This study explores accessibility issues related to Web sites and people with visual impairments. A large number of individuals have these impairments and these individuals should have equal access to information, resources, and services. Guidelines exist that help web designers develop sites that are accessible. One of these set of guidelines is the Web Content Accessibility Guidelines (WCAG) 1.0. Universal design principles should be used in order to help make sites as accessible to as many individuals as possible.

This study examined the Web sites of Protection and Advocacy (P&A) agencies. In this study, the current Web sites of these agencies were compared to the sites of these agencies from 2001. The results of this study show that the accessibility of the current P&A Web sites had improved in the last five years. However, there are still issues related to creating accessible Web sites that need to be explored further.

Headings:

Computers and the handicapped

Web sites -- Evaluation

Web sites -- Design

Handicapped, Library services for -- Blind and partially sighted

Handicapped -- Internet resources

IMPROVING THE ACCESSIBILITY OF WEB SITES FOR VISUALLY IMPAIRED
INDIVIDUALS

by
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A Master's paper submitted to the faculty
of the School of Information and Library Science
of the University of North Carolina at Chapel Hill
in partial fulfillment of the requirements
for the degree of Master of Science in
Information Science.

Chapel Hill, North Carolina

April, 2007

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Introduction

According to the American Foundation for the Blind (2006), in the United States, there are an estimated 10 million people who are visually impaired. It is also estimated that 1.5 million people who are visually impaired use computers. For those of us in the information science field, people with disabilities, including those who are visually impaired, are part of our clientele or customer base. Their needs and rights should play an important role in any decision that we make in regard to our profession. Not only is this the right thing to do, it is also the legal thing to do. In 1990, President Bush signed the Americans with Disabilities Act (ADA) into law. The ADA states that any type of good or service should be accessible for those people with disabilities (Ethridge, 2005). However, gaining access to these goods or services can be problematic for individuals who are visually impaired. This is certainly true when these goods or services are available online and people with this disability must navigate a Web site that is poorly designed. This issue concerning the accessibility of Web sites for individuals who are visually impaired is the main focus of this paper. There are disability rights agencies in the United States called Protection and Advocacy (P&A) agencies. One of the purposes of these agencies is to provide information to individuals with disabilities in order to help them get the assistance they are entitled to by law. The Web sites of these agencies, compared to other types of Web sites on the Internet, should be the most accessible and usable for individuals who are visually impaired. After all, these individuals are the primary users of the P&A Web sites. A select number of these Web sites will be

examined in this paper and compared to these same Web sites from five years earlier to see if improvements have been made in the accessibility of these sites for individuals who are visually impaired. The question to be answered then is: do current Web sites for these disability rights agencies have improved accessibility for visually impaired users compared to those same sites five years ago? Moreover, how can this examination help information professionals insure that Web sites are accessible for all individuals?

Literature Review

There are a large number of individuals in the United States who are visually impaired or blind. The definition for legal blindness that is found on the American Foundation for the Blind (AFB) Web site is: "legal blindness means that someone has a central visual acuity of 20/200 or less in a better eye with the best possible correction, as measured on a Snellen vision chart, or a visual field of 20 degrees or less" (AFB, "Key Definitions," 2006, para. 3). There are also individuals who are not legally blind yet have a "functional limitation" in their visual ability that is either severe or non-severe (AFB, "Key Definitions," 2006, para. 4). The AFB estimates that around 10 million people in the United States are blind or visually impaired (AFB, "Statistics," "Prevalence," 2007).

Two laws mandate that people with disabilities have equal treatment under the law. The first of these laws is the Americans with Disabilities Act (ADA) of 1990. The ADA states that people with disabilities cannot be discriminated against based on their disability in regard to employment, state and local government services, public accommodations, commercial facilities, public transportation, and telecommunications (Ethridge, 2005, p. 82). Title II and Title III of the ADA mandates that local and state governments and business entities should effectively communicate with users with

disabilities over the Internet, especially communication that deals with the programs, goods, and services that they provide to these users (Waddell, 1998). Kim Guenther (2002) explains that in 1996 the United States Department of Justice ruled that Web sites are included in the definition of public accommodations as set down in the ADA (p. 73).

The second law that requires equal treatment for people with disabilities is Section 508 of the Rehabilitation Act. This law compels federal agencies in the United States to make information found on the Internet and computer technology accessible to individuals with disabilities (Miller, 2006, p. 21). It applies when federal agencies create, obtain, maintain or use this information or technology ("Rehabilitation Acts Amendment," n.d.). Section 508 further mandates that any organization that wants to do business with a federal agency must comply with the standard for content accessibility in this law (Miller, 2006, p. 21).

The American Library Association has developed a policy that deals with libraries making all possible accommodations so that people with disabilities can access the resources that they need ("Issues," "Library Services…Policy," 2006). This policy describes how people with disabilities face many challenges that libraries can alleviate by making information, resources, and services available to these individuals, if this is done is such a way that these are accessible to these individuals in an accommodating and welcoming environment ("Issues," "Library Services…Policy," 2006). Besides moral issues related to providing access to individuals with disabilities, the ADA and Section 508 of the Rehabilitation Act are laws that specifically relate to people with disabilities and, therefore, must be followed.

If information content on the Internet is to be accessible for people with disabilities, then how can organizations, businesses, or companies make their online content accessible? Have there been standards developed for Web designers to follow? According to Guenther (2002), the World Wide Web Consortium (W3C) was one of the first organizations to develop standards that deal with web accessibility (p. 74). These standards are called the Web Content Accessibility Guidelines (WCAG) version 1.0. These guidelines were developed in 1999; W3C has developed a 2.0 version of these guidelines, but these will not be ready until sometime in 2007. These guidelines are based on three levels of priority depending on the degree of impact these have on accessibility (Guenther, 2002, p. 74). Altogether, the WCAG consists of 65 checkpoints. The first level of priority contains the checkpoints that are the most important when designing Web sites for individuals with disabilities (Guenther, 2002, p. 74). The W3C states that Web designers "should satisfy the priority two checkpoints" and this group says that Web designers "may address the priority three checkpoints" ("WCAG 1.0," "Priorities," 1999). An organization called the Architectural and Transportation Barriers Compliance Board created its own set of standards, sixteen in all, based on Section 508 of the Rehabilitation Act. Most of these standards are based on the WCAG guidelines. The W3C discusses how WCAG 1.0 will help users of the Internet find information quickly ("WCAG 1.0," "Abstract," 1999).

There are many types of assistive technology (AT) devices that make it possible for visually impaired or legally blind users to access information via the Internet. These are screen magnifiers, screen readers, scanning and reading software, and Braille technology (Ethridge, 2005). Ethridge (2005) discusses how the type of assistive

technology device an individual needs is directly related to their visual abilities (p. 82).

Marti Goddard (2004) writes that assistive or adaptive technology is a device or

accommodation that aids people with disabilities because it helps them compensate for

their disability by supporting the strengths that they do have in order to use the computer

(p. 2). McManus (2005) states that "smooth operation of these technologies is often

prevented by how a web page is designed and created" (p. 87). Miller (2006) points out

that having "semantically correct HTML is important" (p. 22). Screen readers look at

each of the headings within this code to help the user understand the contents of the Web

site (Miller, 2006, p. 22). Guenther (2002) addresses the importance of using HTML code

that is syntactically correct when ensuring that Web sites conform to Section 508

guidelines (p. 74).

Moreover, there are tools that help Web designers test their Web site's

accessibility. "A web validator is a software program that can check your web pages

against the web standards" ("Web Quality-Standards," "Web Validation," 1999-2007,

para. 1). Validators check XML schemas, CSS style sheets, and hyperlinks in an HTML

document. There are also validation tools that check the accessibility of the Web site. An

example of a validation tool is one offered by the World Wide Web Consortium (W3C).

W3C offers a free validator called the W3C Markup Validation Service version 0.7.4 that

checks web pages in formats such as HTML and XHTML to see how well these pages

conform to W3C recommendations.

Why is it important to validate a Web site? An obvious reason is that this is

important for accessibility. Using an accessibility validation tool helps improve the

accessibility of the site. The WCAG 1.0 recommend using W3C technologies, such as

XHTML and CSS, because these already have accessibility features included in them, and because these types of technologies are reviewed early and often in the design process to ensure accessibility ("WCAG 1.0," 1999, para. 2). One of the checkpoints in the WCAG 1.0, checkpoint 11.1, specifically concerns the use of these W3C technologies ("WCAG 1.0," 1999). The World Wide Web Consortium emphasizes the idea that an accessible Web site is important not only for those individuals with disabilities but for any individual ("Web Quality-Accessibility," 1999-2007). Web sites should be both accessible and high in quality. Following web standards, such as making sure that the Web site is written in XHTML and using CSS, helps to improve the quality of the site ("Web Quality-Standards," 1999-2007, para. 1). Furthermore, CSS "increases the readability [of the site] for many different browsers" ("Web Quality-Standards," 1999-2007, para. 3).

