Understanding Curators' Practices and Challenges of Making Exhibitions More Accessible to Blind and Low Vision People

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ABSTRACT

Assistive technologies are increasingly developed and applied in exhibition environments to help blind and low vision (BLV) people deal with the challenges they face when visiting exhibitions. While studies have examined the experiences of BLV people using such technologies, little is known about the experiences and challenges of curators incorporating assistive technologies into exhibitions to make them more accessible to BLV people. This research focuses on assistive technologies for BLV people in exhibitions from a curatorial perspective. We conducted semi-structured interviews with twenty-two experienced curators to understand their practices and challenges. We also curated a list of assistive technologies from published papers and used them as probes to seek curators' attitudes and perceptions of such technologies. We uncovered four critical themes related to curators' challenges of making exhibitions more accessible to BLV people. We further identified a vicious circle, which prevents curators from making exhibitions more accessible and discussed possible ways to support curators in making exhibitions more accessible to BLV people.

CCS CONCEPTS

• **Human-centered computing → Empirical studies in accessibility**.

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KEYWORDS

Exhibition, museum, curator, blind, low vision, visually impaired, visual impairment, assistive technology, accessibility, probe study, interview

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1 INTRODUCTION

Attending exhibitions in museums or art galleries is essential for people to improve cultural awareness [71], relax and recover from the stresses of life [77, 88] and interact with society or family [88, 103]. However, most exhibitions are visually oriented, which can be challenging for 2.2 billion Blind and low vision (BLV) people to access. BLV people face challenges in many aspects while attending exhibitions, including accessing exhibition information, navigating an exhibition, and appreciating the artworks in an exhibition [8, 43, 71, 79, 94]. In recent years, researchers have begun to investigate assistive technologies to help BLV people deal with some of these challenges, such as navigating a museum [9], exploring and interpreting artworks [2, 51, 86]. Although such assistive technologies can be helpful at an individual level, making exhibitions in museums and galleries accessible to BLV visitors collectively requires more efforts from multiple parties, including *curators*. Curators play a critical role in coordinating various parties, including organizers, sponsors, and artists, in order to ensure the smooth running of an exhibition [22, 26, 45, 98].

Curators are relatively understudied in the context of accessibility. Although few studies mentioned curators' comments on specific prototypes [24, 91], little research focused on understanding their experiences and challenges in integrating assistive technology into

their curatorial practices to make exhibitions more accessible to BLV people. Lack of such an understanding not only hinders the design of assistive technologies that curators could integrate into an exhibition with less friction but also prevents the community from better supporting curators to address other challenges in making exhibitions more accessible. To fill in this gap, we seek to answer the following two research questions (RQs):

- **RQ1:** What are the curators' practices and challenges of incorporating assistive technologies into exhibitions for BLV people ?
- **RQ2:** How can curators be better supported in making exhibitions more accessible to BLV people ?

To answer RQs, we conducted semi-structured in-depth interviews with 22 curators who had experience in dealing with the accessibility of their planned exhibitions. Our findings show that although assistive technologies for BLV people have been increasingly developed, it is challenging for curators to incorporate them into exhibitions for BLV people. The curators hope that navigation technology can better adapt to the crowded exhibition environment, offering personalized solutions to the audience and seamlessly connecting with the interpretation of the works. As technology helps BLV people interpret and appreciate artworks, curators are concerned that these technologies can fail to convey the meaning of the work (including misinterpreting, under-interpreting, and over-interpreting). In addition, we found curators' other challenges in making exhibitions more accessible to BLV people, including a lack of industry standards and policy support, hard in attracting BLV people to participate in exhibitions, challenging trade-offs between BLV people and sighted visitors, and a lack of curators' prior knowledge.

Based on our findings, we further identified a vicious circle, which prevents curators from making exhibitions more accessible to BLV people, and further discussed possible ways to break the vicious circle. In summary, we make the following contributions: 1) We show how curators incorporate various assistive technologies into their exhibitions for BLV people and the corresponding challenges that they experience; 2) We discuss the implications of our findings and possible ways to support curators in making exhibitions more accessible to BLV people.

2 BACKGROUND AND RELATED WORK

2.1 Accessible exhibitions and assistive technology for BLV people

For BLV people, barriers to exhibition participation include difficulty accessing exhibition information, navigating the venue's interior [8, 43, 68], and viewing artworks [37, 94]. To address these issues, researchers explored assistive technologies to support daily lives of BLV people, such as indoor/outdoor navigation [35, 40, 69], object recognition techniques [29], and screen reading technologies [70, 82], which have the potential to support them visit exhibitions.

Researchers have investigated assistive technologies in three main directions to make exhibitions more accessible to BLV people. The first direction is to help BLV people find exhibition information and access online museums. Currently, most exhibitions promote themselves through the Web and offer online access options (such as heritage repositories, web-based or VR headset virtual access). This information can help people plan offline visits and provide an alternative means of access for viewers who cannot get to the site. Screen readers play an important role in reading information from devices. Previous researchers have explored to understand how to make visual content (such as text [57, 94], images [92, 100], UI elements [89, 100], videos, and components) more accessible to screen readers [70, 82]. In particular, Nahyun Kwon designed and implemented a museum-specific prototype to help BLV people explore specific objects in each painting by touching personal devices and listening to oral descriptions of objects of interest to them [2]. Meanwhile, with the popularity of VR, more and more exhibitions are offering VR-based virtual access [33, 41, 49, 69]. In contrast, traditional virtual reality (VR) focuses mainly on visual feedback, which is inaccessible to the visually impaired. Researchers have explored several tools and methods to support visually impaired people to access virtual spaces to alleviate this problem. In addition to VR, MusA [1] provides museum visitors with interactive descriptions of artifacts through AR technology, increasing the interest of the visually impaired in visiting the museum.

The second direction is to create assistive technologies to help BLV people navigate in exhibitions. Sensor models [40, 42, 62, 102], augmented reality [35, 69], and information tagging systems have been designed to help BLV people navigate indoor environments. In addition, researchers designed and developed navigation techniques based on the characteristics of exhibition visits [43, 78, 97]. For example, when visiting a museum, one needs not only to walk into the museum but also to discover and appreciate ark works in it. Saki Asakawa et al. developed an approach that enables seamless interaction between navigation and art appreciation by continuously tracking the user's location and orientation [9].

The third direction is to create assistive technologies to help the BLV crowd appreciate works in exhibitions. In most cases, exhibitions are primarily visual, which creates enormous problems for those who can not use their vision to explore the world around them [23, 95]. Previous work has proposed ways, such as speech descriptions and tactile images [5, 51, 86], to help BLV people appreciate works [18, 34]. For example, Kwon et al. built a touch-based mobile application that allows users to play language descriptions with touch [51]. The Andy Warhol Museum has launched an audio guide designed for BLV audiences that offers two kinds of audio content: transforming the formal elements of a work of art into a detailed oral narrative and a guided narrative accompanied by tactile reproductions [34].

Despite increased attention to the issue of exhibition accessibility and the development of assistive technologies, the participation of BLV people in exhibitions still does not reach the level of the general population [59, 99], and exhibitions still need to make more extraordinary efforts to improve access for these people.

