

Technology Solutions to Enhance Accessibility and Engagement in Museums for the Visually Impaired

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Most museums attempt to achieve full accessibility for all members of their community, however few adults with disabilities in the United States engage with the arts with only 23.3% attending a live performing arts event and 25% attending a visual arts event

in 2012 (See Figure

1).¹ Fortunately,

technological

innovations are

increasing

opportunities for

visually impaired

patrons to engage

with the arts.

There are four

common approaches for serving these members of the community: seeing-through-touch tours, beacon technology, expressive audio description, and apps on personal

devices. Both expressive audio description and apps may be categorized as emerging technologies, while beacon technology continues to improve. Seeing-through-touch tours are often specifically designed to serve visually impaired patrons, but the delivery of

Table 1. Percentage of U.S. Adults with Disabilities Attending Performing Arts and Visual Arts Events, 2012

	All adults (Population = 235 million)			Adults with disabilities (Population=27.6 million)		
	Percent attending	Margin of error +/-	Number of adults attending (in millions)	Percent attending	Margin of error +/-	Number of adults attending (in millions)
PERFORMING ARTS ATTENDANCE						
Live performing arts event	37.3%	0.9%	87.7	23.3%	1.9%	6.4
Jazz concert	8.1%	0.5%	19.1	4.3%	0.8%	1.2
Classical concert	8.8%	0.5%	20.6	6.1%	1.0%	1.7
Latin concert	5.1%	0.4%	11.9	1.6%	0.5%	0.4
Opera	2.1%	0.2%	5.0	1.3%	0.5%	0.4
Musical play	15.2%	0.6%	35.7	9.2%	1.2%	2.5
Non-musical play	8.3%	0.5%	19.4	4.9%	0.9%	1.4
Dance	7.4%	0.5%	17.5	5.0%	0.9%	1.4
Outdoor performing arts festivals	20.8%	0.8%	48.9	10.6%	1.5%	2.9
VISUAL ARTS EVENT ATTENDANCE						
Visual arts event	39.0%	0.9%	91.7	25.0%	1.9%	6.9
Visited an art museum or gallery	21.0%	0.7%	49.4	11.4%	1.3%	3.1
Attended a visual arts festival or crafts fair	22.4%	0.8%	52.7	14.8%	1.5%	4.1
Toured a park, monument, building, or neighborhood for its historic or design value	23.9%	0.7%	56.1	14.5%	1.5%	4.0
Source: 2012 Survey of Public Participation in the Arts						
April 2015						
Office of Research & Analysis						

Figure 1. Figure 1. Percentage of US Adults with Disabilities Attending Performing and Visual Arts Events

Technology interfaces offer alternatives for both users and institutions to more deeply engage with visual art.

¹ NEA. "A Matter of Choice? Arts Participation Patterns of Americans with Disabilities."



This paper explores experience enhancement and the development and implementation of new programs and resources to increase accessibility for low-vision and blind individuals to provide an overview of what is possible for museums and other visually-oriented art forms. The accessibility program under Director of Digital Engagement, Dan Sakamoto, at The Warhol Museum in Pittsburgh, PA offers an example that effectively synthesizes all four primary approaches. The Warhol Museum embarked upon a comprehensive accessibility initiative in 2015, including plans to enhance engagement and experience of low-vision and blind patrons, which furthers their mission “To engage and inspire through Warhol’s life, art, and legacy.”² In addition to implementing Sensory-Friendly Days and installing an assistive listening system in The Warhol Theater, the museum had tactile, 3D reproductions of several of Warhol’s works

printed with the intention of allowing visitors to understand the forms of the works through touch. One of the crucial elements to this initiative, however, is the development of ‘Out Loud,’ a free audio guide mobile app that utilizes iBeacon technology (See Figure 2).³ Institutional change that effectively enhances the engagement and accessibility of differently-