These tools can assist Web designers, but the designer makes the ultimate decision. As Erica B. Lilly and Connie Van Fleet (2000) discuss in their article: "Accessibility questions are those that cannot be answered by... [an] automated service. They require human judgment and assessment by the page's creator" ("Wired," p. 17). Miller (2006) discusses the evaluation of Web sites manually, particularly in evaluating the alternative text (the "alt text" tag), which is "language that is associated with non-text elements that provides contextual meaning in cases in which users cannot see the graphic…." (pp. 21-22). He says that it is up to humans to examine the quality of this text (Miller, 2006, p. 22). In order to manually evaluate a Web site, first the designer must select those pages that are the visited the most often within the site; accessibility recommendations should be implemented on these pages first (Guenther, 2002, p. 74).

Guenther (2002) says that "for most sites, this list would include the home page, all links from the home page, or those pages that represent a critical path to specific offerings or functionality of your Web site" (pp. 74-75).

Many individuals who are visually impaired or blind use the computer. "A minimal estimate is that there are 1.5 million visually impaired computer users, including those who are blind" (AFB, "Statistics," "Computer Use," 2007). McManus (2005) discusses how libraries should be accessible for all of their users, including those individuals with disabilities. Just as the physical space of the library needs to be accessible, the virtual space of the Internet should be just as accessible for individuals who are visually impaired or blind. For the purposes of this study, accessibility means that Web sites are organized in such a way that assistive technology devices will not experience any problems in navigating through any page on the site and then users who are visually impaired are able to retrieve the information that they need or want from the site. As Miller (2006) writes: "When you make a Web site accessible, you are designing it so that people who use assistive technology like screen reader software or magnifiers…can access, navigate, and use the site" (p. 21).

Lilly and Van Fleet (2000) conducted a study of 100 college and university library home pages to examine how accessible these pages are and to discover what accessibility problems occur most often. These pages were examined using a validator called Bobby 3.0…" (Lilly & Van Fleet, "Wired," 2000). Lilly and Van Fleet (2000) found that 40 of these 100 home pages were accessible (p. 14). The most common accessibility problem found in this study was that these college and university library home pages failed "to provide alternative text for all images" (Lilly & Van Fleet,

"Wired," 2000, p. 16). This error occurred in 53 out of the 100 pages (Lilly & Van Fleet, "Wired," 2000, p. 16).

Erica Lilly and Connie Van Fleet (2000) conducted another accessibility study, but this time they looked at the accessibility of 100 public libraries. If these public libraries had a Web site, these were checked for accessibility errors using the Bobby validation tool (Lilly & Van Fleet, "Measuring," 2000, p. 159). Seventy-four of the public libraries had Web sites and out of these, 14 or 19 percent were found to be accessible (Lilly & Van Fleet, "Measuring," 2000, p. 160). Lilly and Van Fleet (2000) also found that those libraries with the largest number of users tended to have Web sites that are accessible (p. 162). As with the earlier study conducted on college and university libraries, this study of public libraries discovered that the error that occurred the most often was the failure to provide alternative text for all of the images on the site (Lilly & Van Fleet, "Measuring," 2000, p. 161).

The basis or foundation for accessible Web sites lies in its design. A type of web design called universal design has as its premise that the information or services provided by Web sites should be available to individuals with differing abilities (Lilly & Van Fleet, "Wired," 2000, p. 9). This is a proactive approach as it allows for the widest range of users possible from the outset of the creation of the Web site (Lilly & Van Fleet, "Wired," 2000, p. 9). The seven principles of universal design are to create designs that are flexible, simplistic, perceptible, tolerant, efficient, and approachable (Connell et al, 1997, p. 34-35).

Most users, regardless of their abilities, want to navigate through a Web site efficiently and with as little confusion as possible. A study conducted by Carole George

(2005) found that the users of their library's Web site wanted a site that has: a simple and uncluttered design; clear and consistent labeling; effective use of color, fonts, and positioning on the site for emphasis; cohesive navigation; a site map; and a search option (p. 168). Beth Thomsett-Scott (2005) used a competitive usability study to help in redesigning her university library system's Web site. Competitive usability studies are frequently used in the business sector; these types of studies ask participants to examine several Web sites that differ significantly from the Web site being studied or re-designed (Thomsett-Scott, 2005, p. 35). In her study, Thomsett-Scott (2005) found that users wanted a Web site that is consistent, simple, easy to use, and not overcrowded, and one that has effective navigation, a search box, and a site map. As you can see, in the George (2005) study and the Thomsett-Scott (2005) study, participants wanted similar types of elements included on the Web sites being studied.

One of the reasons that users, regardless of their abilities, access the Internet is to find the information that they need. A study by Lars-Olof Persson and Anna Rydén (2006) looks at coping behaviors in people with disabilities. They explain that one type of coping is to be actively involved in solving or relieving the sources that are causing the stress (Persson & Rydén, 2006, p. 357). Therefore, finding the information necessary to do this is paramount to individuals with disabilities. Persson & Rydén (2006) describe this in some of the coping behaviors that they observed in the participants in their study (p. 357). Some of these behaviors are: "learning compensatory techniques…; inform oneself about the disease or disability; learning and utilizing techniques for symptom reduction; and changing the organization of daily living" (Persson & Rydén, 2006, p. 357).

One of the types of agencies that can provide individuals with disabilities this essential information is the Protection and Advocacy agency. These agencies form what is called the National Disability Rights Network. Their purpose is to safeguard the rights of people with disabilities ("The P&A," 2006). These agencies give legal representation to and advocate for people with disabilities ("The P&A," 2006). Disability rights agencies promote self-advocacy, so their goal is to provide information on their Web sites that people with disabilities can use to keep informed of their rights and to help them gain the services and rights that they deserve.

Methodology

This study evaluated five Protection & Advocacy Web sites, as these are currently found on the Internet, to see how well these sites conform to the checkpoints in all three levels of priority in the Web Content Accessibility Guidelines 1.0. This study also examined the same five P&A Web sites, as these were on the Internet in 2001, to see how well these sites conform to the checkpoints in all three levels of priority in the Web Content Accessibility Guidelines 1.0. This method was used so that a valid comparison could be made between these Web sites. A list of the WCAG 1.0 checkpoints is found in Appendix A. Other checkpoints were used in addition to the WCAG 1.0. Three types of analysis were used in this study in order to evaluate the accessibility of these sites. These types of analysis included a manual verification of the Web sites, an automatic validation of these sites, and an examination of the aesthetic appeal of each site.

1. Items evaluated

The five P&A Web sites that were evaluated in this study are Florida, North Dakota, Washington, North Carolina, and Indiana. From now on, the Web sites from these five

states in 2001 will be referred to as the *old Web sites* and the Web sites from these same

five states as these are currently on the Internet will be referred to as the *new Web sites*.

The urls for these Web sites can be found in Appendix B. Given the time constraints of

this study, it was not possible to evaluate every page within each of these five Web sites.

Therefore, only the home page and level one pages of the site were examined.

1.1 The Web sites chosen

The P&A Web sites from Florida, North Dakota, Washington, North Carolina,

and Indiana were chosen for several reasons. The most obvious reason is that these states

had P&A Web sites in 2001 and these sites could be accessed using the Internet

Archives' Wayback machine, which is a tool that archives Web sites. The url for the

Wayback machine can be found in Appendix B. In other words, the P&A Web site must

be viewable. Viewable means that enough of the design of the site and its information

content is available so that it can be validated.

The time frame was another important factor in the selection of the P&A sites

from these five states. The old Web sites needed to be compared to the new Web sites in

a time frame of five years. This is why the year 2001 was important for this study. The

P&A needed to have a Web site in this year. This excluded some states because these

states did not have a P&A Web site in 2001. More states needed to be excluded, so just

those states that had P&A Web sites archived in the Wayback machine in either the

month of November or the month of December of 2001 were selected. With the

combination of both the ability to view the P&A Web site in the Wayback machine and

the Web site being archived in either November or December of 2001, this narrowed

down the number of states to roughly the five selected for this study. These five states

were chosen based on these characteristics rather than on geographic representation.