2.2 Curator's role in making exhibitions more accessible for BLV people

Recalling the history of curators, the original core function of "curator" is "preservation, protection, and management [4, 17, 46, 63]". With the gradual maturity of the exhibition institutions system and the enrichment of collections, the "custodian" function of curators

has expanded to include "researchers of collections, "researchers of the audience", and "researchers of technology [27, 32, 60, 73, 81]. At the same time, "independent curator" began to emerge and develop into a new profession at the end of the 19th century [76, 83]. Although the institution's curator and the function of the independent curator are different, they all have an influence on the exhibition practice, public exhibition, and evaluation facilities. Beta-Space research [10–12, 30] pointed out that artists, evaluators, and curators of three views together far more than every point can be provided separately. At the same time, the exhibition needs to be curated with multiple stakeholders in mind, including artists, institutions, patrons, collectors, audiences, and so on [16, 44, 48, 93]. Curators must coordinate various parties' interests as secondary producers and present the exhibition [22, 26, 45, 98]. For this reason, they are considered to play an essential role in exhibition practice.

In planning exhibitions for BLV people, curators need to cooperate with various parties. They cooperate with BLV people or relative organizations to understand the needs of BLV people; they work with technical staff of an exhibition to ensure that the works being exhibited can be perceived and engaged by BLV people audiences through various technical means; they work with artists or heritage researchers to ensure that works can be adequately displayed and presented [61, 64, 65, 91]. Therefore, curators are considered to play an essential role in implementing visually impaired assistive technology in exhibitions. However, prior work has primarily focused on developing assistive technologies or assessing the experience and perception of a particular project from the perspectives of BLV people [8]. Curators have rarely been included in the design of accessible exhibitions. For the few studies that did include curators, they primarily asked for curators' suggestions on a specific prototype design [24, 91]. In sum, it remains largely unknown how curators consider and incorporate various assistive technologies into exhibitions to make them accessible to BLV people.

Inspired by the importance of curators' roles in making exhibitions accessible and the gap in the literature, our research seeks to understand curators' experiences and challenges in incorporating assistive technologies into their curatorial practices to make exhibitions more accessible to BLV people. Such an understanding can help the community understand the needs of curators and help relevant organizations support curators' accessible curatorial practice so that curators can help make exhibitions more accessible.

3 METHOD

To answer our RQs, we conducted semi-structured in-depth interviews with 22 curators. During the interview, we asked participants about the accessibility projects they were involved in, the processes they followed, and their experiences and expectations for making exhibitions more accessible. In addition, we curated a list of assistive technologies from published papers and used them as probes to elicit participants' attitudes and perceptions of these assistive technologies and the challenges of using them in exhibitions. We present the details of these steps in the following subsection.

The study was approved by the ethical board of our institution. We followed local coronavirus social distance regulations while conducting interviews online. All interviews were audio recorded and lasted on average 62 minutes (between 45 and 90 minutes). Participants were compensated about 12 USD.

3.1 Participants

We advertised in local curatorial communities and finally recruited 22 curators. Table 1 shows the demographic information of the participants, including gender, type of workplace, type of curator, number of exhibitions, and related training. Nine were museum curators and thirteen were art curators, five of whom were also artists. One had visual impairment (vulnerable, born with cataracts). 22 participants were familiar with the NISE Network's Universal Design Guidelines for Public Programs in Museums(NISE), and 18 participants were familiar with the Smithsonian's guidelines(Sg). All curators have received professional training in curatorial studies and accessibility. 17 participants (P2-P9, P11-P19, and P22) had experience interacting with deaf and hard of hearing people, people with limited mobility, minority groups in addition to BLV people.

3.2 Interview Questions

The interview questions consist of the following four parts:

Part 1: The first part of the interview questions was about basic demographic information and a brief description of their experience of practicing accessible exhibitions for BLV people.

Part 2: The questions were centered on understanding the challenges of practicing accessible exhibitions for BLV people. We asked questions about their encounters and observations of BLV people and interactions with regular visitors, how they collaborate with other departments to address the process of accessibility in practice, the challenges they encounter, and the strategies they adopt to deal with them.

Part 3: A body of assistive technologies was proposed in the accessibility research community. We would like to understand curators' attitudes and perceptions of such assistive technologies and potential challenges in deploying them in exhibitions. To do so, we curated a list of assistive technologies by searching ACM digital library and Google Scholar with the following keywords: accessible exhibition (museum, gallery), accessible exhibition (museum or gallery) for blind (low vision or visual impairment) people, and searches were conducted. We set the time restriction to be the last 10 years (2014 to 2023) to focus on the most recent assistive technologies. The research team manually scrutinized each entry in the search results for appropriateness. As our focus was on assistive technology, we primarily identified archived articles published in the ACM Digital Library and well-known journals on curatorial and museum accessibility (e.g., Curator-Museum Journal, Accessible Museums). After an initial search based on titles and abstracts, we identified 32 studies. Then, we reviewed the complete manuscripts and identified 15 assistive techniques. Figure 1 shows seven examples. The complete list can be found in the appendix. We explained these technologies to participants and asked questions about their attitudes and perceptions and potential deployment in exhibitions for BLV people, including the impact of these technologies on their curatorial practices, their assessment of the efficiency of the technologies in solving problems, their concerns and challenges in operational and real-life situations (e.g. funding, learning costs, exhibition effectiveness, venue space), and so on.

Table 1: Participants' demographic information.

ID	Gender	Types of work place	Type of curator	Number of exhibitions	Related training
1	F	For-profit galleries	Freelance Curator	2	Sg+ NISE
2	F	Public Museum	Museum Curator	3	Sg+ NISE
3	F	Public Museum	Museum Curator	3	Sg+ NISE
4	M	Public gallery	Museum Curator	4	Sg+ NISE
5	F	Public Museum	Museum Curator	3	Sg+ NISE
6	F	For-profit galleries	Freelance Curator	2	Sg+ NISE
7	F	Public galleries	Museum Curator	2	Sg+ NISE
8	M	For-profit galleries	Freelance Curator+Artist	2	Sg+ NISE
9	F	For-profit galleries	Freelance Curator	4	Sg+ NISE
10	M	For-profit galleries	Freelance Curator+Artist	1	Sg+ NISE
11	F	For-profit galleries	Freelance Curator+Artist	2	NISE
12	F	For-profit galleries	Freelance Curator	4	NISE
13	F	Public museum	Museum Curator	4	Sg+ NISE
14	F	For-profit galleries	Freelance Curator	2	NISE
15	F	Public Museum	Museum Curator	4	Sg+ NISE
16	F	University of Fine Arts Pavilion	Museum Curator	1	Sg+ NISE
17	F	For-profit galleries	Museum Curator	4	NISE
18	F	For-profit galleries	Museum Curator	2	Sg+ NISE
19	M	University of Fine Arts Pavilion	Museum Curator	3	Sg+ NISE
20	F	For-profit galleries	Museum Curator	2	Sg+ NISE
21	M	Public gallery	Museum Curator	3	Sg+ NISE
22	F	For-profit galleries	Museum Curator	4	Sg+ NISE

