Improving Accessibility at Aquariums for the Visually Impaired

Tristan Bernardo

DePaul University

Human-Computer Interaction Department

College of Computing and Digital Media

Chicago, IL 60604, USA

Deepak Pradeep

DePaul University

Human-Computer Interaction Department

College of Computing and Digital Media

Chicago, IL 60604, USA

Yunyi Wang

DePaul University

Human-Computer Interaction Department

College of Computing and Digital Media

Chicago, IL 60604, USA

Abstract

Historically, museums have failed to accommodate the needs of people with disabilities, particularly those with visual impairments. Museums such as aquariums have a unique challenge to provide accessibility because of the dynamic nature of their exhibits. Our team conducted interviews and observations with visually impaired visitors at the Shedd Aquarium in Chicago to examine this problem space. Also, to understand audio descriptions (a means to enhance the experience for people with visual impairments), we interviewed Dr. Joel Snyder, one of the first audio describers. From our research, we found that (1) museum staff lacked training in assistive technology, (2) exhibits could be made more accessible by adding multi-modal sensory information such as tactile and auditory elements, and (3) information on accessible exhibits and navigation needs to be provided ahead of time.

Author Keywords

Accessibility; aquarium; museum; blind; audio description; visual impairment; AD; assistive technology.

ACM Classification Keywords

K.4.2. Social Issues: Assistive technologies for persons with disabilities.

Figure 1: The researcher is describing a 3D model of a sea otter to the participant. Participants mentioned that they preferred to complement tactile elements with audio descriptions.

Introduction and Related Work

Many museums are inaccessible to people who are visually impaired [1]. Exhibitions in museums, galleries and other cultural institutions are often designed with an expectation that people 'go to see' them [6]. Due to the lack of braille information and audio descriptions, people with visual impairments are discouraged from visiting cultural institutions, like museums, and need to rely on tour guides when they do visit [1].

As a type of assistive technology, audio descriptions (AD) can enhance and make the arts accessible for all people in museums, theaters, television or at the movies [8]. While audio descriptions can help to improve content comprehension and social inclusion, they are often not engaging to people with visual impairments because some original audio content, namely non-verbal sound, may be partially obscured for the duration of an AD utterance [5]. Also, since there are countless visual qualities of objects, audio describers may not focus on certain characteristics that provide the most meaning to their users [4].

To facilitate accessibility, some museums provide special exhibits that allow visitors to touch displays. However, these are usually small and do not include all the artifacts that visitors came to see or experience [2]. Another major challenge for people with visual impairments is independent path-based mobility in an unfamiliar indoor environment. Existing solutions do not provide active guidance, and are bulky and expensive [7]. People with visual impairments favor query style navigation in museums compared to a linear style as it provides greater agency [3].

To gain initial insights into this problem space, we first observed a focus group session with a panel of people with visual impairments, conducted by the Shedd Aquarium. The concerns raised by the participants included undertrained museum staff and difficulty navigating indoors. However, they mentioned that they enjoyed being able to touch props and tactile elements at exhibitions. This confirmed some of our initial findings from the literature review, while raising the following research questions: (1) What challenges do visually impaired visitors face when they visit museums? (2) What are their needs during the visit? (3) What type of information do they look for when they visit?

We found that research on accessibility in aquariums, with dynamic exhibitions such as live animals, is limited. Our research aimed to fill that gap by examining the experience of people with visual impairments at an aquarium, and learning their pain points, as well as potential areas for improvement. We also evaluated current assistive technology used by aquariums, and gathered feedback on their effectiveness to make recommendations for improvement.

Methods

In the following sections, we will discuss our participants, research procedures, and our data collection and analysis methods.

Participants

We recruited two participants who were visually impaired from the Chicago area for interviews and observations. These participants were recruited from the initial focus group session that we observed using

the snowball method. Our pre-screening conditions for the participants were: (1) they were visually impaired; and (2) They had visited museums in Chicago within the past year.

Visitor	Age	Gender
Brett	27-35	Male
Gertrude	27-35	Female

Table 1: Demographic information of the participants.

We also wanted to understand an audio describer's perspective, so we contacted Dr. Joel Snyder [8], one of the first official audio describers. Our interview with him helped us gain valuable insights into an audio describer's methods.

Data Collection
Our data collection process involved: (1) one initial 30-minute interview per participant about their previous experiences at Shedd Aquarium; and (2) one 60-minute observation per participant of their interaction with exhibits at Shedd Aquarium. For each session, we alternated between the roles of moderator, observer/note-taker, and navigator for the participant. We carried out the sessions on two Saturdays mornings, a week apart, for each participant. We met the participants at the accessible entrance of the Shedd Aquarium, and guided them inside to conduct our interviews. In the interviews, we asked participants how they felt about audio descriptions and accessible exhibits, as well as tools and resources used to improve their experience. After the interviews, we guided them around the aquarium to visit exhibits and observed their interactions. During the observations, one of the team members described the exhibits for the participants who were guided by a second team member, while the third took notes. We also recorded our sessions for analysis.

