Exhibit Design Relating to Low Vision and Blindness

Current Media Technology, Appropriate Application of Technology, Future Research Needs

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Introduction

This paper provides an overview of current media technologies which can be employed for providing more accessible experiences for people who are blind or have low vision when they visit exhibits, museums, park, zoos, and other cultural venues; surveys appropriate situational applications of technology in exhibit design; and suggests future research needs in the field.

Overview of Current Media Technologies

Our nation's museums, science centers, art galleries, historic sites, and national parks are places where visitors with disabilities should be fully welcome and accommodated. Live and media-based offerings have played a central role in recasting these institutions into today's vibrant, family-oriented community resources. They employ multimedia, social media, live events, and conventional and large-format films to build on exhibits and make an era, a topic, or an experience come alive for visitors, providing educational, community and recreational resources for both students and lifelong learners.[1]

New technologies offer these institutions myriad new ways to allow visitors to explore artifacts, collections, concepts, and sites[2]. Museums and galleries as well as historic and nature sites use multimedia and new immersive technologies to engage and retain current audiences and attract new audiences on-site and online. They offer digital resources for the public to experience before, during and after in-person visits, and many institutions are realizing that their multimedia exhibits and streamed or downloadable events reach audiences who may never visit their physical building. Students, home-schooled and otherwise, use online resources in classwork and homework, and other "virtual" visitors who may be unable to travel due to economics or illness or disability, or who may be geographically distant, regularly use technology-based resources to pursue personal interests or scholarship.

New technologies also offer cultural institutions the ability to make their content and facilities accessible and welcoming to people with disabilities[3]. A number of institutions have pioneered or prototyped accessibility implementations with captioned exhibits and tactile explorations and/or audio descriptions for select exhibits, such as the Tate Modern in London4, the Los Angeles County Museum of Art5, the New York Hall of Science[6], the New England Aquarium[7], the Museum of Modern Art[8], some exhibits and

[1] "Getting an Earful at the Museum," Wall St. Journal, N. Matsumoto, August 26, 2009
[2] "Museum Technologies and Trends on the Horizon - A Critical Review," N. Honeysett, AAM Philadelphia, April 30th 2009
[3] Constantine, 2007
[4] http://www.tate.org.uk/modern/information/access.htm
[5] http://www.lacma.org
[6] http://www.nysci.org/visit/1428642
[7] http://www.neaq.org/visit_planning/accessibility/index.php

museums within the Smithsonian[9] in Washington, and various national parks sites around the country. More and more interest groups are discussing accessibility challenges on listservs[10] moderated by museum organizations. The Museum Accessibility Consortium[11] in New York provides a forum for addressing museum accessibility issues, and Art Beyond Sight[12] regularly convenes seminars on sensory access for museum professionals. A major resource in the field is the Leadership Exchange in Arts and Disability (LEAD)[13], which convenes an annual conference and maintains an active online discussion. Most members of cultural institutions that participate in these conferences, fora and groups are from audience-services departments that are eager to learn more about how to meet the needs of disabled visitors. They are well-versed in accommodations such as provision of sign-language interpreters, Braille signage and handouts, individual or group tours and service-animal policies. The next frontier for these dedicated staffers is determining the best new technologies to be used to deliver, in an accessible manner, alternate format services to enhance the on-site and online experiences for blind and visually impaired visitors.

Staffs of cultural institutions are increasingly interested in what is available today for captioning and audio description systems, via handheld tours as well as description and caption display options for their live performances and IMAX movies (i.e., for description, wireless audio via IR and FM; for captions, projected open captions, seat-back or open caption LED or Rear Window Captioning systems). However, beyond basic Web-site accessibility and limited captioning of video and audio, few museums have the resources or expertise to explore how universal design can be integrated into their overall technology strategy for exhibit design and collections access. Most are overwhelmed by the degree of technical expertise required to advocate for and select accessible technology implementations as well as the attendant costs. In fact, many are struggling to maintain or upgrade existing systems and solutions and are actively seeking less-expensive methods of offering accessible tours using visitors' own personal devices.

