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Library Service Innovation Based on New Information Technology:
Taking the Interactive Experience Space "Tsinghua Impression" as an Example

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ABSTRACT

The development of new information technologies changes and affects the services in libraries. In this article, taking the interactive experience space "Tsinghua Impression" as an example, the authors analyzed the application of many new technologies in the information resource construction and information service of library and explained how to use multimedia, touch screens, 3D, and other technologies to enhance collections and services. They probed the new information technologies to promote the service innovation of the library in order to provide reference for the service innovation of the university libraries.

KEYWORDS

Interactive Experience, Library Service, New Information Technology, Service Innovation, Service Mode

INTRODUCTION

Library services combine the professional knowledge of the library by information technology. It not only needs the professional knowledge of Information organization and information retrieval, but also a combination of experience with user services and traditional library services. The innovation of library services not only need the innovation of thought, but also the innovation of technology.

The rapid development of information technology has broken the time and space restrictions of library services, lead great changes in the methods of services used in traditional libraries. The application of information technology in libraries not only expands the range and improves the quality of service, but also changes the mode of service in libraries. The rapid evolution of information technology brings opportunities and challenges to libraries. New technologies could improve the mode and quality of service, and meets the requirements of patrons better. Modern libraries cannot neglect the application of information technology. The quality of the service offered by a modern library directly depends on how it applies information technology. How to exploit the characteristics of various new technologies and make innovations in library service is a question that librarians face to.

In recent years, libraries in-house and outside have incorporated the use and design of space into service innovation of the libraries, and new information technologies apply to these spaces. For

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example, in 2011 an innovative space was set up in the Fayetteville Free Library in northern New York USA, and advanced software and 3D printing equipment were used to attract people to come to the library. In May 2013, the Shanghai Library built a new creative reading room that is open to the outside world. There is professional drawing equipment and design software including multimedia touchscreens, 3D printing and other devices, that make it easier for readers to communicate with each other and show their innovative results.

Library service innovation aims to integrate new ideas into traditional library services and to apply new information technology to library services, so as to transform the concept of service and improve the mode of service. In April 2016, the interactive experience space "Tsinghua impression" came into use in Tsinghua University Library. Figure 1 illustrates a Panorama of the interactive experience space "Tsinghua impression". This space combines new technology with the reading habits of readers, and establishes a new service model.

APPLICATION OF NEW INFORMATION TECHNOLOGY IN THE INNOVATION OF LIBRARY SERVICES

Using HTML5 Technology to Promote E-Book Lending Services

HTML5 is the fifth revised standard of HTML and is a new generation of HTML. Its main goal is the semantics of the Internet. Semantics makes the Internet more readable for both human and machines, and better supports embedded multimedia devices. Therefore, HTML5 has the advantage of mobility and user-friendliness. It is widely used in various games and applications. With the development of information technology, libraries not only provide paper books but also offer e-books. Meanwhile, reading habits are changing from reading e-books on personal computers or laptops to reading them on tablets and mobile phones. Since HTML5 is friendly to various terminals, especially portable terminals, using HTML5 is an innovation and a major task for libraries.

In 2014, Tsinghua University Library applied HTML5 to its guidebook service platform, which was the first time a library uses this technology (Library, 2017). In 2015, with a developing demand for mobile reading, the library launched "Reading in Tsinghua" and "Weekly Selection"; a reading promotion platform and a weekly book recommendation program each week (Library, Reading in Tsinghua, 2017).

However, there are also problems with the reading promotion programs. Since the recommended books are usually best sellers, paper copies are inadequate, and cause patrons to wait in line to borrow a book. Though some of the recommended books have e-books, to read them patrons need special browsers that only supported by PCs or laptops, so it is still inconvenient for students to read the books.

