Design Research on Cultural Exhibition Platforms for the Visually Impaired Based on Accessibility Concepts in Interactive Installations Art

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Abstract: In recent years, with the continuous development of the socio-economic landscape and the increasing awareness of the general public, more and more people have begun to pay attention to the visually impaired community as a special group. However, at the current stage, individuals with visual impairments still encounter multiple barriers when participating in social public activities or visiting museums and exhibition halls. This article aims to integrate the concept of accessible design with emerging interactive technologies. By designing comprehensive pathways and incorporating sensory elements such as auditory, tactile, and temperature sensations, we employ a synesthetic approach to provide the visually impaired community with a holistic understanding of the exhibited items. The integration of interactive art installations with the concept of accessibility is put into practical design, allowing individuals with visual impairments to have opportunities to experience cultural life.

Keywords: Accessible Design, Visually Impaired Community, Cultural Life, Interactive Art Installations

1 Introduction

This paper discusses the importance of public awareness for accessible design and the visually impaired community. The visually impaired, as a vulnerable group, often face difficulties in enjoying cultural life on par with the sighted population due to the lack of public awareness and accessible facilities in society. The United Nations Convention on the Rights of Persons with Disabilities emphasizes the necessity of accessible facilities to provide equal access to culture and leisure experiences for the visually impaired. Promoting accessible design is crucial for creating a more equal and inclusive society.Interactive installation art, as an emerging art form, utilizes technological advancements to create immersive interactive experiences. It can provide the visually impaired with more cultural information and opportunities for participation, especially for younger visually impaired individuals who aspire to communicate with others and experience the dynamic world around them.Using "Touch & Listen the Oracle" as an example, this innovative design combines tactile and auditory elements to offer a multi-sensory interactive experience for the visually impaired, enabling them to better understand Chinese culture. This demonstrates the significance of accessible design and opens doors to culture for the visually impaired community.

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2 Public awareness and the current situation of the visually impaired community

Self-awareness of the public is the fundamental prerequisite for any activities conducted by public relations entities, to a certain extent, it signifies the high level of modern civilization of a nation. However, the visually impaired community, as a vulnerable group in modern society, cannot enjoy the same cultural life as normal individuals, which stems from the lack of public awareness and accessible design in society.On December 13, 2006, the United Nations adopted the "Convention on the Rights of Persons with Disabilities," which is the first comprehensive human rights convention of the 21st century. In Article 9 "Accessibility" and Article 30 "Participation in cultural, recreational, and leisure activities" of the Convention, it is emphasized that facilities and services must be provided to ensure equal access for persons with disabilities to cultural performance venues such as theaters, cinemas; cultural service places such as museums, libraries; and recreational and leisure venues [1]. Persons with visual impairments and other disabled individuals should receive the attention and importance of the entire society, and the construction and improvement of infrastructure, especially accessible facilities, are a prerequisite for this.

In recent years, the world has been actively promoting the construction of accessible facilities. Accessible design not only improves the lives of people with special needs but also helps create a more equal and inclusive society where everyone can fully realize their potential and participate in social life. Therefore, the promotion of accessible design in society is urgent. The basic scientific and cultural literacy required by modern citizens has also emphasized the cultivation of citizens' social responsibility and the promotion of public awareness and respect for visually impaired individuals. The comprehensive development of accessible facilities, allowing visually impaired individuals to live in a society where they are cared for, and providing them with opportunities to participate in social and cultural activities, is a key focus. How to better cultivate the social awareness of the public and enhance the construction of accessible facilities is of great significance.

3 The incorporation of accessibility concepts in interactive devices

"Interactive Installation Art" is a new creation that has emerged in recent years with the continuous advancement of technology. It is closely related to and interdependent with new media art and interactive art. Interactive installation art is based on the framework of new media art installations, mediated through interactive art, and presented through the language of new media art. It is not a separate category of art but rather a collection that encompasses installation art, new media art, and interactive art, all falling within the scope of installation art [2]. Through various technological means, interactive installations establish connections between objects and objects, people and people, and people and objects, facilitating deeper levels of interaction and intellectual exchange, allowing users to experience a sense of presence.

The concept of accessible design originated in the early 20th century and was first proposed by the United Nations in 1974. It advocates for the creation of cities where all individuals, including the able-bodied, the elderly, and those with disabilities, can live and move freely

without barriers[3].The concept of universal design is based on equality and aims to maximize the usability of products by eliminating barriers that may cause confusion or difficulties for users in any design activity related to people and objects[4].In terms of promoting the concept of accessibility, interactive installation art has also made significant progress and achievements. Photographer Yann Arthus-Bertrand exhibited his famous work "Earth from the Air" at the Natural History Museum in London in 2003, showcasing the wonders of nature and the modernization of cities(As shown in Figure 1a) [5].Specifically for blind visitors, the photographer selected 30 representative images, providing braille descriptions next to each image and creating tactile versions of the aerial photographs. This tactile feedback allowed visually impaired individuals to understand the shapes, textures, and basic information of the objects. However, tactile images with too many details can become overly complex and challenging for users to comprehend.

