Yongzheng Emperor's Interactive Tabletop: Seamless Multimedia System in a Museum Context

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ABSTRACT

In this paper, we propose the seamless multimedia system, *Yongzheng Emperor's interactive tabletop*, which has been incorporated into the special exhibition "Harmony and Integrity: The Yongzheng Emperor and His Times" at the National Palace Museum in Taiwan. The multimedia system features the innovative use of physical artifacts- Yongzheng figurines and a model of a Yongzheng-era calendar clock as tangible user interfaces, which have been used to activate on the Surface the emperor's life at court and chronological events of his times. Museum audiences can naturally and intuitively explore the Emperor's stories by the use of hand gestures. The system vividly connects the modern world of the audiences with the emperor's virtual world, engaging museum audiences in the most interactive and compelling way to learn about the emperor. The paper aims to present the development of the seamless tabletop system in a historical museum context, including design principles, implementation, applications, and effectiveness of the system. Our contribution in this project is to demonstrate a new exhibition display model for the museum sector.

Categories and Subject Descriptors

D.5.2 [**Information Interfaces and Presentation**]: User Interfaces – Input devices and strategies, User-centered design.

General Terms

Design, Human Factors

Keywords

Aesthetic interaction, metaphor, museum, tabletop, tangible user interface, seamless, semiotics

1. INTRODUCTION

Museums around the world have constantly shifted with the changes in society, and they need to be more aware of the power of learning, through engaging audiences with more sophisticated

approaches[5]. The National Palace Museum has actively developed non-conventional multimedia with the aim of engaging more diverse audiences, enhancing learning opportunities, and strengthening creative capacity and an aesthetic life experience for the public.

In this paper, we propose the seamless multimedia system- Yongzheng Emperor's Interactive Tabletop, which has been successfully incorporated into the special exhibition. The system was utilized to interpret the Yongzheng Emperor from three aspects: his places, his times and himself. To achieve these three objectives, the team has developed novel tangible user interfaces (TUIs) and aesthetic interactions integrated with the Microsoft Surface, an interactive tabletop. By manipulating the innovative TUIs on the Surface, visitors can naturally and intuitively manipulate digital images of exhibit artifacts, and seamlessly extend their senses to the Yongzheng' socio-cultural context. The application has made the boundary indistinct between the virtual world and the users' physical environment.

Figure1: The figurines of Yongzheng Emperor are applied as semiotic tangible user interfaces on the Microsoft Surface.

2. RELATED WORK

2.1 Tabletops in Museums

Interactive tabletops have been implemented in many museums and galleries around the world. According to Geller's survey, there are many examples which demonstrate that tabletop systems are successful applications in museum settings[3]. For example, the study undertaken in the Berlin Museum of Natural History found that visitors employed a wide variety of gestures for interacting; different interface elements invited different types of gestures[6]. Another study carried out in the National Palace Museum indicated that the tabletop system is a highly accessible multimedia system, which enables users to feel authentic interactions with real artifacts without a mouse or keyboard [7].

2.2 Tangible User Interface

Tangible User Interfaces (TUIs) are those in which physical objects are used to represent and control computational abstractions[1]. In recent years, a large amount of research has been devoted to the study of TUI. For example, Weiss *et al* propose SLAP (Silicone illuminated Active Peripherals) Widgets, offering tactile feedback to multi-touch tabletops, and combining the flexibility of virtual objects with physical affordances. According to their empirical studies, the SLAP Widgets are easy to use and significantly superior to virtual controls[11].

3. DESIGN PRINCIPLES

3.1 Direct Manipulation

In a museum context, visitors with diverse backgrounds in nationality, age or education might have different levels of computer literacy in manipulating multimedia systems. Some might be frustrated by the complex use of a menu, buttons, keyboard or mouse. To move beyond traditional computer interfaces, a multi-touch tabletop has been utilized to provide museum users with a more natural and intuitive means to explore artifacts by use of hand gestures. The multi-touch tabletop systems can quickly respond to touch and direct manipulation, using fingers or physical objects. Users will feel more free and confident when interacting with the system.