Recently, the New Media Consortium (NMC)'s Horizon Museum Project[14] conducted a collaborative two-year process to identify the emerging technologies most likely to impact cultural institutions in the next five years. The research confirmed the impact of the following technological solutions all of which, if appropriately implemented, have tremendous potential to better meet the needs of visitors with disabilities and include: 1) mobile devices; 2) systems for collection, digital asset, and content management; 3) geolocation capabilities; 4) alternative-interaction devices; 5) open content and open educational resources and 6) multi-language capabilities.

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[8] http://www.moma.org/visit/plan/accessibility
[9] http://www.si.edu/visit/visitors_with_disabilities.htm
[10] culturalartsaccess@yahoogroups.com
[11] http://cityaccessny.org/mac.php
[12] http://www.artbeyondsight.org/
[13] http://www.kennedy-center.org/accessibility/education/lead/conference.html
[14] http://www.nmc.org/horizon

A widely circulated response to the previously mentioned Horizon Museum Report notes that museums have scarce resources to respond to opportunities offered by new technologies or to keep up with visitors' expectations of technology-enabled services (Honeysett, 2009). Technology expertise is not yet a core competency for staff at most cultural institutions, although there is growing agreement that technology is becoming a key strategic factor across multiple program areas. Most institutions rely on the expertise of external design firms and technical consultants to develop cutting-edge exhibits that incorporate new media and learning technologies, interface design, and user interactions and these consultants rarely have much of a base of accessible technology expertise or experience.

By involving leading technology and design firms in the drive to design more inclusive cultural institutions, accessibility and universal design issues can be more widely understood and implemented from the initial development phase. Accessibility advocates within the field can produce approaches and tools that address the challenges of integration and sustained implementation of accessibility solutions into today's technology solutions. In particular, the increasingly creative use of handheld devices as a vehicle for interpretation of exhibits holds great promise for accessibility. Currently, accessible tours are the primary means through which people with disabilities enjoy and understand content offered by cultural institutions. These tours can be enabled by human guides or handheld devices and are sometimes as low-tech as simple paper scripts or Braille guides. The use of handhelds and personal devices is growing fast. In the near future, mobile interpretations offered by cultural institutions are projected to be more Web-like, with applications available for handhelds that offer customized and contextualized information, with search functions that tap directly into the museum's or companion sites' collections, incorporating user-generated content and social-networking options.

However, existing accessibility solutions for handheld devices are expensive and not flexible enough to keep pace with new forms of content, and emerging solutions and innovative approaches are not widely known and are mostly still in development.[15] There is presently an extremely limited set of systems and technologies available, and too many accessibility solutions used in cultural institutions are based on proprietary applications or only work with particular operating systems or device platforms. None of the existing systems offer portable, extensible and sharable content across institutions. Some solutions focus on only one segment of audience needs (i.e., only captioning or signing for people who are deaf or hard-of-hearing, or only audio description for people who are blind or visually impaired). Use of off-the-shelf hardware and software and industry-standard file formats will help resolve many of these barriers. Recommendations and solutions recognize that all technologies are moving targets and are in a period of rapid growth and change and that access elements (captions, description, sign language interpretation) added by museums must be able to survive generation after generation of software and hardware upgrades. Further, all access elements should be included in collection-management systems to accompany those objects in future uses, whether in exhibits, handheld tours or online.

[15] NCAM research for U.S. Department of Education proposal (not published)

Appropriate Situational Applications of Technology

Hands-on exploration is important whenever possible, whether through models or haptic representations, but technology can also offer access to exhibits through magnification or description. Descriptions can be audio files of recorded human voices, or text files of descriptions that can be read by text-to-speech utilities or screen-reader software. If audio files of image descriptions are used in exhibits, the online versions should also offer text files of descriptions, which are necessary to drive a refreshable Braille device, critical to users who are deaf-blind and who rely on Braille for both text and audio information. Handheld solutions require a speech interface or a navigation scheme that will work with a text-to-speech utility. Online access to collections and pre- or post-visit exploration of content requires proper formatting to work with text-to-speech solutions or a screen reader.

