

**Accessibility of Digital Libraries:
In Regards to People with Disabilities**

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The Digital Divide is alive and well and growing stronger as technology advances on the Web with the use of multi-media. This divide is more than just an economic divide between the haves and have-nots. It is a divide between an able-bodied person and a disabled person. There are barriers that divide accessibility on the Web in regards to images, video, and website design. One might ask the following questions: How do digital libraries fare in regards to accessibility? Are they designed with Universal Design and Inclusive Design principles in mind? Do digital libraries support adaptive technology, and are they following the W3C's Web Accessibility Initiative (WAI) standards? Do the digital libraries developers today understand how important Audio Description (AD) is for the blind, low-vision, and learning disabled individuals? Do the developers of digital libraries and other Web applications have an understanding that there are standards and best practices in the work they do? Are developers aware of the federal mandates that govern Web design that directly speak to issues of accessibility? Do the developers know that they can check their websites for accessibility through free online tools?

The Digital Divide has not gone away since the concerns of the mid-1990s. According to the latest statistics from the 2007 American Community Survey, 275,748,779 people five years and older, or 6.7% of the population in the United States, have a disability.¹ For the people who have a disability, and whose financial status had been determined 40,995,566 or 21.0% is determined to be below the poverty level.² This means that they are relying on public access to high-speed Internet in public libraries. Otherwise, these individuals do not have access to

information. Libraries that only provide enlarged screens and screen readers are not providing equal access.

Is There Equal Access for People with Disabilities?

The problem of access goes beyond the economic barriers of individuals, institutions, lack of adaptive technologies, and what one can control. Digital libraries are part of the Web 2.0 technologies that are emerging today. It has been said, “Could Helen Keller Read Your Page?”³ This is an issue that people who create Web content need to address. How does one make a digital library accessible to the visually impaired? Is it possible and is it cost effective? This problem stems from the lack of Universal Design principles, or Inclusive Design principles, when developing for the Web. This is especially true in the use of images, sound, motion, and other Web 2.0 features.

What is Universal Design & Inclusive Design?

Universal Design is “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.”⁴ There are seven principals of Universal Design, (see *Appendix A*). Inclusive Design has six principals (See *Appendix B*). It is not that different from Universal Design, except it is speaking directly to the way technology is designed. Inclusive Design is defined as follows:

Inclusive design of technology means developing systems flexible enough to serve the broadest possible range of users. Inclusive design calls for adaptable interfaces to be built into the product early in the design phase, producing systems more easily used by everyone.⁵

What these two theories of design have in common is that they both stress that before a product is designed, a designer should think about issues of accessibility for everyone. Designers should be thinking about creating a product that is inclusive and can be customized for user needs and/or adaptive technologies. There are benefits to this type of design for everyone, not just the disabled. For example, the way information is needed for a blind individual who uses an adaptive device like a screen reader is very much like the way the Web is displayed on devices like PDAs and cellphones. This is accomplished by using cascading style sheets (CSS) instead of HTML tables to control layout of webpages.⁶ Providing inclusively designed products will reach more users and provide the most flexibility of their use. This style of design does not necessarily increase the cost of the product.⁷

What One Needs to Know When Designing for the Web

In general, when designing a digital library or a website, there are basic principles that a Web developer should follow so that the digital library site can be accessed by anyone. Using the two theories of Universal Design and Inclusive Design, a Web developer could accomplish accessibility by any user with or without a disability. This can be as simple as providing a text alternative for audio content (including captions with multimedia) for the hearing-impaired. It can also benefit anyone who is trying to access content in a noisy environment or individuals with hardware of poor sound quality.⁸ In addition, designers need to take into consideration the World Wide Web Consortium (W3C) Web Accessibility Initiative (WAI) guidelines 2.0.

