Accessible Technology

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Abstract

According to the American Alliance of Museums, a museum should not only strive to be inclusive by complying with accessibility laws and offering opportunities for diverse participation, but should also demonstrate a commitment to providing the public with both physical and intellectual access (AAM 2016). As part of the effort to inform the museum field of ways museums integrate accessible technology into their collections and programmatic interpretation, this paper provides an overview of the U.S. population with disabilities, a brief survey of some of the latest accessibility technologies used by museums and an outline of VMG's development and implementation of its Virtual Access Tour.

Introduction

According to the American Alliance of Museums, a museum should not only strive to be inclusive by complying with accessibility laws and offering opportunities for diverse participation, but should also demonstrate a commitment to providing the public with both physical and intellectual access (AAM 2016). Vizcaya Museum and Gardens (VMG) located in Miami, FL is a National Historic Landmark that strives to meet these goals, but is also greatly challenged with accessibility for its diverse visitors. Vizcaya is a 43-acre estate that was built in 1916. It is comprised of a main house, where most of its museum collections are featured, as well as a formal garden and a variety of outbuildings. Historic places such as this pose barriers to adaptive reuse projects and current Americans with Disabilities Act regulations. Like most historic structures, VMG was not originally designed to accommodate people with disabilities. However, persons with disabilities should be able to experience the museum and gardens in the same manner as other users whenever possible. Providing access (exterior and interior) for all visitors in ways that preserve the character of the historic institution requires creativity and collaboration among staff. As a result, the museum is intent on experimenting with technology to help offer greater access opportunities to all of its visitors.

As part of the effort to inform the museum field of ways museums integrate accessible technology into their interpretation, this paper provides an overview of the U.S. population with disabilities, a brief survey of some of the latest accessibility technologies used by museums and an outline of VMG's development and implementation of its Virtual Access Tour.

Context

Substantial regulations are in place in the U.S. that mandate physical accessibility of public spaces. The Americans with Disabilities Act (ADA) of 1990 makes clear the responsibilities of museums to visitors with a broad range of disabilities and upon a spectrum of each disability. The ADA is a civil rights law that prohibits discrimination against individuals with disabilities in all areas of public life, including jobs, schools, transportation, and all public and private places that are open to the general public including museums. In 2010, the New Americans with Disability Act standards were adopted by the Department of Justice, replacing the original ADA standards. The revised standards continue to help create buildings and facilities that are accessible to more than 56 million Americans with disabilities.

About 56.7 million people, 19 percent of the US population had a reported disability in 2010 (U.S. Census Bureau, 2010). Of the 69.6 million families in the U.S., 20.3 million families have at least one member with a disability and about half of all families have loved ones or close friends with disabilities (U.S. Census Bureau, 2010). Between 2006 and 2016 in the U.S., the age 50+ population will have grown by 22 million with 1 in 4 people over age 50 and 1 in 2 people over age 65 (U.S. Census Bureau, 2010, 2000). As Baby Boomers age, the probability of developing a disability or chronic illness increases. In 2015, the baby boomer generation commanded 60% of the net U.S. wealth and 40% of its spending (VSAFL and U.S. Census Bureau, 2010). This constituency makes up a large proportion of the museum going population. Museum staff must be conscious of the needs of visitors as we think about accessibility and realize that access issues affect a large rather than small part of the population, especially those attending museums.

To be vigilant, museums must view disabilities upon a spectrum that can be both visible and hidden. Disabilities include physical, sensory (vision, hearing, touch, smell), developmental, cognitive, and psychological. A spectrum model refers to the range of ability under which people function. For example, a person who is legally blind can see at 20 feet what a person with vision can see at 200 feet. This does not mean that individual has total blindness. People with vision loss will range from those who are completely blind to those who can't adjust quickly to changes in lighting conditions. We should never presume that someone doesn't have a disability just because it is not readily apparent.

Museums have been steadily incorporating accommodations and programs that ensure inclusion for all visitors and participants (Bienvenu, 2015). In 2011, The Smithsonian took a leadership role in not only ensuring accessibility in its own programs and exhibits but, by guiding the museum field through its publications and resources, including the Smithsonian's Guide to Accessible Exhibit Design. Within, guidelines are offered for audiovisuals and interactives providing recommendations on control and operation, heights and locations, glare and reflection, and basic user interface characteristics for interactive elements such as touchscreens.

Additionally, the Institute of Museum and Library Services maintains a page of web resources related to accessibility in museums and libraries to assist libraries and museums in embracing easily accessible physical and virtual spaces, and interactive innovative technologies. The organization supports these projects through grants and awards as well.

Access Technologies in Museums

Some examples of technologies that are improving inclusion and accessibility in museums include: The Beam, a telepresence robot that allows users to take one-on-one guided tours through a museum without ever being physically in the space; the interactive Augsburg Display Cabinet at the Getty Museum for homebound and deaf museumgoers; The Vlog (virtual blogs) Project at the Whitney Museum that caters to the deaf community; Assisted Listening Devices (ADLs), devices that amplify the volume of a desired sound without increasing the background noise; and the Louvre's Nintendo 3DS offering, which includes in-depth audio guides as well as location mapping services—a useful feature for visually-impaired visitors. For those with visual impairments, many museums are incorporating tactile exhibits as well as updated audio guides and apps. Museums are also experimenting with beacon technology, which connect to a

smartphone app to improve accessibility for people with visual impairments guiding blind visitors through a space.

