Research on Interactive Display Design Based on "Educational" Demand

Taking the "Kizil Cave — Temple Complex" Exhibition Area of the Aksu Museum as an Example

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Abstract—In Modern museum display, the original information dissemination mode in which visitors simply visit the exhibitions has been broken, and the mode of interaction between audience and exhibits are increasingly adopted to promote the degree of participation and fun in the display. Through elaborating the design method of interactive project in Aksu Museum, this paper introduces the new media interactive design mode based on the educational demand of the museum in detail.

Keywords—education; interaction; cultural communication

I. INTRODUCTION

In the 21st international congress of museums held in Vienna, Austria in 2007, the definition of museum was revised, and "education" was put forward as the first main function of museum. In 2008, the official website of the International Council of Museums (ICOM) defined a museum as one that aims at education, research and entertainment, serves the society and its development, and is open to the public. These new definitions of museums indicate that great changes have taken place in the practice and concept of museums, and the functions of public education of museums are increasingly important. In today's China, more and more museums begin to use multimedia interactive display design.

The "Kizil Cave — Temple Complex" exhibition area of the Aksu Museum in Xinjiang, is part of the cultural and educational development deployment of "the Belt and Road Initiative". The whole exhibition area, including interactive design of new media, also shoulders the responsibility of spreading the core concept that "Southern Xinjiang has been China's territory since ancient times and Buddhism is the earliest popular religion in the region" to visitors from Xinjiang and all other regions. The author completes the overall display design through modern interactive human body induction design, interactive form of the multi-touch wall-ground digital content. The overall project is the key construction exhibition hall of Aksu Museum in 2018. Together with other exhibition halls of Aksu Museum, it won the title of "national research and practical education base for primary and secondary school students" in 2018.

II. THE REFLECTION OF "EDUCATIONAL" DEMAND IN THE INTERACTIVE CONTENT DESIGN

In interactive design of museums, digital interactive content is one of the cores of communication between experiencers and exhibitors, and is the key to play an educational role. It hasn't been a long time since the new media interaction design started to be used in the exhibition. The emergence of new media makes interaction design closely involved in the traditional field of display design. [1] In current design of museum exhibition, there is a big difference between the display mode focusing on simple display and the one that requires human-computer interaction. In human-computer interactive display, the exhibition content needs to be re-designed by designers on the basis of fully understanding the exhibition materials. For example, in the new museum of Shanghai Natural History Museum, there is a multimedia interactive screen about polar animals. The designer combs the scientific and educational contents and creates interactive digital contents through secondary analysis and visitors can thus learn knowledge in the interactive process. Through case study and practice, the author thinks that the design process of multimedia interactive display digital content in modern museum should adhere to the following creation principles, that is, revivification of history and politics, cultural inheritance, the intelligibility and popularization, and the combination of education with entertainment. These principles ensure the dissemination of rich and diverse content and contribute to achieving the purpose of education.

A. The Principle of Revivification of History and Politics in Digital Contents

In digital content creation, respecting historical and political authenticity is the primary element. Since the birth of the museum, it has mainly been exhibiting and maintaining its relationship with the audience through real cultural relics, original works of art and other forms of physical display. As the center of national mainstream history, art, politics and culture communication, museums shoulder the historical mission of "being true". Designers help the audience to understand the history, think about the

present, to master the ancient and present learning through digital content display designs with respect for the history. For example, in the multimedia interactive screen design of Dong Qichang painting and calligraphy exhibition recently held in Shanghai Museum, the graphic design of the painter's traveling spots for several decades provides a reference for his painting style and the change of painting content. The audience can select a route through the large touch screen, which dynamically displays the routes. This turns the audience's simple visit to a process of a "seeking answers by themselves", so as to achieve the purpose of evoking audience's reflection and spreading the educational content. For example, in the digital interactive content of this project, the portraits of the two eminent monks need to be created. In order to correctly show the image of the two masters, the author has carried out a research through large number of historical data. Through copying the facial form of