We observed this situation and want to solve these problems. So we set up six columnar display screens in the interactive experience space "Tsinghua Impression". They are e-book lending platforms. Figure 2 illustrates the six columnar display screens in the interactive experience space "Tsinghua Impression". The screens show the book covers of recommended books, when you touch one cover, a QR code and the content abstract will be shown. To get a whole e-book, patron only needs to scan the QR code from the screen. Moreover, the patron can do a full text search, and chose to read in image pattern or text pattern, and share the book on the same platform.

All the books on the platforms have book information and recommendations provided by teachers in the library. After that information is recorded, the books are processed with OCR and HTML5 techniques to meet different needs of patrons. Finally, they are classified and put on the six different display screens. When borrowing the books, a patron does not need to input the title of the book. Instead, the patron can click the book cover on the screen, read its information and then scan the QR code to read the book on mobile phone or tablet. Another function of the platform is to provide statistical data for further analysis. In order to protect intellectual property rights, the platform has

Figure 1. The Panorama of the interactive experience space "Tsinghua impression"

Figure 2. Six columnar display screens

a short-term (15 days) loan service. To continue reading the book, the patron needs to scan the QR code again.

Popularize Characteristic Collections Using 3D E-Books

In the past 100 years, many famous scholars have studied or worked in Tsinghua University. A huge amount of precious materials with historical value was left to the university. Tsinghua University Library stores and preserves these materials (Library, Tsinghua legacy, 2017).

In 2016, there is a corridor made of eight 46-inch LCD screens established in the interactive experience space "Tsinghua Impression" to display these historical materials. "Tsinghua Weekly" was displayed first, since it is the most important part of all the materials.

"Tsinghua Weekly", a student publication, which was firstly published in March 1914. There were 676 issues were published before May 1937. Publication stopped during the Anti-Japanese war, and resumed in February 1947. However, publication soon stopped again, a mere 17 issues after its recovery. Although all the editors and publishers were students at that time, it was a comprehensive publication with great influence. It is not too common to see a student publication that can survive such a long time and exert such influence in the history of Chinese education. Former chief editors and managers include many well-known scholars (Library, Tsinghua Weekly, 2017).

In order to introduce these historical materials to more patrons, the library digitized the materials and displayed them on the corridor wall. Readers can view these materials by clicking the digital copies on the screens. Different readers may have different focus points. For example, students from the school of fine arts might focus on the typeset and design of the historical publications, and the students from the school of social science might focus on the content. To meet the various needs of readers, we used a high-resolution color scan to make 3D e-books, which preserved both the format and the content of the original publications. Additionally, we added a page effect to the 3D e-book to provide a better reading experience.

In the corridor of historical materials, over six hundred issues of "Tsinghua Weekly" are displayed as 3D e-books. Covers of various styles lie on a time line and scroll down automatically in chronical order. Figure 3 illustrates this scroll screen with a time axis. Figure 4 illustrates how the system can support four readers reading at the same time. Each reader occupies two LCD screens and does not need worry about disturbing others. If a reader wants to read more carefully on his own mobile phone, he can scan the QR code which shows on the e-book and download any issue he needs. "Tsinghua Weekly" is not a end of this program, it is only a start. In the future, more historical materials will be displayed on this corridor wall.

Figure 3. The interface of time axis scroll screen

Figure 4. Four groups of browsing interfaces

Display Academic Achievements With Data Visualization

Data visualization is the theory, method and technology that used to convert data into graphics and images that interact with each other on a screen. It can improve the effectiveness of data processing by making huge amounts of data more accessible for researchers. Data visualization can be used to transmit information between people and data or between people and people, so that people can observe the informations hidden in the data and provide a powerful tool for the discovery and understanding of the law of science. It can guide and control the process of computation and programming, observe its influence through changing the conditions based on the process (Zhou. H., 2002).

Traditionally, data is analyzed with the help of charts and diagrams (Zhao, 2015). However, Data Visualization enables people to see the structures of data in a more direct way, and therefore improves the outcomes of data analysis (Zhou. H., 2002).