3.2 Semiotic TUI

Semiotics is the study of sign processes, signification and communication. In the real world, a sign is used to form link between intangible meanings and tangible artifacts. Peirce claims that the most fundamental signs may be categorized as iconic signs, indexical signs and symbolic signs [2]. Accordingly, the signs that are interpreted correctly by most people are iconic signs, because users tend to guess the meaning of a sign upon its visual elements, and further to link to an artifact or action[4]. In this respect, iconic signs are designed to represent the historical artifacts in this project. Based on different images of Yongzheng in the historical relics, the Yongzheng figurines were designed in various costumes to interpret his life at court (Fig. 2).

Figure 2: The figurine design was based on Yongzheng's portrait from the historical artifact.

3.3 Metaphorical TUI

In metaphor theory, whatever humans think or do, the actions which could be driven by the metaphor that we have in the present context would probably be associated with primitive

knowledge and experience[8]. Metaphors usually serve to facilitate the understanding of abstract concepts through more concrete objects. Lakoff and Johnson[9] cite that "MONEY IS A LIQUID" as an example of a conceptual metaphor: we understand the abstract concept of money in terms of our physical experiences with liquids. Hence, in this study, to interpret the Yongzheng Emperor's times, a model based on a rare Yongzheng-era calendar clock was made and served as a metaphor to express the abstract times of the emperor (Fig 3).

Figure 3: The model of a Yongzheng-era calendar clock serves as a metaphor for the times of the Emperor Yongzheng.

3.4 Aesthetic Interaction

Dewey insists that art and the aesthetic cannot be understood without full appreciation of their socio-historical dimensions. Further, according to the concept of aesthetic interaction, the system must to deal with the complex dialogue between mind and body in a sense-making process; interaction is based on not just immediate sensation, but it builds on earlier experiences and their social-cultural context [10].

In this regard, we designed two aesthetic interfaces based on the Yongzheng's socio-cultural elements, and super-realistic responses from modern times. One of the Surface backgrounds is designed with Yongzheng Emperor's favorite exotic-pattern extracted from the black enamelware. As a Yongzheng figurine is placed on the Surface, a golden circle with a dragon pattern emerges, with the title of the location written inside. The dragon, representing the Chinese emperor, the son of Heaven, has been widely recognized in world history. One the contrary, the figurine of the high official has only a fluorescent ring underneath. The other Surface background is designed with flowing streams, symbolizing the flow of time in Yongzheng's era. When the model of the calendar clock is placed on the Surface, a fluorescent ring will emerge peripherally. The clock is divided into fourteen sections. As the user turns to each section, the purple tag is magnified to show the Yongzheng year and the corresponding Christian era (Fig 4).

Figure 4: The aesthetic interfaces consist of Yongzheng's socio-cultural elements and super-realistic responses from modern times, triggering users' imagination through interactions.

4. IMPLEMENTATION

The implementation will be illustrated in five steps. The first important point is to indentify three interpretation objectives related to Yongzheng. The following processes of implementation were undertaken in alignment with the core objectives shown in figure 5. In particular, domino tags were constructed for each TUI and attached underneath them (Fig 6). Once the system has indentified the tags, it then responds to its programmed actions.
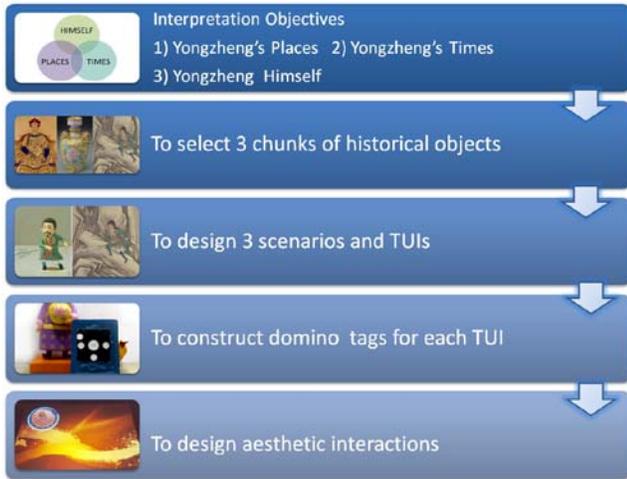

Figure 5: The implementation of the exhibition display model.