World Wide Web Consortium (W3C)

The World Wide Web Consortium (W3C) is an organization that has established a Web Accessibility Initiative (WAI), which contains a set of Web Content Accessibility Guidelines (WCAG) 2.0. These guidelines stress that Web designers provide alternatives to users in four categories: Perceivable, Operable, Understandable and Robust. An example of perceivable is to have choices for individuals who need non-text content described, by providing captions for non-hearing for audio and video content, and providing the ability to use assistive technology. “Operable” insures that users who need to use a keyboard can, allows enough time to read for slow readers, avoids content that can cause seizures, and places navigation consistently. “Understandable” provides clean and readable text, places content in consistent places, and has operations that can be predictable in the way they work. “Robust” makes sure that one maximizes the compatibility with current and future technologies.⁹

Digital Libraries Making Them Accessible with Audio Description

One of the ways to accomplish the WCAG 2.0 objectives for Digital Libraries is using Audio Description (AD) for people with visual impairments. The Audio Description International, an organization that is presently dormant but still maintains a website (<http://www.adinternational.org>), was formed to support and promote the use of audio description in live cultural performances, movies, television, museums, libraries, and elsewhere. They define Audio Description (AD) as follows:

The descriptive narration of key visual elements of live theatre, television, movies, and other media to enhance their enjoyment by consumers who are

blind or have low vision. AD is the insertion of audio explanations and descriptions of the settings, characters, and action-taking place in such media, when such information about these visual elements is not offered in the regular audio presentation. Thanks to the work of dedicated organizations around the world, audio description is now offered in selected movie theaters, videos, live theatre, and television programming, and is making its presence felt in a variety of new venues.¹⁰

A Digital Library Project Using Audio Description

In 2004, Lori Bell (Alliance Library System) in the State of Illinois and Tom Peters (TAP Information Services) became interested in exploring if any library website or digital archive was using Audio Description (AD) to make images on their sites accessible to visually impaired individuals. Their findings were disappointing. Outside of oral histories placed online, music or other audio files, they did not find any library creating audio description and placing the recordings online with MP3 files or even the use of text for the description of historical collections. This led the Alliance Library System to write a grant to the Illinois State Library for a pilot project involving seven libraries that would digitize images and learn the techniques on the creation of effective audio description and have a professional record the audio description with a human voice. These recordings would be placed on the websites as MP3 files along with the text description. The grant was awarded to the Alliance Library System by Illinois State Library (ISL), a Division of the Office of Secretary of State, using funds provided by the Institute of Museum and Library Services. The funds help to make digital imaging initiatives throughout Illinois and incorporate

audio descriptions into their websites and archives of digital images. The project is Audio Description Illinois, and it can be viewed at the website: Illinois Alive! Early Illinois Heroes and Heroines: A Multimedia Montage (<http://www.alsaudioillinois.net/illinoisalive/>). The Illinois Alive project seems to be the only digital library project that is using audio description. They state the following:

The key to audio description is the guiding principles of AD, key elements in a photograph that are important to include in the description (style, setting, focus, period, dress, facial features, objects, aesthetics, etc.), and to try and objectively describe a photo without passing judgment or conveying reactions to an image.¹¹

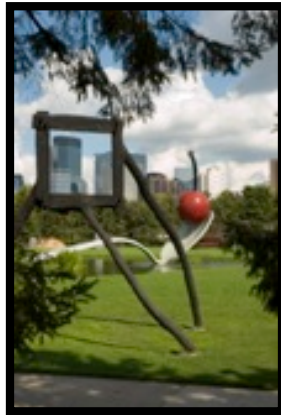
The people who are part of the Illinois Alive project feel that the way they view an image has changed. They were surprised at the length of time it took to write an audio description. One key element to audio description is choosing every word carefully and most importantly, to be concise. They stated that they were noticing things about the pictures they were working with that they would not have normally noticed. It occurred to them that it was not an easy task to objectively describe the picture in detail (but not in too much detail).¹²

How Audio Description Developed

Without audio description, people who are visually impaired are at a distinct disadvantage. "Libraries and the Web are hostile places for people with vision problems," states Kitty Pope, executive director of the Alliance Library Systems. "Through audio description, they can enjoy the same access to historical photographs. The description can also enhance the experience for a sighted person

viewing digital photos.”¹³ Audio description has been used in theatre, television, movies, and other media to bring equal access and enjoyment to those individuals with vision impairments. This concept is not a new one. It has been around since the 1970s. Gregory Frazier developed the concepts that underlay audio description, while working on his broadcasting master's thesis in *Television for the Blind*.¹⁴

Example of the Use of Audio Description.