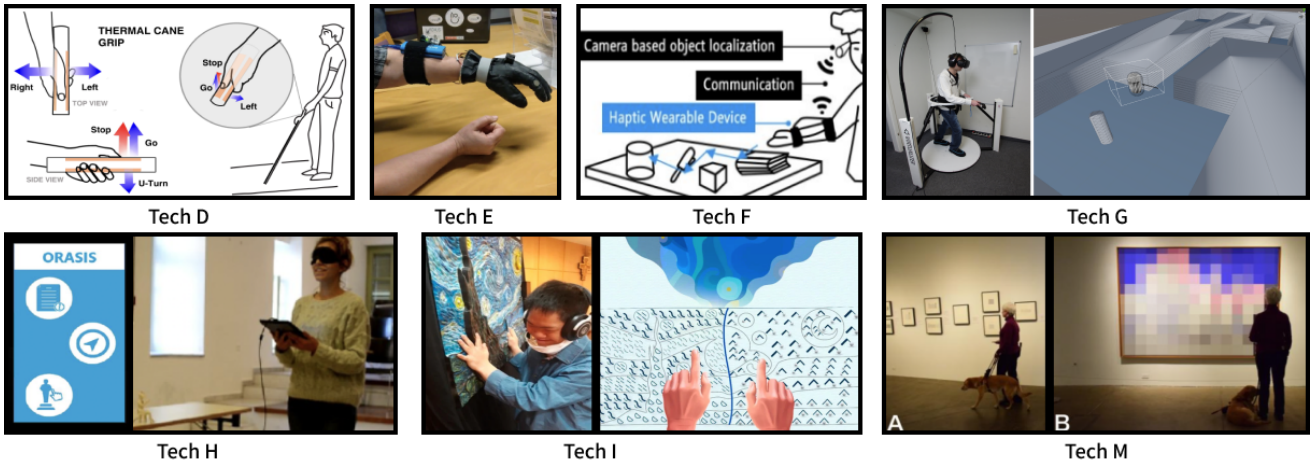

Figure 1: A sample of assistive technologies that were used as probes in our study and frequently mentioned by our participants. The complete list is in the appendix. Tech D [74]: The ThermalCane is a white cane grip instrument with multiple flexible thermal modules that provides BLV users with directional orientation cues guided by thermal haptics; Tech E [41]: A prototype of a glove that alerts the user when an obstacle is detected at the pointing position; Tech F [38]:PneuFetch is a wearable device based on light tactile cues that supports BLV people in accessing nearby objects in unfamiliar environments; Tech G [49]: BLV people explore virtual environments (VE) by walking in a virtual reality (VR) treadmill; Tech H [92]: AMCI for VI is a prototype system that enhances the accessibility of museum exhibits for visually impaired users; Tech I [19]: The visual elements of the work are communicated to the visually impaired through a variety of sensory elements; Tech M [9]: The technology continuously tracks the user's position and orientation, allowing seamless interaction between navigation into the art painting tour.

Part 4: The final section is about the general considerations and expectations of an accessible and inclusive museum for BLV people, including questions such as what is the ideal state of access for BLV

people, and how technology can increase the level of accessibility for people with disabilities.

3.3 Analysis Method

Thematic analysis [15] was utilized to analyze the interview data in this study. Firstly, all recordings were transcribed verbatim into text. The research team then employed an open coding [25] by reading the transcripts to familiarize themselves with the data. Two coders independently coded the data, and the coding was discussed with the rest of the team during weekly research meetings. The team iteratively revised the coding during these meetings. An online tool called Miro was used to perform an affinity diagram analysis of the codes, which allowed the team to group the codes and identify common themes from the data. The findings were based on these themes, sub-themes, and codes.

4 FINDINGS

We have identified four key themes related to curators' practices and challenges of making exhibitions more accessible to BLV people: (1) *Attracting BLV Visitors*, (2) *Assistive technology usage and challenge*, (3) *Industry Standards for Assistive Technology and Policy Support*, and (4) *Trade offs between BLV and sighted visitors and curators' prior knowledge*.

4.1 Attracting BLV people

Participants (N=6) indicated that they often had difficulty attracting BLV visitors to their exhibitions. P5 elaborated on it: *"We tried to contact disability groups, like schools, but it was difficult, and they did not seem to trust us."*. P5 felt that this was likely because exhibitions tend to pay less attention to BLV visitors than sighted visitors and lack accessibility services. There were BLV visitors who once complained to her that they had bad experiences attending other exhibitions with low levels of accessibility and were reluctant to visit exhibitions since then as they were concerned about encountering similar problems.

The low number of BLV visitors also made it hard for curators to gain feedback from BLV people, which is critical for them to improve the accessibility of exhibitions. In turn, this might result in potentially bad experiences for BLV people visitors if they do visit, and this vicious cycle continues.

To mitigate the challenge, some participants (N=3) suggested that BLV people should be provided with a detailed introduction to the accessible facilities of the exhibition or virtual tours before or upon their visits to alleviate their concerns. In the meantime, curators should seek more ways to gain feedback from BLV people visitors in order to make the exhibitions more attractive to them.

4.2 Assistive Technology Usage and Challenge

Overall participants had experiences of using assistive technologies to help BLV people *navigate an exhibition venue* and *interpret and appreciate artworks*, but few participants used accessible assistive technology in the context of publicizing information about the exhibition, stating that they either interfaced with organizations for the blind from the start or used traditional audio-visual aids for electronic promotion. Next, we report on participants' experiences and challenges in these two aspects respectively.

4.2.1 Navigate an exhibition venue. It is increasingly crucial to deploy navigation technology in exhibitions to cater to the needs of BLV people. Most existing navigation services mentioned by participants are manual. Meanwhile, they drew on their past experiences to describe the challenges of the dilemmas associated with manual navigation services, such as staff turnover. P5 said, "*The training of volunteer docents is at risk of staff turnover. Many volunteers are university students who leave the local area after four years of graduation, so we have to conduct training again.*" Participants hoped to use the example navigation techniques that were shown in our study as they felt that many of these technologies could operate independently and were less dependent on human intervention. Specifically, participants (P21, P16, P7, P13, and P15) felt that technologies D- G could be instrumental. For instance, the flexible thermal module for canes (technology D) was seen as a promising solution for providing tactile orientation and temperature feedback to BLV visitors. P20 stated, " *A flexible thermal module for canes, to provide tactile orientation and temperature feedback. I think there is a lot of scope for the technology to be used, at least it can fit perfectly with the idea of measuring the exhibition.*". Despite the potential of these technologies, participants also expressed concerns about their use in museum exhibitions for BLV visitors. Next, we elaborate on the three concerns of the participants.

Crowded environment. In exhibition accessibility, a 'crowded environment' is one in which there is a high concentration of people, objects, or stimuli that may interfere with the proper functioning of the assistive technology and thus its user experience. Participants noted that exhibition spaces were often crowded, but that most existing navigation technologies were not equipped to cope with such environments. One participant (P6) explained that robots are often designed and tested as navigational aids. However, they are often tested in sparsely populated areas, such as research laboratories, where they can follow a predetermined path and stop when they encounter people. In reality, however, exhibitions are full of visitors, and robots can get stuck or become useless.

Lack of connectivity between different types of technology. Secondly, participants reported that navigation techniques and artwork interpretation techniques are not integrated properly into BLV people's visiting flow. As P5 points out, most of the existing navigation technologies (e.g. navigation robots, navigation handbooks, etc.) bring the BLV people to the artwork but rarely mention how it is connected to the interpretation technology afterward. As a result, although blind people come to the front of the artwork, they cannot get an interpretation of the artwork. Some participants agreed on the ability of guide dog technology (L) to provide a seamless connection between navigation and interpretation. As the participant(P17) said: "*The continuous tracking of the user's position and direction in enjoying the art is intended to enable a seamless interaction between the A and B tours, which I think is a very interesting technology*". This highlights the need to develop and use more integrated technology in the exhibition.