Xuanzang's portrait in Taipei Palace Museum, and consulting the description of Xuanzang's costume in historical documents, Xuanzang's image design was completed. In the creation of the portrait of Kumarajiva, the author used the statue of Kumarajiva in scenic area of Kuqa County in Xinjiang for reference, and carried out graphic design and drawing. (See "Fig. 1") The whole process is carried out with strict respect for history. Under the guidance and requirements of Aksu Museum and Xinjiang Qiuci Research Institute, the creation team conducted a lot of research and communication to ensure the authenticity of the content. In doing so, they provide visitors with the closest visual experience to reality. They give the same respect to historical facts in the expression of the two masters' routes of transiting scriptures and taking scriptures so as to the audience with the interactive experience of retracing the route, as shown in "Fig. 3".

The portrait of Kumarajiva recorded by ancient book

The statue of Kumarajiva in the "Kizil Cave — Temple Complex" in the scenic area

The sketch and colored portrait of the master created by the design team

Fig. 1. Xuanzang and Kumarajiva painted by the author.

B. *The Cultural Inheritance in Digital Contents*

In the display of modern museums, most exhibitions revolve around one or more historical objects. Multimedia interaction is just a form of presentation. Therefore, no matter what kind of exhibition it is, it must be carried out around the connotation of the exhibition itself, that is, the expression of the cultural connotation of the exhibition. Each

piece of exhibit in the museum is an important part of the excellent traditional culture of its country. As an important carrier of national culture and spirit, it embodies national wisdom. Exhibitions in museums are also a way to spread outstanding cultures of various countries and a major bridge and link for the public to perceive traditional culture. Various exhibitions are a major way to carry out cultural inheritance and social education. For example, in the overall visual design of the Saudi pavilion of Shanghai World Expo, the continuous pattern unique to Saudi Arabia is used as the overall environment identification design, which was used in the content of dynamic projection. Only by combining the promotion content with national features organically can the purpose of cultural transmission be achieved. In this project, the overall content structure is entirely based on the real experience of collecting and transmitting scriptures of the masters, and the visual setting of screen and text introduction all focus on cultural communication. The most typical

representative of the local cultural characteristics focuses on the design of the ground sensing circle with multi-person interaction. The "diamond-type lattice" based skeleton uniquely seen in Qiuci murals was selected. A large number of existing murals in Kizil Cave — Temple Complex show the visual artistic characteristics, which not only reflects the style changes of Buddhist art in the historical and cultural background of this region, but also becomes an important factor to construct the exotic characteristics of Kizil murals. The creation of diamond-type lattice reflects the theme of Buddhism traveling from the West to East and the blend of East and West. (See "Fig. 2") The whole design process fully respects the regional art and culture of the exhibition content, reflecting the design concept of cultural inheritance and the fact that since the Tang Dynasty, the culture of the central plain of the Han nationality has been integrated into the long history of the region together with the local culture, becoming the precious wealth of local culture.

The ceiling inside the grotto

The diamond-type murals inside the grotto

The Western vol-grass pattern

The finished ground trampling interactive circle   (expanding as the number of people grows and moving as people move)

Fig. 2.   The creation of diamond-type lattice.

