Popularization of Digital Science and Technology have done much work in the collection and arrangement of manuscripts.

Thank you.

The Editorial Board

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⇒ CHAPTER 1

Letting Cultural Relics Live

— The Creative Digitization of the Museum

Preliminary Exploration into the Construction of a Digital Museum

Qian Wenzhong

(China Agriculture Museum Information Center, Beijing 100026, China)

Abstract: With the development of digital museums, increasing numbers of Chinese and foreign museums have begun research and exploration into digitization, making achievements in both theory and practice. The following paper introduces the current status quo of museum digitization, and the relationship between physical museums and digital museum applications. It discusses prevalent issues that must be attended to in the development of the digital museum, engaging with construction practices, and using the China Agriculture Museum as a key example.

Keywords: digital museum; network; construction

Introduction

Since their introduction in the 1990s, digital museums have continued to develop over more than two decades, with increasing numbers of museums both in China and abroad engaging in relevant research and exploration. Early proponents such as the Digital Palace, the International Dunhuang Project, and China University Digital Museum Construction set the precedent. Since then, the digital museum has seen continuing research and booming construction, with guidance from the Ministry of Education, the State Administration of Cultural Heritage, and other relevant government departments. It has also received support from academic organizations such as the Association for the Digitization of Chinese Museums, the Informatization Committee of the China Society of Cultural Relics, and the Beijing Association for the Popularization of Digital Science and Technology, as well as positive responses from a variety of museums and active participation from several professional IT companies.

1. Outline of the Digital Museum

1.1 The concept of the digital museum

There are many concepts involved in the digital museum, but generally speaking, they emphasize the use of digital network technology, relying on digital methods to fully present the substance of a physical museum, including an on-site digital display system for the physical exhibition hall, a digital service management system using network technology, and a network platform system.

1.2 Current status of digital museums

In the late 1990s, digital museums began attracting the attention cultural and artistic circles in China, sparking a surge of research. In 1997, Nanjing Museum built the first online museum, and hundreds of museums in China followed suit.

In June 2000, the Palace Museum put forward the “Digital Palace” concept, establishing a website the following year. This was the birth of China’s first genuine digital museum. Since then, the Palace Museum’s website has released a time-walking section, allowing users to explore a complete rendering of the Palace online.

In 2001, the Ministry of Education launched a project called “Modern Distance Education Using Online Public Resources — The Construction of a Digital University Museum”. As of the start of 2007, the project had built 18 digital university museums, providing a wealth of digital resources for teaching, scientific research, and popular science.

In September 2003, the State Administration of Cultural Heritage formally began research into digital museum engineering in China.

In 2002, the National Palace Museum in Taipei implemented a digitized collection plan. At present, its website has four components: selected collections, topical websites, 3D appreciation of cultural artefacts, and a collection database system. Aside from providing introductions to various cultural artefacts, it also offers an enquiry function.

Furthermore, the Capital Museum and the Nanjing Museum have also developed relatively complete and valuable object informatization databases and digital museums.

1.3 The relationship between digital museums and physical museums

1) Both digital and physical museums have strengths, and are mutually beneficial. Physical museums allow visitors to be fully immersed in the historical and cultural environment of a meticulously arranged museum hall. They can view actual valuable cultural artefacts, listening to and enjoying them in close proximity, and gaining knowledge and experience. By contrast, digital museums break the restrictions of physical space, offering visitors an online experience anytime and anywhere. They use digital resources to reorganize, consolidate, and improve collections, providing lifelike, vivid,

and moving displays. They also use expert, network-based remote education to offer more convenient, enriched, and systematic knowledge. They utilize forums, message boards, public mailboxes, and various other interactive forms to evaluate individual feedback.

2) Physical museums are the foundation and support for digital museums

Digital collections are at the core of digital museums, and these collections are entirely reliant on the artefacts of a physical museum. Physical museums revolve around the collection, protection, research, and dissemination of cultural artefacts, all of which are necessary for the development of the digital museum. Each artefact within a physical museum is an irreplaceable symbol of a specific moment in history, with its own life and character. Without these artefacts, the physical museum would not exist, and there would be no source for digital artefacts.

3) Digital museums are the supplement and extension of physical museums

Digital museums can reduce the contradiction between the collection and preservation and research and display of cultural artefacts, allowing them to escape quantitative confines, and expanding their scope and spread. They are an opportunity for physical museums to attract potential visitors, and a crucial channel for the spread of their influence. Digital museums can enhance displays and maximize the hidden depths of exhibitions. They can also satisfy the need to protect and safeguard the legacy of intangible culture, meeting the demand for personal experience in a mutual interaction between visitors and displays. Moreover, they offer an effective means by which to improve the management of the physical museum.

1.4 Digital museum applications

Digital museums integrate the digitization, management, and interactive display of cultural collections, working to provide services for their preservation, management, and utilization. Most importantly, they provide the following applications:

- 1) Digitization of collections, including the collection and processing of text, 2D images, and 3D scan data regarding basic information, management information, and research information.
- 2) Business information management, i.e. collecting statistics, inquiries, and information regarding collections, accumulating conservation research and management information to form a “life archive” for the collection.
- 3) Digital information display, including an on-site digital display system in the physical museum’s display hall, and network platform display system.