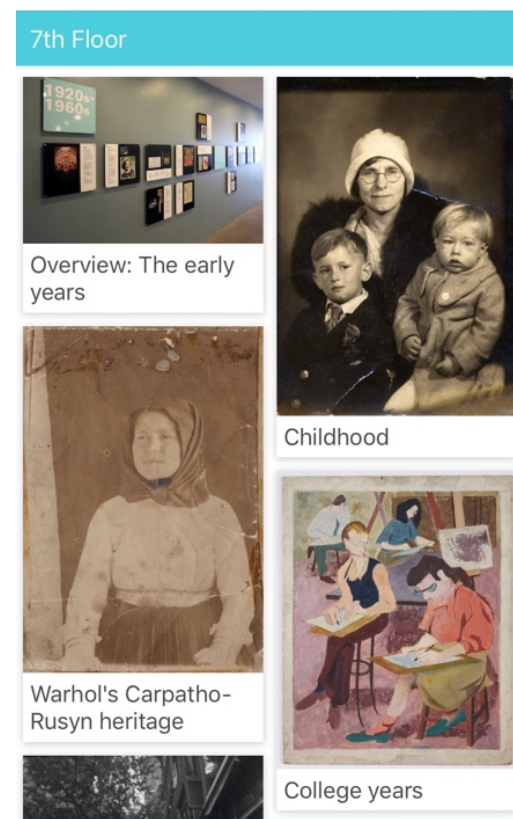


Figure 2. Personal iPhone Screenshot of ‘Out Loud’ Home Screen

² The Warhol. “Museum.”

³ Dan Sakamoto, “The Warhol ‘Out Loud’ Interview with the author.”

abled groups begins with an understanding of the phrase “Nothing about Us without Us,” and requires a familiarity with the guidelines for the Americans with Disabilities Act (ADA). “Nothing about Us without Us” has been used since the 1980s by disability rights advocates, leading up to and beyond President George H.W. Bush’s signing of the Americans with Disabilities Act in 1990.⁴ The motto is crucial to remember when planning new programs or resources for differently abled patrons. At its core, the motto means that institutions and legislators must not implement policy concerning differently-abled individuals without direct communication with the population and a thorough understanding of potential consequences. New programs and resources to enhance accessibility must begin with the population organizations aim to serve. Administering surveys, leading focus groups, and partnering with a consultant from the community are all positive strategies to create

trust with the community and develop effective solutions.⁵ For example, to ensure that the Warhol’s plans for the accessibility initiative were needed, wanted, and effectively designed, the museum aligned with the “Nothing about Us without Us” saying as leaders from the visually and hearing-impaired Pittsburgh community were brought onto the project as consultants. To gain further knowledge of their audience’s needs, the museum hosted a focus group in January 2016 that included parents, occupational therapists, and young people on the Autism Spectrum and with and sensory disabilities. Finally, initiative leaders collaborated with volunteer students and professors from local occupational therapy programs at the University of Pittsburgh and Chatham University to understand how best to integrate public feedback in the project design. Consultants of the project beta-tested the ‘Out Loud’ app in July 2016, and the app was

⁴ Scotch, “Nothing about Us without Us: Disability Rights in America.”

⁵ Sakamoto, “The Warhol ‘Out Loud’ Interview with the author.”

officially launched the following month at the Leadership Exchange in the Arts and Disability (LEAD) national conference at The Warhol.⁶

To implement experience-enhancing programs or resources for differently-abled patrons, there are several important factors that cannot be overlooked: respect the target community; ensure the changes are mission-oriented; confirm ADA compliance; and install measurable methods of evaluation. In the planning process, the program committee must ask the question “Are we doing this to check an ADA box or are we doing it because it aligns with and reinforces our mission and vision?” Hopefully, the answer is the latter. Developing a new educational or community program and installing new technology meant to increase accessibility should not be done simply to check a box. Rather, it should be carefully planned and executed to support a specific audience—which then drives the museum’s mission and

vision. Furthermore, any changes must be in alignment with ADA guidelines, and the museum must continue to evaluate the program post-launch to ensure that compliance continues. To determine if the new program is achieving the intended outcome, install quantitative methods of evaluation for each new program and resource (e.g. patron questionnaires, monthly use, or observation). Analysis of the gathered data may lead to promising adjustments of the program/resource that allows for better engagement and accessibility.

Creating opportunities for guests with low-vision or blindness to touch original objects or 3D printed copies of works in the collection is a time-tested approach to making art accessible to everyone.⁷ The Art Institute of Chicago has maintained a version of their Touch Gallery since 1920. In this gallery, visitors of all ages and abilities have the opportunity to explore

⁶ Sakamoto, “The Warhol ‘Out Loud’ Interview with the author.”

⁷ Paulette Bette, “Touch and See: Accessibility Programs for People with Vision Impairments at the Art Institute of Chicago.”

four original works of art from the collection.⁸ The Louvre opened a similar space in 1995 which presents bronze, plaster, and terra cotta replicas of sculptures in the collection and allows museum-goers to freely explore them through touch,⁹ providing visitors with a better understanding of texture, shape, form, and line.¹⁰ The Victoria & Albert Museum, however, takes the idea of seeing art through touch a step further by including touch objects from the collection throughout their galleries—not just in one gallery—and offering docent-led touch tours upon appointment.¹¹ By presenting original works of art as touch objects the museum risks damage to the object. Therefore, museums must take the proper measure to ensure that the work of art cannot fall and will not be harmed by contact with skin. 3D printing offers a solution to this risk that provides

opportunities to “touch” paintings, silkscreens, and works on paper in addition to sculptures and ceramics. The Warhol Museum exhibits several 3D printed works on each floor of the museum for visitors of all abilities to explore the surface of Warhol’s works through touch.^{12,13}

