To the Graduate Council:

I am submitting herewith a dissertation written by Harriette L. Spiegel entitled "When the Disability Is Not the Problem - Experiencing the Barriers to Web Accessibility: A Study of the Experiences of Computer Users With Visual Disabilities Using the Internet." I have examined the final electronic copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.

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“When the Disability Is Not the Problem - Experiencing the Barriers to Web Accessibility: The Experiences of Computer Users with Visual Disabilities Using the Internet

A Dissertation Presented for
the Doctor of Philosophy Degree
The University of Tennessee, Knoxville

Harriette L. Spiegel
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Thank you.

"Only power that springs from the weakness of the oppressed will be sufficiently strong to free both" (Freire, 1970).

ABSTRACT

The purpose of this study is to describe the experiences and perceptions of three computer users with visual disabilities as they accessed and reviewed Web pages on the Internet. Attention is focused on the use of the Internet by individuals with visual disabilities: blindness, low vision, and deaf/blindness.

Data were gathered through interviews and observation, during eight sessions with each participant. Data were qualitatively analyzed using an inductive process (Hatch, 2002). Data analysis revealed six categories of meaning: interactions with computer; personal characteristics, strategies to find solutions to barriers encountered; personal feeling and opinions; design features, and communication.

Sites viewed included commercial, educational, non-profit, and governmental sites. Interviews consisted of structured and unstructured questions.

The knowledge gained in this study will add to the literature of Web Accessibility and will contribute to raising awareness of the barriers that computer users with visual disabilities encounter when using the Internet.

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CHAPTER I
INTRODUCTION TO THE STUDY

"We must believe in man's struggle for an even better world; that man is moving towards a world of more beauty, love, laughter, and creation. This is the vision of man." Saul Alinsky (Finks, 1984)

Web accessibility is the degree to which a Web page can be accessed by all users. While there are many elements that make a Web site accessible or inaccessible, some are directly related to visual disabilities, such as whether or not a screen reader can interpret unlabeled graphics, or read a file, such as a Portable Document Format (pdf), or whether font size or color combinations are hard to read. Because of its visual nature, the World Wide Web presents difficulties more frequently to users with visual impairments, although with the rapid development of the use of audio on the Internet, users with hearing impairments are increasingly affected (Ratner, 2003, p. 23). Other elements such as organization of content or amount of text on a page are Web accessibility issues that are not directly related to one's disability in terms of assistive technology.

There are (at least) three reasons for Web accessibility:

(1) Legislation in many countries is mandating that Web pages be accessible. In the United States, the 1998 Section 508 amendment of the Rehabilitation Act of 1973 mandated that all federal Web sites be accessible, and by extension, institutions receiving funds from the Federal government must follow Web accessibility guidelines in the design of their Web pages;

(2) a sense of altruism calls for considering the user when designing Web pages; and

(3) acknowledgement of the growing percentage of computer users with or without disabilities defines the economic sense of designing Web pages so that as many users as possible can access the content.

A blind computer user can use such assistive technology devices as screen readers (or Braille displays) that use text-to-speech technologies (Ratner, 2003, p. 24). However, a Web page that contains graphics may not be accessible to a blind computer user whose screen reader cannot interpret a graphic. If, however, the underlying Web page code contains a text description of the content of the graphic, the screen reader can interpret the content of the graphic. Otherwise, the screen reader will read out, “image,” or “graphic,” or nothing at all. Solutions exist, however. Guidelines have been developed that specify for the Web developer the effective design of Web pages. These guidelines incorporate clear textual descriptions for non-textual elements, ease of navigation, ease of keyboard navigation, auditory elements if necessary, and effective information organization (Ratner, 2003, p. 24).

Throughout the dissertation, the term “Internet” is used interchangeably with the term “Net,” “Web,” or “World Wide Web.” The study describes the experiences of three computer users with visual disabilities as they use the Internet, often encountering Web pages that are not fully accessible.

This chapter will begin by introducing the issues surrounding Web accessibility, followed by the context of the study, the research problem, the

purpose of the study, the research question, the conceptual framework, the significance of the study, assumptions, limitations and delimitations, definitions, and the organization of the study. The last section will provide a personal statement about my experience with disability.