C. The Intelligibility and Popularization of the Content

With the introduction of new museology in the early 20th century, the main function of museums as educational institutions has shifted from the focus on "objects" to the concern for "people", with the purpose of making more people benefit from art galleries and museums. [2] With the increasing number of modern museums, people growing demands to visit and study in museums, it has become more and more important that exhibition contents and forms should be understandable and thus can be popularized. Since museum exhibitions are not for exclusive service and they should be loved by the mass, the intelligible design with exhibition contents that are of a certain cultural height and can be understood by audiences of different cognitive levels are an important research content of museum design nowadays. For example, "the Digital Along the River During the Qingming Festival" presented at the 2010 Shanghai World Expo is based on the content popular with the public and further digitized to produce a good educational display effect. According to the data released at the 2018 national symposium on museum work, nearly 1 billion person-time visit museums in China every year. Visitors may be a combination of different gender, different age, different ethnic group, different education level, and different nationality and interest, etc. among which there are both universality and particularity. So how to make these different visitors understand the exhibition and obtain certain knowledge so as to achieve educational purpose is what the designers need to set in advance. As in the Aksu Museum project, according to the regional data of the local administrative department, the biggest characteristic of visitors in Aksu is multi-ethnic, and they are mainly teenagers. Visitors outside Aksu are dominated by tourists from all over China and around the world. Due to its position as the base of "Qiuci Study", a small number of professional researchers are also included in the visitors. Faced with such a complex group of visitors, based on the needs of popularizing content and improving understanding, the following design principles are put forward in the overall design of this project. That is, the overall expression should mainly be visual; the Chinese introduction content should be easy to read; and the logical framework should be concise and so on. Aksu area is an ethnic gathering area dominated by Uighur, and most of the local visitors are Uighur teenagers. After many in-depth observation made by the design team in the early stage of the design, most of the local adult minority people cannot or only know a little Mandarin most of the teenagers can read and understand basic Mandarin, with the state's requirement of the full popularization of mandarin there. In the design of digital contents, most of them are mainly illustrations or dynamic images, with a small amount of narration and text. The slow-talking standard mandarin dubbing is confirmed as the final version of the narration. At the same time, the subtitles appear slowly and stay on the screen for a long time. Basically, the whole text appears for more than 30 seconds, so that visitors of ethnic minorities can read, understand and hear the content smoothly. There are basically feature films and illustrations of traditional culture that can be understood by visitors in the picture. Enabling the public to understand the contents are conducive to achieve the fundamental aim of popularize education.

D. The Combination of Education with Entertainment in Digital Content Design

In the process of designing educational programs and activities in the post-museum era, visitors should be the primary consideration, and the participation and interaction of visitors are an important part of the exhibition. Unlike schools, museums do not belong to compulsory education and thus belong to non-compulsory education model. In this case, the audience is no longer a passive education receiver, but needs to be attracted to take an active part by the present content. It gets extremely important to mobilize the audience's subjective initiative and enhance their interest. What multimedia is designed to show are the exhibits themselves, not the technical means. This requires the formation of a complete and appropriate display design concept before the design. [3] In the overall display experience, the participation of audience in the actual interactive experience can improve the speed of knowledge dissemination and memory. Therefore, in the modern interactive media display design, the educational content should be rich and colorful, and educational contents should be combined with entertainment to ensure a high participation degree. For example, the overall name of this project is designated as "Visiting the Silk Road Landscapes across the Centuries, Having a Dialogue with the Masters Through the Veil of Time". Such a theme of "passing through time" can first arouse the curiosity of visitors who will then experience it. In the overall process of experiencing, participants need to make multiple choices and have different rich contents presented. After completing the route of one master, they can have a second experience and follow the route of the other master. Young people and teenager visitors are able to experience the whole thing and are interested in experiencing it again. Among them, teenagers can clearly remember most of the knowledge points after interactive activities. It can be found that the interesting experience of interactive content can effectively contribute to the input of educational content for visitors who experience fun at the same time.

III. THE EMBODIMENT OF "EDUCATIONAL" DEMAND IN INTERACTIVE MODE

In addition to the educational function embodiment of digital content, another important aspect of audience experience in interactive exhibition content of museums is the interactive mode, which is the process setting of audience experience content. Constructivism emphasizes the audience's self-expression and thinks that education is communication and dialogue, in which audience's participation and expression become an important part of activities. This paper summarizes several key points of interaction mode design, namely, openness of experience process design, rationality of logical design, immersion of space environment, necessity of multi-person interaction setting, etc.

A. Openness of Experience Process Design

In terms of interpersonal interaction design, in new media display design, "the audience is both the object of display service and the object of display." [4] The openness and participatory performance of new media display design attract the audience to participate in it, and the most attractive activities are role playing, parent-child interaction and so on. In the design of interactive mode, it is an important display form of modern museum to make the audience participate in the interaction from the first perspective and let them have the pleasant experience of "virtual experience". For example, in this project, the two experience routes of "Retracing Xuanzang's Journey to the West" and "Retracing Kumarajiva's Journey to the East" are adopted in the interactive framework. The summary of the two routes enables participants to quickly understand the experience of the two masters through different experiences in a few minutes, so as to achieve the purpose of popularizing knowledge.