Lack of catering to individual preference and interest. In addition, the lack of personalized navigation options for visitors can hinder the visitor experience. Most existing technology expects visitors to follow a path predesigned by the curator. However, this approach ignores the fact that BLV visitors have different interests and preferences from regular visitors, and they should be allowed

to choose their preferred route. In addition, their navigational needs may change as they explore the exhibition. As P12 perceptively observed, "*... the system should allow visitors the freedom to explore exhibits outside the lines or change them ...in the same way that a car navigation system allows the driver to deviate from the planned route.*". Participants hoped that future navigation technology would provide visitors with a more customized experience so that they could choose their preferred route and have the flexibility to adapt it to their interests and needs.

4.2.2 Interpret and Appreciate Artworks. Interpreting and appreciating artworks is a key part of visiting exhibitions. We summarize participants' *interpreting practices using different senses*, and *concerns about interpretation technologies*.

Interpretative practices using different senses. Firstly, participants highlighted the importance of designing aids based on tactile senses. Touch is the most sensitive sense other than vision [55, 90] and is considered to be an important perceptual mode for BLV people. Some participants suggested the use of easily accessible raw materials, such as ancient musical instruments in the exhibition. However, in many cases, touching an exhibit to preserve it for a longer period of time is prohibited, especially in the case of heritage exhibits. This is because touching artworks could potentially damage them. As a result, some participants chose to create or design haptic conversion devices. For example, P5 provided visitors with scaled-down replicas (Figure 2 shows that the participant has used 3d printing to reproduce small models of the exhibits from left to right: the position of the replica, a detailed display of the replica, and an explanation in Braille next to the replica.), making the exhibits touchable while avoiding damage to the original objects. In other cases, for example: "the One Eye exhibition"(Figure3 shows that the exhibition encourages visitors to touch the works with their hands. The aim is to attempt to share contemporary art, with the target group being the general able-bodied audience as well as people with visual impairments.), directing visitors to actively touch the work was considered the best way to appreciate it (P8). Therefore, participants suggested that curators should engage with artists to create tactile-based interpretations that would enhance the overall accessibility of an exhibition. For example, referring to her role as curator, P15 mentioned that it would be useful for artists to create tactile-based interpretations (Figure4 shows the artist conceals part of the work in a sculpture box, shielding it from view. The interaction between the viewer and the artist, the visually impaired and the able-bodied, is a 'handshake' of surprise and emotion, with no visual effect.), saying:

> "*The type of sculpture is still visual. But because of the needs of our exhibition, I specifically mentioned that we want the blind audience can feel your sculpture as well as the able-bodied audience. So the sculptor used a 3D printing technique and then used the negative space technique to print the part of the clay that was not his hand – the hand that was holding the clay. When the audience enters the exhibition hall, they will put their hands into a closed box to feel.*"

Secondly, participants (N=9) emphasized the importance of auditory-based design in helping BLV people interpret exhibits and pointed out that sound interpretation is not limited to people with disabilities, it is an immersive and enriching experience for the general audience too. For example, P15 said, "*Next to each piece is a triggered audio guide that any viewer can use, which automatically begins to explain the context of the piece when one walks into it. This in itself is helpful to the general audience, not just to the blind*". In addition, P5 discussed how, in an exhibition relating to ancient instruments, the visuals were arranged to support the musical experience and guide the audio so that BLV people could hear and experience the exhibition." *Because we focus so much on that experience of music*", as the exhibition relates to ancient musical instruments, she arranged visuals as support and music and audio as guides so that "when blind people walk in, they can go and listen". In parallel to the usual audio tours, participants also mentioned that they often use multimedia and stereo surround sound technology to create a more immersive experience for BLV people. For example, P8 mentioned "*Doing a surround sound-like installation on site. ..., where people actually stand in the middle and then listen to different angles and then different sounds coming from all directions.*", resulting in a rich auditory experience (Figure5). In short, the integration of auditory-based design into curatorial practice is essential to creating inclusive exhibition experiences that meet the diverse needs of visitors, including BLV people. This approach is not limited to people with disabilities, but can also provide a rich, immersive experience for all visitors. Thirdly, many participants (N=6) described multiple methods of interaction that combined the use of two or more senses to enhance the overall experience. For example, P5 described a tea culture exhibition,

> "In this exhibition we are putting a lot of samples of different teas, so when the audience goes in they can smell the different teas, it's an olfactory sense. At the same time, there is tea brewed from each type of tea leaves for people to drink, which is a taste experience. At the same time, the temperature also makes people feel something."

P15 further emphasized the importance of integrating multi-sensory senses, including taste, in curatorial practices. This approach echoes the work of the artists, who use the senses of smell and touch in their work. In this case, she used the sense of taste in her curatorial practice to echo the artist's own work in which the sense of smell 'the cloth sack of the granary is full of the smell of grain' and the sense of touch 'people need to walk through the rough cloth sack and feel for it'. P11, however, offered an example of the use of taste to describe color for the congenitally visually impaired, providing a more holistic sensory experience.

> "Let's say we ask a child in the exhibition to make a shape as well, and he or she can choose the colors, but the colors, like red, orange, yellow, and green, are not always understood by the congenitally blind. So we might use a material like a curry chili lavender which is linked to color but has a sense of taste to describe it." -P11

Moreover, P14 referred to the combination of sound and touch (Braille) used by some artists who have experienced eye problems to create works that are inherently significant in terms of their interpretation to the visually impaired. For example, figure6 shows

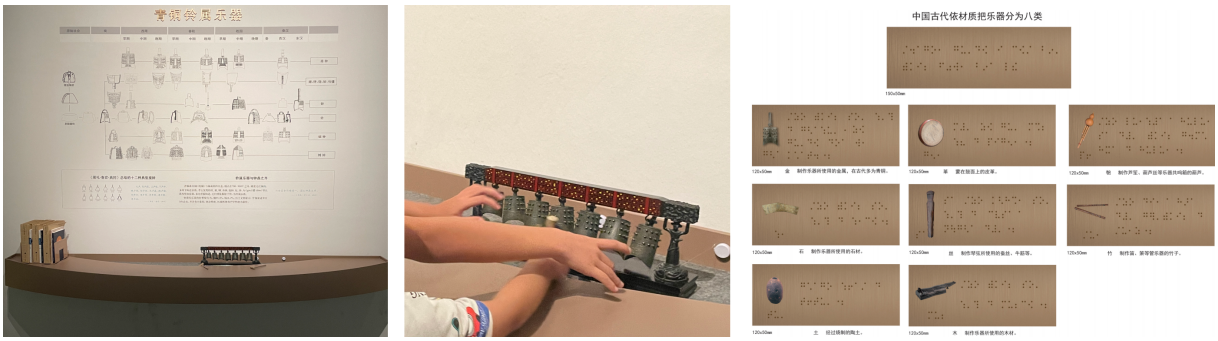

Figure 2: For the exhibition on the theme of ancient Chinese musical instruments, the curators have used 3d printing to reproduce small models of the exhibits from left to right: the position of the replica, a detailed display of the replica, and an explanation in Braille next to the replica. Image courtesy of P5

Figure 3: "The One Eye" exhibition encourages visitors to touch the works with their hands. The aim is to attempt to share contemporary art, with the target group being the general able-bodied audience as well as people with visual impairments. Image courtesy of P12

Figure 4: The artist has blindfolded himself and used basic sculptural techniques to shape the clay dough, leaving traces of his fingers and palms in the negative space of the sculptures, which are printed using 3D technology. Image courtesy of P15

an artist's personal experience with an eye problem has led to the creation of a work that incorporates Braille, while the material of the work makes a sound when struck, resulting in a multi-sensory interaction between the senses of touch and hearing.