Content properly formatted to work with text-to-speech solutions or screen readers can also provide online access to people with motor disabilities who use assistive technology to operate computers. Text-to-speech solutions and descriptions can benefit people who experience difficulty understanding complex graphics and people who struggle with text for any number of reasons, including those who are learning English as a second language. It is unknown just how many people have audio- or visual-processing deficits or experience strong preferences for one modality over another. Accessible content and multiple modes of navigation and interaction will enrich the overall learning experience for all users in keeping with the tenets of universal design for learning (Rose & Meyer, 2002).

Delivery of audio enhancements for people who are blind or visually impaired can be accomplished by a number of hardware, software and distribution means. Hardware options include museum-provided or visitor-owned off-the-shelf mp3 players such as iPods, iPhones and similar devices; museum-provided or visitor-owned cell phones; and proprietary audio tour devices provided by such companies as Antenna Audio, Softeq, and Acoustiguide[16.] Software options include any number of file formats (such as mp3, .wav, .mov, and others) as well as audio authoring tools both proprietary and widely available on the market for both Mac and Windows operating systems, including open-source audio tools such as Audacity. Audio content can be "on-board" (pre-installed) on any available device provided by a cultural institution; alternatively synchronized and asynchronous delivery of audio files can be accomplished by wireless protocols such as WiFi, infra-red, Bluetooth and cell phone, and synchronization can be aided by those technologies in conjunction with GPS triggering. Audio files can be provided to users in advance or subsequent to their visits from accessible web sites in any of the common digital audio formats, for listening at home on their computers or for downloading to their personal audio device or PDA.

[16] http://www.antennaaudio.com/ , http://www.softeq.com/products.assistive.asp , http://www.acoustiguide.com/

Each of these delivery options has their own pros and cons and the list of technical issues a cultural institution should consider when shopping for appropriate technologies which enhance their accessibility include the following design parameters[17]:

- Allowance for synchronization of caption text and audio description with museum's exhibits and media
- Accessible user interface to blind and visually impaired people via "talking menus," "audible keyboard echoing" of user input and tactile controls
- Device and content management system which enables fast-turnaround content creation and adaptation, authored by museum staff or variety of vendor(s) to enable access at first public opening of exhibits regardless of deadlines
- IR emitter (or other wireless signals) with ability to adjust for narrow-zone coverage and accommodate multiple exhibits within small gallery space
- If using public bandwidth (cell, WiFi, GPS), signals must be able to reach all areas of the museum
- If relying on user-owned equipment, consider battery usage, personal data plan usage, national and international cell network compatibility
- Ruggedized - able to withstand moderate abuse from adult visitors (e.g., dropping the device from a height of four feet)
- Easy to use for visitors - young or old, technophilic or technophobic
- Easy to use for museum staff (for automated or near-automated content loading and reprogramming)
- Programming of device employs contemporary programming techniques (drag-and-drop, pick lists, etc.)
- Uses non-proprietary, industry standard content formats (e.g., .mp3, .txt, .wav, .mov, etc.)
- Protects user privacy, accords with museum IT security needs
- Open architecture - device's on-board software and device management software written in commonly used computer languages to allow for third-party alterations should the vendor no longer be able to support the product
- Extensible - can be "built-out" or evolve over years to add new features and take advantage of new technologies
- Fully customizable look and feel, menus, branding, etc.
- Upgradeable for adding new software, new processors, new memory capacity
- Potential for incorporating (or demonstrating) industry-wide standards for museum access devices
- Interoperable with off-the-shelf technology so alternate hardware could be used
- Able to download content from the web on-site or in advance

For the portion of a cultural institution's collection that is previewed or housed online, full accessibility is readily achievable via standards, tools, practices and guidelines available from a number of organizations, starting with the World Wide Web Consortium's Web Accessibility Initiative. A deep collection of recommended practices,