B. Rationality of Logical Design

As is known to all, the logic of the framework is the key to the success of interaction design, so logical design is a skill interaction designers must master. In the process of audience participation, a complete logical framework is needed to allow participators to smoothly complete the whole experience without too much guidance. For example, in this project, due to the actual situation of the space, given the space setting that the flow of people are set in the two sides of the space, it was finally determined that the final pictures of the interaction presented in the path begins at the west (left side of the map) are different from that begins at the left. It increases the diversity and interest of the interaction, guides the audience to participate in the experience for many times and finally obtains comprehensive knowledge. Specific interaction logic can be seen in "Fig. 3" and "Fig. 4".
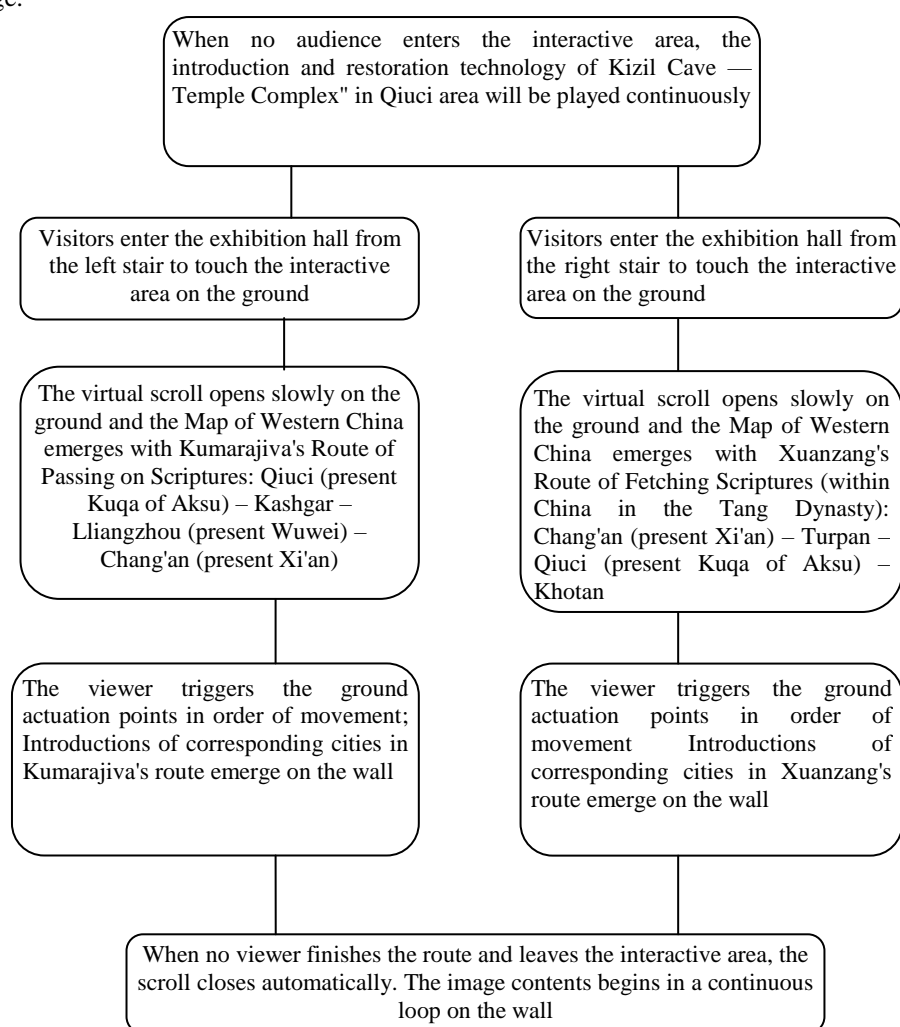