What is it like to access the Internet if you are blind, deaf-blind, or have low vision? This topic is not often addressed in the literature. On the one hand, how are people supposed to know what it is like to be blind, or deaf-blind, or have low vision, if they themselves are *not* blind, deaf-blind, or do not have low vision? Yet on the other hand, simple absence of such a disability does not mean the phenomenon should not be discussed in our everyday world. The focus of this dissertation, the experiences of my participants, will contribute to awareness of these experiences. Figure 1 illustrates the context of this dissertation: three large intersecting circles, one containing a smaller fourth circle as a sub-circle, intersect, with a star in the middle. The three large circles represent 1) Internet Use, 2) Awareness of Web accessibility, and 3) Disabilities with the smaller sub-circle representing Visual Disabilities. The orange star in the middle, touching all circles, represents the research problem formed inside the intersection of the four circles (Figure 1).

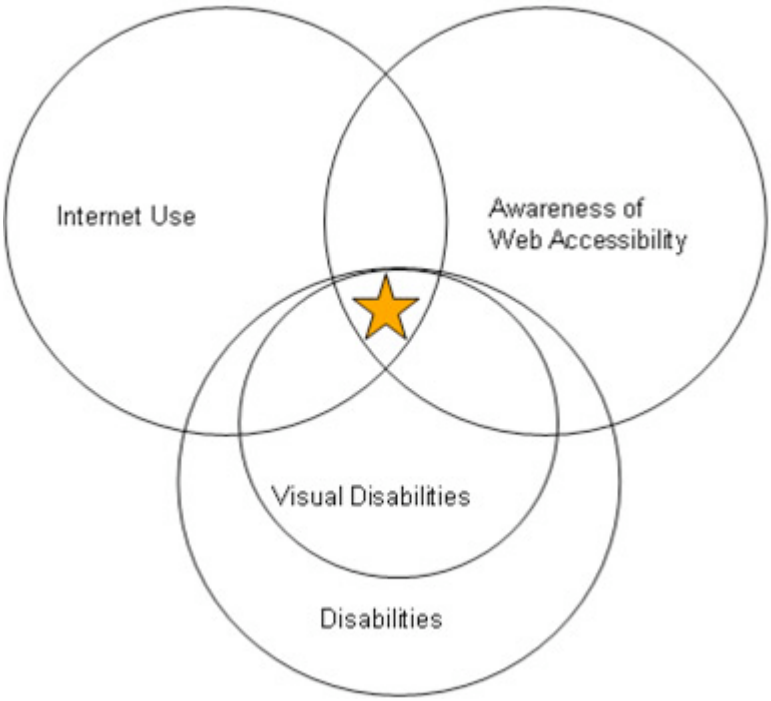


Figure 1: The three large intersecting circles with the smaller fourth circle represent the contexts explored in this study: 1) Internet Use, 2) Awareness of Web Accessibility, and 3) Disabilities. The smaller circle represents Visual Disabilities in the three participants. The orange star in the middle, touching all circles, represents the research problem formed inside the intersection of the four circles.

Context of the Study and Research Problem

The study examined Web accessibility as experienced by selected individuals with visual disabilities as they used a computer to access information on the Internet. The next sections will describe the context of the study and the research problem.

Context

The Internet has provided great opportunities, especially to disabled users who can take part in social interactions as never before. Unfortunately, to many computer users with different kinds of disabilities, accessing the opportunities available on the Internet can be an issue of confronting barriers. An example of barriers faced by computer users with visual disabilities is the element of a Web page that is incompatible with the assistive technology that a blind student uses. A blind person uses an assistive technology device called a screen reader to access information on the Internet. If the screen reader cannot accurately interpret the content of the Web page such as an assignment, the blind student will be prevented from accessing that information. Or if there are incompatibilities in the hardware and software that disable the screen reader, the student cannot complete a given assignment. Similarly, a computer user with low vision simply cannot read most text that is colored, much less on a poorly-contrasted background. Such barriers to smooth and effective use of the Internet are encountered by many computer users with disabilities. The experiences of selected computer users with differing degrees of visual disabilities will be highlighted.

Research Problem

The problem to be addressed by this study is the gap caused by lack of understanding of (or reluctance to recognize) the experiences of computer users with disabilities, and how barriers to Web accessibility on the Internet

are experienced by computer users with visual disabilities. A *problem (or need)* is generally defined by instructional designers as the *gap*, or area, between the way things are now and the way they 'ought' to be (Mager & Pipe, 1984; Kaufman, 1993). Such a gap exists in the design of many Web pages. Not everybody can access the content on the Internet; but everybody 'ought' to be able to. Universal access to information on the Internet is often restricted by barriers due to the inaccessible design of a Web page or incompatibilities in hardware or software. In the literature, these barriers have been defined and solutions have been proposed, but the experiences and perceptions of computer users with visual disabilities who encounter these barriers have not been described from the users' perspectives. Scherer (1996) described another gap that this study is addressing: "As useful as technologies are, we still do not know enough about how they affect the individuals who use them" (p. 167). The experiences of such users can guide designers in producing more accessible Web pages.

