

Adaptation of Barrier-Free Design Approach to Abilities of the Blind and Visually Impaired People With a Tactile Art Space

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Abstract

China has the most significant number of visually impaired people globally, and the disease is increasing every year. With China's urbanization and steady economic development, people with visual disabilities' basic living needs can be solved through government security policies. However, only a few long-term museums, art galleries, and public art space resources can provide them with art appreciation. Challenging to touch the art and challenging to access exhibition halls always restrict the equal rights of disabled people to pursue art sharing. This paper aims to study how the adaptability of barrier-free design methods can meet the needs of blind and visually impaired people to participate in art exhibitions. Finally, implement the design scheme, combined with the experience of modern design multi-sensory art exhibition, and explore a movable presentation form of blind art space exhibition. A movable art exhibition, which goes deep into urban communities, rural suburbs, or places with inconvenient transportation. The exhibition space and exhibits are mainly tactile, supplemented by hearing and vision. It aims to provide more possibilities for visually impaired people to participate in art exhibitions and provide new ideas for barrier-free design for museums, art galleries, and public art spaces in China. Provide more opportunities for the visually impaired to participate in social and public activities, promote exchanges and interactions between healthy people, and promote diversified and inclusive social and cultural development.

Keywords: Barrier-Free Design, Blind and Visually Impaired, Art Space, Multi-Sensory Experience

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1 Introduction

The rapid development of the global economy and urban modernization has become influential in improving everyone's living environment and meeting people's expectations and vision for a better life. China also pays more and more attention to the demands of particular groups. From the perspective of the blind, it is essential and timely to design a more inclusive and friendly art space that can meet the needs of the blind and serve the public. Focusing on the needs of the visually impaired, this paper uses the concept of barrier-free design to a new model of art space exhibition that both the blind and the sighted can visit and experience (Holmes-Seidle, J. 2012). Finally, it implements a design scheme that combines modern design with a multi-sensory art exhibition experience to explore a moveable form of art space exhibition presentation for the blind. A kind of art exhibition that can be moved around, reaching out to urban communities, rural suburbs, or places with limited transportation, reaching out to the range of areas where visually impaired people are concentrated, set up in unique education school activity rooms, clubs for the blind, and public welfare activity parks. The art space also needs to accommodate traveling exhibitions in different cities so that the art exhibition can reach more people. The exhibition space and exhibits are primarily tactile, with aural and visual aids. The information is conveyed through a multi-sensory art experience approach to facilitate the blind to visit the art space and interact with the exhibition content to move around the space freely. The aim is to provide more possibilities for people with visual disabilities to participate in art exhibitions and provide new ideas for accessible design for museums, art galleries, and public art spaces in China. To provide more opportunities for people with visual disabilities to participate in social and public activities, promote communication and interaction between them and non-disabled people, and promote the development of a diverse and inclusive society and culture.

1.1 Accessible design approach adapts to blind and visually impaired people

The influx of accessibility design and humanized design concepts and design ideas from the United States in the early 20th century profoundly influenced the renewal of modern urban planning and museum exhibition space design in China. By learning from American accessibility legislation and design codes for accessibility, such as The Civil Rights Act passed in 1964 in the United States, clearly states that public places must be unified according to standards (Brown, P. 2014). Architectural Barriers Act (ABA) require the use of facilities designed, constructed, altered, or leased to be accessible to persons with disabilities (Rhoads, M. A. 2010). Americans with Disabilities Act (ADA) prohibits discrimination on the basis of disability in employment, State and local government, public accommodations, commercial facilities, transportation, and telecommunications (Walk, E. 1993). China introduced the concept of barrier-free design in 1985 and explored the construction program of a barrier-free facility system, the construction of a barrier-free physical environment, and multi-level legislative protection. In 1989, the trial version of *The Design Code for Accessible Urban Roads and Buildings* was published, the earliest theory of barrier-free city construction in China (Zhang, X., & Jia, W. 2022). The museums and galleries' cultural-educational system in China was established later. The system is not robust, mainly open to the public, the space accessibility of the museums is seriously lacking, and the popularity is low, ignoring the needs of particular groups for art. Therefore, starting from the initial spatial accessibility, we first meet the problem of accessibility of museums and galleries for blind and visually impaired people, gradually realize spatial universality, and eventually expand to the inclusion of people in the whole society.