"i-Map" [TATE, 2002] was a new online art resource on the internet "to help visually impaired people explore key concepts in modern art". It complemented the "Matisse Picasso" exhibition at Tate Modern in 2002 by focusing on three pairs of works by the artists that "explore their innovations, influences and personal motivations" but it will be permanently available after the "Matisse Picasso" exhibition finishes[6] . It can be used in conjunction with raised-text documents, with page numbers in braille, and raised portions on the image section for tactile explorationc. Additionally, the online resource provides audio interaction, combining both sound and tactile feedback to enhance visually impaired individuals' understanding of the artworks, employing a synesthetic approach.

These examples demonstrate how interactive installation art can play a crucial role in promoting accessibility and making art and culture more inclusive for everyone, including those with visual impairments.

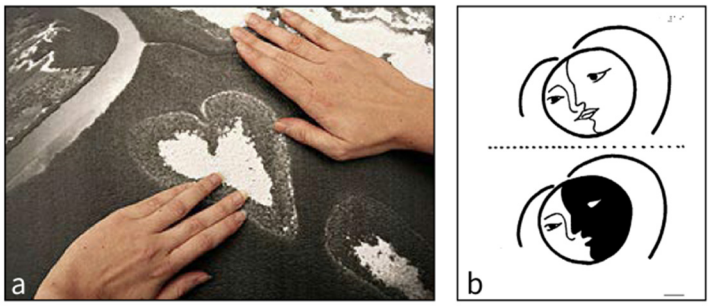

Figure 1 "Earth from the Air" and "I-Map"

Compared to traditional Braille books, the organic integration of interactive art installations with knowledge can provide a more convenient learning environment for the visually impaired, allowing them to easily access various forms of information. However, the existing guidance systems for the visually impaired in museums are far from perfect, with few offline cultural activities available for them. Additionally, the materials provided for the visually impaired are mostly Braille versions of textual descriptions, which may not satisfy their need for in-depth understanding. Therefore, the author hopes to improve the interactive methods, exhibition design, visit sequences, and experience modes by harnessing the advantages of existing

interactive installations in the context of accessible design. The goal is to design an interactive installation, centered around the concept of accessible design, that facilitates the participation of the visually impaired in social and cultural activities.

4 Touch & Listen the Oracle design application practice

4.1 Design description

The cultural level of the blind community is generally lower, but their demand for literary information is very strong, especially among young visually impaired individuals. They aspire to enjoy digital and online knowledge and information services just like sighted people. They yearn for more interaction with others and hope to have a more intuitive experience of this ever-changing world[7]. *Touch & Listen the Oracle* is an interactive cultural installation designed with the theme of "Touching the civilization of oracle and experience the cultural heritage of chinese characters" specifically for the visually impaired community. This artwork utilizes CNC carving technology to create a physical exhibition stand with hollowed-out interior space for electronic circuits. Oracle bone fragments and hexahedra are designed using Arduino programming techniques(As shown in Figure 2a) and modeling software such as ZBrush and SolidWorks. SLA light-curing and 3D printing technology(As shown in Figure 2b) , followed by paint finishing(As shown in Figure 2c). Visually impaired individuals often possess heightened sensory abilities beyond the average person, including enhanced hearing, tactile perception, smell, and taste. Consequently, they have the capacity to integrate various external information through sensory channels such as auditory, tactile, olfactory, and gustatory senses, combining it with their existing memory and experiences to reorganize and integrate information in their minds. This process results in their unique cognition of the objective world. Building upon this concept, this project combines tactile and auditory elements to provide a multi-sensory interactive experience for visually impaired individuals, offering them opportunities to participate in social activities and gain insights into Chinese culture.

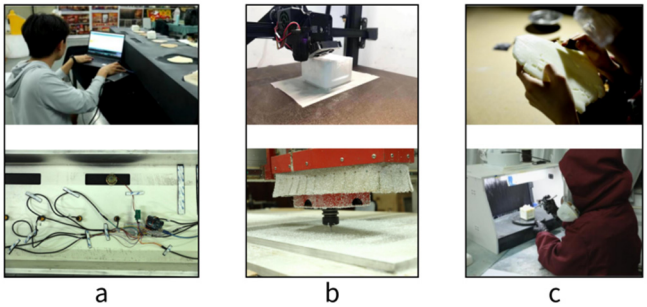

Figure 2 Production process

In the design process, we primarily considered the characteristics of the visually impaired community. Therefore, the overall design adopts a multimedia information accessibility exhibition installation that focuses on touch and sound. In the layered information design of '*Touch & Listen the Oracle*' we follow an experiential sequence from the whole to the details. I

used digital technology to perform a 1:1 realistic printing of the inscriptions on the oracle bones, which are attributed to Tu Fang Zhengtu, known as the 'King of Oracle Bones.' Among these inscriptions, I carefully selected six characters that are representative and easy to understand. These characters are '告' (gao), '贞' (zhen), '日' (ri), '示' (shi), '饮' (yin), and '角' (jiao) (As shown in Figure 3).