Description: Title: “Cherry in the Park.” by Merle A. Branner.

This is a photograph of a sculpture in a park in Minneapolis, Minnesota. The above description is not written using the principals of audio description. A blind or low vision person would not be able to create the image of this photograph in his or her mind.

Here is an attempt to do an audio description of the above image using the principals of audio description:

Description: The title of this photograph is “Cherry in the Park.”

This image was taken by Merle A. Branner. This color photograph was taken in the summer, outside in a park. There are big puffy clouds and a deep blue sky behind big, tall modern buildings in Minneapolis, Minnesota. The photographer used tree leaves to frame the top and side edges of the image of the brightly colored

grass located in the foreground of the image. In the middle ground of the image, there is a pond of water that has a giant-sized, spoon-shaped sculpture and a giant round cherry with a long stem pointing up to the sky. In front of the water and the giant spoon sculpture, there are two long, thin cylindrical metal objects shaped like thin tree trunks. They are leaning on an angle to the left. On top of these tree-like cylinders is a large metal shape of a square (frame) that one can see through. This metal frame is attached to the leaning cylinders. This square-shaped frame figure is framing a tall glass building that is in the background.

This style of description is perfect for digital libraries that feature images. Whether a person with a visual disability can hear the audio description and be able to have equal access to a digital library, or if the library provides written descriptions like above, that same visually-impaired individual could use his or her adaptive technology, like a screen reader with synthesized speech. In the same way, a person who is hearing impaired would be able to have use of his or her adaptive technology, such as Text Browser software showing the printed description.¹⁵ There are benefits for the written description, too. The written description brings an added element to people with learning disabilities and even those with no disabilities. This would be considered a Universal Design feature.

There is a project underway outside of the United States that addresses the issue of accessibility of digital libraries. The European Commission Consultation, eContentplus programme on *i2010: digital libraries policy*, which has funded the Thematic Network to creation the Europeana. This is a digital library, museum, and archive. The development of the Europeana project began in July 2007. Europeana

is just a prototype website, that will be giving users direct access to some two million digital objects, including film material, photos, paintings, sounds, maps, manuscripts, books, newspapers and archival papers. This is a multilingual (French, English and German) site, with intentions to develop in additional languages, following the launch. This prototype launched in November 2008. This project projects by 2010 there will be well over 6 million digital sounds, pictures, books, archival records, and films.¹⁶ Upon the launch of Europeana, the site crashed. The site was designed to handle 5 million hits per hour, and it was stated that the site had three times that amount. The servers are being upgraded, and the site should be up sometime in December, 2008.¹⁷

A Tool to Help Developers Check Accessibility of a Site

Developers of digital libraries and other Web applications can check to see if their projects are accessible by testing their work with an accessibility-checking tool called Bobby. This tool was recently purchased by IBM and has undergone a name change.

Bobby is designed to assist webmasters in creating standard-compliant websites, and to increase the accessibility of a website. Bobby tests webpages using the guidelines established by the World Wide Web Consortium's (W3C) Web Access Initiative (WAI), as well as Section 508 guidelines from the Architectural and Transportation Barriers Compliance Board (Access Board) of the U.S. Federal Government.¹⁸

Bobby has a report structure: The report consists in three sections, each having a different priority level.

- **Priority 1:** Accessibility problems seriously affect the usability of the page by users and should be addressed first. Fixing these problems will get a website a Bobby-Approved rating.
- **Priority 2:** Accessibility problems, while not as vital as priority one problems, do affect the accessibility of a website. Addressing both priority one and priority two problems is considered the preferred minimum conformance level for an accessible website.
- **Priority 3:** Accessibility problems includes other errors which, if corrected, can get a website the AAA-Bobby-approved level.¹⁹

The goal of Bobby is to help developers improve where possible the accessibility of the website. An AAA rating is extremely hard to achieve. Nevertheless, developers should strive to achieve better accessibility. The tool follows guidelines and identifies areas of concern. The tool will produce a report so developers can make corrections to achieve better accessibility. This is a great tool purchased by IBM. It is now called the Rational Policy Tester Accessibility Edition, an edition of IBM Rational Policy Tester.