1.2 The spatial cognitive style for the blind

Tactile is the most common cognitive modality used by blind and visually impaired to familiarize themselves with objects, understand information, and perceive their surroundings (Collins, J. J., Imhoff, T. T., & Grigg, P. 1996). Due to the absence of visual perception, the main channel for acquiring information is lost. At the same time, tactile and auditory senses become the primary sensory organs for acquiring information, reading Braille requires touching and recognizing words with fingertips, walking requires feeling the texture of the blind path with the feet, and holding a guide stick to detect whether there is an obstacle ahead. The tactile muscle memory is the primary sensory organ for reading Braille and recognizing words, walking with the feet, and holding a cane to see an obstacle ahead. Through touch, blind people can recognize the form and material of objects and obtain richer information in terms of texture (Lu, L. 2021). However, there is some difficulty in recognizing the complete form of an object. In addition to perceiving objects and space through touch, blind people can also judge the size of space and the direction and speed of object movement through hearing. Hearing is an essential perceptual channel for blind people to absorb and learn information from the outside world. After processing auditory information to judge the surrounding environment and assist in complementing their other senses, the characteristics of sound, such as timbre, volume, and pitch, will also enhance the impressions of blind people.

2 Overview of Art Space for The Blind

2.1 Typical cases of art spaces for the blind

Art spaces for the blind can be divided into two types according to the opening hours of exhibitions. One type is the long-term art museums for the blind, galleries for the blind, and interactive workshops for the blind. The other is the short-term art training workshops for the blind, art exhibitions for the blind with a flash mob, and interactive street exhibitions. Based on an analysis of existing art spaces for the blind around the world, it was found that most of the exhibition spaces for the blind are held in "metropolitan" cities, but the number of people reached by the exhibitions is relatively small, and a small percentage of blind people can only experience the carefully prepared exhibitions. Here is an analysis of the long-established Madrid Museum for the Blind that summarizes the characteristics of foreign art spaces for the blind. The Spanish National Organization for the Blind (ONCE) founded the Madrid Museum for the Blind to provide accessibility for blind people to experience art exhibitions in the museum and reduce visual barriers in the space (Garvía, R. 2016). The museum holds exhibitions throughout the year, featuring models of architectural monuments, works by blind artists and artists with severe visual impairments. The museum organizes touch experiences from time to time, allowing the blind to experience life as a blind person and to touch architectural models.

2.2 Analysis and Interpretation of Art Spaces for the Blind

Through researching long-term art museums for the blind, galleries, art exhibition spaces and public art spaces abroad, in summary, the following six points are common to the above museums:

The overall design of the exhibition space uses the concept of barrier-free design to plan the exhibition route. The exhibition route is divided according to the exhibition's content, while

the interactive touch areas are divided according to the types of objects on display, and the concept of barrier-free design goes into every detail of the exhibition hall.

Art reproductions and art aids that blind people can touch are set up in the exhibition space. The replicas can be reproduced to the original scale to help blind people understand and learn more about their own culture and history.

The exhibition is equipped with a touch and sensor-based audio interpretation system throughout. When visitors enter a specific area, the current exhibition content is played. Touch voice announcement buttons will introduce the exhibit items with information about the object's material use, shape and colour, usage and descriptive information.

Museum staff must undergo special people services training, disability awareness training and visual awareness training. To remove attitudinal barriers to museum access for the visually impaired to provide better services and exhibitions for them.