In 2015, Tsinghua University Library started to build a database about scholars in Tsinghua University (Library, The Exhibition of Tsinghua international coauthor, 2017). The database collects information about Tsinghua scholars' work and publications from major databases such as Web of Science. Using data from these databases, a digital academic display platform was set up in "Tsinghua Impression". Through Data Visualization technology and the database, the academic achievements of Tsinghua University in the past 100 years are exhibited on a big LCD screen. Looking at this exhibit, people can see the distribution of Tsinghua's international academic cooperation and can trace the university's influence power in global.

The maps on the platform automatically scroll in chronical order, showing the number and distribution of the co-authored papers around the world. Figure 5 illustrates the change from 1980 to 2016 in the distribution of International coauthored papers. Figure 6 illustrates a heat map of cooperation made by calculating the times in 2016 that Tsinghua cooperated with 15 famous universities and countries around the world.

Using this platform, we found that Tsinghua University had already published 87 SCI papers in 1949. We also found copies of the first papers published on *Science* and *Nature*, which recorded by SCI. All of those are valuable materials.

When we face the large amount of data coming in ceaselessly, traditional analysis tools such as diagrams and charts can no longer meet researchers' need. Now people can see all the results from the visualized data directly. By this technology, comparing with traditional charts, data analysis is more readable through visualization.

Exhibit the Library's Relics With 3D Scanning and 3D Printing

Tsinghua University Libraries (including specialized libraries and faculty libraries) has a collection of 5.027 million volumes of books. Its collection includes a number of valuable ancient publications and cultural relics (Library, Collection layout of Tsinghua university library, 2017). These cultural relics include 1489 bronze wares, 1755 oracle bones, 234 pieces of animal bones and jade wares, 217 ancient coins, 40 pieces of calligraphy and painting, 27 ancient maps, a giant Kesi Buddha from Qing Dynasty and nearly a thousand rubbings. These relics reflect culture of different times and are of great aesthetic value (Library, Ancient books of Library of Tsinghua University, 2017). They played an important role in the rebuilding of the art facility in Tsinghua University.

For the purpose of better preservation, most of these cultural relics are locked in warehouses and not accessible. To a certain extent, the locked relics lose their research value. The library wants to share these relics to all in this world to research purpose and people can enjoy the beauty. However, the technology of 3D scanning and 3D printing may be can solve this problem to some degree. On this time many museums and libraries are applying these new techniques to the preservation, restoration and research of cultural relics.

3D scanning is a new technology that combines mechanics, electrics and computer science. It is used to record the contour, structure and color of an item in the form of space coordinates. 3D scanning is widely used in the advanced manufacturing industry because it is high speed and high