Concerns about interpretation techniques. Participants highlighted three types of concerns: 1) a general agreement with objective interpretation techniques, but the need to consider the nature of the exhibition and the degree of visual impairment, 2) their concern about interpretation techniques of abstract concepts their degree of translation, and the author's wishes, and 3) their expectations for a systematic approach to cross-sensory translation

First and foremost, most curators expressed a willingness to explore measures of basic size, color, and content interpretation, such as technology (H), P5-22. However, some participants (N=8) expressed reservations about certain aspects of technology. For example, although outputting image-based information through textual descriptions was straightforward, it was not considered appropriate for the congenitally blind because they lacked the concept

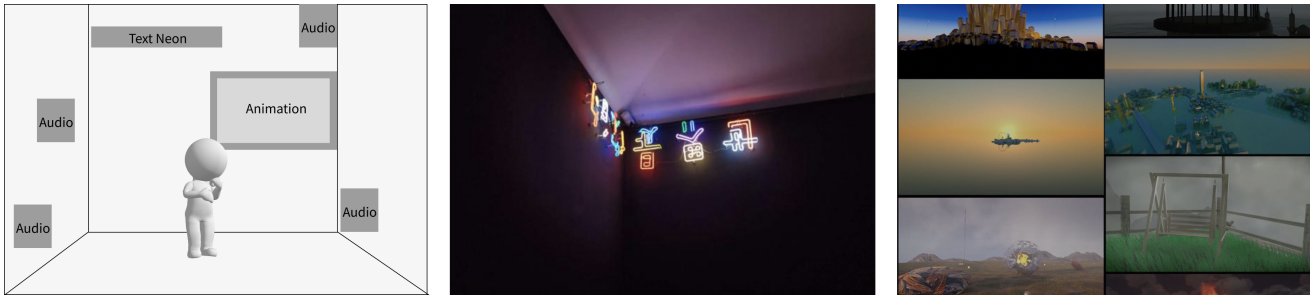

Figure 5: The artist uses multimedia and sound installations to present the work in a darkened interior setting. At the same time, the sound comes from the visually impaired people themselves. Image courtesy of P8

Figure 6: An artist's personal experience with an eye problem has led her to experience life as a blind person and to create works that incorporate Braille and interact with materials that make a sound when struck. Image courtesy of P14

of color. One participant (P7) argued that visual art is untranslatable because of the inherent incompatibility between it and language. Furthermore, P20 illustrated the inadequacy of the approach with the example of 'Technology K', which should be considered in relation to the works exhibited, asking: "*Should I describe the image and identify the subject, the color, and the shape? Or should I focus on how the blind person can touch it and express this basic information?*". They suggested that such an approach failed to provide an adequate experience for BLV people.

At the same time, the majority of participants (N=16) noted that many of the works were translated into other senses to describe abstract information. p20 highlighted the merits of this interpretation technique: "*... If this kind of thing is done in this way, it actually opens up the dimension in which we can appreciate an existing visual object, an art historical object, so we can appreciate it through smell, sound, temperature, and all sorts of different ways. It is not just for the blind that it makes sense to appreciate an existing artwork that has been frozen in time*". However, determining the degree of transformation and the best way to present the information remains a challenge. p17 "*There is a gradual process, and the more complete the transformation, the more complete it is for the viewer. The more complete the experience is for the viewer or for those who cannot see it. However, the more radically it strips the artwork, the less it becomes what it was*". The ability of the assistive technology facility to properly present the content of the exhibition is therefore a major challenge for participants.

> P17 may cry out the concern of many curators: "After the transformation of the medium, is it still the original work of art, does it respect the original work of art?"

To ensure that in order to ensure the accuracy of the transformation they work with the artist, as P17 put it: "I will choose artists who are willing to transform the work into two or three dimensions. I will choose artists who are willing to convert the work themselves into a 2D or 3D model for the audience to experience.".

They also looked for a systematic approach to translation or technology that overrides the existing sensory base, for example, P17 stated that "Braille is a systematic process of translating the visual into the tactile, and perhaps in the future there will also be a system or rule for translating the visual into the tactile. In the future there will also be a system or rules to deal with these issues.". P18, on the other hand, said that the fairer way she can think of for the visually impaired might be to use brain-computer interfaces, as the technology seems "the same for everyone".

4.3 Industry Standards for Assistive Technology and Policy Support

Overall, participants felt that the lack of clear industry standards for assistive technology is a significant barrier that hinders them from creating accessible exhibitions. For example, without clear industry standards for assistive technology, our participants were

often unsure of which assistive devices should be equipped. P8 argued: "*Exhibitions should have at least some standard equipment, similar to blind paths in cities.*".

Moreover, our participants also felt that they lacked clear support from the management and supervision team. They mentioned that the virtualization of the management and supervision team, which means that it is no longer a real process but rather a formal symbol that exists only in name, also hindered the construction and development of accessible exhibitions. P7 pointed out the loopholes in supervision and management: *"In theory, during the annual inspection, (regulatory agencies) should try it (accessible facilities) out to see whether it works or not, but they (regulatory agencies) rarely do that.*". This loophole causes the accessible facilities of exhibitions to deteriorate over time due to the lack of timely management and maintenance, depriving BLV people of their due services and wasting the exhibition's funds.

Furthermore, participants also pointed out the lack of funding, training, and technical support to help curators better achieve accessible exhibitions. P3 complained: "When I apply for funding, convincing the institutional leader is a big problem.". P4 pointed out that the exhibition did not provide adequate training and technical support, which made it difficult for him to start with accessible curation for BLV people. The incompleteness of policies indirectly causes a lack of funding, training, and technical support. Specifically, the lack of policies has led to a lack of unified requirements and supervision for the accessibility construction of exhibitions, making institutional leaders not pay attention to accessibility issues, resulting in relatively insufficient funding and support for building accessible facilities.

4.4 Trade offs between BLV and sighted visitors and curators' prior knowledge

Participants highlighted another challenge was to balance the needs of and resource allocations for BLV and sighted visitors. P17 elaborated on it: "*I am worried that it is challenging to satisfy both sighted and BLV visitors in the same exhibition, and there may be some unsatisfactory aspects.*". P5 expressed specific concerns about space allocation: "*The proportion of BLV visitors to an exhibition is relatively smaller compared to that of sighted visitors. Although a museum exhibition must consider BLV people, it remains unclear how much space and funds should be invested for accessibility.*"

In addition, participants also felt that their lack of knowledge about assistive technology was another barrier to planning accessible exhibitions. P4 expressed his difficulty in choosing and using assistive technologies for BLV people: " *I do not know how to use them; I am not a tech expert... I need guidance.*". More specifically, P4 pointed out that he and his colleagues once wanted to make a museum app friendly to BLV people but gave up because they did not know what assistive technologies could be used. To acquire more knowledge about accessibility, some participants suggested to establish a communication platform to help them learn about effective practices from other curators and the needs of people with disabilities.