The use of modern technology is combined with museum gallery exhibitions. For example, the Prado Museum uses 3D printing technology to convert drawings from flat shapes into touchable 3D images similar in colour to the originals and contain rich detail in their shapes (Anagnostakis, G. 2016). 2018 saw The Prado Museum host the Touching Masterpieces Exhibition, using VR simulation technology to provide art for the blind (Todorova-Ekmekci, M. 2021). NeuroDigital (Spain), used digital reconstructions of three world-famous sculptural works of art, David, Aphrodite of Milos and The Bust of Navratri, using specially adapted tactile gloves to create a unique artistic experience (McCutcheon, J. 2020).

In 2014 the Metropolitan Museum of Art in New York partnered with multimedia designer Ezgi Ucar to create The Multisensory Met Museum project, which adds sound and taste to the reproductions of iconic sculptures in the collection. Taste, allowing visitors to appreciate the museum's objects through the senses of touch, sound and smell (Ucar, E. 2015), using floral, brine and spicy cocoa scents to make everything in the painting smell like they do in real life. Everything in the painting smells like they do in real life.

3 Principles of art space design adapted to blind and visually impaired people

Summarizing specific cases of art spaces for the blind, the design principles for art spaces for the blind are proposed and applied to form a movable, tactile art exhibition space. The space is based on barrier-free design and multi-sensory concepts and art space design methods for the blind-accessible in terms of information and space. Making the art space approachable, accessible, barrier-free, and touchable for the blind and visually impaired. There are five points as follows:

As the spatial sense of blind and visually impaired is lacking, the exhibition route planning and blind paving in the art space must be based on barrier-free design to achieve "three-dimensional" exhibition guidance, from navigating the blind path, wall navigation symbols, audio explanation, touch Braille introduction, touchable exhibits, forming a three-dimensional immersive space around the visitors.

The material, weight, temperature and shape, specification and texture of the objects touched, together with the voice-assisted explanation and environmental ambience, can assist the blind

person to the maximum extent in gathering information and gaining an in-depth understanding of the art exhibits.

Choose exhibits at the forefront of art and safety. The blind and visually impaired lack the visual senses to judge the type of object, weight and distance. When selecting and designing exhibits, protecting the rights of special people to have unique cognitive modalities and reducing the harm of touching objects are also essential design principles. The use of safe and non-invasive soft materials as far as possible, the reduction of objects requiring complex cognitive judgement, and the translation of the frontiers of technology into designs that apply to the basic cognition of blind people allow them to experience the progressive development of the times together with them.

Assisted arts education. People with visual impairment need the arts and spiritual comfort. Vitrally, social acceptance. We will enrich art education for the blind and visually impaired, improve their cultural and artistic literacy, promote and popularize the basic knowledge of helping special groups, and create community and social friendship and mutual assistance.

4 Design Practice for Art Spaces for The Blind

4.1 Integrated Design

Based on the above analysis of art spaces for the blind, it was found that most of the exhibition spaces for the blind are held in 'metropolitan' cities, but the exhibitions reach a small number of people and are only experienced by a small percentage of blind people. The team is thinking of designing a mobile art space that can be set up in areas where blind people are concentrated. The design also needed to accommodate travelling exhibitions in different cities so that the blind art exhibition could reach a wider audience.

The design was inspired by the Bauhaus 100th anniversary exhibition bus. The concept of the exhibition bus coincides with the need for a portable art space for the blind. The 20-foot container is the smallest size, 5.69m x 2.13m x 2.18m, with a volume of 24-26 cubic meters, and it is very convenient to use the supporting truck for transportation, which is a mature transportation method (Figure 1). The focus is on the design of the exterior and interior space of the transport truck, space guided, selection of exhibit and presentation experience. The design of the exterior requires distinctive features that reflect crucial elements. The logo for the art space needs to be distinctive and eye-catching, attracting the attention of the surrounding population during transport and when staying at the exhibition, serving to attract visitors, increase the level of publicity and dissemination, and improve impact. On the other hand, the logo on the front needs to have a specific guiding effect and provide directional information.