It is possible that many people, including designers of the Web pages in question, simply are not aware of the need to design with accessibility in mind. For instance, users without such disabilities (the 'otherwise able-bodied') may not know what it feels like to run into barriers on a Web page, or what the strategies are, if any, that computer users with visual disabilities might employ to cope with barriers on the Internet. As illustration, I regretfully recall the reaction from an unknowing individual when I was casually talking about my dissertation topic, "...you mean, blind people use a computer?" This

gap in knowledge has led to misunderstandings and consequent lack of consideration on the part of designers, and frustration on the part of a large population of computer and Internet users.

Taken to a more political extreme, the issues concerning barriers to Web accessibility constitute an aspect of the “disablism” that is discussed by Barnes and Mercer (2000): “Like sexism and racism, disablism expresses itself in exclusionary and oppressive practices at a wide range of levels: interpersonal, institutional, cultural and societal” (Barnes and Mercer, p. 20). Most people who are simply unaware of the potential barriers for computer users with disabilities on the Internet probably do not intend to marginalize or exclude anyone. Yet, by the simple act of designing a Web page that is inaccessible to assistive technology, when solutions exist, a form of “social oppression and exclusion” (Barnes and Mercer, p. 16) does indeed develop. The attitudes that contribute to such lack of awareness are similar to those that contribute to stigma: As quoted by Parette and Scherer (2004, p. 217), Crocker, Major, and Steele (1998) wrote: “A person who is stigmatized is a person whose social identity, or membership in some social category, calls into question his or her humanity - the person is devalued, spoiled, or flawed in the eyes of others.” This stigma encourages an assumption that the stigmatized are powerless. Smith (2003) addressed the issue when he described the ‘power of the powerless’:

> The uses and abuses of power are fundamental concerns of the human condition. ... Less obvious to many

> of us ... is the question of how the actions and values associated with power may be influenced by people who are thought of as lacking power themselves (Smith, 2003).

By revealing the experiences of my participants, I have contributed to the discussion about the relationship of power and disability. The experiences of three computer users with visual disabilities as they used the Internet have been described in this study. In sharing what it is like to encounter barriers on the Internet, each of the participants has helped me contribute to the literature about Web accessibility and add to the literature on disability.

In today's learning environment, computer technology - including the Internet - is frequently used to support learning and help learners accomplish goals (Curry, 2003). This technology has been especially beneficial to people with disabilities who have learned to use computer and adaptive and assistive technology "to benefit from the educational resources in our society and ... become full participants in [the] economic enterprise" (Cunningham and Coombs, 1997). However, universal access to the information on the Internet is often restricted by barriers due to inaccessible design of a Web page or incompatibilities in hardware or software, creating a type of digital divide between users who can access information, and users who cannot access information (Coombs, 2002). Raising awareness of Web accessibility is crucial to ensuring equitable participation in the promises of the information revolution.

Though recent federal (U.S. and worldwide) legislation has encouraged awareness of the issues concerning barriers to Web accessibility, and there has been some litigation leading to wider compliance with accessibility and usability guidelines, there remains a severe lack of awareness of the issue among the general public, including Web page designers. As described by Goggin and Newell (2003), technologies of the "New Media" maintain disablist values that impose disability on persons with disabilities. By presenting inequality and a different kind of digital divide, the continuing exclusion of persons with disabilities from such areas of life as the business of the Internet has resulted essentially in discrimination against computer users who encounter these barriers. Thus by highlighting the experiences of individuals with visual disabilities as they use the Internet, this study will address the problem by contributing to raising awareness of these issues. Such enhanced awareness should surely lead to more considerate design of Web pages.

Purpose of the Study and Research Question

The purpose of this study was to describe the experiences of three individuals with the visual disabilities of blindness, low vision, and deaf/blindness, as they accessed and reviewed Web pages on the Internet. The knowledge gained will both add to the literature of Web Accessibility and highlight the barriers faced by computer users with visual disabilities. The research question of this study is: What are the experiences and perceptions

expressed by computer users with visual disabilities while accessing information on the Internet?