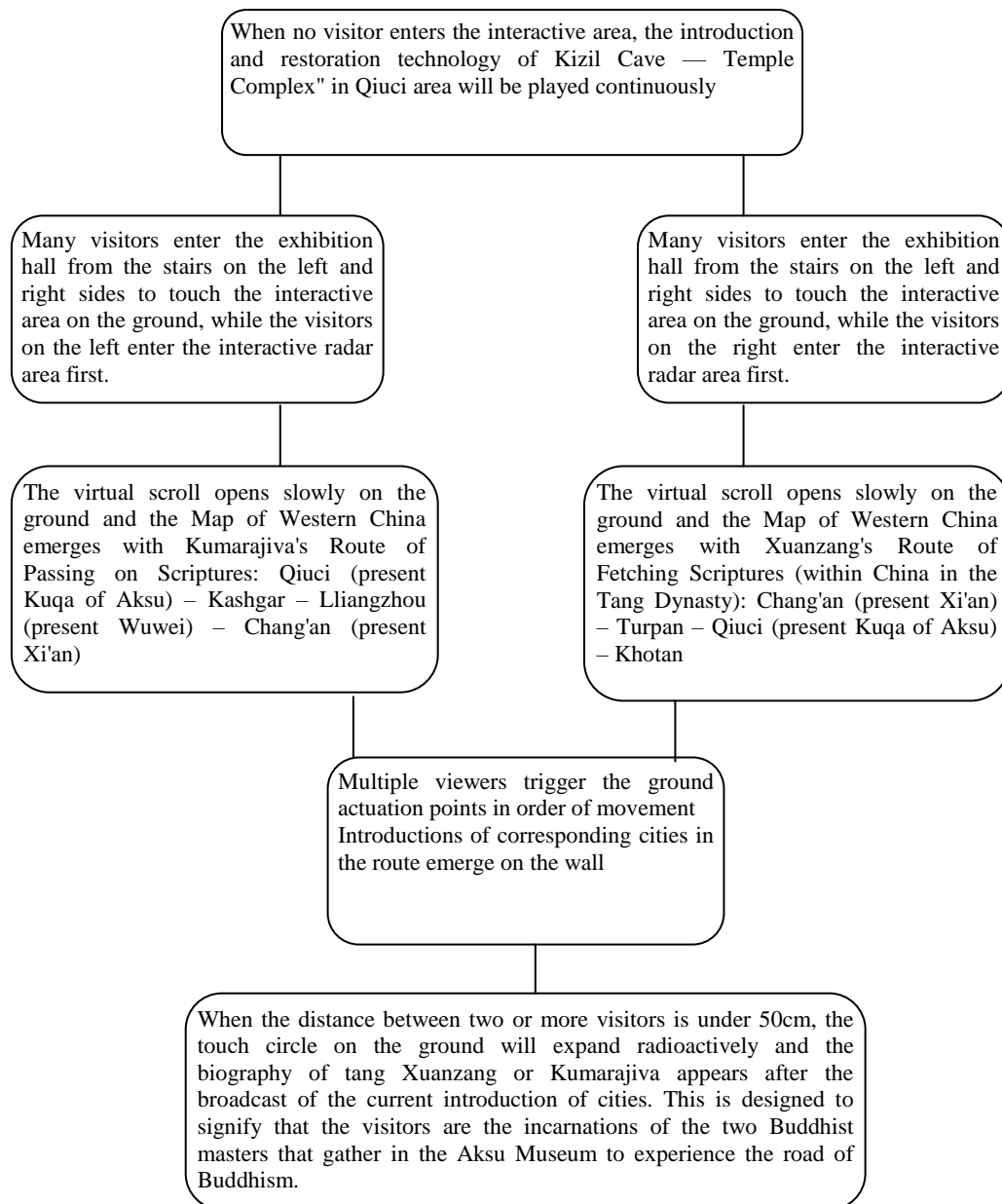Fig. 3. Logic diagram of interactive program (single visitor).

When no visitor enters the interactive area, the introduction and restoration technology of Kizil Cave — Temple Complex" in Qiuci area will be played continuously

Many visitors enter the exhibition hall from the stairs on the left and right sides to touch the interactive area on the ground, while the visitors on the left enter the interactive radar area first.

Many visitors enter the exhibition hall from the stairs on the left and right sides to touch the interactive area on the ground, while the visitors on the right enter the interactive radar area first.