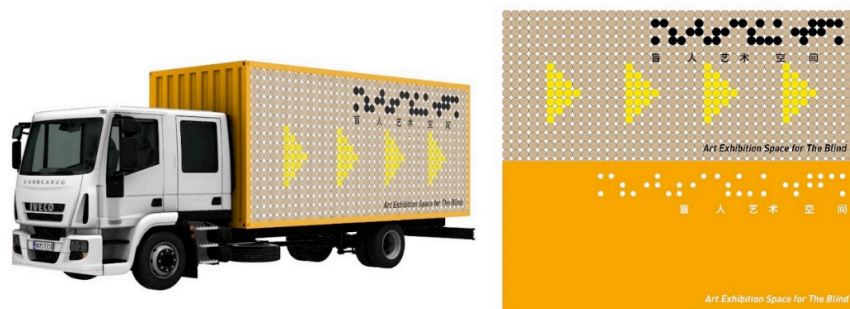


Figure 1: 20ft container trucking display, Logo design

The space and exhibits are touchable, supported by the sense of hearing and vision. Multi-sensory information facilitates access to art spaces for blind and visually impaired, enabling them to move around the space and visit the exhibits with ease. The traditional visual-based exhibition of space design is transformed into a tactile-based that focuses on the body's materiality and the transmission of non-visual information. The exhibition is divided into four zones, Area A small tactile artwork, Area B Three-dimensional modern art, Area C Multi-Sensory Audio-Visual Artwork, Area D Tactile Educational Tools (Figure 2).



Figure 2: Plan of the exhibition zones and guided tour routes

4.2 Design details

Area A the tactile cognitive product *Textscapes*, selecting six in A4 size (Figure 3). This product is the main exhibit of the art space and was designed by the author's team. The Text Landscapes generate letter-sized 3D texts that visually depict the text's subject matter, such as cities, landscapes, or people. These 3D tactile artworks make the content more tangible, allowing blind people to understand the shape of the described object by touch while reading the Braille. The artworks contain textual variants of Braille, verbal texts, calligraphy and digital systems to connect texts and their visuals in architecture, landscapes, portraits and abstract things. The exhibits in Area A are placed on a cork-textured backboard consisting, this area is clearly identifiable and easy to remember. The exhibit is placed at the height of 1.2 metres and is colored to contrast with the backboard, making it easy for low vision experiencers to find their target. The back panel has horizontal stripes in the middle to guide visitors to follow the direction of the stripes and touch them. Blind tiles are laid at the foot near the exhibition area to provide additional tactile guidance for visitors.

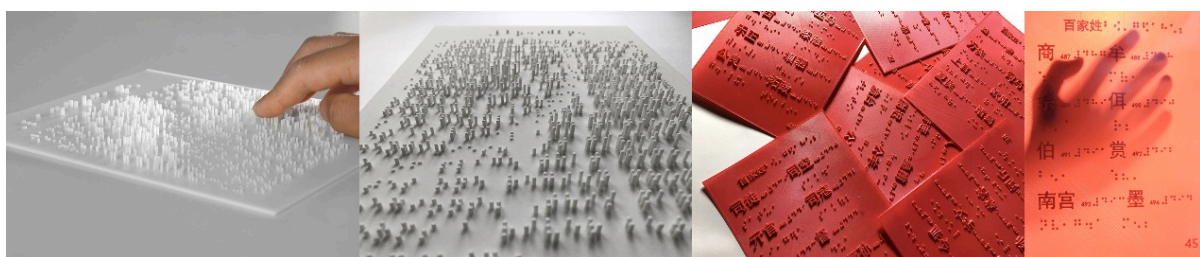


Figure 3: *Textscapes*, Braille touch interface

In Area B is Andrew Myers's *Martini Night*, a frameless wood panel with screws, paint, wooden hangers and an acrylic polyurethane enamel background, is selected (Figure 4). This work has toured the world many times as a popular exhibit of tactile art abroad, with its solid tactile contrast stimulating the visitor's senses and provoking a sensory stimulation experience. Diagram showing the dimensions of the exhibit layout in Areas B and C. Areas C and D are tactile-auditory co-construction areas, which are multi-sensory immersive experience areas equipped with video monitors and audio explanations to meet visitors' barrier-free experience. A polyphonic voice will be played when visitors walk to the formulated guidance area. The entire exhibition area is equipped with a blind guide on the