5 DISCUSSION

Previous research has examined museum accessibility, including the level of accessibility in public museums [6, 67, 96], prototypes of assistive technologies [9, 13, 19, 51, 56, 86, 92, 101]. While few studies have explored how to create and display work for specific populations, they have focused on specific types of work by specific artists [39, 54, 58]. How assistive technology can be integrated into actual exhibitions to make them accessible is important but rarely studied, especially from the perspective of curators, who play a key role in selecting and arranging artworks, creating exhibition themes, and developing interpretive materials, among other responsibilities. To address this gap, we sought to understand how curators view the role of assistive technologies and integrate them into their curatorial practices for BLV people as well as the challenges encountered in implementing accessible practices.

We found four key themes related to curators' practices and challenges of making exhibitions more accessible to BLV people: attracting BLV visitors to exhibitions, assistive technology usage, and challenge, industrial standards for assistive technology and policy support, trade-offs between BLV and sighted visitors as well as curators' prior knowledge. These challenges can create a vicious circle: Difficulty in inviting BLV people to exhibitions can lead to wasted resources and funding cuts, which reinforces the idea that accessibility is unnecessary and makes it harder to attract BLV visitors and improve the user experience of assistive technologies. Additionally, curators' inadequate knowledge of accessible curation and the lack of effective assistive technologies further exacerbate the situation. The lack of policy support and management supervision also makes it difficult for curators to improve the accessibility level of exhibitions for BLV people. Next, we discuss possible ways to support curators to better curate accessible exhibitions and propose a multi-party collaborative model.

5.1 How to help curators invite BLV people to the exhibition?

In order to maximize the usage of assistive technologies in an exhibition, curators should consider ways to attract more BLV people to visit it. Our findings show that this is challenging because once BLV people have bad experience with one or two exhibitions they might form the impression that exhibitions are generally inaccessible and thus are less likely to visit future exhibitions. One possible way to break this vicious circle is to adopt a participatory-design or co-creation approach by inviting BLV people into the planning phase of an exhibition, for example, by including them in co-creation projects, so that their concerns can surface early and possible mitigation strategies can be discussed upfront too. Indeed, this approach has been shown to be effective in empowering participants and meeting their needs and stimulating community dialogue [51, 87].Meanwhile, some of the previous studies[7, 28] focus on what promotes or discourages BLV people from visiting museums and the emotions they feel when visiting museums. These should serve as factors that curators can consider when inviting BLV people.

Although co-curating can make exhibitions more friendly for BLV people, they might still feel nervous about adapting to a new environment. Virtual reality (VR) can provide a safe environment

to help BLV people familiarise themselves with the exhibition environment in advance and practice basic access skills. Previous research has developed VR environments to help people with disabilities, stroke, and Parkinson's disease practice daily living skills [31, 51, 80], and to help BLV people learn the proper location and obstacle perception skills [66, 85]. However, it remains an open research question of whether having early access to exhibitions through virtual reality can increase the motivation of BLV people to visit exhibitions in the physical world.

5.2 How to design more usable assistive technology for exhibitions?

More and more assistive technologies have been designed either in the research community or in industry. On the one hand, curators felt these are powerful tools that should be explored. On the other hand, they found that many assistive technologies did not work well in reality. Moreover, they also felt they lacked knowledge of emerging assistive technologies. Next, we propose and discuss possible directions to explore.

5.2.1 Design more effective navigation techniques. Participants noted that most current exhibition navigation services rely on the manual services of exhibition volunteers. Previous studies have noted that BLV people prefer not to rely on this type of assistance all the time because they are concerned about the burden placed on sighted assistants and the relative restriction of their activities [8]. Our study adds another disadvantage of using the manual services of exhibition volunteers, namely that the services of volunteers are temporary and discontinuous and that the departure of volunteers imposes additional training costs on the institution. In-exhibition navigation systems, which can accurately locate users in the environment, were identified as a potential solution [72] and installed in many different venues, such as shopping centers [84] and universities [75]. We suggest designing navigation techniques that can be better adapted to exhibition environments, especially when there are constant visitor flows.

Participants pointed out that BLV people need to not only walk through the museum but also find and appreciate their artworks. As a result, navigation should be able to link route planning and navigation guidance, artwork discovery, and artwork interpretation together to help BLV people complete their visiting experience. To enable seamless interaction between navigation and artwork appreciation, Asakawa et al. have developed a solution that continuously tracks the user's location and orientation and records the work's interpretation when a BLV person reaches the artwork [36]. Similarly, when a visitor needs to interact with an artwork, such as a 3D printed replica of the artwork, the navigation system should be able to guide BLV people to the object, grasp it, and play the interpretation or guide the visitor to the interpretation. Devices that provide fine-grained tactile cues would help to enable the grasping of objects [38]. However, there is currently no technology to enable seamless interaction between the grasping and interpretation of objects. In addition, given that natural exhibition environments are crowded, these technologies would need to be tested in crowded environments to reveal potential issues.

In addition, participants noted that each exhibition visitor has their own interests and preferences and should be allowed to choose their preferred route and explore the exhibition content freely. Kayukawa et al. [47] have developed a solution that allows BLV people to explore the exhibition independently and to be able to choose exhibits according to their interests and enjoy the exhibition at their own pace. However, the elements of their system, including interpretation of works and route setting, were done by technicians with a computer background. This is challenging for curators, who do not have sufficient technical knowledge, to adopt when curating exhibitions. Thus, one potential direction is to design user-friendly tools for curators so that they could easily customize assistive technologies to suit the needs of different visitors without knowing too much about the technical detail.

5.2.2 Design and refinement of a multi-sensory system for interpreting works in exhibitions. Most works in exhibitions can only be appreciated visually and are difficult for BLV people to appreciate. Previous work has proposed several multi-sensory approaches to help BLV people understand these works [3, 5, 34, 51], for example, by developing tactile colored pictograms that use the sky, earth, and shapes from the heavens, earth, and the human mind as metaphors to identify color by touching different patterns [21]; or using features of musical instruments (e.g., tones, keys, rhythms, and pitches) to interpret the overall colors of "Starry Night" [20] and that multisensory design in exhibitions can also enhance the general visitor experience and make the exhibition more memorable to visitors [52].

However, we should be cautious about designing and using multisensory systems for interpreting works. Some participants questioned whether the visual information of a work and the transformed information obtained by other senses afterward are equivalent or not. This concern is justified as the visual perception of artifacts and artworks is complex, including color, texture, position, size, contrast variation, and cool versus warm colors [56]. Other senses might not be able to fully capture such visual information. Future research should conduct more research to understand the information translation between different sensory modalities and design multi-sensory systems that can best capture the type of information that is deemed important in a different sensory modality.

5.3 How to provide a favorable policy environment for curators?

We found that the lack of policy, including unclear industry standards and the absence of regulation and oversight, posed challenges to curators' curatorial practice. Specifically, curators pointed out that the lack of clarity in industry standards and the absence of governance and oversight had led to curators not knowing the standards for the provision of visual aids, the lack of timely management and maintenance of visual aids, and the relative lack of funding, training and technical support for the construction of visual aids. We call on legal bodies to broaden citizens' political participation channels and actively explore the mechanism of "open door legislation" to listen to the complaints, suggestions, consultations, and evaluations of relevant stakeholders of accessible exhibitions, including curators, to support the construction of friendly exhibitions for BLV people. Providing information technology platforms to open up channels for public response may be a way forward.