1.2 Home page and level one pages

For each type of analysis completed for this study, each home page and

level one page of the Web site was analyzed. The home page of each site was evaluated

in this study because this page is the jumping-off point for the user's entrance into the

rest of the Web site, so the home page is important for navigational reasons. This page is

also the user's first impression of the site; a good impression of a Web site welcomes the

user and invites her to further explore the site's contents.

Level one pages refer to those pages that a user can access from the home page in

one click. The best method would be to analyze every page in a Web site, but given the

time constraints of this study, it was impossible to analyze every page of the site. The

level one pages were analyzed in this study because next to the home page, these are the

pages that users are most likely to visit. It is important that, at least, the home page and

level one pages of a Web site are accessible and are high in quality. Many of these level

one pages, not just one, were examined for the manual validation to see how well these

complied with each WCAG 1.0 checkpoint.

2. Types of analysis

For the manual type of verification, six checkpoints were added to the

checkpoints in WCAG 1.0. From now on these checkpoints will be referred to as

additional checkpoints. For the automatic evaluation, tools were used to validate the

syntax, CSS, and accessibility of each Web page. The W3C Markup Validation Service

version 0.7.4 was used to check the syntax of each Web site. The validation tool used to

evaluate the cascading style sheets was the W3C CSS Validation service. The automated

accessibility tool utilized in this study was the Cynthia Says tool provided by HiSoftware.

The urls for all three of these tools are included in Appendix B.

2.1 The additional checkpoints

The additional checkpoints are major points of emphasis found in the current

literature related to the accessibility of Web sites. These points are: whether or not the

Web page provided instructions on how to change the font size of the text; the overall

aesthetic appeal of the Web site, as evidenced by the choice of colors selected for it;

whether or not the user would have to horizontally scroll to access information on the

Web page; whether or not each page had too much white space; and whether or not an

external style sheet is used on the Web page. Another additional checkpoint is whether or

not an icon was located on the Web site to let users know that the home page or level one

pages had been validated previously and had passed validation.

2.2 Manual verification

First, with the WCAG 1.0 checkpoints, it was essential that the explanation of the

checkpoint and the examples provided by the W3C were fully understood. Next, the

home page of each of the five P&A Web sites was given either a zero or a one value for

each checkpoint. If the web page conformed to the checkpoint, it received a value of one.

If the page did not conform to the checkpoint, it received a value of zero. This method

was used in order to simplify the manual analysis.

Table 1

Manual Validation of the Home Page of
Florida's Old Web Site

Checkpoint	Priority Level	Value
1.2	1	NA
1.5	3	NA
2.1	1	1
3.7	2	NA
6.4	2	NA
7.1	1	NA
8.1	2	NA
10.3	3	NA
13.7	3	NA
14.1	1	1
White space?	Author-added	1

Table 1 presents a snapshot of the raw data collected from the manual checking of the

home page of the old Web site of Florida. There were a total of 71 checkpoints used to

evaluate these sites manually, but just a few of these are presented in Table 1. The W3C

specifies that in order for a Web site to be accessible, it must comply with all of the

priority one checkpoints ("WCAG 1.0," "Priorities," 1999). A number of WCAG 1.0

checkpoints are not relevant for a specific page within a particular Web site. For example,

if the checkpoint refers to tables and these are not present in the site, these were marked

as not applicable (NA). For the manual validation of the old Web sites, the number of NA

checkpoints varied from site to site.

1. Checkpoint 2.1 in the WCAG 1.0 "ensures that all information conveyed with

   color is also available without color…." ("WCAG 1.0," "Guideline 2," 1999).

   This is a priority one checkpoint. The home page of Florida's old site conveyed

   information without relying on color, so this checkpoint was coded as one for this

   home page on this site. One of the additional checkpoints asks whether or not

each Web site uses the appropriate amount of white space. Florida's home page

used the appropriate amount of white space, so this checkpoint was given a value

of one for this home page. Checkpoint 14.1 is a priority one checkpoint. It

specifies for an accessible Web site to "use the clearest and simplest language

appropriate for a site's content" ("WCAG 1.0," "Guideline 14," 1999).

Components of this type of language are the use of common words, the lack of

complex sentences, and one main idea included in one paragraph ("Core

Techniques," "Writing Style," 1999-2000). The textual content of the home page

of Florida's old site is both simple and clear, as determined by the components

listed above. So this page received a value of one for checkpoint 14.1

2. Finally, the number of checkpoints given a value of one was added together. The

best result that could be achieved for any page is for this to comply with all of the

total number of checkpoints. The home page of Florida's old Web site conformed

to 18 of the 71 checkpoints. This same method was used to manually validate the

home page and level one pages of both the old and new Web sites.

2.3 Exceptions

1. For some of the checkpoints in the WCAG 1.0, there are multiple components. If

the page conformed to even one of these multiple components, it was given a

value of one for the checkpoint. Moreover, in the page itself, there may be

multiple occurrences related to a checkpoint. In these situations, if even one

occurrence did not comply with the checkpoint, then a value of zero was given to

the page for that particular checkpoint. For example, the code may have a "<b>"

tag in it, which is used to bold text, instead of a "<strong>" tag, which is

recommended in the WCAG 1.0. If even one "<b>" tag was found, then the page was given a value of zero for this checkpoint.

2.4 Automatic validation of the Web site's syntax and CSS

For this study, the W3C Markup Validation Service was chosen because the user can input either the url for the Web site to be validated or she can directly input the code that is to be validated. Because the P&A Web sites from 2001 are only viewable through the Wayback machine, the code from these sites needed to be put directly into the W3C validation tool. The code from the home page and from one of the level one pages of each Web site was used for the analyses of the syntax, the CSS, and the accessibility. Because of time constraints, one of these level one pages was selected and these pages were selected at random. An automatic validation tool was also utilized to validate CSS. This tool was only used for those Web sites with external cascading style sheets. The tool used to validate these external sheets was the W3C CSS Validation service. It made the most sense to use this software because it was created by the W3C, which also created CSS.

2.5 Automatic accessibility tool

There are many types of automated accessibility tools available for web designers. The Cynthia Says tool was chosen for this study because it allows Web designers to validate all of the WCAG 1.0 checkpoints, including those that are priority level one, two, and three. This software is also free to use. The Cynthia Says tool only validates one page at a time; this was not a hindrance for this study because only the P&A website's home page and one of its level one pages needed to be validated.

This tool generates a report that lists each checkpoint and whether or not the page passed validation for each of these. If the checkpoint failed validation, the report specifies

the error and where it occurred. The Cynthia Says tool is also able to check the quality of

the alt text provided on each web page. It generates a report that lists five checkpoints in

WCAG 1.0 that specifically refer to alt text and whether or not the page passed validation

for each of these. If the checkpoint failed validation for the alt text quality, the report

gives the Web designer information on the error and where it occurred.

Table 2

Automatic Validation of the Level One
Page of Washington's New Web Site

Checkpoint	Priority Level	Value
6.3	1	1
1.4	1	NA
3.2	2	0
3.6	2	NA
7.4	2	1
11.2	2	0
13.1	2	0
13.2	2	1
13.3	2	1
10.5	3	1
1.5	3	NA
10.4	3	NA

Table 2 shows the results from the automatic validation of the level one page of

Washington's new Web site. The report generated by the Cynthia Says tool assigned a

value of "yes," if the page passed validation. For this study, the "yes" value was

converted to a value of one. This accessibility tool assigned a value of "no," if the page

did not pass validation. For this study, the value of "no" was converted to a value of zero.

The total number of checkpoints varied for each Web site. This occurred for

several reasons. In the Cynthia Says tool validation report, no value was given for some

of the WCAG 1.0 checkpoints. For instance, checkpoint 13.4 specifies the use of

"navigation mechanisms in a consistent manner" ("WCAG 1.0," "Guideline 13," 1999).

This checkpoint was not assigned a value when Washington's level one page was

checked. No additional information was given for this checkpoint. Therefore, in this

study, this checkpoint was labeled as NA. Checkpoint 3.3 states that style sheets should

be used to "control layout and presentation" ("WCAG 1.0," "Guideline 3," 1999). The

report generated by Cynthia Says asks the Web designer to verify manually if these style

sheets are present or not. In these instances where the checkpoint can only be validated

manually, these checkpoints are also labeled NA in this study. Finally, some of the

checkpoints were assigned a value of "NA" by the accessibility tool and these were also

assigned a value of NA in this study.