floor and three-dimensional touch symbols on the wall to provide visitors with a comprehensive, immersive experience. The floor and walls of different areas are made of different materials to texturally divide the exhibition area and prompt visitors to enter other areas. The primary colours of the exhibition are chosen to be contrasting in brightness and purity, providing a certain degree of guidance for blind people with a sense of light.

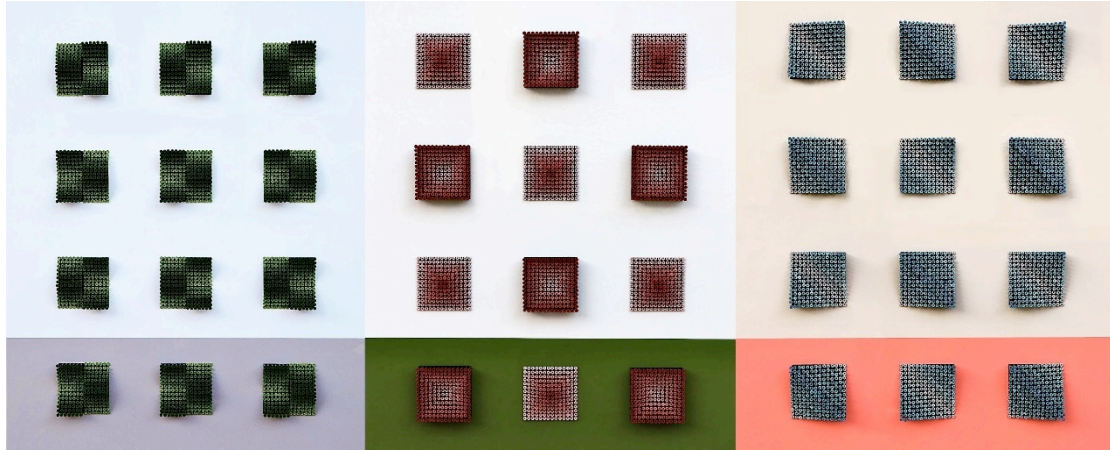


Figure 4: Andrew Myers's *Martini Night*

The exhibits in Area D are tactile educational tools to support tactile cognition and enhance experience. Tactile books and toys are used internationally. Tactile books include *The Fittle* (Figure 5), *DK Braille Shapes* (Figure 6).

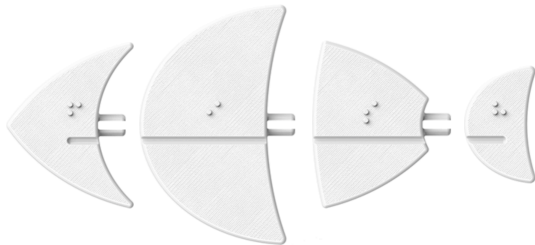


Figure 5: *Fittle* Braille Toys



Figure 6: *DK Braille Shapes*

The Fittle is the world first 3D Braille puzzle, made with 3D printing and open-source, downloadable models. 26 letters and 8 puzzle models are currently available for open-source download and printing. High gloss and embossed tactile formation of shapes that can be touched out, each with rhyming text, both written and in Braille.