Figure 5. International coauthor distribution change map from 1980 to 2016

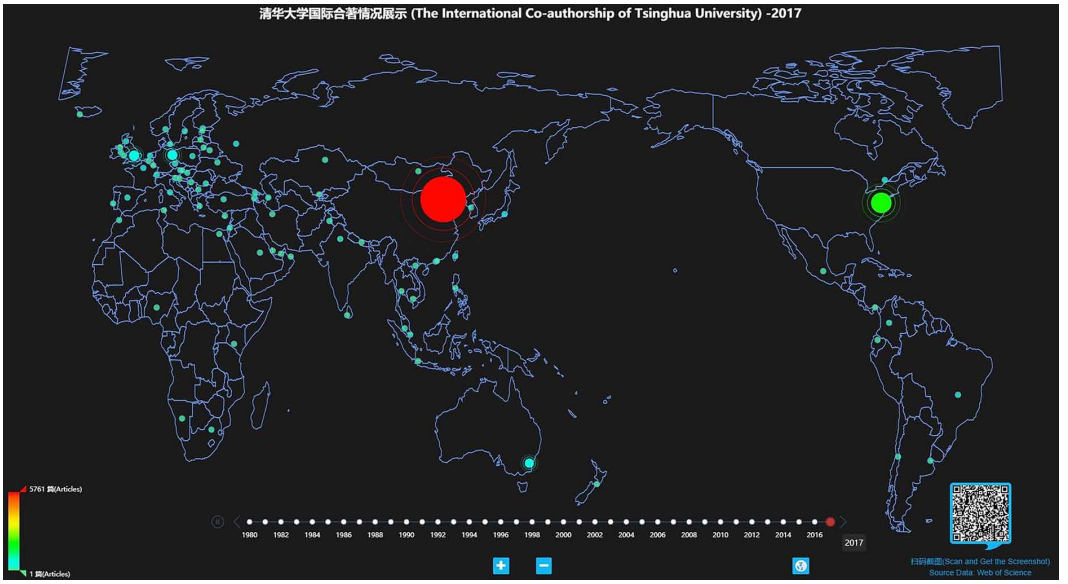
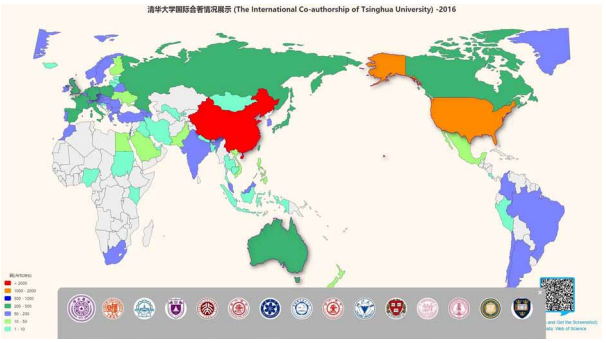


Figure 6. The international co distribution heat map of 15 universities in 2016



resolution, and is contactless and convenient. 3D printing refers to the technology of building models with fusible materials such as plastic and powder-like metal based on a digital model file. 3D printing first came into being in the middle 1990s.

A digital humanities area, established in "Tsinghua Impression", where we display copies, made by 3D scanning and 3D printing, of four typical bronze wares. Figure 8 illustrates a photo of the bronze ware. Figure 9 illustrates the Modeling diagram of 3D scanning. Figure 10 illustrates the Photo of 3D printing model. The copies are put on rotating exhibition booths so that visitors do not need to walk around it to see all the facets of a bronze ware. Visitors can also scan the nearby QR code to see the photos and introduction of a bronze ware. In the future, we will print more relics by 3D printer to present.

Combination of Tradition and Modernity

Library service innovation based on new information technology is not the abandonment of traditional technology, but the combination of tradition and modernity.

Figure 7. The location of the Tsinghua University Library

1. The wall showing landmarks of the library's history.

Tsinghua University Library experienced several historic milestones in the past 100 years. A wall showing information on the development of Tsinghua University Library was built with traditional strip wood at the entrance of "Tsinghua Impression." When entering this space, the reader will feel that "interaction" is the theme. We want the visitor can feel the cross of the ancient and new technology.

2. "Tsinghua Memory" interactive photography system.

There are many memorable buildings and figures in the history of Tsinghua University. Unfortunately, most of them only exist in historical records. The interactive photography system can make these historical moments reappear using image synthesis technology. We collected old photos of ancient buildings and figures, and digitalize them into the system. If you want to take a photo with these symbols, you only need to stand in a certain zone and click the screen, then a cameral take a picture of you and mix it with the old photo that you choose. At the last you can change the color and size of the photo and take it away by scanning QR code.