2.6 First Impressions

The last type of analysis looked at just the aesthetical aspects of each Web page

for each site. The results of this analysis are located in Appendix C. Web sites can be

accessible, high in quality, and aesthetically pleasing as well. This was the purpose for

this particular analysis. For example, Florida's new Web site uses the same images as the

ones that were on the site in 2001. On Indiana's new site, the images send an important

message to users. This message lets users know how important they are to this agency

and welcomes them to their site. This first impressions analysis also looked at the

placement of navigational menus on each site and when the content of the site was last

updated. These are important considerations for a Web site designer, although these do

not relate just to accessibility issues. For this analysis, all of the Web site was examined

not just individual pages.

Results

1.1 Manual verification of the old Web sites

Table 3

Manual Validation of the Home Pages of the Old Web Sites

State Web Site	Number of Checkpoints Followed (out of 71)	Number of Priority One Checkpoints Followed (out of 16)	Author-added Additional Checkpoints Followed (out of 6)
Florida	18	5	3
North Dakota	28	6	4
Washington	19	3	2
North Carolina	16	2	2
Indiana	20	4	4

Table 4

Manual Validation of the Level One Pages of the Old Web Sites

State Web Site	Number of Total Checkpoints Followed (out of 71)	Number of Priority One Checkpoints Followed (out of 16)	Author-added Additional Checkpoints Followed (out of 6)
Florida	16	5	2
North Dakota	25	3	4
Washington	22	4	3
North Carolina	17	2	2
Indiana	22	3	4

Table 3 summarizes the results found from manually checking the home pages of the old

Web sites and Table 4 summarizes the results from manually validating the level one

pages of these P&A sites.

1. The results from the manual validation of the home page are similar to the results from the manual validation of the level one pages.

2. Out of the home pages of the old Web sites that were examined in this study, North Dakota's home page complied with the most checkpoints. It conformed to 28 of the 71 checkpoints included in this evaluation. North Dakota's level one page complied with the most checkpoints as well. It conformed to 25 of the 71 checkpoints. This is slightly less than North Dakota's home page.

3. Looking at the priority one checkpoints, North Dakota's home page performed better than the home pages of the other four sites. North Dakota's home page complied with six of the 16 priority one checkpoints. Its level one page did not do as well. Florida's level one page conformed to five of the 16 priority one checkpoints whereas North Dakota's level one page complied with three of the 16 priority one checkpoints.

   The level one page of Florida's old site conformed to the WCAG 1.0 checkpoint 2.1 and North Dakota's page did not. North Dakota's level one page did rely on color to emphasize some of the important text on this page. Florida's level one page of its old site conformed to checkpoint 1.1, which deals with providing "alt" text for images ("WCAG," "Guideline 1," 1999). North Dakota's level one page failed to provide this text for several of the images on its site.

4. For the checkpoints that were added by the author, the home pages and level one pages of the old Web sites of North Dakota and Indiana performed the best. Both of these complied with four of the six additional checkpoints.

The home page and level one page of North Dakota's old Web site conformed to the most checkpoints and, along with Indiana's home page, the most author-added checkpoints. Therefore, North Dakota's old Web site had the most accessible home page and the most accessible level one page.

1.2 Manual validation of the new Web sites

Table 5

Manual Validation of the Home Pages of the New Web Sites

State Web Site	Number of Checkpoints Followed (out of 71)	Number of Priority One Checkpoints Followed (out of 16)	Author-added Additional Checkpoints Followed (out of 6)
Florida	42	8	5
North Dakota	30	5	2
Washington	25	5	4
North Carolina	32	4	5
Indiana	32	5	5

Table 6

Manual Validation of the Level One Pages of the New Web Sites

State Web Site	Number of Checkpoints Followed (out of 71)	Number of Priority One Checkpoints Followed (out of 16)	Author-added Additional Checkpoints Followed (out of 6)
Florida	43	9	5
North Dakota	28	5	4
Washington	25	4	4
North Carolina	36	5	4
Indiana	29	5	4

Tables 5 and 6 show the results obtained from the manual verification of the new Web sites. Table 5 refers to the home pages of these sites and Table 6 refers to the level one pages of these new sites.

1. With the manual verification, the new Web sites did improve over the old sites. Florida's new Web site improved the most. The home page of its new site complied with 42 of the 71 checkpoints and Florida's level one page conformed to 43 of the 71 checkpoints. For Florida's new Web site, its home page complied with 24 more points than the home page of its old site did and Florida's level one page complied with 27 more checkpoints than the level one page of its old Web site did.

2. The results of the priority one checkpoints do not show as marked an improvement as is shown in the total number of checkpoints. However, again, the home page and level one page of Florida's new Web site followed more priority one checkpoints than either type of page for either type of site. Florida's home page conformed to eight of the 16 priority one checkpoints and its level one page conformed to nine of these 16 checkpoints.

3. North Dakota's new Web site shows the least amount of improvement over its old site. Its home page complied with 30 of the 71 checkpoints and North Dakota's level one page conformed to 28 of the 71 checkpoints. This means that the home page of North Dakota's new site complied with only two more checkpoints than the same page on its old Web site. For the level one page of North Dakota's new site, the improvement results are similar. This page complied with only three more checkpoints than the level one page of North Dakota's old site.

4. Overall, for the new Web sites, Florida's site was superior to any of the other four

sites. It conformed to the most checkpoints, the most priority one checkpoints,

and the most additional checkpoints. The home pages of North Carolina and

Indiana came in second; these pages complied with 32 of the 71 checkpoints.

2.1 Automatic validation of the accessibility of the old Web sites

Table 7

Automatic Validation of the Home Pages of the Old Web Sites

State Web Site	Number of Checkpoints Followed	Number of Priority One Checkpoints Followed	Number of Priority Two Checkpoints Followed	Number of Priority Three Checkpoints Followed
Florida	7 (out of 24)	1 (out of 8)	6 (out of 10)	0 (out of 6)
North Dakota	7 (out of 23)	1 (out of 5)	5 (out of 11)	1 (out of 7)
Washington	8 (out of 23)	1 (out of 5)	6 (out of 11)	1 (out of 7)
North Carolina	8 (out of 25)	1 (out of 6)	6 (out of 12)	1 (out of 7)
Indiana	6 (out of 24)	0 (out of 8)	5 (out of 11)	1 (out of 5)

Table 8

Automatic Validation of the Level One Pages of the Old Web Sites

State Web Site	Number of Checkpoints Followed	Number of Priority One Checkpoints Followed	Number of Priority Two Checkpoints Followed	Number of Priority Three Checkpoints Followed
Florida	6 (out of 23)	0 (out of 8)	5 (out of 9)	1 (out of 6)
North Dakota	8 (out of 24)	1 (out of 7)	6 (out of 10)	1 (out of 7)
Washington	8 (out of 24)	1 (out of 7)	6 (out of 10)	1 (out of 7)
North Carolina	8 (out of 27)	1 (out of 8)	6 (out of 12)	1 (out of 7)
Indiana	5 (out of 22)	0 (out of 7)	5 (out of 10)	0 (out of 5)

Table 7 and Table 8 summarize the results from the automatic validation of the old Web sites. Table 7 deals with the home pages of these sites. Table 8 deals with the level one pages of these Web sites.

1. None of the ten pages of the old Web sites that were checked automatically using the Cynthia Says tool passed validation for accessibility.

2. The home page of Washington's Web site conformed to the most checkpoints. Washington's home page complied with eight out of 23 checkpoints. It is interesting to note that with the manual validation of the old sites, North Dakota's home page conformed to the most checkpoints. North Carolina's home page was close behind Washington's. This page on North Carolina's old Web site conformed to eight of 25 checkpoints.

3. For the level one pages of the old Web sites, North Dakota and Washington both complied with eight of 24 checkpoints. This was the most for the level one pages of the old sites.

4. For the priority one checkpoints of the old Web sites, the numbers for the home pages and level one pages were very small. Four out of the five home pages complied with only one priority one checkpoint. Indiana's home page did not comply with any of the priority one checkpoints. Two out of the five level one pages did not conform to any of the priority one checkpoints.

2.2 Automatic validation of the accessibility of the new Web sites

Table 9 and Table 10 display the results of the automatic validation of the new Web sites. Table 9 deals specifically with the home pages of these new sites and Table 10 deals specifically with the level one pages of these sites.