The World Wide Web is a place that is hard to control. Since 1973, there has been some work in Washington to provide access to people who are disabled. The United States created legislation that provides standards for accessible electronic and information technology. Section 508 is an amendment to the Workforce Rehabilitation Act of 1973, which requires:

That information and electronic technology developed or purchased by the Federal Government is comparably accessible for individuals with disabilities

and individuals without disabilities. The law states that comparable access should be ensured, unless there is undue burden to the agency of department.²⁰

This legislation was created well before the Internet came into being. In addition, this law only applies to the Federal Government or people who sell to the Federal Government. “The Americans with Disabilities Act (ADA) of 1990 mandates that no otherwise qualified individuals shall, solely by reason of their disabilities, be excluded from participation in, be denied the benefits of, or be subjected to discrimination in public programs.”²¹ In 1996, the last piece of legislation was created concerning access for people with disabilities, the Telecommunications Act:

Section 255 and Section 251(a)(2) of the Communications Act of 1934, as amended by the Telecommunications Act of 1996, require manufacturers of telecommunications equipment and providers of telecommunications services to ensure that such equipment and services are accessible to and usable by persons with disabilities, if readily achievable. These amendments ensure that people with disabilities will have access to a broad range of products and services such as telephones, cell phones, pagers, call-waiting, and operator services, that were often inaccessible to many users with disabilities.²²

We live in a totally different world today from a technological standpoint. In the Congressional records on May 1, 2008, Representative John D. Dingell (D-MI), Chairman of the Committee on Energy and Commerce, inserted a statement in the hearing record at a Subcommittee on Telecommunications and the Internet hearing entitled *H.R., Draft Legislation Enhancing Access to Broadband Technology and*

Services for Persons with Disabilities. In his statement, he discussed how the Internet has changed the way the world communicates. Representative Dingell stated that the current legislation needs to be examined and modernized. The governing law of access to communications for individuals with disabilities needs to reflect today's world and how we communicate. He went on to say:

Though technology has rapidly evolved, our core values should remain constant. The principal of universal service has been part of our communications policy since the early part of the last century. In my view, however, service cannot be termed universal unless it can be accessed by all. It is necessary and proper that everyone has access to our communications infrastructure, including the next generation of communications and video programming.

I am sure there will be lively discussions about the best way to ensure universal accessibility of communications. Our telecommunications industry, including service providers, manufacturers, and content providers, can each point to one or more applications or devices that contain accessibility features, and I am encouraged by these efforts. In my experience, if we simply ask the innovators and engineers to ensure that technologies are designed to include all persons, no matter how they communicate, they are up to the task.²³

The United States government understands that closing the digital divide is important. The divide is not just an economic one, but one of equal access to people who are disabled as well. In my opinion, no government can place mandates on the

World Wide Web in a free society. Anyone who has a computer and Web tools can be a Web developer. However, through education and awareness of the ways to create Web applications, like digital libraries, it can be accessible to everyone. It can be done by the principles of Universal Design, Inclusive Design, and the W3C's Web Accessibility Initiative 2.0 guidelines. If they are followed, there will be less need for the use of adaptive technologies. Finally, audio description is one of the best ways to make digital libraries accessible to the visually impaired. It will add a unique dimension for everyone. There needs to be more research in this area and more attempts by developers of Web 2.0 applications that are in digital libraries and websites in general to incorporate audio description along with other accessibility practices.

Appendix: A

THE PRINCIPLES OF UNIVERSAL DESIGN: Version 2.0 - 4/1/97

Compiled by advocates of universal design, listed in alphabetical order:

Betty Rose Connell, Mike Jones, Ron Mace, Jim Mueller, Abir Mullick, Elaine Ostroff, Jon Sanford, Ed Steinfeld, Molly Story, and Gregg Vanderheiden

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UNIVERSAL DESIGN:

The design of products and environments to be usable by all people to the greatest extent possible without the need for adaptation or specialized design.