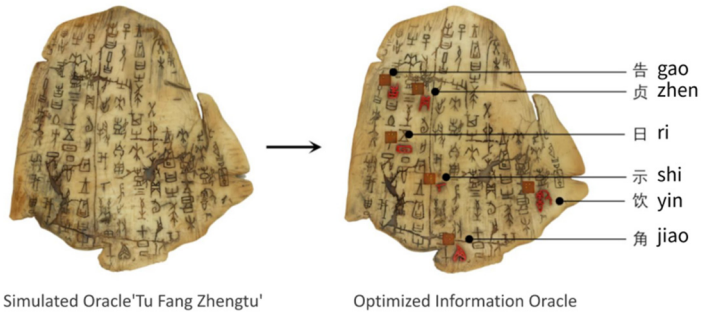

Figure 3 Simulated Oracle

Among these six characters, '贞' (interpreted as 'ding,' a type of ancient bronze vessel) is designed to have tactile bronze patterns, making it heavier compared to other bone pieces. '示' has a simulated stone table texture in terms of material. '角' provides a tactile sensation of goat horn patterns. When touching '日,' the bone piece slightly warms up. '告' comes with the sound of a cow eating when picked up. '饮' is accompanied by the sound of a person drinking water when lifted (As shown in Figure 4).

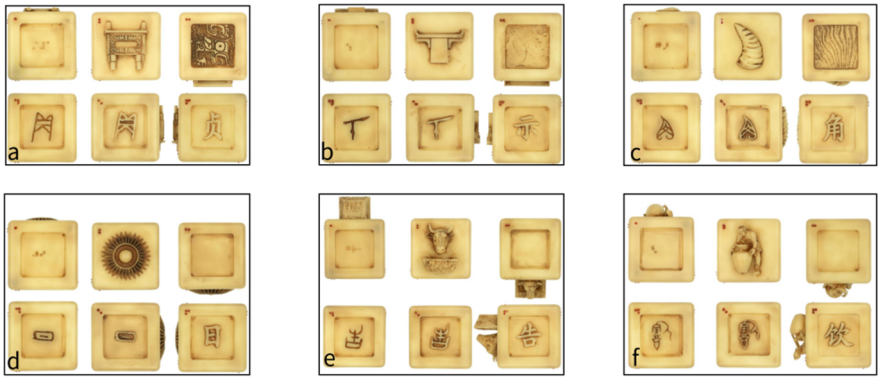

Figure 4 Oracle Cube

In order to facilitate the accessibility for the visually impaired, the product's form avoids excessive sharp edges, presenting a simple, orderly, and gentle overall appearance that aligns with the preferences of the visually impaired community[8]. It incorporates trapezoidal grooves, curved surfaces, as well as Braille tags and directional symbols. The directional symbols are designed to match the dimensions of a human index finger, ensuring ease of touch.The second type of directional symbols features a higher left side and a lower right side, effectively enhancing reading speed for the visually impaired[9]. In addition, the display

platform is equipped with tactile pathways, allowing the visually impaired to independently navigate the exhibition without assistance.Tactile pathways [10] provide distinctive surface patterns detectable by white cane or underfoot, in order to alert Visually Impaired about approaching streets' elements and hazardous areas (As shown in Figure 5).

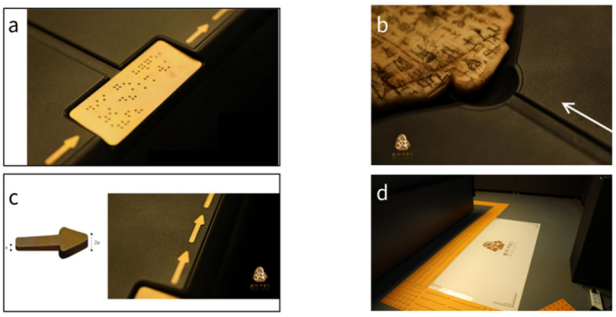

Figure 5 a,Braille symbols. b&c,directional symbols. d,Tactile paving.