Since the Shedd Aquarium provides on-demand audio descriptions to visually impaired visitors for live shows, we wanted to understand an audio describer's process. Therefore, we conducted a 30-minute Skype interview with Dr. Joel Snyder, in which we asked about his approach to audio descriptions, and common challenges of providing audio descriptions at museums with live exhibits.

Data Analysis
The data gathered from our research was organized into three sets: (1) observations from the participants, (2) interviews with the participants and (3) the interview with an audio describer. We created three separate affinity diagrams and abstracted insights and themes from the raw data.

Findings
In the following section, we will talk about the findings from our research sessions.

Visitors
In regard to how participants felt about the current setup at the aquarium, we grouped our findings into the following categories:

STAFF TRAINING
We found that Assistive Technology is only as good as the training that staff have received. For example, one participant said that she was not told how to use the assistive listening device she was given before the audio described show began.

Figure 2: In this image, a person is touching a tactile seahorse model. When certain areas of the seahorse are touched, a specific corresponding description is played.

Image credit:
https://i.ytimg.com/vi/maPiYeGdf
ps/maxresdefault.jpg

EXHIBIT DESIGN

Our findings on Exhibit Design are as follows:

Text-based Elements

We found that participants preferred to receive information about accessible exhibits and navigation in advance via email or text message, so that they can prepare for the visit. When at the museum, they preferred having text information for signage in braille, but needed help to know that the signage was there. For lengthy text information, they preferred it in audio format.

Tactile Elements

There are several benefits of having tactile elements in exhibits. Our participants mentioned that they enjoyed tactile elements because they helped create a fuller mental picture, and improved engagement and knowledge retention. For example, both participants specifically remembered touching tactile elements in the 'Amazon Rising' exhibit.

We also found that tactile elements are most effective when complemented with other sensory information such as audio descriptions and sound. Both participants indicated that when there was no audio description, they did not understand the purpose of tactile elements.

When interacting with the seahorse tactile model (see Figure 2), both participants mentioned that they were not sure which areas on the seahorse corresponded to the audio prompts that they heard. They suggested that the areas that trigger audio prompts should be differentiated from the rest of the seahorse, so that they can make the connection between a specific point on the seahorse and its corresponding feedback.

Sound Elements

One of the exhibits had an ambient sound of tidal waves that greeted visitors upon entrance. This sound reverberated off of the narrow space in which it was located. One participant commented that this helped them understand that the area we were moving through was more enclosed.

ASSISTIVE TECHNOLOGY (AUDIO DESCRIPTION)

Shedd Aquarium offers a live aquatic show with on-demand audio descriptions that both of our participants had experienced. The process involved an audio describer, who is situated at an optimal vantage point, speaking to visitors with visual impairments through an assistive listening device (remote audio receiver). This provided a discreet experience for the visitors. The audio describer also provided a general description of the physical setup of the venue before the show began.

NAVIGATION

Both participants indicated that the size of the aquarium's open space, its dome-shaped architecture, and the crowd level had a negative impact on their ability to navigate the space on their own. Their concerns included running into people, being run into, and causing damage to the exhibits.

ENGAGEMENT

During the interviews and observations, we explored our participants' emotional needs and feelings as they experienced the aquarium. Participants indicated that their experiences were emotional. One participant said the live aquatic show with audio descriptions was a special experience, and the other participant commented on having a smile throughout the show.

Figure 3: The researcher is guiding the participant's arm to touch a sturgeon's body.

However, they mentioned that the lack of accessibility at other exhibits negatively affected their emotions.

Both participants strongly indicated that they wanted to be a part of the general public and enjoy the experience with everyone rather than having a separate one. Also, understanding the full context of the experience with multiple modes of sensory information, and being able to enjoy laughable moments keeps them engaged in the experience.

DETERRENTS

Both participants talked about what prevented them from visiting museums. We grouped these deterrents into the following sub-categories:

1. *Assumptions*: Only a small portion of museums are accessible, and most of the information presented is in visual format. Therefore, they assume that a museum is not accessible and are discouraged from going.
2. *Navigation*: Museum entrances are hard to find for people with visual impairments because public spaces are generally not designed for them. Also, location related information such as directionality and maps are purely visual based.
3. *Touchscreen Displays*: Touchscreen displays are common at museums, but they are not accessible.
4. *Sensory Overload*: Crowd noise can interfere with the audio description and affect its quality. It also interferes with their ability to learn the information in the exhibits and navigate.
5. *Fear*: The fear of having to navigate on their own because of the unpredictable nature of public spaces can hinder people with visual impairments.