5.4 How to help curators gain knowledge and experience in curating friendly exhibitions for BLV people?

Participants perceived a lack of knowledge about planning friendly exhibitions for BLV people also led them to believe that they could not integrate visually impaired assistive technology well into their exhibitions to make them accessible. Specifically, they were concerned about not being able to balance the needs of general audiences with those of visually impaired visitors and not knowing how to select and use assistive technologies for BLV people. While previous research has suggested the general needs of blind people in terms of accessing exhibition information [14, 53], navigating within venues [79], and viewing artworks [37, 94] and made recommendations accordingly, the feedback and recommendations were one-off. As the presentation of exhibitions changes over time (e.g., from physical to digital presentation), so do the needs of blind people. Not only that, but the needs of audiences in different places may also vary due to different living standards, education levels, and cultural backgrounds. Furthermore, the accessibility technologies required, especially for interpreting works, may also vary from one type of exhibition to another. For these reasons, an ongoing communication platform may be a more helpful solution for curators. A network that promotes accessibility to art and culture, which can build on previous research and existing online platforms [1]. We suggest that the communication platform needs to be categorized according to the location of the exhibition, the different levels of visual impairment of the visually impaired, the different types of exhibitions, as well as discussions, events, and follow-ups on real-time hotspots around different themes, in order to help curators gain more easily the knowledge and experience of curating friendly exhibitions for BLV people.

5.5 Multi-party cooperation model

Our findings suggest that to make exhibitions accessible to BLV people, curators must collaborate with various parties, such as artists, heritage experts, institutions, audiences with disabilities, accessibility researchers, technical staff, and others. Previous research has recognized the significance of the curator in exhibition planning and their relationship with other stakeholders [22]. However, there is a lack of research examining how the curator can collaborate with other stakeholders to integrate assistive technologies for BLV people into the exhibition more effectively to ensure accessibility. In this study, we propose a model of curator-centered multi-stakeholder collaboration to address this gap.

Engaging with BLV audiences and BLV organizations: Curators are responsible for working with BLV people and organizations to gain insight into their views on accessibility in exhibitions. Curators can build such partnerships through web searches, social media, local communities, and associations. Once a suitable partner is found, the curator should share the theme and timing of the exhibition with them and provide a detailed introduction or virtual access platform to address accessibility concerns. During the exhibition, the curator should communicate with the BLV audience or representatives of BLV organizations to understand their accessibility needs, preferences, and expectations. Based on these insights, curators can take appropriate steps to improve accessibility and relay feedback to technical staff for further improvement.

Collaborating with assistive technology designers and developers: Curators must work closely with assistive technology designers and developers to ensure that exhibits are accessible to BLV audiences by designing appropriate assistive technologies that work in harmony with the infrastructure and visitors of an exhibition venue. The curator should analyze the characteristics of each exhibit venue and provide detailed instructions to assistive technology designers and developers to design and implement appropriate technical solutions. They should test and evaluate the usability and effectiveness of each exhibit, make adjustments as needed, and communicate with technicians during the exhibition to ensure that BLV visitors' needs are met.

Working with artists and heritage researchers: Curators must work with artists and heritage researchers who are in charge of creating narratives for artifacts whose creators may no longer live to ensure that the works are appropriately displayed and interpreted. To address the challenge of communicating the intended meaning of an artist or an artifact, curators can work with an interdisciplinary team of artists, artifact researchers, and technicians to devise interpretive techniques.

Collaboration with the management and supervision team of an exhibition/museum/gallery: Curators may consider different ways to communicate accessibility needs and assistive equipment and services required for exhibitions with the management and supervision team who hold the power of granting grants and implementing policies. However, there is little work in this space and future work should investigate ways to promote this collaboration.

6 LIMITATIONS AND FUTURE WORK

This study provides insights into the challenges faced by curators when incorporating assistive technologies for BLV people to achieve accessible exhibitions. Based on the findings, we discussed possible ways to support curators in creating accessible exhibitions for BLV people. To our knowledge, this is the first study to investigate how to make exhibitions in museums and galleries more accessible from the perspective of curators. Next, we discuss limitations and call for more actions in our community to collectively make exhibitions more accessible to BLV people and people with disabilities in general.

First, as most exhibitions are visually oriented, we chose to focus on visual impairments as the first step so that we could dive deep into the topic with curators without scattering too much on people with different types of disabilities at this stage. However, we believe it is critical to make exhibitions more accessible to people with all types of disabilities. Visitors with different types of disabilities may face similar and different challenges when visiting museums. Thus, making exhibitions accessible to all is extremely challenging. We urge the community to have more open conversations and explorations on how accessibility researchers can do to help make exhibitions more accessible to visitors with all types of disabilities.

[1] https://www.berlinklusion.de/

Second, our study focused on offline exhibitions in our physical world as such exhibitions are still the most popular form and have advantages over online/virtual ones in many aspects. However, online or virtual reality museums are becoming increasingly popular. Thus, future work should also investigate the accessibility challenges in making online exhibitions more accessible to people with disabilities.

Third, our participants were curators working on different types of exhibitions, such as contemporary art exhibitions and historical and cultural exhibitions. We noticed that although they shared the same general set of concerns and demands for assistive technologies and how to integrate them into exhibitions, the exact type of exhibitions seemed to affect their priorities. However, our current study had limited data to draw conclusions. It is worth studying how the types of exhibitions in different museums (e.g., arts, science, history) and galleries might affect accessibility needs and challenges.

Fourth, most of our participants were based in inner-city or metropolitan areas. Given the potential influence of regional infrastructure differences on curatorial practices and challenges, there might be differences in curators' experiences of accessibility in developed and less developed regions. Future work should conduct similar studies in other regions and cultures (e.g. developed and less-developed regions) to see identify similarities and differences in exhibition practices.

Lastly, although our study focused on curators' experiences and challenges in incorporating assistive technologies, improving accessibility for BLV people requires the involvement of multiple stakeholders, including people with disabilities, technicians, artists, and exhibition institutions. Future research should therefore incorporate the perspectives of these stakeholders to gain a comprehensive understanding of the issues involved.

7 CONCLUSION

We have conducted in-depth semi-structured interviews using example assistive technologies as probes with 22 curators to understand their experiences and challenges of incorporating assistive technologies into their exhibitions to make them more accessible to BLV visitors. Our findings suggest that curators face four challenges: 1) difficulty in attracting BLV visitors; 2) difficulty in incorporating assistive technologies; 3) Lack of industry standards for assistive technology and policy support; 4) trade-offs between BLV and sighted visitors as well as lack of curators' prior knowledge. As a first step toward understanding the practices and challenges of using assistive technologies in exhibitions among curators, our work reveals what currently works and what does not for curatorial workers and highlights technical and social challenges that HCI and accessibility researchers could further investigate.