Table 9

Automatic Validation of the Home Pages of the New Web Sites

State Web Site	Number of Checkpoints Followed	Number of Priority One Checkpoints Followed	Number of Priority Two Checkpoints Followed	Number of Priority Three Checkpoints Followed
Florida	10 (out of 22)	2 (out of 8)	6 (out of 9)	2 (out of 5)
North Dakota	9 (out of 23)	2 (out of 6)	6 (out of 10)	1 (out of 7)
Washington	7 (out of 25)	1 (out of 8)	5 (out of 10)	1 (out of 7)
North Carolina	9 (out of 21)	1 (out of 7)	6 (out of 8)	2 (out of 6)
Indiana	8 (out of 21)	1 (out of 5)	5 (out of 10)	2 (out of 6)

Table 10

Automatic Validation of the Level One Pages of the New Web Sites

State Web Site	Number of Checkpoints Followed	Number of Priority One Checkpoints Followed	Number of Priority Two Checkpoints Followed	Number of Priority Three Checkpoints Followed
Florida	10 (out of 21)	1 (out of 7)	7 (out of 9)	2 (out of 5)
North Dakota	8 (out of 24)	2 (out of 8)	6 (out of 9)	0 (out of 7)
Washington	8 (out of 23)	2 (out of 6)	5 (out of 10)	1 (out of 7)
North Carolina	10 (out of 22)	2 (out of 8)	6 (out of 8)	2 (out of 6)
Indiana	9 (out of 20)	1 (out of 5)	6 (out of 9)	2 (out of 6)

1. One of the 10 pages of the new Web sites passed validation. This page was the

   level one page of Florida's new site. Specifically, it was the "Teams" page on this

   Web site. None of the other 10 pages passed validation for accessibility.

2. The results of the automatic validation were similar to those found with the

   manual validation. For both types of validation, the new Web sites performed

   better than the old Web sites.

3. The home page of Florida's new Web site complied with 10 out of 22

   checkpoints. This is the most out of the five new Web sites. It is important to

   remember that with the manual verification of the new Web sites, the home page

   of Florida's new site also conformed to the most checkpoints.

4. For the new Web sites, the level one pages of Florida and North Carolina conform

   to the most checkpoints. Indiana's level one page was close behind.

2.3 Exceptions with the old Web sites

   An interesting finding needs to be addressed with the automatic validation of the

old Web sites. This finding relates to the NA checkpoints and it is shown in Table 11 and

Table 12.

Table 11

Automatic Validation of the Home Pages of the Old Web Sites (Without NA Checkpoints)

State Web Site	Number of Checkpoints Followed (without NA checkpoints)	Number of Priority One Checkpoints Followed (without NA checkpoints)	Number of Priority Two Checkpoints Followed (without NA checkpoints)	Number of Priority Three Checkpoints Followed (without NA checkpoints)
Florida	7 (out of 12)	1 (out of 1)	6 (out of 7)	0 (out of 4)
North Dakota	7 (out of 12)	1 (out of 1)	5 (out of 7)	1 (out of 4)
Washington	8 (out of 13)	1 (out of 1)	6 (out of 8)	1 (out of 4)
North Carolina	8 (out of 13)	1 (out of 1)	6 (out of 8)	1 (out of 4)
Indiana	6 (out of 13)	0 (out of 1)	5 (out of 8)	0 (out of 4)

Table 12

Automatic Validation of the Level One Pages of the Old Web Sites (Without NA Checkpoints)

State Web Site	Number of Checkpoints Followed (without NA checkpoints)	Number of Priority One Checkpoints Followed (without NA checkpoints)	Number of Priority Two Checkpoints Followed (without NA checkpoints)	Number of Priority Three Checkpoints Followed (without NA checkpoints)
Florida	6 (out of 12)	0 (out of 1)	5 (out of 7)	1 (out of 4)
North Dakota	8 (out of 12)	1 (out of 1)	6 (out of 7)	1 (out of 4)
Washington	8 (out of 13)	1 (out of 1)	6 (out of 8)	1 (out of 4)
North Carolina	8 (out of 13)	1 (out of 1)	6 (out of 8)	1 (out of 4)
Indiana	5 (out of 13)	0 (out of 1)	5 (out of 8)	0 (out of 4)

1. For the automatic validation of the old Web sites, both the home pages of Washington and North Carolina conformed to the same number of checkpoints. However, North Carolina's home page performed slightly worse than Washington's page because the Cynthia Says tool validated two more checkpoints for North Carolina's home page than this tool did for Washington's home page.

   However, when the NA checkpoints for this automatic validation were taken out, these two home pages had the same exact result. The home page of Washington's and North Carolina's old Web site conformed to eight of the 13 checkpoints.

2. For the level one pages of the old Web sites, North Dakota's page and Washington's page had the same result. Both of these pages complied with eight of the 24 checkpoints. However, when the NA checkpoints are excluded from the total number of checkpoints, North Dakota's level one page performed slightly

better than Washington's level one page. North Dakota's page complied with

eight of the 12 checkpoints. Washington's level one page complied with eight of

the 13 checkpoints.

3. With the priority one checkpoints, four of the five old Web sites conformed to one

    of these checkpoints. For instance, the home page of Florida's old Web site

    complied with one of the eight priority one checkpoints. When the NA

    checkpoints are excluded from the total number of priority one checkpoints, the

    home page of Florida's old Web site conformed to one of the one priority one

    checkpoints. This is significantly better than when looking at results found with

    the total number of checkpoints. A similar result is found with the level one pages

    of these old Web sites.

2.4 Exceptions with the new Web sites.

This exception also occurs with the new Web sites as shown in Tables 13 and 14.

Table 13

Automatic Validation of the Home Pages of the New Web Sites (Without NA Checkpoints)

State Web Site	Number of Checkpoints Followed (without NA checkpoints)	Number of Priority One Checkpoints Followed (without NA checkpoints)	Number of Priority Two Checkpoints Followed (without NA checkpoints)	Number of Priority Three Checkpoints Followed (without NA checkpoints)
Florida	10 (out of 13)	2 (out of 2)	6 (out of 7)	2 (out of 4)
North Dakota	9 (out of 13)	2 (out of 2)	6 (out of 7)	1 (out of 4)
Washington	7 (out of 14)	1 (out of 2)	5 (out of 8)	1 (out of 4)
North Carolina	9 (out of 13)	1 (out of 2)	6 (out of 8)	2 (out of 4)
Indiana	8 (out of 12)	1 (out of 1)	5 (out of 10)	2 (out of 4)

Table 14

Automatic Validation of the Level One Pages of the New Web Sites (Without NA Checkpoints)

State Web Site	Number of Checkpoints Followed (without NA checkpoints)	Number of Priority One Checkpoints Followed (without NA checkpoints)	Number of Priority Two Checkpoints Followed (without NA checkpoints)	Number of Priority Three Checkpoints Followed (without NA checkpoints)
Florida	10 (out of 12)	1 (out of 1)	7 (out of 7)	2 (out of 5)
North Dakota	8 (out of 13)	2 (out of 2)	6 (out of 7)	0 (out of 7)
Washington	8 (out of 14)	2 (out of 2)	5 (out of 8)	1 (out of 7)
North Carolina	10 (out of 13)	2 (out of 2)	6 (out of 8)	2 (out of 6)
Indiana	9 (out of 12)	1 (out of 1)	6 (out of 9)	2 (out of 6)

1. For the automatic validation of the new Web sites, the NA checkpoints played an interesting role. For the home pages of the new sites, North Carolina's page performed slightly better than North Dakota's. North Carolina's home page conformed to nine of the 21 checkpoints and North Dakota's home page conformed to nine of the 23 checkpoints. However, when the NA checkpoints were not included in the total number of checkpoints, North Dakota's home page and North Carolina's home page had the same result. North Dakota's home page and North Carolina's conformed to nine of the 13 checkpoints.

2. For the new Web sites, the level one pages of Florida and North Carolina complied with 10 checkpoints. Florida's page complied with 10 of the 21 checkpoints and North Carolina's page complied with 10 of the 22 checkpoints. However, when the NA checkpoints were excluded from the total number of checkpoints, Florida's level one page performed slightly better than North

Carolina's level one page. Florida's page complied with 10 of the 12 checkpoints and North Carolina's page complied with 10 of the 13 checkpoints.

3. For the priority one checkpoints, the home pages of the new Web sites of Florida and North Dakota conformed to two checkpoints. Florida's home page complied with two of the eight priority one checkpoints and North Dakota's home page conformed to two of the six priority one checkpoints. When the NA checkpoints were excluded from the priority one checkpoints, both of the home pages of Florida and North Dakota complied with two of the two checkpoints.