Figure 6: The domino tags are attached underneath the TUIs.

5. APPLICATIONS

According to the studies of historians, the Emperor Yongzheng is the most controversial and legendary emperor in the Qing dynasty of China. Three scenarios have been developed to interpret the Yongzheng Emperor from different aspects: his places, his times, and his relations with high officials.

5.1 Yongzheng's Life at Court

In terms of his places, we selected the most representative places to interpret his life at court: the Yangxin Palace, Yuanming Garden, Imperial Workshops, and the Grand Council. Each of the Yongzheng figurines is used to activate historical artifacts digitally on the Surface. Between five and twelve historical objects are associated with each figurine, since the reduced information can more easily formulate information chunks, and enhance visitors' motivation in learning. For example, the Yongzheng figurine holding an imperial vase will activate imperial artifacts produced by the Imperial Workshop, fully reflecting the emperor's sophisticated taste in art (Fig. 7). The Yongzheng figurines of various roles represent a series of visual semiotics which are vividly connected with historical objects, and trigger the imagination of the audiences towards the emperor's life.

Figure 7: The Yongzheng figurine holding an imperial vase will activate digital images of imperial objects produced by the Imperial Workshop.

5.2 Yongzheng's Chronology

The gilt copper calendar clock exhibited, which is recognized as a very rare artifact produced in the Yongzheng-era, ran the Chinese lunar calendar and had an Eight Trigrams carved on its surface. Yongzheng's times were divided into fourteen time zones around the clock. The first time zone represents the period from his birth year to the year before he succeeded to the throne. Next, the thirteen time zones stand for each year of his ruling period. Yongzheng's important life events and the art of his reign are arranged chronologically in these fourteen time zones. As the calendar clock is turned to the Yongzheng second year, for example, the white eagle painted at the time by the court painter, Italian artist Giuseppe Castiglione emerges on the Surface (Fig.8). The life of the Yongzheng Emperor and the art of his reign appear one after the other on the Surface, providing a marvelous and natural flashback for audiences.

Figure 8: As the user turns the model of clock, the historical artifacts will chronologically emerge on the Surface.

5.3 Yongzheng and His Officials

In the scenario, the Yongzheng figurine in court dress is designed to interact with the figurine of his high official through the processes of delivery of memories. As the palace memorials were personally written by the Yongzheng Emperor and his officials, they can reflect the emperor's forthright nature and his relationship with officials. First, if only the high official is placed on the Surface, six selected memorials will be displayed around his fluorescent ring. The user can drag and open the memorial to read by hand gestures (Fig. 9.1). Next, while the Yongzheng figurine is also placed on the Surface, a small horse will come out to present the system of the palace memorial, including submitting, reviewing, and returning (Fig.9.2-9.4).

Figure 9: The figurine of the high official is interacting with the Yongzheng figurine through the process of delivery of memorial.

6. DISCUSSION AND CONCLUSION

In observation, the multimedia system evidently creates seamless experiences by extending the users' sense beyond the tabletop. The main effectiveness of the system is described below in alignment with the design principles:

1) Aesthetic Experience: the semiotic and metaphorical TUIs triggering the emperor's historical artifacts on the tabletop have seamlessly taken audiences back to the Yongzheng's historical context from the real world. After reading through the personal writings of the memorials, one visitor felt that Yongzheng was a very diligent emperor.

2) Learning Potential: the direct manipulation and multi-sensory feedback have encouraged both children and adults to learn more about the emperor. The sensory information from the kinesthetic receptors kept the majority of children constantly asking questions about the Yongzehng Emperor.

3) Social Interactions: the system has not only facilitated two-way communication between Yongzheng and audiences but provoked conversation among audiences. One visitor from Austria was surprised at the Yongzheng's western costume, and tried to share her thinking with Chinese visitors.

It follows from what has been mentioned above, that the Yongzheng Emperor's interactive tabletop demonstrates a new exhibition display model in the museum setting. It is our hope that the model is applicable and may be tailored to different styles of exhibitions around the world.

8. REFERENCES

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