2. Crucial Focal Points for the Construction of Digital Museums

The development of digital museums is a huge and highly complex systematic project, requiring large capital investments, and involving a large amount of content, a long process, and complex techniques. As such, it appears crucial to clarify the theory, system architecture, technical requirements, and target visitors of digital museum development.

2.1 Users

Cultural artefacts are at the center of the physical museum, which acts as a means for their collection, preservation, research, and spread, achieving the purposes of education, research, and appreciation, with user seeing only what is exhibited. Alternatively, digital museums display “cultural artefacts” to users via the Internet, using digital technology, network technology, multimedia technology, and virtual reality to create lifelike, three-dimensional “virtual artefacts”. With service at its core, user demands are studied so that they may see whatever they choose.

2.2 System architecture

The development of the digital museum contains both an on-site digitized display system of the physical museum exhibition hall and a network platform display system, as well as a basic network management system. These systems each have their own storage, processing, and display platforms, formed of huge and complex systems that require distinct and logical design, sensible architecture, and a clear hierarchy. They must distinguish among basic platforms, production and processing platforms, and application management platforms, determining the logical relationship and data integration between each, on a foundation of construction, safeguarding, and expansion.

2.3 Digital techniques

Within the development of the digital museum, many key technologies have arisen to promote rapid growth. Choosing appropriate digital techniques can improve visitation, benefitting user experience, increasing the sense of immersion, and offering users necessary knowledge while they take part in learning and entertainment.

These key digital techniques include: multimedia technology, used for the processing, production, and display of text, images, and audiovisual components of artefacts; virtual reality, used to recreate the environments of ancient artefacts, and conjure 3D, panoramic forms, and virtual roaming; 3D scanning, used to digitize artefacts, obtaining 3D data on cultural objects; 3D display, used to display artefacts in solid, 3D form, using methods of 3D modeling and automatic 3D imaging systems; QR codes, used in intelligent mobile terminals to obtain information efficiently, offering internet access, messaging, calls, material exchange, and automatic text import; mobile applications, used for location-

based information push, and information browsing, and including mobile websites and mobile apps. Furthermore, advanced technologies, such as augmented reality, are also used in digital museums. Given the characteristics of these technologies and the requirements of displaying collections, with the appropriate selection, twice the results can be achieved with half the effort.

2.4 Standards for organizing information

Due to differences in organizational nature and professional categories, domestic museums have various classifications, recording regulations, structural systems, and management records. In the development of a digital museum, the organization of information is not standardized, meaning that digital museums become “information islands”, which are not conducive to the sharing, dissemination, and utilization of data in collections.

1) Digitization of collections and database design

Formulating the digitization and database design specifications for a collection requires reference to the relevant national standards, other specifications such as the Information Index System Specifications for Museums (Trial), and the Information Index Specifications for Museum Collections as promulgated by the State Administration of Cultural Heritage. This is necessary to maintain consistency in the digitization of collections, the design of databases, and the development of information systems.

Collections should be comprehensive, complete, and standardized, and should describe their content accurately, supplemented by multimedia information including images, audiovisual content, 3D content, and animation from multiple perspectives. They should be well-rounded and deeply interpreted, all the while ensuring compatibility with system data.

2) Websites must abide by web standards

The design and production of a digital museum’s webpage should abide by web standards, abandoning the traditional form layout and adopting an XML (extensible markup language) and CSS (cascading style sheet) layout. Webpage content and form should be created completely independently, with simplified site access and maintenance, and improved speeds for file download and page display. The appearance and feel of the page must be consistent, providing easily attainable information and greater usability.

2.5 Target visitors

Digital museum visitors fall into different groups, the positioning of which relates to the depth and breadth of digital collection resources, as well as the choice of interface style and expression. Specific visitors have different levels of knowledge and cognitive ability, and different preferences, meaning that the target positioning, function construction,

overall content, style and form of a digital museum must be specifically determined to suit them. It is also possible to target multiple visitors with different columns.

3. Construction of the digital China Agricultural Museum

The development of the digital China Agricultural Museum entailed a unified framework and standards, focusing on user service, with an on-site digital exhibition display system, business management system, and network platform display system as the main construction content. Various technologies were applied – such as multimedia, virtual reality, and 3D display – to build a network-based, integrated information system with business, office, and public information service functions. The following section explains the network platform's display system.

3.1 Construction objectives

The digital China Agricultural Museum is based on its physical counterparts. With information resources at the core, information standards as the basis, information technology as the means, information networks as the carrier, and information application as a guide, it: digitally preserves and archives agricultural artefacts, sites, documents, historical figures, and customs; digitally simulates agricultural activities; digitally displays agricultural cultural artefacts and cultural heritage, creating a public service multimedia display platform that disseminates agricultural knowledge, publicizes agricultural conditions, and develops and expands agricultural civilization. The use of techniques such as information virtualization, digitization of information resources, and diversification of information display offers another window into the physical museum's content. The digital China Agricultural Museum focuses on agriculture, rural life, and peasantry, and has user service at its core. Its design ideas, content, and expression meet a variety of needs in terms of knowledge and entertainment for many different visitors.