3.1 Automatic validation of the syntax of the old Web sites

Table 15

Automatic Validation of the Syntax of the
Home Pages of the Old Web Sites

State Web Site	Passed Validation?	Number of Errors Found
Florida	Yes	0
North Dakota	No	1
Washington	No	19
North Carolina	No	18
Indiana	No	16

Table 16

Automatic Validation of the Syntax of the
Level One Pages of the Old Web Sites

State Web Site	Passed Validation?	Number of Errors Found
Florida	No	7
North Dakota	Yes	0
Washington	No	19
North Carolina	No	7
Indiana	No	33

Table 15 and Table 16 summarize the results from the automatic validation of the syntax of the old Web sites. Table 15 refers to the home pages of these sites and Table 16 refers to the level one pages of these Web sites.

1. Out of the home pages of the old Web sites, Florida's page is the only one that passed validation. The other four home pages of the old sites were not valid. The home page of Washington's old site performed the worst; it had 19 errors. Most of these errors were caused by the fact that this page did not even have a doctype declaration. This is a basic component of any site and inserting this declaration is simple. The home pages of North Carolina and Indiana also did not include this declaration.

2. For the level one pages of the old Web sites, North Dakota's page is the only one that passed validation. The other four home pages of these sites were not valid. The level one page for Indiana performed the worst; it had 35 errors in its syntax. Again, three of the home pages of the old Web sites did not include the doctype declaration. The home pages of Washington, North Carolina, and Indiana did not include this declaration.

3.2 Automatic validation of the syntax of the new Web sites

Table 17 summarizes the results of automatically checking the syntax of the home pages of the new Web sites. Table 18 summarizes the results of the automatic validation of the syntax of the level one pages of these new sites.

Table 17

*Automatic Validation of the Syntax of the
Home Pages of the New Web Sites*

State Web Site	Passed Validation?	Number of Errors Found
Florida	No	1
North Dakota	Yes	0
Washington	No	22
North Carolina	No	10
Indiana	No	35

Table 18

*Automatic Validation of the Syntax
of the Level One Pages of the New Web Sites*

State Web Site	Passed Validation?	Number of Errors Found
Florida	No	1
North Dakota	Yes	0
Washington	No	30
North Carolina	No	9
Indiana	No	22

1. The results of the syntax validation of the new Web sites produced similar results in the automatic checking of both the home pages and level one pages. North Dakota's new site is the only one that passed validation for both of its pages. The other four home pages and level one pages of the new Web sites were not valid.

2. Florida's home page had only one error. The home page of Indiana's new site had the most errors in its syntax with 35 errors. The level one page of Washington's new site had no doctype declaration. This is why Washington's page had the most errors in its syntax with 30 errors.

4.1 Automatic validation of the CSS of the old Web sites

Table 19

*Automatic Validation of the CSS of the New
Web Sites*

State Web Site	Passed Validation?	Number of Errors Found
Florida	Yes	0
North Dakota	Yes	0
North Carolina	Yes	0
Indiana	No	4

Table 19 shows the results of the automatic verification of the external cascading style

sheet of the new Web sites.

1. Out of the five new Web sites, Washington's site is the only one that did not use

     an external style sheet. North Dakota's old site is the only one that used an

     external style sheet. However, this sheet is the same for both its old and new site.

2.   Out of the four new Web sites that had external style sheets, three passed

     validation. The only one that did not is Indiana's new site. Most of these errors in

     this CSS were caused by the use of incorrect operators.

Discussion

Were all of the new P&A Web sites examined in this study more accessible for

people with visual impairments than the old sites? From the results obtained, this seems

for the most part to be the case. Specifically looking at the manual checking performed in

this study, the new Web sites performed better than the old Web sites. This is based on

the fact that these new sites conformed to more of the total number of checkpoints than

the old Web sites did. Florida's new Web site showed the greatest improvement in

performance. The Web site that showed the smallest amount of improvement was North Dakota's new Web site.

Two of the most interesting results obtained from this study concern the large improvement in Florida's new Web site and the small amount of improvement in North Dakota's new site. Why did Florida's Web site improve so much over its old site? There are four main reasons for this significant improvement. None of the other Web sites, new or old, used these accessibility features. The first reason is that the new Web site does not use any type of table. Seven of the WCAG 1.0 checkpoints specifically concern the appropriate use of tables. However, if these are not used on this site, these checkpoints have to be coded as NA, which increases the percentage of conformance. Moreover, because of a link on this site, users with screen reader technology can skip over the navigation menu found on each page of the site. As Guenther (2002) explains: "Provide end-users the ability to bypass repeated navigational elements by placing an anchor link directly on the top of the page that then links to the main content of that page" (p. 72). Imagine a Web site that has two or three navigation menus on each page. A visually impaired individual would have a frustrating experience finding information on this site. Because the screen reader reads all of the text on the screen from the top to the bottom, the user would have to listen as this technology read through every navigation menu on every page. Fortunately, this link lets the screen reader skip over these menus and go directly to the content of the page. In this way, the user is able to find the information that she wants or needs more efficiently. The link is hidden from users and it is easy to implement.

The third reason for the considerable improvement of Florida's new Web site over its old Web site concerns the use of access keys. These keys are important for individuals who cannot use a pointing device. Justin Petruzzelli (2001) explains that "…instead of using a mouse to navigate the web page, a blind individual can use tab and arrow keys to navigate the screen" (p. 1063). Two of the WCAG 1.0 checkpoints, checkpoint 9.4 and 9.5, refer to the use of these types of keys. These can be implemented through the use of the "accesskey" attribute. Finally, the Web designer of Florida's new site clearly explains the ways in which the site is accessible. Although its placement at the bottom of the page is suspect, this information is linked directly from the home page. Lilly and Van Fleet (2000) advocate the use of this accessibility statement on a Web site ("Wired," p. 11). "Visitors to your site will see that access is an important issue….By defining your position on accessibility, you may encourage dialogue with users about this topic" (Lilly & Van Fleet, "Wired," 2000, p. 11). The designers of Florida's site do not merely "state their position," they provide specifics on how they have made their site accessible. Since people with disabilities are the primary users of the P&A Web sites, this shows these users how valued they are and this statement welcomes and invites them to the site.

The second surprise in the results obtained in this study concern the fact that North Dakota's new Web site improved slightly over its old Web site. What might be a reason for this? It is important to remember that North Dakota's old site was the most accessible out of all the old Web sites. One of the analyses carried out for this study was to look at each Web site and write down the author's first impressions of each one, which is located in Appendix C. Surprisingly, the data obtained in this study backed up these first impressions. The author liked North Dakota's old Web site better than its new site.

The old site was aesthetically more appealing than the new site. North Dakota's old Web site was an accessible site in 2001. Although a few features were added to North Dakota's new Web site, other features could be added to make it more accessible and appealing. The navigation and the layout of the Web site need to be improved. This site also does not have a text-only alternative. Finally, the contrast between the foreground and background colors on the Web site is a problem. As it states on the WCAG 1.0 site: "When foreground and background colors are too close to the same hue, they may not provide sufficient contrast when viewed using monochrome displays or by people with different types of color deficits" ("WCAG 1.0," "Guideline 2," 1999). These are just a few examples of features to be improved on this site.

The results for the level one pages of the new Web sites were similar to those obtained from the home pages of these sites, although these level one pages did not conform as well as their home page counterparts. For instance, the level one page of North Dakota's old Web site complied with 25 of the 71 checkpoints. On the other hand, the home page of North Dakota's old Web site complied with 28 of the 71 checkpoints. Looking at the new Web sites, the level one page of North Carolina's new Web site conformed to 36 of the 71 checkpoints. The home page of North Carolina's new site conformed to 32 of the 71 checkpoints.

Moreover, the home page of North Carolina's new site is the only one that gives users instructions on how to increase the font size of any textual content. Users may know how to do this already, but it is important enough to prominently display this information or a link to it in case some individuals may not know how to do this. As McManus (2005) notes those individuals with "low vision" may need to increase the font

size of textual content (p. 88). None of the new Web sites require individuals to use horizontal scrolling in order to view all of the text on the screen. In order to scroll through a screen horizontally, users need to use a mouse, which is extremely difficult for those who are visually impaired. McManus (2005) advocates testing the Web site by resizing the window in the browser to ensure that the site does not require this type of scrolling (p. 89).