The authors, a working group of architects, product designers, engineers and environmental design researchers, collaborated to establish the following Principles of Universal Design to guide a wide range of design disciplines including environments, products, and communications. These seven principles may be applied to evaluate existing designs, guide the design process, and educate both designers and consumers about the characteristics of more usable products and environments.

The Principles of Universal Design are presented here in the following format: name of the principle, intended to be a concise and easily remembered statement of the key concept embodied in the principle; definition of the principle, a brief description of the principle's primary directive for design; and guidelines, a list of the key elements that should be present in a design that adheres to the principle. (Note: all guidelines may not be relevant to all designs.)

PRINCIPLE ONE: Equitable Use

The design is useful and marketable to people with diverse abilities.

Guidelines:

- 1a. Provide the same means of use for all users: identical whenever possible; equivalent when not.
- 1b. Avoid segregating or stigmatizing any users.
- 1c. Provisions for privacy, security, and safety should be equally available to all users.
- 1d. Make the design appealing to all users.

PRINCIPLE TWO: Flexibility in Use

The design accommodates a wide range of individual preferences and abilities.

Guidelines:

- 2a. Provide choice in methods of use.
- 2b. Accommodate right- or left-handed access and use.
- 2c. Facilitate the user's accuracy and precision.
- 2d. Provide adaptability to the user's pace.

PRINCIPLE THREE: Simple and Intuitive Use

Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

Guidelines:

- 3a. Eliminate unnecessary complexity.
- 3b. Be consistent with user expectations and intuition.
- 3c. Accommodate a wide range of literacy and language skills.
- 3d. Arrange information consistent with its importance.
- 3e. Provide effective prompting and feedback during and after task completion.

PRINCIPLE FOUR: Perceptible Information

The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

Guidelines:

- 4a. Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
- 4b. Provide adequate contrast between essential information and its surroundings.
- 4c. Maximize "legibility" of essential information.
- 4d. Differentiate elements in ways that can be described (i.e., make it easy to give instructions or directions).
- 4e. Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

PRINCIPLE FIVE: Tolerance for Error

The design minimizes hazards and the adverse consequences of accidental or unintended actions.

Guidelines:

- 5a. Arrange elements to minimize hazards and errors: most used elements, most accessible; hazardous elements eliminated, isolated, or shielded.
- 5b. Provide warnings of hazards and errors.
- 5c. Provide fail safe features.
- 5d. Discourage unconscious action in tasks that require vigilance.

PRINCIPLE SIX: Low Physical Effort

The design can be used efficiently and comfortably and with a minimum of fatigue.

Guidelines:

- 6a. Allow user to maintain a neutral body position.
- 6b. Use reasonable operating forces.
- 6c. Minimize repetitive actions.
- 6d. Minimize sustained physical effort.

PRINCIPLE SEVEN: Size and Space for Approach and Use

Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

Guidelines:

- 7a. Provide a clear line of sight to important elements for any seated or standing user.

7b. Make reach to all components comfortable for any seated or standing user

7c. Accommodate variations in hand and grip size.

7d. Provide adequate space for the use of assistive devices or personal assistance.

Please note that the Principles of Universal Design address only universally usable design, while the practice of design involves more than consideration for usability. Designers must also incorporate other considerations such as economic, engineering, cultural, gender, and environmental concerns in their design processes. These Principles offer designers guidance to better integrate features that meet the needs of as many users as possible.

Appendix B

Principles for Inclusive Design

1. Allow for customization based on user preference.
2. Provide equivalent access to auditory and visual content based on user preference.
3. Provide compatibility with assistive technologies and include complete keyboard access.
4. Provide context and orientation information.
5. Follow relevant specifications, standards, and/or guidelines.
6. Consider the use of XML.