Conceptual Framework

The conceptual framework of this study draws from critical theory. Critical theory addresses the issue of changing conditions that affect human life (Seilor, n.d.). The issue in this study (of how accessible a given Web page is for a given user with disabilities) is as pertinent as the issues regarding power confronting the poor people championed by Paolo Freire, or the civil rights issues embraced by Myles Horton of the Highlander Center in Tennessee (Horton and Freire, 1990), or other advocates of equality who recognized the relationship between knowledge and power (Gumbert, 1984).

The underlying issue is the same: there is a perceived inequality in distribution of power concerning individuals' determination to direct their lives (Riordan, 1976) in one way or another and to one degree or another. In highlighting the experiences of three individuals with visual disabilities as they used the Internet, I observed my participants face the issue of power as they encountered barriers that they were powerless to overcome. In submitting to my requests to visit Web pages that were going to be inaccessible, they relinquished control, however willingly.

It is not enough to say that the frustration of not being able to skim through a given Web page due to the barriers presented by inaccessibility is less an issue of power than others. Saul Alinsky, a well-known organizer of

the powerless and solver of problems, commented, “All definitions of words, like everything else, are relative. Definition is to a major degree dependent upon your partisan position” (Alinsky, 1971, p. 60). It is a question of degree but no less an issue of power, and the advocate who chooses to further the solution by raising awareness of the situation has an opportunity to narrow that digital divide between users who ‘can’ and users who ‘cannot’ benefit fully from access to the Internet, and thus share in the full participation of the digital economy (U. S. Department of Commerce, 2000).

The use of a critical lens through which to look at the experiences of the three individuals in this study was a natural approach for me. Living with a disability that causes self-effacing situations is a constant source of feelings of oppression, marginalization and lack of control, no matter the degree. I identified with the desire not to be stigmatized that is a part of not wanting to bring attention to one’s lack of normalcy. My Personal Statement at the end of the Introduction describes my disability.

In contemplating why some Web pages are not accessible, I decided that most Web designers were simply unaware of the experiences of those computer users with disabilities who cannot access the content of a Web page. In writing this dissertation, I have chosen to advocate for increased awareness of Web accessibility by describing the experiences of my participants. A different explanation for a Web page’s inaccessibility may be that some designers do not care unless they are legally forced to consider

Web accessibility, in which case my advocating on behalf of these users by describing their experiences is all the more necessary.

The inaccessible Web pages that contributed to the experiences of my participants as they encountered examples of Web pages with inaccessible design are part of a larger, but serious, challenge facing society as technology becomes increasingly ubiquitous. Slatin (2003) described the implications of the societal choice to “become an information marketplace” (p. 61). The author asks, “do we not have the responsibility to ensure that everyone has equal opportunity to participate as producers and consumers?” (p. 61). Such participation, including government initiatives at all levels of government, implies that the Web sites by which such participation is made possible must be accessible. “Fortunately, the tools to achieve that are readily available. The key is to raise public awareness of the need and of the overall societal benefit” (p. 71).

According to Kincheloe and McLaren (2000, p. 279), “we can be against critical theory or for it, but...we cannot be without it...” I refer to the aspect of critical theory that “disrupt[s] and challenges[s] the status quo” (Kincheloe and McLaren, p. 279). This dissertation has given me a way to “...challenge the status quo” by highlighting the experiences of my participants.

As described by Lincoln and Denzin (2000, p. 1056), “the critique and concern of the critical theorists has been an effort to design a pedagogy of resistance within communities of difference.” Creswell and Miller (2000)

describe two perspectives that govern the choice of validity procedures in qualitative research: “the lens researchers choose to validate their studies and researchers’ paradigm assumptions.” In my case, using a lens of the critical paradigm allowed me to reinterpret an unfair situation (the inaccessibility of many Web sites) through the experiences of my participants (computer users with visual disabilities). The first-hand examples in the data illustrate the marginalization that a computer user with visual disabilities can feel, and a critical paradigm contributes toward emancipation (Symington, 1999) of such “socially excluded” computer users (Brown, Powell, Battersby, Lewis, Shopland, and Yazdanparast, 2002).

“One of the most important aspects of critical theory-informed qualitative research involves ... the interpretation of information” (Kincheloe and McLaren, 2000, p. 285). Throughout the study, the theme of perception pulled on my interpretation. Understanding life and successfully surviving life’s many challenges are guided by one’s perception. Perception is the basis for perspective, and in documenting the experiences of my three participants with visual disabilities, I have contributed to the discussion about recognizing different perspectives, specifically, the need to understand how technology can be planned so that all users can benefit from its promises.