Other technologies such as 3D documentation through photogrammetry and laser scanning is allowing for accurate scans and 3D print-outs of objects that museumgoers can touch and handle (Nolan 2016). In order for 3D printing to allow greater accessibility to European museums, the Ambavis project was launched with the support of the European Union. For this project 3D printers recreate "touch copies" for the visually impaired, so that they can explore the exhibits in a tactile manner. Austria, Germany and the United Kingdom are some of the countries in which this initiative is being implemented. In 2015, the Museo del Prado in Madrid launched the exhibition "Hoy toca el Prado", in collaboration with the AXA Foundation and ONCE. The exhibit created 3D prints of works of different genres that could be touched by people with visual disabilities. The exhibition also featured texts in Braille, audio guides and opaque cardboard glasses.

The Museum of Modern Art offers a variety of accessibility technologies. MoMA Audio: Visual Descriptions is an audio program for blind and partially sighted visitors that provides detailed descriptions of key works from the Museum's collection. In addition all MoMA theaters, lobby desks, ticketing desks, audioguide desks, and one of the classrooms are equipped with induction loops that transmit directly to hearing aids with T-Coils.

The Guggenheim app covers special exhibitions, selections from the permanent collection, and the architecture of the building. The app includes verbal descriptions of select collection artworks and exhibitions for visitors who are blind or have low vision. The Guggenheim's admissions desk, membership desk, and store are equipped with T-coil compatible induction loops. The museum's app devices are also T-coil compatible and include transcripts of all tour stops. In addition, the free Guggenheim app includes video guides of the Thannhauser Collection in American Sign Language (ASL) with open captions for visitors who are deaf or hearing impaired.

The Museum of Fine Arts Boston (MFA) has Assistive Listening Devices (ALD) for gallery tours and talks. For visitors with hearing aids with a T-coil switch, there are induction loops at all entrances, the box office, and the information desk. The MFA is also committed to facilitating the accessibility and usability of its website, http://www.mfa.org/, for all people with disabilities. The MFA will be implementing over time the relevant portions of the World Wide Web Consortium's Web Content Accessibility Guidelines 2.0 Level AA as its web accessibility standard, which will also bring the MFA into conformance with the Section 5-8 Web Accessibility Standards developed by the United States Access Board.

The Museum of Science, Boston, is noted for its work in developing accessible touchscreen interactives. For example, its Provocative Questions exhibition incorporated an extensive program of testing that included visitors with and without disabilities. Staff discovered that they anticipated the users' needs regarding physical layout, but they needed to clarify on-screen instructions and display sensitivity (O'Hara, 2015).

The American Museum of Natural History makes its website accessible to individuals with disabilities and is in the process of reviewing and updating its web resources in accordance with the Web Content Accessibility Guidelines 2.0, Level AA. The Smithsonian institution offers a variety of ALDs for its visitors and as mentioned has led the field in providing many guidelines as relates to accessibility in exhibitions, programs and kiosk design.

What the author has provided is a small sampling of the museum field's attempts at accessibility through technology. Please take into account the author has not included the vast efforts by museums outside of the specific realm of technology to make their institutions more accessible to a wide variety of visitors. With the continued integration of accessible technology into museum exhibits, programs and general interpretation new challenges and solutions continue to arise. It is the author's hope that technology will continue to allow for greater accessible design through multi-media approaches that are highly adaptive to context and content.

Vizcaya's Virtual Access Tour

The primary objective for Vizcaya's Virtual Access Tour (VAT) was to replace a narrated video of the main house's second floor decorated rooms with a broader platform of enhanced accessibility and an active free-choice learning experience. Vizcaya's second floor is primarily only accessible by a two-story main staircase and sections of the gardens are difficult to access with even minor mobility impairments. VAT achieves accessibility and inclusion for diverse audiences through universal design and allows virtual access to the second floor and non-accessible areas of the gardens. ADA compliance for this project was paramount and represented a combination of proper kiosk design, appropriate installation and site preparation, and accommodating software application development.

Vizcaya's work on the VAT was highlighted by a social justice model to accessibility, universal design and free-choice learning. The social justice model considers inclusion from the standpoint that everyone belongs and that all people have a range of abilities and disabilities that need to be catered to (Loewen & Pollard, 2010). Universal design considers all audiences and levels of ability, rather than single populations that are targeted at the expense of others. Universal design is a concept originated by Ron Mace, the founder of the Center for Universal Design in North Carolina. Mace was an architect with a disability (Mace, 1988). Free-choice learning theory promotes personalization of experience so that users may navigate in a way that is appropriate for their interest and cognitive and developmental level. Falk (2005) defines free-choice learning environments, such as museums, aquariums, zoos, nature centers, and national parks, as places where individuals have significant choice and control over their learning. Free-choice learning is also defined by the National Research Council (2009) as "Learner motivated, guided by learner interests, voluntary, personal, ongoing, contextually relevant, collaborative, nonlinear, and open-ended" (p. 11).