3.2 Functional framework

The digital museum system involves five functions: gathering information about the collection, processing and production, display, publication, and application support.

1) A comprehensive platform for information about the collection

The integrated information platform is the foundation of the entire system. By digitizing the collection, it is transformed into digital information that can be accessed via computer, including sounds, graphics, and moving images, involving 2D and 3D forms. Currently, 2D photography and 3D scanning are largely used to gather this information in lieu of a highly automated, computer-controlled, high-definition photography and 3D information scanning system.

2) A multimedia processing and production platform

A key component of the overall system, the multimedia processing and production platform processes basic information attained by the integrated information collection platform, selecting various complete materials to be displayed on the network platform. Using computer system applications (such as Adobe Photoshop, Flash, Authorware, Director, 3D panorama, virtual roaming, 3dsMax, Web3D, 3D automatic imaging systems, and other professional software) the platform processes 2D and 3D information, creating 360° panoramic roaming, a virtual exhibition, 3D models, online virtual reality experiences, and other crucial content for the digital museum.

3) A display platform

Focusing on public web services, this platform configures various application servers to offer services via the Internet. Content and information displayed here is not limited to text and images, but also includes videos, panoramas, animations, puzzles and games, virtual reality (VR), 3D displays, and augmented reality. As such, the display platform extends the depth and breadth of information dissemination from the physical museum via storytelling, full-scale multimedia stereoscopic display, mass data, and interactive functions, conveying a rich web of information to visitors.

4) Platforms for the publication of information and application support

At the core of the system, the publication of information is achieved using a free framework system function and category settings, independently establishing the management permissions of each category, and publishing and offering on-demand features including text, images, panoramas, and 2D/ virtual 3D displays. The application support platform hosts various operating environments, including VR, 3D displays, and panoramic displays, providing a convenient background for management across a variety of systems and platforms. This platform is the support framework for the entire overall system.

5) The design of the system's background database

The system's background database offers support to the whole system, and must be built in conjunction with the information publication and application support platforms. Construction of the database must conform to standards for the organization of information, and must be built with the requirements of the overall system in mind. It must be unified and connected to the collection's database system, designed with a library and record format that is aligned with the existing collection database, with unified metadata, input, and output, so that data can be transplanted quickly and efficiently. Meanwhile, the interfaces of other digitally-networked business management systems for museums must be taken into account.

3.3 *The content of construction*

- 1) Digitization of collections: Basic information about collections, including photos, videos and 3D scanning information, is obtained through the comprehensive information collection platform, and then entered into the standard database and processed by the multimedia processing and production platform into integrated display materials.
- 2) Web portal: Multimedia and database technologies are used to build a full-text search system; this includes animations of agricultural history, memorabilia, agricultural figures, and sites, as well as sharing information from a variety of research publications and electronic magazines. Furthermore, expert blogs, question and answer systems, and the like must be created.
- 3) Pocket museums: This involves the development and utilization of mobile apps and the WeChat public platform, using network positioning systems, QR codes, RFID, and other such technologies to identify visitors by their identities and locations, then pushing customized guides and collections based on specific interests and hobbies. It also involves offering information services such as explanations, location services, and data downloads.
- 4) Virtual museums: This involves constructing a web-based 3D panoramic view of the exhibition hall and a virtual 3D exhibition using digital simulation technology (Virtual Reality/VR) and exploring the restoration of monuments and the protection of cultural heritage (augmented reality/AR); enabling visitors to enter a virtual world via high-precision 3D display, immersing them in “real” ancient scenes, and allowing for intimate contact with historical artefacts.

4. *Conclusion*

The digital museum offers an escape from the restrictions of time and space, allowing the public to enjoy cultural heritage and global cultural artefacts without leaving their homes. However, the development of digital museums is a complex project, involving interdisciplinary integration of the cultural and IT industries, and requiring support from experts, capital, and technology. Only with in-depth research, continuing exploration, and the gradual mastery of the theory and regulation of digital museum development will it be possible to build public digital museums as new windows to culture.

References

- [1] Chen Gang. *Analysis of the concept, characteristics and development model of the digital museum*. National Museum of China, 2007, 3: 88–93.

- [2] Zhang Haoda. 'Lessons and reflections on the recent construction of digital museums', *Digital Library Forum*. Beijing: Editorial Office of the Digital Library Forum, 2010 (1, 2).
- [3] Qi Xiande, Ma Qi, Han Jun. *Preliminary study on digital museum solutions and current trends in digital museum development*. Beijing: Communication University of China CUC Publishing House, 2014, pp. 28-32.
- [4] *Thinking about digital museums*. Bobo Art Network: <http://news.artxun.com/siyangfangzun-1467-7330289.shtml>.
- [5] The Digital Museum. Baidu Encyclopedia: <http://baike.baidu.com/view/1528687.htm>.