Audio Describers

Our interview with Dr. Joel Snyder revealed the following five categories of findings specific to audio description:

BACKGROUND INFORMATION

Dr. Snyder emphasized that audio description is "*an art, not a science*". It is a structured technique to describe. It can benefit everyone, more than just people with visual impairments.

CHALLENGES

According to Dr. Snyder, there are many challenges to providing audio description; the most apparent being museum staff who are not adequately trained to use assistive technology and interact with people who are blind. Also, sometimes the audio describer may not be well trained. Other challenges include on-the-fly descriptions for dynamic exhibits, determining what is most critical for visualizing an event, and making sure users are as engaged as sighted audience members.

FEEDBACK

Dr. Snyder recommended collecting feedback on the effectiveness of audio description from users in a controlled environment, such as through administering surveys, to guarantee that the data are unbiased.

BEST PRACTICES

According to Dr. Snyder, "*from general to specific*" is the fundamental principle of audio description. He also mentioned that audio describers need to know what information to convey at the right time. For live exhibits, audio describers should pay more attention to the atmosphere and environment, while not being too literal or linear. When describing his process, Dr. Snyder said he does extensive prior domain research to gather contextual information. He takes multiple trips

to museums, and takes pictures and videos, in order to create a draft for his audio descriptions.

Discussion

With this study we have examined the experience of people with visual impairments at the Shedd Aquarium and noted their pain points. We interviewed and observed their interactions with various exhibits. We also conducted an interview with Dr. Joel Snyder to understand an audio describer's process and the common challenges to providing audio descriptions.

Some of the findings from our study at the Shedd Aquarium seem to reiterate challenges that were documented in the literature, such as a lack of braille information and audio descriptions, and concerns with independent path-based mobility in an unfamiliar indoor environment.

We also discovered that aquariums have unique challenges for providing accessibility, because of the dynamic nature of live animal exhibits. To address these unique challenges, the Shedd Aquarium has already taken steps to improve their accessibility by (1) showing a commitment to learning the needs of the Blind Community through methods such as focus groups, (2) designing exhibits that deliver multi-modal sensory information such as the interactive seahorse exhibit (see Figure 2), and (3) providing audio descriptions for live shows through assistive technology.

Based on our findings we recommend the following measures to improve accessibility at aquariums:

- Provide domain-specific training to audio describers, and assistive technology training to museum staff
- Bring museum staff and people with visual impairments together regularly to promote understanding
- Add multi-modal sensory information such as tactile and auditory elements to more exhibits
- Perform user testing on existing accessible exhibits to improve existing and inform future designs
- Provide information on accessible exhibits and navigation to visitors with visual impairments prior to their visit
- Have short text information such as signage in braille, and long text information in audio format

Limitations
As with every research study, ours had certain limitations that may have affected our data. These include (1) small sample size, (2) having evaluated only one aquarium, and (3) our participants worked for an organization that is already promoting accessibility for the visually impaired, so they are aware of advanced assistive technology.

Future Work
We plan to conduct more studies at multiple aquariums with a larger and more diverse sample group.

Acknowledgements

References

1. Anagnostakis, G., Antoniou, M., Kardamitsi, E., Sachinidis, T., Koutsabasis, P., Stavrakis, M., ... & Zissis, D. (2016, September). 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). ACM.

2. Brewster, S. A. "The Impact of Haptic 'Touching' Technology on Cultural Applications." Proceedings of EVA. Vol. 1. 2001.

3. Cober, R., Au, O., & Son, J. J. (2012, February). Using a Participatory Approach to Design a Technology-Enhanced Museum Tour for Visitors Who are Blind. In Proceedings of the 2012 iConference (pp. 592-594). ACM.

4. Fryer, L. (2013). An ecological approach to audio description. Psychologist, 26(6), 458-460.

5. Fryer, L., & Freeman, J. (2013, June). Visual Impairment and Presence: Measuring the Effect of Audio Description. In Proceedings of the 2013 Inputs-Outputs Conference: An Interdisciplinary Conference on Engagement in HCI and Performance (p. 4). ACM.

6. Herschel-Shorland, C. (2003). Talking Images: audio description in museums, galleries and heritage sites. Access by Design, (96), 9-10.

7. Jain, Dhruv. "Pilot Evaluation of a Path-Guided Indoor Navigation System for Visually Impaired in a Public Museum." Proceedings of the 16th International ACM SIGACCESS Conference on Computers & Accessibility. ACM, 2014.

8. Snyder, Joel. "Audio description: The Visual Made Verbal." International Congress Series. Vol. 1282. Elsevier, 2005.