The final point concerns the types of information provided by these P&A Web sites that are mandated by the government. Individuals with disabilities use the information provided on these sites to help them procure the goods and services that they are legally entitled to. Traci Hong (2006) emphasizes the fact that "the currency of information…contribute[s] to information quality" (p. 115). Peter Gremett (2006) reports that "84% of all Americans expect to find information in at least one of the following topical areas: government agency, electronic commerce, news, and health care" (p. 808). Would not individuals want the most current information in these domains that they could possibly find? It is possible that this would be the case, especially for those domains where information changes frequently and where it is important that the information is as current as possible. Yet, only three of the Web sites provide any information as to when the content of the site was last updated or revised. These are North Carolina's old and new Web site and Washington's old Web site. The information on Washington's old Web site was revised about a month earlier. The information on North Carolina's old Web site was revised about a year ago, but it is difficult to tell when the information on North Carolina's new Web site was last revised. Two dates are given on the site, so either the content on the site was revised in 2002 or it was updated about a

year ago. Obviously, this is important for any individual using the Internet not just those individuals with disabilities.

Conclusion

How can this study help Web designers create more accessible Web sites? There are three main points to take from this study. The first one concerns accessibility tools. There are many types of these tools available to designers. The Cynthia Says validation tool was chosen for this study. Although it generates a report, it provides no explanation as to how it determines if a Web site has either failed or passed validation. Many of the WCAG 1.0 checkpoints were skipped over with no explanation as to whether or not these checkpoints passed or failed validation. In other words, no value was assigned to these checkpoints. It is important that anyone who chooses to evaluate a site selects the tool that best suits their needs. By this I mean the designer should make sure that she fully understands the reports generated by these tools. If the Web site fails automatic validation, then what exactly does this mean? Is it clear from the report that the tool generates where the errors in the report are and how these can be corrected? For this study, the results obtained using this automatic tool were similar to those obtained through the manual checking of each site. However, this study is limited in that only one automatic accessibility tool was used to evaluate these Web sites.

The second important implication that designers can take from this study concerns the use of images on accessible Web sites. Very few of the Web sites examined in this study used graphics to enhance the textual information on the site. Also, many of the WCAG 1.0 checkpoints concern multimedia presentation of textual content including both video and audio. However, none of the Web sites examined in this study utilized this

type of presentation. The W3C affirms that checkpoints included in the WCAG 1.0 do not prohibit the use of graphics or images on Web sites ("WCAG 1.0," "Introduction," 1999, para. 3). "The guidelines do not suggest avoiding images as a way to improve accessibility. Instead, they explain that providing a text equivalent will make it accessible" ("WCAG 1.0," "Introduction," 1999, para. 3). Steve Murphy (2005) says that "graphics accompanying text, enhance the comprehension of written information, but are often a secondary thought when it comes to accessibility" (p. 15). He further explains that using alt text to describe the image and using description links to link to a page that describes the image are practices to use if designers want to create accessible Web sites that also use graphics (Murphy, 2005, p. 15). The P&A Web sites evaluated in this study provided information to users without a lot of images. It would be interesting to see why this occurred. Do designers really believe that providing these images will prove to be a barrier for individuals with disabilities to find the information that they need? Can accessible Web sites also be aesthetically appealing?

From this review, the premise of this study seems quite simple. Of course, people with visual impairments should have equal access under the law. Of course, companies, organizations, and institutions should take into account the needs of all of their users or customers. On the surface, it seems like it would be easy to design Web sites that are accessible for these individuals. There are design principles in place to insure access for all, there are standards in place that Web designers can follow to insure accessible sites, and there are validation tools freely available to spot accessibility errors. However, if these are not accessible, then why is this so? Is it that these P&A agencies, which are nonprofit organizations with relatively small staffs, lack the technical expertise necessary

to design and maintain accessible Web sites? It would be interesting to further explore

this to see if there is a link between accessibility and the technical expertise of the P&A

staff. Hopefully, these issues can be explored in more detail in the future.

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Appendix A

1. WCAG 1.0 Checkpoints

1.1 Priority 1 checkpoints

- 1.1 Use "alt" for the IMG elements.

- 1.2 Provide redundant text links for each active region of a server-side image map.

- 1.3 Provide an auditory description of the important information of the visual track of a multimedia presentation.

- 1.4 For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation.

- 2.1 Ensure that all information conveyed with color is also available without color for example from context or markup.

- 4.1 Clearly identify changes in the natural language of a document's text and any text equivalents.

- 5.1 For data tables, identify row and column headers.

- 5.2 For data tables that have two or more logical levels of row or column headers, use markup to associate data cells and header cells.

- 6.1 Organize documents so they may be read without style sheets.

- 6.2 Ensure that equivalents for dynamic content are updated when the dynamic content changes.

- 6.3 Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported. If this is not possible, provide equivalent information on an alternative accessible page.

- 7.1 Until user agents allow users to control flickering, avoid causing the screen to flicker.

- 9.1 Provide client-side image maps instead of server-side image maps except where the regions cannot be defined with an available geometric shape.

- 11.4 If, after best efforts, you cannot create an accessible page, provide a link to an alternative page that uses W3C technologies, is accessible, has equivalent information (or functionality), and is updated as often as the inaccessible (original) page.

- 12.1 Title each frame to facilitate frame identification and navigation.

- 14.1 Use the clearest and simplest language appropriate for a site's content.

1.2 Priority 2 checkpoints

- 2.2 Ensure that foreground and background color combinations provide sufficient contrast when viewed by someone having color deficits or when viewed on a black and white screen.

- 3.1 When an appropriate markup language exists, use markup rather than images to convey information.

- 3.2 Create documents that validate to published formal grammars.

- 3.3 Use style sheets to control layout and presentation.

- 3.4 Use relative rather than absolute units in markup language attribute values and style sheet property values.

- 3.5 Use header elements to convey document structure and use them according to specification.

- 3.6 Mark up lists and list items properly.

- 3.7 Mark up quotations. Do not use quotation markup for formatting effects such as indentation.

- 5.3 Do not use tables for layout unless the table makes sense when linearized. Otherwise, if the table does not make sense, provide an alternative equivalent, which may be a linearized version.

- 5.4 If a table is used for layout, do not use any structural markup for the purpose of visual formatting.

- 6.4 For scripts and applets, ensure that event handlers are input device-independent.

- 6.5 Ensure that dynamic content is accessible or provide an alternative presentation or page.

- 7.2 Until user agents allow users to control blinking, avoid causing content to blink.

- 7.3 Until user agents allow users to freeze moving content, avoid movement in pages.

- 7.4 Until user agents provide the ability to stop the refresh, do not create periodically auto-refreshing pages.

- 7.5 Until user agents provide the ability to stop auto-redirect, do not use markup to redirect pages automatically. Instead, configure the server to perform redirects.

- 8.1 Make programmatic elements such as scripts and applets directly accessible or compatible with assistive technologies.

- 9.2 Ensure that any element that has its own interface can be operated in a device-independent manner.

- 9.3 For scripts, specify logical event handlers rather than device-dependent event handlers.

- 10.1 Until user agents allow users to turn off spawned windows, do not cause pop-ups or other windows to appear and do not change the current window without informing the user.

- 10.2 Until user agents support explicit associations between labels and form controls, for all form controls with implicitly associated labels, ensure that the label is properly positioned.

- 11.1 Use W3C technologies when they are available and appropriate for a task and use the latest versions when supported.

- 11.2 Avoid deprecated features of W3C technologies.

- 12.2 Describe the purpose of frames and how frames relate to each other if it is not obvious by frame titles alone.

- 12.3 Divide large blocks of information into more manageable groups where natural and appropriate.

- 12.4 Associate labels explicitly with their controls.

- 13.1 Clearly identify the target of each link.

- 13.2 Provide metadata to add semantic information to pages and sites.

- 13.3 Provide information about the general layout of a site (e.g., a site map or table of contents).

- 13.4 Use navigation mechanisms in a consistent manner.

1.3 Priority 3 checkpoints

- 1.5 Provide redundant text links for each active region of a client-side image map.

- 4.2 Specify the expansion of each abbreviation or acronym in a document where it first occurs.

- 4.3 Identify the primary natural language of a document.

- 5.5 Provide summaries for tables.

- 5.6 Provide abbreviations for header labels.

- 9.4 Create a logical tab order through links, form controls, and objects.

- 9.5 Provide keyboard shortcuts to important links (including those in client-side image maps), form controls, and groups of form controls.

- 10.3 Until user agents (including assistive technologies) render side-by-side text correctly, provide a linear text alternative (on the current page or some other) for all tables that lay out text in parallel, word-wrapped columns.

- 10.4 Until user agents handle empty controls correctly, include default, place-holding characters in edit boxes and text areas.