The tactile Rubik's Cube (Figure 7) has tactile markings on different sides to facilitate blind people to exercise their tactile cognition, spatial thinking, and memory skills. It aids cognitive learning, enhances tactile judgement and improves traditional cognitive education for the blind. Tactile toys include two types of tactile Cube. Zec Chen's 2005 IF Design Award-winning Cube for the Blind (Figure 8), which has several faces differentiated by materials with different properties to make it accessible to the visually impaired. Rubik's Tactile Cube has different tactile markings on different faces, such as circular bumps, directional raised borders, or flat surfaces, which can allow the visually impaired to identify the same faces by touch.



Figure 7: Fittle Braille Toys



Figure 8: DK Braille Shapes

5 Conclusion

In summary, the movable art space for the blind can meet the exhibition needs of the blind and visually impaired, from the selection of the primary visual color of the exhibition space to the barrier-free guide system and immersive multi-sensory art experience in the indoor space, to the selection of specific exhibition artworks. It fully follows the design principles of the art space for the blind in the new era. Combining the movable box and mature transportation method solves the disadvantages of traditional art. The combination of movable boxes and sophisticated transportation methods not only solves the disadvantages of traditional art exhibitions in terms of a small audience, short exhibition period, inconvenient transfer, and high publicity costs but also allows for the replacement of specific exhibits according to the transfer of the exhibition site, meeting the exhibition experience needs of visitors of different environments, educational levels, and ages.

This paper explores the tactile art space adapted by blind and visually impaired people by taking the barrier-free design method as the entry point. On the one hand, the art space serves the blind and visually impaired to have more opportunities to participate in social activities, approach museums and galleries more conveniently, and appreciate artworks. On the other hand, it promotes the development and application of new modes of multi-sensory experience exhibitions by providing design concepts and solutions that can be referred to as multi-sensory experiences that are widely used in museums, galleries, and artwork. It is hoped that this paper can provide implications for the global promotion of public culture and art for the blind.

References

- Anagnostakis, G., Antoniou, M., Kardamitsi, E., Sachinidis, T., Koutsabasis, P., Stavrakis, M., ... & Zissis, D. (2016). Accessible museum collections for the visually impaired: combining tactile exploration, audio descriptions and mobile gestures. In *Proceedings of the 18th International Conference on Human-Computer Interaction with Mobile Devices and Services Adjunct* (pp. 1021-1025).
- Brown, P. (2014). The civil rights act of 1964. *Wash. UL Rev.*, 92, 527.
- Collins, J. J., Imhoff, T. T., & Grigg, P. (1996). Noise-enhanced tactile sensation. *Nature*.
- Garvía, R. (2016). *Organizing the blind: The case of ONCE in Spain*. Routledge.
- Holmes-Seidle, J. (2012). *Barrier-free design*. Routledge.
- Lu Lai. (2020). Convert the phonetic word into pictographic word: research on the design and application of Chinese character font based on braille.
- McCutcheon, J., & Ramalho, A. (Eds.). (2020). *International Perspectives on Disability Exceptions in Copyright Law and the Visual Arts: Feeling Art*. Routledge.
- Rhoads, M. A. (2010). *The ADA companion Guide: Understanding the Americans with disabilities act accessibility guidelines (ADAAG) and the architectural barriers act (ABA)*. John Wiley & Sons.
- Todorova-Ekmekci, M. (2021). Using Innovative Technologies, Digital Media and Site Tools for Presentation and Sustainable Preservation of Cultural Heritage. In *2021 5th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT)* (pp. 135-140). IEEE.
- Ucar, E. (2015). Multisensory met: Touch, smell, and hear art. *The Metropolitan Museum of Art*.
- Walk, E. E., Ahn, H. C., Lampkin, P. M., Nabizadeh, S. A., & Edlich, R. F. (1993). *Americans with disabilities act*. *The Journal of burn care & rehabilitation*, 14(1), 91-98.
- Zhang, X., & Jia, W. (2022). Review and Prospect of Accessible Design Standards in China. In *2021 International Conference on Culture, Design and Social Development (CDSO 2021)* (pp. 284-288). Atlantis Press.

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