Adopting expressive language for audio description technology is a promising way for museums to increase accessibility for the low-vision and blind community. The Smithsonian’s American Art Museum offers ‘InSight’ tours once a month for low-vision and blind patrons of the visual arts. During these tours, docents describe body positions in works of art and encourage visitors to position their bodies in the same way to gain a better understanding of the form of work. Additionally, they bring in the other senses—hearing, tasting, smelling—to help describe scenes and colors.¹⁴ Such

⁸ Beete, “Touch and See: Accessibility Programs for People with Vision Impairments at the Art Institute of Chicago.”

⁹ “Go ahead and touch, says Louvre Museum,” *The LA Times*.

¹⁰ The Louvre, “The Touch Gallery.”

¹¹ Barry Ginley, “Museums: A Whole New World for Visually Impaired People.”

¹² The Warhol Museum. “Accessibility.”

¹³ Stephanie Sun, “5 Technologies with the Potential to Enhance Museum Experience.”

¹⁴ Susan Stamberg, “Blind Art Lovers Make the Most of Museum Visits With ‘Insight’ Tours.”

descriptive prompts and language can easily be used in common audio tours allowing low-vision and blind patrons to have access to museums whenever they wanted—not just once a month when a tour was available.

Museums are increasingly developing apps that users download on their personal smart devices—or devices owned by the museum—that aid in navigating the building. For instance, The Louvre approached this by using

museum-owned Nintendo 3DS systems to provide navigation and audio guides to users.¹⁵ The Warhol Museum, however, chose to develop ‘Out Loud’ to enhance engagement with the collection at all levels of ability, but with low-vision and blind patrons’ at the forefront of the app’s design.¹⁶ The ‘Out Loud’

app—designed for iOS devices—works with beacons placed through the museum to provide users with stories about Warhol’s life and works on each floor of the museum, including information about 3D-printed reproductions.¹⁷

Table 4c. Percentage of Adults with Disabilities Using Mobile or Handheld Devices to Explore the Arts, 2012

	All adults (Population = 235 million)			Adults with disabilities (Population=27.6 million)		
	Percentage of adults using devices	Margin of error +/-	Number of adults using devices (in millions)	Percentage of adults using devices	Margin of error +/-	Number of adults using devices (in millions)
MOBILE OR HANDHELD DEVICES						
Read, listen to, or download novels, short stories, poetry, or plays	16.0%	0.9%	37.6	8.7%	1.7%	2.4
Watch, listen to, or download any music	34.1%	1.0%	80.2	14.6%	2.0%	4.0
Watch, listen to, or download any theater or dance performances	3.4%	0.4%	7.9	2.4%	0.9%	0.7
Download or view any visual arts (paintings, sculpture, design, or photographs)	7.9%	0.6%	18.5	3.6%	0.9%	1.0
Source: 2012 Survey of Public Participation in the Arts						
April 2015						
Office of Research & Analysis						
National Endowment for the Arts						

Figure 3. Percentage of U.S. Adults with Disabilities Attending Performing Arts and Visual Arts Events, 2012

Beacons are small devices that emit Bluetooth signals to user’s phones and provide information on their location in the museum, such as nearby artworks or exhibitions of interest.¹⁸ The use of beacon technology to

¹⁵ Christine Nolan, “Accessibility Rebooted: Technological Advancements to Improve Accessibility in Museums.”

¹⁶ For example, the app can be used with VoiceOver and Dynamic Type.

¹⁷ More detailed information about ‘Out Loud’ is found in the case study beginning on page 7.

¹⁸ Kate Martin, “Intro to Beacons for Arts Managers.”

enhance visitor experience¹⁹ for patrons of all abilities within museums has emerged as a potentially effective way to increase accessibility for differently-abled individuals, especially for those who are vision-impaired. The Cleveland Museum of Art's ArtLens, the Solomon R. Guggenheim Museum, and the Brooklyn Museum are just three of many museums using beacons to promote accessibility and engagement with their collections. Focusing on vision-impaired individuals, beacon technology can be used to guide visitors through museums using smartphone apps.²⁰ Additionally, beacons can notify users of nearby works of art, provide descriptive, and informational dialogue and answer questions about works of art.²¹

For museums with the resources to develop a unique app that has been properly researched, such as The Warhol's 'Out Loud'

app, this option offers an effective way to enhance engagement for individuals with visual impairments. It allows patrons to use their own smart devices in the building to access information and descriptions about the collection and navigate the museum. In other words, they are not limited to special, scheduled tours. A challenge that museums may have to overcome with apps and beacon technology is that few adults with disabilities are engaging with the visual arts through handheld devices, at only 3.6% (See Figure 3).²² However, this data is from 2012 and needs to be updated. With smart devices becoming more and more prevalent amongst the U.S. population in general, I expect this percentage to be higher in 2018.