- 10.5 Until user agents (including assistive technologies) render adjacent links distinctly, include non-link, printable characters (surrounded by spaces) between adjacent links.

- 11.3 Provide information so that users may receive documents according to their preferences (e.g., language, content type, etc.).

- 13.5 Provide navigation bars to highlight and give access to the navigation mechanism.

- 13.6 Group related links, identify the group (for user agents), and, until user agents do so, provide a way to bypass the group.

- 13.7 If search functions are provided, enable different types of searches for different skill levels and preferences.

- 13.8 Place distinguishing information at the beginning of headings, paragraphs, lists, etc.

- 13.9 Provide information about document collections (i.e., documents comprising multiple pages).

- 13.10 Provide a means to skip over multi-line ASCII art.

- 14.2 Supplement text with graphic or auditory presentations where they will facilitate comprehension of the page.

- 14.3 Create a style of presentation that is consistent across pages.

Appendix B

1. URLs of the Five P&A Web Sites and the Validation Tools

1.1 URLs of the Old Web Sites

Florida **–** www.advocacycenter.org (archived on November 29, 2001)

North Dakota **–** www.ndpanda.org (archived on November 27, 2001)

Washington **–** www.wpas-rights.org (archived on November 26, 2001)

North Carolina – www.doa.state.nc.us/doa/gacpd/gacpd.html
(archived on December 5, 2001)

Indiana **–** www.in.gov/ipas (archived on December 17, 2001)

1.2 URLs of the New Web Sites

Florida **–** www.advocacycenter.org

North Dakota **–** www.ndpanda.org

Washington – www.wpas-rights.org

North Carolina **–** www.gacpd.com

Indiana – www.in.gov/ipas

2. URL for the Internet Archives' Wayback machine **–** www.archive.org/web/web.php

3. URLs of the Validation Tools

W3C Markup Validation Service version 0.7.4 – validator.w3.org

W3C CSS Validation service – jigsaw.w3.org/css-validator

Cynthia Says provided by HiSoftware – www.cynthiasays.com

Appendix C

1. First Impressions

1.1 Florida's old Web site

- It is a nice touch for images to be included on the Web site. However, the colors used in the image make it difficult to see. Also, the choice of color for the site is questionable, especially in regards to the contrast in color. Moreover, the same images are used on multiple pages within the Web site. Surely, images could have been selected that would not all be the same and that would also enhance the text.

- There are many acronyms included in the content on the Web site without any explanation given as to what these acronyms mean.

- The choice of words used in the headings for the navigation menu could be better. It is difficult for the user to Poor choices were made when these were selected.

- The navigation menu is on the top of the level one pages and on the top and on the bottom on the home page.

- No information is given about when the content of the site was last updated.

1.2 Florida's new Web site

- There is a very simple search box (just enter keywords).

- The Web site does not provide contextual clues in nested lists.

- In the text, a lot of acronyms are used without any explanation as to their meaning.

- It has a lot of hyperlinks on both the home page and on the level one pages.

- I like the statement linked from the home page regarding the webmaster's concern for accessibility and the ways in which the design of the Web site promotes accessibility.

- The images included on this Web site are the same as the ones that were on the Web site five years ago. Also, the same images are used on multiple pages.

- The navigation menu is at the top and on the bottom of both the home page and on the level one pages.

- No information is given on when the content of the Web site was last updated.

1.3 North Dakota's old Web site

- On the "Programs" page, there is a lot of text without the use of anchor tags.

- Overall, the Web site has mostly text without the use of images, which means it is not visually appealing.

- There is an excessive use of tables

- There is no navigation bar or menu for this Web site.

- No information is provided as to when the content of the Web site was last updated.

1.4 North Dakota's new Web site

- This Web site is not aesthetically appealing; the old Web site is more appealing than this Web site.

- The Web site has too much white space.

- The same style sheet is used both on this Web site and on the old Web site from five years ago.

- I do not understand why the home link is placed on both the top and the bottom of the page; does it really need to be in both places?

- Some of the text on the Web site is underlined but it is not a hyperlink; this is really misleading.

- The navigation menu for this Web site is at the top of the page.

- No information is provided as to when the content of the Web site was last updated.

1.5 Washington's old Web site

- This Web site has too much white space.

- It is not visually appealing.

- The font size used in some sections of the site is too small even for those with regular vision.

- The navigation menu is at the bottom of the page; I think this is a poor design decision.

- Information is provided as to when the content of the Web site was last revised; the content was last revised about a month earlier.

1.6 Washington's new Web site

- There is too much white space in this Web site.

- There are too little images on this site.

- When you click on "Support WPAS," you are directed to the directory for the Web site. This is confusing to the user.

- The html code is messy. It is hard to tell where the internal style sheet for the site begins and where it ends.

- The navigation menu for this Web site is at the top and at the bottom of the page.

- No information is provided as to when the content of the Web site was last updated.

1.7 North Carolina's old Web site

- This Web site is not visually appealing. The choice of background colors is poor.

- The site is disorganized. It is difficult for the user to tell which page is the home page, the actual beginning of the Web site.

- Only part of the site is devoted to the North Carolina P&A; the rest of the Web site is devoted to another agency. It is difficult for the user to tell which pages in the site are devoted to which agency.

- The graphics on the site seem to have been placed at random without any logic or reason to their placement. The images do not enhance the text at all. I also question, for an agency such as this one, the usefulness of clip art images.

- The url for this site is long. It would be difficult for the user to remember it or type it in correctly.

- The amount of text on many of the web pages is questionable, especially since there are no anchor tags. Again, the user has to do a lot of scrolling.

- This Web site does not have a navigation menu.

- Information is provided as to when the content of the Web site was last updated; it was updated about a year earlier.

1.8 North Carolina's new Web site

- The url for this Web site is much shorter than the url for the old Web site; it is easier to remember and it is easier to type it in correctly.

- The banner used in the site is unique and appealing. Overall, the images used for this Web site really enhance the text. Also, different images are used on each page.

- There are instructions for helping the user to change the size of the font. This is the only Web site out of the ten examined in this study that provides this for users.

- There is an excessive amount of tables used on this site.

- There are some formatting issues related to the search box on the Web site and there are some small mistakes in the html code.

- On the "FAQ" page and on the "Board and Committee Membership" page, there is too much white space.

- Both internal and external style sheets are used in formatting this Web site. It seems like a lot more formatting could be done in the external style sheet. Why are both types of style sheets needed?

- The length of the text on the "Newsletters" page is too long without the use of any anchor tags.

- The navigation menu is located on the left-hand side of the page and on the bottom of the page. The left-hand side menu is too long.

- A date is provided as to when the content of the Web site was last updated; actually, two dates are given and so it's difficult to tell which one is accurate. The content was either updated about a year ago or it was updated last in 2002.

1.9 Indiana's old Web site

- Overall, the Web site has too much white space.

- Contact information is provided on multiple pages.

- An acronym is used as a heading in the navigation menu. Will all users understand what this acronym means?

- Overall, there is an appropriate amount of text on each page of this Web site.

- There is a navigation menu on both the left-hand side of the page and also at the bottom of the page for the home page. Why is the navigation menu at the bottom of the page? The navigation menu for the level one pages is on the left-hand side of the page and also at the top of the page.

- No information is provided as to when the content of the Web site was last updated.

1.10 Indiana's new Web site

- The graphics used on the home page are appealing. The information provided on the site about the individuals in each image sends a message to the site's primary users. This message tells these users how important they are to this agency. This personalizes the site and explains in a way that text could not what the Indiana P&A is all about. Why are there not more images on the level one pages of this site?

- The use of colors on this Web site is appealing. However, the contrast in these colors is large enough for individuals to be able to read it very well in black and white.

- The user can translate the text on this site into multiple languages. This is the only Web site out of the ten examined in this study that allows the user to do this. However, the translation software does not work well for all of the languages in all browsers. The hyperlink to each country is an icon of the flag of the country,

so the user has to know which flag goes with each country in order to use this service.

- Text-only is provided for one page on this site, which is the "Contact Information" page.

- There are four navigation menus on two of the level one pages, the "Equal Access" page and the "Special Education" page. Why do these pages need four navigation menus?

- The use of pictures and the background and personal information provided on the "Commission" page for both the board and the advisory council is a nice touch. Again, this makes this Web site more welcoming to users.

- This Web site uses anchor tags in an effective way.

- There are three navigation menus on this site – one on the top, one on the bottom, and one on the left-hand side. Why are three navigation menus needed for this Web site?

- No information is given as to when the content of this Web site was last updated.