Notes:

¹ U.S. Census Bureau, "S801 Disability Characteristics," *American Fact Finder*, http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2007_1YR_G00_S1801&-ds_name=ACS_2007_1YR_G00_&-_lang=en&-redoLog=false.

² U.S. Census Bureau, "S801 Disability Characteristics," *American Fact Finder*, http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2007_1YR_G00_S1801&-ds_name=ACS_2007_1YR_G00_&-_lang=en&-redoLog=false.

³ Terry Sullivan and Krystyn Manning, *All Things Web*, <http://pantos.org/atw/35412.html>.

⁴ The Center for Universal Design, "The Principles of Universal Design Version 2.0," *North Carolina State University*, http://design.ncsu.edu/cud/about_ud/udprinciplestext.htm.

⁵ National Center for Accessible Media (NCAM), "Understanding Accessibility," *Access NSDL*, <http://accessnsdl.org/SPT--Inclusive.php>.

⁶ AccessIT, "How does accessible web design benefit all web users?" *University of Washington*, <http://www.washington.edu/accessit/print.html?ID=1197>.

⁷ National Center for Accessible Media (NCAM), "Understanding Accessibility," *Access NSDL*, <http://accessnsdl.org/SPT--Inclusive.php>.

⁸ AccessIT, "How does accessible web design benefit all web users?" *University of Washington*, <http://www.washington.edu/accessit/print.html?ID=1197>.

⁹ "Web Accessibility Quicktips WCAG 2.0 at a Glance," *W3C, Web Accessibility Initiative*, <http://www.w3.org/WAI/WCAG20/glance/>.

¹⁰ Tom Peters and Lori Bell, "Audio Description Adds Value to Digital Images," *Computers in Libraries*, 26, no. 4 (2006): 26.

¹¹ *Ibid.*, 27.

¹² *Ibid.*, 27.

¹³ Lori Bell, Alliance Library Systems, *Digital Archives Images for the Visually Impaired*, *ALA-Interface*, 29 No. 3 (2007), [http://web.archive.org/web/20071002202631/alliancelibrarysystem.com/article.cfm?="](http://web.archive.org/web/20071002202631/alliancelibrarysystem.com/article.cfm?=)

1819.

¹⁴ Channy Lyons and Tom Peters, "Audio Description Illinois: Workshop Outline," *TAP Information Systems*, <http://www.tapinformation.com/ADworkshopoutline200704.htm>.

¹⁵ Barbra T. Mates, *Adaptive Technology for the Internet: Making Electronic Resources Accessible to All*, (Chicago: American Library Association, 2000), 1-10.

¹⁶ "Europeana: digital paintings, books, films and archives," *Europeana Connecting Culture Heritage*, <http://dev.europeana.eu/about.php>.

¹⁷ Stephen Castle, "Europeana Goes Online and Is Then Overwhelmed," *New York Times: NYTime.com*, November 22, 2008, <http://www.nytimes.com/2008/11/22/technology/internet/22digital.html?pagewanted=print>.

¹⁸ "How Accessible Is Your Web Site? - Accessible Web Design," *Mardiros*, <http://www.mardiros.net/bobby-accessibility-tool.html>.

¹⁹ "How Accessible Is Your Web Site?" *Mardiros*, <http://www.mardiros.net/bobby-accessibility-tool.html>.

²⁰ "Accessibility in Law and Policy," *University of Florida*, http://www.at.ufl.edu/accessibility/accessibility_cd/Law/section508.html.

²¹ Sheryl Burgstahler, "Equal Access: Universal Design of Distance Learning," *University of Washington*, <http://www.washington.edu/doit/Brochures/Technology/distance.learn.html>.

²² U.S. Department of Justice, *Civil Rights Division, Disability Rights: Section, A Guide to Disability Rights Laws. 2005* (Washington D.C.: 2005), 8 <http://www.ada.gov/cguide.pdf>.

²³ John D. Dingell, "The House Committee on Energy and Commerce, Subcommittee on Telecommunications and the Internet Hearings," *U.S. House of Representatives: Committee on Energy and Commerce*, http://energycommerce.house.gov/Press_110/110st156.html.