4.2 Overall process

For the visually impaired individuals learning Braille, they go through linear training. Therefore, the experiential items are arranged in a straight line, and the installation platform has an overall elongated shape, making it more convenient for visually impaired individuals to experience (As shown in Figure 6). The experiencer first touches the first Braille symbol, which has an arrow-shaped indicator symbolizing 'the first step is located above the current position.' Then, following the semantics along the guided path, they pick up the simulated oracle bones from the grooves. This process continues sequentially.

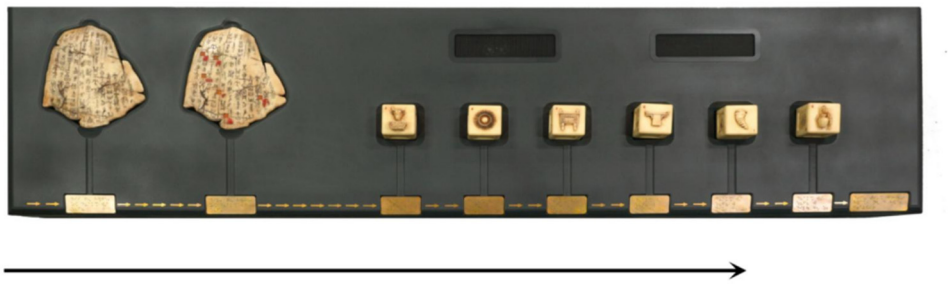

Figure 6 Overall traffic flow

In accordance with the principles of accessible teaching design, to enable blind individuals to touch the recessed oracle bone script, the design process incorporated optimized oracle bone pieces between the individual characters. This involved raising and emboldening the selected oracle bone script, with each raised character accompanied by a Braille numeral for easy correspondence with the subsequent individual character experience (As shown in Figure 7).

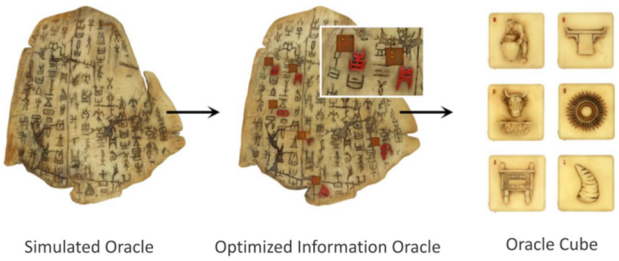

Figure 7 Overall experience sequence

This project is presented through a cube. Taking the character '贞,' which means 'tripod,' as an example, visually impaired individuals will sequentially touch the Braille surface, relief pattern surface, texture sound of the tripod, concave surface of oracle bone script, convex surface of oracle bone script, and finally, the corresponding simplified Chinese character on the cube when holding it in their palm, as shown in Figure 8. Each face has Braille in the upper left corner indicating the order of rotation, accompanied by audio guidance to facilitate an organized experience for visually impaired individuals.

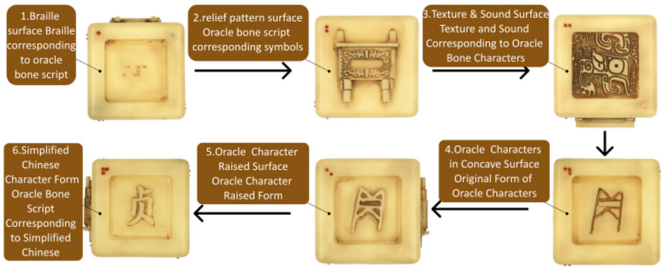

Figure 8 Cube utilization order

5 Summary

This article explores the combination of interactive art and the concept of accessibility design through the project "*Touch & Listen the Oracle*." By utilizing technologies such as Arduino, CNC machining, and 3D printing, this design practice contributes positively to the promotion of inclusive design in society. The concept of accessibility design should be emphasized and widely applied to various product designs, ensuring that visually impaired individuals also have the right to enjoy social welfare and participate in cultural activities.This design practice breaks away from the limitations and drawbacks of traditional exhibition platforms by employing a multisensory approach, allowing visually impaired individuals to understand exhibits fully through auditory and tactile senses, thereby enhancing their comprehension of the content's underlying meaning. The flourishing development of interactive art is made possible by advancements in modern technology, enabling artifacts to come to life and reach a broader and more diverse audience. Interaction is no longer limited to simple communication with users but has evolved into a multidimensional, multisensory form of interaction, reducing misunderstandings and discrepancies in the communication process.Technology forms the

foundation of interactive art, and, conversely, interactive art also serves as an external manifestation of technology. The pursuit of deeper interaction has also driven technological advancements to a certain extent.

This article provides a new design process and approach for creating accessible exhibition platforms for visually impaired individuals. Further exploration and research are needed to expand the scope of application of this method, explore different exhibition platform designs to offer diverse cultural experiences to the visually impaired community, and delve deeper into exhibition platform design to introduce new interaction methods and sensory experiences for a more comprehensive understanding.

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