The virtual scroll opens slowly on the ground and the Map of Western China emerges with Kumarajiva's Route of Passing on Scriptures: Qiuci (present Kuqa of Aksu) – Kashgar – Lliangzhou (present Wuwei) – Chang'an (present Xi'an)

The virtual scroll opens slowly on the ground and the Map of Western China emerges with Xuanzang's Route of Fetching Scriptures (within China in the Tang Dynasty): Chang'an (present Xi'an) – Turpan – Qiuci (present Kuqa of Aksu) – Khotan

Multiple viewers trigger the ground actuation points in order of movement Introductions of corresponding cities in the route emerge on the wall

When the distance between two or more visitors is under 50cm, the touch circle on the ground will expand radioactively and the biography of tang Xuanzang or Kumarajiva appears after the broadcast of the current introduction of cities. This is designed to signify that the visitors are the incarnations of the two Buddhist masters that gather in the Aksu Museum to experience the road of Buddhism.

Fig. 4. Logic diagram of interactive program (multiple visitors).

C. *Immersion of Space Environment*

Immersive interaction design is a kind of comprehensive media composed of interaction is computer simulation. Such media can sense the location and movement of participants and control the overall experience through the movements and positions of them so as to allow them to have a feeling that they are mentally immersed or appearing in a virtual world. Through this mental experience, participants can better experience the content and focus their thoughts so as to complete changing process of thinking behavior from "immersion – interaction – fantasy". For example, in the series of activities of the Leonardo Da Vinci Museum in Italy — a Tribute to Leonardo Da Vinci's Global Light Art Experience Exhibition, the 360 degree omni-directional multimedia video experience hall gives people a complete immersion experience. In this project, the design team also started from several aspects to create immersion. Firstly, in terms of space environment, the design team set the interactive space in the intermediate region between two full-scale restored caves and large projection areas on the wall and the ground. The projected area of the wall is 4.5m x 5m, and the projected area of the ground is 3.5m x 4m. The LED starry ceiling is installed on the spot and the use of accent light is forbidden there, which enable the visitors to enter a semi-closed space similar to a cinema and conduct the design of immersive experience from the space. (As can be seen in "Fig. 5") In addition, within the projection area, the opening of the ground route map inductor and the differentiation of the contents presented in each spot as the visitors go, are all controlled by the induction radar device of high sensitivity and computers backstage. This not only allows the audience

to see the high imitation grottos, but also enables some of the content without physical objects to be presented in digital forms, strengthening the dissemination of the content in the exhibition area.

Fig. 5.   The 360 degree omni-directional multimedia video experience hall.

D. Necessity of Multi-person Interaction Setting

For most of the museum's multimedia interactive projects, the number of simultaneous participants is small and mostly only a single person can participate in the interaction at one time. For the exhibition needs of museums, the increase of the number of people who can participate in the interaction at the same time in each batch is conducive to the dissemination of content and the necessity of achieving educational goals. Meanwhile, in the process of group participation, participants participate in the experience together and will have similar psychological activities. They become members of a group during a few minutes of the experience, and get psychological belonging, thus a pattern of interaction between participants can be formed. In this project, five people at most can participate in the interaction on ground at one time, which is seldom realized in the domestic multimedia interactive design. And interaction between people can also be made. Visitors can experience the theme of the two masters through multi-person interaction. To be specific, each experiencer stepping into the interactive ground area will have a rotating and changing pattern under their feet. As shown in "Fig. 2", when the distance between visitors is under 50cm, the pattern will be enlarged and encircle visitors around, and at the same time, the life stories of the two masters will emerge on the interactive wall. Such changes in content generated by the interaction between visitors enable the experiencer to quickly understand the need for communication between different

regions for the development of culture, art, religion and other fields, and promote the awareness of communication among visitors, especially teenagers.

IV.   CONCLUSION

In today's museum display design, multimedia interactive means of expression are increasingly used, and better dissemination of educational content in interactive design is based on the needs of new museum functions. Therefore, this paper summarizes some design methods and put forward their design concepts through case study and analysis, so as to provide reference for design practice and production practice.

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