Through iBeacon technology, The Warhol's 'Out Loud' pushes stories told by scholars, curators, and members of the Warhol

¹⁹ HBS Digital Initiative, "The Guggenheim Museum: Tracking Visitor Movements to Deliver a Better Museum Experience."

²⁰ Marion Lahaye, "The Use of Beacons at The Cleveland Museum of Art's Gallery One."

²¹ Neha Mallik, "3 Museums Using Beacons to Enhance Interactivity."

²² National Endowment for the Arts, "A Matter of Choice? Arts Participation Patterns of Americans with Disabilities."

family about the artist, his family, and his work to users based on their location within the museum.²³ While the app is used by visitors of all abilities, it is designed to work with screen readers and has enlargeable text for visually impaired individuals. In addition to playing stories about Warhol to the user, the app offers expressive descriptions and “guided tactile narration” of the 3D-printed works throughout the museum²⁴ so that patrons with low-vision or blindness may understand formal elements such as texture, depth, and color of Warhol’s work.

Implementation of the app was not without issue, however. Having never used iBeacon technology, the museum discovered that the technology’s still evolving form resulted in some inaccuracy regarding precise user location in the museum. As the museum continues to support and evaluate the app, they

hope to resolve location-tracking and refresh rate issues to more effectively meet user needs. The Cognitive Assistance Laboratory in the School of Computer Science at Carnegie Mellon University, with whom The Warhol has a collaborative relationship,²⁵ is “developing a more accurate and responsive system for turn-by-turn beacon-based navigation.”²⁶ The result of this project is an app called ‘NavCog.’²⁷ As the Cognitive Assistance Laboratory continues to improve the system, the museum hopes that the technology will eventually ease the location issues with ‘Out Loud.’²⁸

In addition to making changes to the location tracking element of ‘Out Loud,’ Sakamoto hopes to improve the content management system. In its current form, all of the media has to be stored locally within the app, and anytime content needs to be updated (such as when the gallery rotates works), a new

²³ The Warhol Museum. “Accessibility”

²⁴ Ibid.

²⁵ Sakamoto, “The Warhol ‘Out Loud’ Interview with the author.”

²⁶ Ibid.

²⁷ Cognitive Assistance Lab at Carnegie Mellon University, “NavCog.”

²⁸ Sakamoto, “The Warhol ‘Out Loud’ Interview with the author.”

version of the app has to be compiled and pushed out. Sakamoto says: “My hope is that once we have this in place, we can become much nimbler in terms of what content is available via the app, whether that’s including content around special exhibitions or even around performances and events.”²⁹

Any of the four options help improve accessibility and engagement within museums, but each has strengths and weaknesses. Seeing-through-touch tours is a dynamic option because patrons gain an understanding of shape and texture. However, the availability of touch tours is limited.³⁰ Additionally, if museums do not have original objects that can be touched, museums may be limited by the cost of 3D printing copies of works in the collection. Even when a museum can produce 3D replicas of items in their collection, it is only part of a collection: most of the collection remains inaccessible to the low-vision and blind

community. Beacon technology can help patrons navigate museums with their personal phones or devices owned by the museums. However, beacon technology is expensive to install and more challenging to coordinate.

Apps on personal smart devices, such as The Warhol’s ‘Out Loud’ and ‘Seeing AI,’³¹ allow low-vision and blind patrons to access museums at any time. However, developing apps for specific institutions, such as ‘Out Loud,’ takes time and can build barriers for evaluation. For example, it is difficult to measure the success of ‘Out Loud’ for visitors with visual impairments alone, because it is available for all patrons and museum staff does not ask visitors about their disability status upon admission. However, the year the app was introduced, 2016, the museum experienced their highest attendance numbers at over 160,000, an increase by 8.9% from 2015. Additionally, between October and December of 2016, ‘Out Loud’ was downloaded

²⁹ Ibid.

³⁰ Stamberg, “Blind Art Lovers Make the Most of Museum Visits With ‘Insight’ Tours.”

³¹ Link to Long, Elizabeth “Seeing AI: An Audible Experience of the Visual World.”