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A APPENDIX

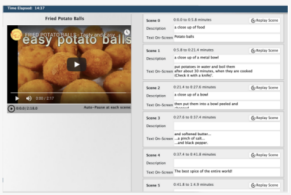
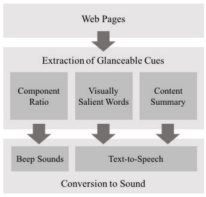
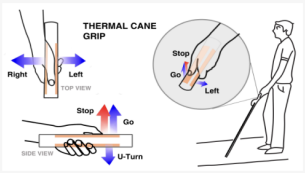
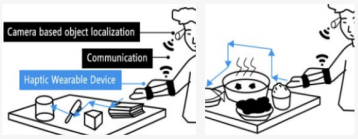
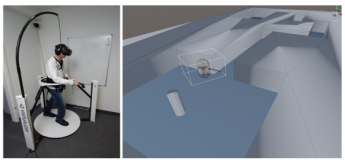
Number/name	Illustrations	Introduction
Tech A		Best practices and recommendations for the use of emoji are presented to improve the accessibility of future emoji for people with visual impairment.
Tech B		A looped human machine learning (HILML) video description method by automatically generating video text and scene segmentation while allowing human editing of the output. Our HILML system is much faster and easier for first-time video descriptors to use than human-only control conditions without the aid of machine learning.
Tech C		SoundGlance, a novel application that provides a brief aural summary of a web page, supports screen reader users by converting important first glance cues on a page into sound.
Tech D		The ThermalCane is a white cane grip instrument with multiple flexible thermal modules that provides blind and visually impaired (BVI) users with directional orientation cues guided by thermal haptics. We also conducted two thermal haptic experiments on user perceptions of the ThermalCane.
Tech E		A prototype of a glove that alerts the user when an obstacle is detected at the pointing position. EyeR provided real time feedback and aided in navigation.
Tech F		PneuFetch is a wearable device based on light tactile cues that supports blind and visually impaired (BVI) people in accessing nearby objects in unfamiliar environments. In into a friendly, non-invasive and gentle press and drag, it provides directional and distance cues on the user's wrist and forearm.
Tech G		People with visual impairment (PVI) explore virtual environments (VE) by walking in a virtual reality (VR) treadmill. A new, more intuitive way of exploring unknown spaces virtually in advance, for example.

Figure 7: Tech A [92], Tech B [100], Tech C [89], Tech D [74], Tech E [41], Tech F [38], Tech G [50]

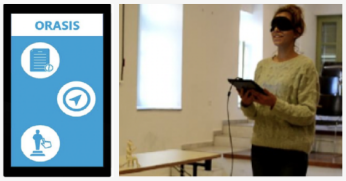
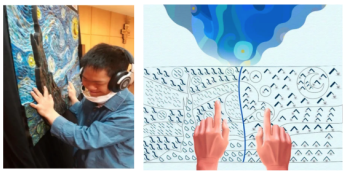
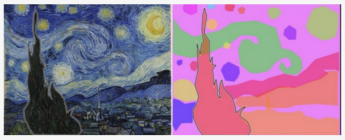
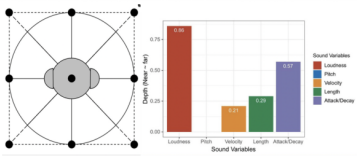
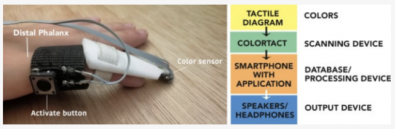
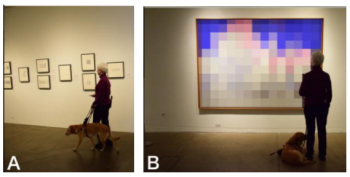
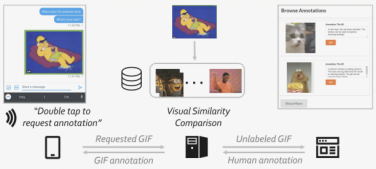
Number/name	Illustrations	Introduction
Tech H		AMC for VI is a prototype system that enhances the accessibility of museum exhibits for visually impaired users. The approach supports navigation through the galleries as well as tactile exploration of exhibit replicas on mobile devices using touch-sensitive audio descriptions and touch gestures. The required technology includes 3D printed exhibits, additional touch sensors, an Arduino board and a corresponding mobile application.
Tech I		The visual elements of the work are communicated to the visually impaired through a variety of sensory elements. In addition, techniques that integrate patterns, temperature, scent, music and vibration to express colour coding are explored and future research topics are proposed in order to open up new perspectives on the appreciation of the work.
Tech J		A touchscreen-based mobile application that acts as a prototype focusing on 2D painting, allowing users to learn the artwork at a less physically and time-constrained time while hearing the details of the content as they explore each painting by touch.
Tech K		This study attempts to convey to the visually impaired a colour and depth coding scheme based on alternative sensory modalities such as auditory (encoding colour and depth information through audio descriptions of 3D sounds) and tactile (for interface trigger information such as colour and depth).
Tech L		ColorTact is a finger wearable device for accessing audio annotations on the haptic map. It is designed to cater for a seamless audio experience while exploring haptic imagery. It allows the user to use both hands to detect haptic images without restricting fingertip movement and tactile sensation.
Tech M		The technology continuously tracks the user's position and orientation, allowing seamless interaction between navigation into the art painting tour. When the visitor has finished looking at (A), the visitor is informed that artwork B, which is close at hand, is to your right, while the guide dog user receives rotational instructions to guide her body towards the artwork approaching (B), which the system then automatically begins to describe.
Tech N		To improve the accessibility of animated GIFs for BLV users, this study provided a system called Ga11y (pronounced "kitchen") for Create GIF annotations.
Tech O		A 3D tactile system to help visually impaired people to recognise colours through texture perception when viewing art paintings. The system is designed based on the basic principles of colour perception, tactile acuity and Braille information. The tactile colour texture scheme is intended for visually impaired people who lack colour perception to learn intuitively.

Figure 8: Tech H [92], Tech I [19], Tech J [51], Tech K [56], Tech L [73], Tech M [9], Tech N [101], Tech O [86]

Table 2: Participants' additional information.

ID	Type of focus of the museum	Type of work of freelance curator	Accessibility coordinator
1	Contemporary Art Gallery	Musical Works, multimedia	N
2	Historical Museum	Historical artifacts (books/paintings/sculptures)	Y
3	Contemporary Art Gallery	Paintings, installations, multimedia works	Y
4	Art Museum	Paintings, installations, multimedia works	Y
5	Historical Museum	Historical artifacts (books/paintings/sculptures)	Y
6	Contemporary Art Gallery	Paintings, installations, multimedia works	N
7	Historical museum	Historical artifacts (books/paintings/sculptures)	Y
8	Contemporary Art Gallery	Paintings, installations, multimedia works	N
9	Contemporary Art Gallery	Paintings, installations, multimedia works	N
10	Contemporary Art Gallery	Musical Works, multimedia	N
11	Contemporary Art Gallery	Paintings, installations, multimedia works	Y
12	Contemporary Art Gallery	Paintings, installations, multimedia works	Y
13	Historical museum	Historical artifacts (books/paintings/sculptures)	Y
14	Contemporary Art Gallery	Paintings, installations, multimedia works	Y
15	Art Museum	Historical artifacts (books/paintings/sculptures),Paintings	Y
16	Art Museum	Paintings, installations, multimedia works	Y
17	Contemporary Art Gallery	Paintings, installations, multimedia works	N
18	Contemporary Art Gallery	Paintings, installations, multimedia works	N
19	Art Museum	Paintings, installations, multimedia works	Y
20	Contemporary Art Gallery	Paintings, installations, multimedia works	Y
21	Art Museum	Historical artifacts (books/paintings/sculptures),Paintings	Y
22	Contemporary Art Gallery	Paintings, installations, multimedia works	N