NEW TECHNOLOGY PROVIDES NEW WAYS FOR THE SERVICE INNOVATION OF THE LIBRARY

For libraries, innovation means using new technology to provide new services. Libraries do not create new technologies, but they do promote and adopt emerging technologies. A library is an institution that provides various information services through information technology. Facing with the rapid development of information technology, the task of libraries is to apply the newest technology to the

Figure 8. The photo of the bronze ware

Figure 9. The modeling diagram of 3D scanning

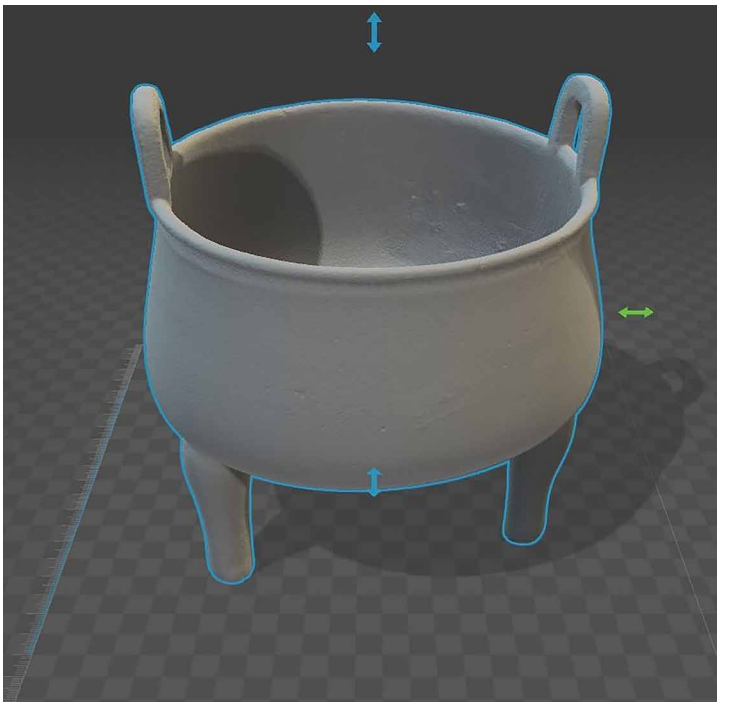


Figure 10. The photo of 3D printing model

innovation of service. Libraries must study the newest information technology and the find the way to use it. It is the innovation of library reader service combining reader experience service mode with library service. It not only expands the service content and service mode of library reader service, but also embodies the core value of "reader centered" library.

Adding Retrieval Function in E-Book Platform

Current e-book systems mainly focus on promotion and recommendation. Patrons can borrow a book easily by scanning a QR code on a mobile device. In practice, some patrons hope that retrieval functions could be added to the e-book systems. We plan to further development to improve the system and add retrieval and search functions. And further more, patrons will be able to appreciate recordings and videos of a book.

The Third-Generation Page Effect System

In the future, illustrations in books can be animated and designed, audio and video can be inserted into e-books. The library users can see not only images and texts in an e-book, but also videos and animations. By making these changes, we can better exploit the advantages of e-books. The third-generation page effect system that we are going to apply is a system that combines images, texts, videos and animations together based on traditional e-books. It uses the newest generation of interactive coding projection technology in the world.

Using VR in Cultural Relic Exhibition

Currently, 3D models in the digital humanities area are only used for exhibitions. The only way visitors can learn more from it is scanning the QR code and reading provided information. The next goal is to help visitors interact with the process. In the future visitors will be able to record the item from all

aspects and the record will generate a point cloud model (a 3D model with complex surfaces). The output can be shared through AR (Augmented Reality), VR (Virtual Reality) or MR (Mixed Reality), in addition to 3D printing (Library, Creative innovation and entrepreneurship education platform of Tsinghua University, 2017).

SHARING READING IS THE TREND OF THE FUTURE LIBRARY

With the improvement of people's living standards and the change of reading methods, the function of the libraries is changing slowly. The libraries will be liberated from traditional basic services, and be developed to make full use of all kinds of information technology to promote reading and provide a variety of innovative services. If traditional libraries merely lend the books, then modern libraries need to provide various information services, like book promotion, with new technology and other innovative services. Exploiting collections, creating interactive experiences and sharing reading experience is the new trend. In the face of challenges brought on by new information technology, we libraries not only need to improve hardware facilities, but also need to innovate service modes, and improve service standards.

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