[17] Research performed by NCAM for Whitney Museum, not published

standards for full inclusion and pointers to tools and examples are available at the W3C's web site: www.w3c.org/wai

Future Research Needs

A unified and widespread effort is needed to identify and elevate attention to an array of possible methods to integrate universal design into museum technology strategies across the continuum — collection digitization and management, resource discovery, exhibit and program designs and on-site and remote visitors' interactions with collections, artifacts, events, and exhibits. Such an identification process must be a living repository of existing and emerging solutions to assure that the rapidly evolving world of mobile and digital technologies are included and exploited for the accessibility needs of cultural institutions.

Wider understanding and solution discovery in the mainstream exhibit design communities can result from demonstrations of collaborative design processes involving leading museum technologists, designers and expert consumers which jointly identify and explore technology-based accessibility and universal design approaches. Publication of the outcomes of such collaborations can foster a national dialog on how accessibility and universal design can be integrated into cultural institutions' technology strategies and practices and can include feasibility and technical evaluations of selected approaches.

Research should identify and develop effective and practical technology-based methods to further equal access to exhibits, collections tours, live presentations, events, performances, and multimedia. One development focus should be on the creation of a software suite of authoring tools that cultural institutions can use to create industry-standard formatted files for timed text, audio, and video to create captions, descriptions or sign language files. Such software tools can enable museums to enhance the accessibility of static exhibits, guided audio or live tours, live performances, films, and live events by creating flexible, non-proprietary multi-lingual files which can be used with a wide range of mobile and fixed platforms and technologies. Such proposed software must be grounded in well-documented user needs and should build capacity within resource-constrained cultural institutions to cost-effectively address the needs of people with sensory disabilities at museums, galleries, visitor centers, historic sites, and science centers all over the country.

The efficacy and utility of creating a "Museum Accessibility Network" should be researched to determine whether a network of cultural institutions that create and use accessibility services could be employed to share audio, video and text files that enhance access (i.e., descriptions, captions, sign language) as well as further the use of such services for exhibits which tour the country. Efforts toward greater accessibility made by one cultural institution should not be duplicated by another if the initial work can be effectively utilized elsewhere. An investigation into whether costs for creation of access services can also be shared across such a network of institutions would also be a worthwhile way of addressing the limited resources of such institutions.

Summary

The rapidly evolving world of technology brings a wide variety of inexpensive, off-the-shelf devices and services to cultural institutions to be exploitation to enhance the experiences of disabled visitors. Handheld and mobile devices are emerging that make use of standard text, audio and video formats and those devices are becoming more accessible themselves. Additional research is needed to help museums and other organizations determine the appropriate application of the particular technology to the specific venue, exhibit, content and space. Museums should also expand their existing relationships into a collaborative effort to share, recycle and reuse adaptive content for exhibits and traveling shows which are common to a number of institutions. Finally, institutions should closely follow the accessibility guidelines of the Web Accessibility Initiative of the W3C so as to assure accessible online and well as on-site experiences.

Footnotes and Citations

"Getting an Earful at the Museum," Wall St. Journal, N. Matsumoto, August 26, 2009

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LACMA - http://www.lacma.org

New York Hall of Science - http://www.nysci.org/visit/1428642

New England Aquarium - http://www.neaq.org/visit_planning/accessibility/index.php

Museum of Modern Art - http://www.moma.org/visit/plan/accessibility

Smithsonian - http://www.si.edu/visit/visitors_with_disabilities.htm

Cultural Arts Access listserv - culturalartsaccess@yahoogroups.com

Museum Access Consortium - http://cityaccessny.org/mac.php

Art Beyond Sight - http://www.artbeyondsight.org/

Kennedy Center/LEAD Conference - http://www.kennedy-center.org/accessibility/education/lead/conference.html

New Media Consortium, Horizon Project - http://www.nmc.org/horizon

NCAM research for U.S. Department of Education proposal (not published)

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