As Vizcaya explored design considerations for the VAT staff utilized a comprehensive study of issues and potential solutions related to kiosk accessibility prepared by Fain (2009). This study guided Vizcaya's design. Areas of focus when designing the VAT included:

1. **Height of interactive elements**. Working closely with the software designer all interactive elements were placed at the bottom of the touch screen to meet ADA requires of 15 inches and 48 inches from the ground.
2. **Use high contrast colors for text**. ADA has multiple recommendations for various elements to ensure color contrast. It suggests either light on dark, or dark on light elements. Recommendation is to keep contrast level of 70 percent between the background and foreground text for all interface elements in our user interfaces. The kiosk was placed in a room with consistent lighting to ensure the screen appearance remains the same throughout the day.
3. **Size of text and interface elements**. ADA requires the use of large text (3/16 inches). Vizcaya ensured that text was sufficient in size with adequate spacing between each element. Icons were designed as large as possible, given the space available. All buttons were designed large and spaced far enough apart to minimize the possibility of accidental activation of adjacent buttons.
4. **LCD viewing angle**: Vizcaya ensured that the viewing angle of the kiosk display accommodates both standing and seated users.
5. **Limit physical barriers**. Vizcaya provided a minimum clear floor space of 60" in diameter in front of the device (ADA recommended) so the kiosk can easily be accessed by someone using wheelchair and to accommodate both forward approach and a circular or T-shaped turning space for leaving the kiosk.

The widespread use of touchscreens is problematic for those with impaired vision. With some exceptions, notably ATMs, touchscreens typically do not cater to the needs of the vision impaired, thus limiting the ability to access and take advantage of such devices and creates unequal or restricted access to information. With this in mind future design considerations for a next generation VAT should include: visitor controlled contrast adjustment for the display, alternate display mode with larger fonts and high contrast options along with large widely spaced controls and alternatives to the visual display such as descriptive auditory experience to facilitate interaction by users with low vision. Currently, Vizcaya does offer an audio tour that can be used by all visitors to learn about the museum, though the audio tour does not incorporate audio description.

Next steps

Vizcaya Museum and Gardens is in the planning phase of evaluating the VAT with regard to both physical and intellectual accessibility. Items to be assessed include (a) physical accessibility of the display; (b) intellectual accessibility of the content (e.g. quality and length of text, understanding of messages); (c) interface design (e. g. how easy is it to navigate the tour). Vizcaya will also collect basic demographic information. The museum's approach to assessment will be both quantitative through survey delivery and qualitative through staff observation of visitor use and informal oral discussions with visitors. Vizcaya hopes to use the findings to augment, refine and if necessary change the VAT to better accommodate our visitors.

The lessons learned from the VAT project will inform Vizcaya's strategic approach to interactive delivery throughout the museum. This includes digital room labels and exhibition-specific kiosks.

Conclusion

Museums continue to be challenged by accessibility, but it is the field's duty to conceive of ways to best accommodate all visitors in the most inclusive manner possible. As museum practitioners we must leverage technology to be both an interpretive tool and a tool of accessibility. When designing technology interfaces, museums should always incorporate the goal of inclusion into projects from the very beginning, consider ways to involve people with disabilities in the design process and perform user testing and evaluation with people with disabilities (Beyer, et. al 2014). Following through on these basic principles can help keep inclusion at the forefront of project design. As museums become increasingly digital we must utilize a variety of interfaces that can appeal and be accessible to as many people as possible. Through a universal design approach museums can avoid targeting specific populations at the exclusion of others. Many accessibility features can be useful to a wider group than just the visitors with disabilities who inspired them. For example, VMGs Virtual Access Tour is used by a wide spectrum of visitors satisfying many different interpretive needs of the museum.

Moving forward and for effective design museums must continue to learn and have an increased understanding of the communication needs and styles of people with disabilities so that experiences are accessible to all. Though VMG has a long way to go in making itself a fully accessible space, we are intent on improving. VMG's use of the VAT, iPad media kiosks, audio tours, guide books and braille guide books are a beginning for us. In addition, we are currently researching mobile app development to combine the power of the audio tour and VAT to have one platform that will be accessible to many audiences. Furthermore, we working with laser scanning and photogrammetry 3D documentation methods that in the future can help all visitors including those with disabilities tailor their museum experiences to meet their individual needs.

Museums and cultural organizations provide incredible opportunities to experience and engage with history and culture. Physical and digital accessibility should be a focus of how we go about making such experiences accessible increasing our value our contributions to society. As exhibited in this paper, numerous museums across the country and abroad have initiated efforts to improve their accessibility through technology for visitors. Museums that invest in removing barriers from their facilities, design accessible interpretive tools and provide effective communication for their programs can potentially attract more than 50 million Americans with disabilities.

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