317 times and used 683 times.³² Consequently, it appears that the app has had a positive impact on visitors. In the future, Sakamoto hopes to establish more effective means of evaluating the app. Whether or not an institution is developing a unique app, The Warhol Museum is a strong example for institutions developing accessibility improvements through the care, research, and informed consultation in the design of new programs and resources (including 'Out Loud'), a high usage rate in the first few months of use, ongoing improvements to the system, and a synthesis of multiple means of engagement and accessibility including seeing-through-touch, expressive audio description, beacon technology, and apps on personal smart devices.

A more effective way to include apps in museum accessibility programs is to utilize already existing apps. 'Smart Braille,' an app

available for Android devices through Google Play, allows users to communicate more quickly by tapping combinations for braille figures, and it can read text to users.³³ Therefore, museums could incorporate this technology, allowing low-vision and blind patrons to access the collection at their leisure by taking photographs of wall text.

Audio description might be the easiest resource to implement because museums already develop audio tours. Incorporating vivid language in audio guides has the ability to reach the low-vision and blind community in new, non-isolating, and impactful ways³⁴ because it would enhance every visitor's experience of the collection—not simply those with visual impairments. Implementing descriptive language in new audio guides would not be a challenge, but re-recording existing audio tours is costly in terms of time. For institutions hoping to implement expressive audio description that

³² Sakamoto, "The Warhol 'Out Loud' Interview with the author."

³³ Google Play. "Smart Braille."

³⁴ Daniela Dimitrova-Radojichikj, "Museums: Accessibility to visitors with vision impairments."

does not alienate visually impaired individuals, 'Project ALICE,' designed in part by a low-vision student out of Harvard University, offers guidelines for writing effective audio descriptions that last approximately two to three minutes.³⁵ While the project focuses on increasing accessibility for all listeners, it is designed with visually impaired patrons in mind. Each description should begin with the name of the artwork, the artist who created it, the collection it belongs to, and the year it was made. Next, the description should discuss the material of the object; if it was meant to be handled, the texture, weight, and shape of the object must be included so that listeners may understand how it would feel in their hands. Including the size of the object by describing its measurements using inches/feet and by comparing it to body size is important for visitors to understand how size impacts the experience of the work. Color needs also to be

discussed, but not in terms of specific shades.³⁶ For example, descriptions should say dark, or deep, red rather than crimson. Finally, the description should specifically detail what is happening in the scene of each work, moving from foreground to background of 2D objects and top to bottom of 3D objects, incorporated with art historical information about the artist, medium, and time period.

Weaving references to senses other than sight is also extremely effective in describing scenes; smell, touch, taste, and hearing are dynamic references for individuals lacking vision. Relating a color to a specific object is quite successful, as 'InSight' tour docent Phoebe Kline at the Smithsonian American Art Museum discovered. Rather than simply say that there is red in a painting, she might describe it "like biting into a strawberry,"³⁷ which gives visitors a vivid experience of the color in terms of texture and

³⁵ Project ALICE PowerPoint slide from MCN 2018.

³⁶ Ibid.

³⁷ Stamberg, Susan. "Blind Art Lovers Make the Most of Museum Visits With 'Insight' Tours."

taste. Connecting scenes to experiences also offers active engagement with art. For example, a depiction of a beach might bring back memories of walking barefoot through the sand. Project ALICE promotes an audio description model that is not difficult to implement and increases engagement with museum collections for all patrons while focusing on those with visual impairments.

While expressive audio description is one of the most effective and inexpensive ways to enhance accessibility, combining technologies can provide the most complete experience for each individual, regardless of ability. The Warhol's 'Out Loud' is a promising example of technologies working together—patrons download the app on their personal iOS device which then uses beacons throughout the museum to suggest stories and descriptions to the user based on their location and invites users to explore 3D-printed works through

touch. As The Warhol Museum continues to work on effective methods of evaluation of 'Out Loud,' the development of the program brought their population of interest to the forefront of decision-making. Consultants and community members with visual impairments were in the room with the program developers, offering their insights. Therefore, The Warhol adhered to the "Nothing about Us without Us" phrase, and, presumably, ensured ADA compliance. Furthermore, the 'Out Loud' advanced the museum's mission "To engage and inspire through Warhol's life, art, and legacy"³⁸ by providing opportunities for visually impaired individuals to more deeply engage with the museum's collection—the museum did not simply "check a box." Rather, they thoughtfully engaged with their target population to develop an effective accessibility program. Ultimately, combining technologies, resources allowing, is the most effective and comprehensive way to

³⁸ The Warhol Museum. "Museum."

engage visually impaired individuals and The Warhol Museum is a model institution in this regard.



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