My research on computer users with visual disabilities uncovered my own feelings about one’s reactions to perception by others, a reaction I had not expected. The data illustrate the marginalization that individuals with disabilities often experience in the world of computers. Brown et al. (2002)

referred to disabled individuals as “socially excluded.” Each of my participants referred to this aspect of experiencing a disability. Because I discovered my passion for a) exposing, if not repairing, unfair situations in life, and b) championing efforts to raise awareness of such situations, this research is framed by a critical paradigm.

Significance of the Study

The findings of this study contribute to the knowledge base and literature of Web accessibility by highlighting the experiences and perceptions of computer users with visual disabilities as they use the Internet. The findings will open up areas for research into the gap between what is known and what is not known about how computer users with visual disabilities experience the Internet. The findings of this study may inform instructional designers who are designing instruction to be delivered on the Internet by focusing on learner characteristics, an important element of effective design of instruction. The findings of this study may benefit all designers of Web pages who are concerned with making the content of their Web pages attractive, available, and easy to use for as many users as possible.

The issue of Web accessibility - making the online products of computer technology accessible to everyone - is one part of the disability issues facing all levels of education and society as a whole. With compliance to guidelines mandated by law, this issue is of interest to institutions of learning, to creators of online learning materials, and to designers of Web

pages as technology and the Internet truly make “anytime, anywhere” learning possible for a growing, and diverse, population of computer users and computer-using students.

The significance of this study is in its focus on the experiences of the computer user with visual disabilities and in its implications for any entity connected with the Internet. For some users with disabilities, whose health and physical disabilities can present challenges that make the use of a computer a real ordeal, the accessibility of a Web page is the least of their concerns. A Web page that presents obstacle after obstacle to such a user will simply be avoided. The Web page loses its audience, and information to be gained is lost.

Assumptions, Limitations and Delimitations

There are several assumptions on which the study was based. I assumed that the computer users in this study would encounter barriers while they interacted with the Internet, and I expected to find that individuals with disabilities experience things in unique ways. By highlighting even a subset of experiences, awareness can be raised about the need to include accessible design in the design of Web pages. I assumed that the computer users in this study were at least minimally computer-literate and minimally familiar with the Internet and were familiar with assistive technology and computers and the Internet. By being able to rely on the minimal computer-literacy and Internet-familiarity of my participants, I could eliminate access or

use issues that might have been related to computer literacy rather than the impact of disability. However, computer literacy is measured in relative terms, so that the level of computer literacy of the individuals in the study was part of the overall exploration.

I assumed that the computer users in this study would communicate to me, the researcher, their feelings, reactions and opinions that accompanied their experiences. I assumed and was prepared for the possibility that these individuals with disabilities might have issues of health which could have affected not only their participation, but also their reactions and coping strategies that I was observing.

A limitation of this study is that, because of the unique nature of each disability, a study of particular disabilities is limited to individuals with those particular disabilities, and the results are not generalizable to all disabilities. A small sample of three individuals revealed a variety of unique experiences.

This study is delimited to computer users with visual disabilities. The three individuals observed had visual disabilities which fell along a continuum from totally visually impaired (blind) to less extensively visually impaired (low-vision). The participants were selected from individuals with visual disabilities who were at least minimally computer-literate and were familiar with Web pages.

Definitions

- Alt text - HTML code that contains description of a graphical element in a Web page. The addition of 'alt text' facilitates interpretation of a Web page by a screen reader.
- Assistive technology – devices and tools to aid the computer user with disabilities in accomplishing tasks on a computer, such as accessing the contents of a Web page
- Barriers – obstacles to access of information from a Web page, or from computer-generated information - these include the incompatibility of the code of the Web page with assistive technology.
- Braille - a tactile system of communication used by blind readers and writers in which letters are formed by patterns of raised dots in a cell of a possible six dots.
- Braille Lite - a portable note taker with a Braille keyboard for input and Braille display and speech for output.
- CAPTCHA (Completely Automated Public Turing test to tell Computers and Humans Apart) - "a program that protects websites against bots by generating and grading tests that humans can pass but current computer programs cannot" - (http://www.captcha.net/)
- CSS - Cascading Style Sheets, a feature of Hypertext Markup Language (HTML) that enables Web designers and users to control the display of a Web page, using style sheets.

- Distance Education - defined by the Institution of Education Scientists of the National Center for Educational Statistics as “education or training courses delivered to remote (off-campus) sites via audio, video (live or prerecorded), or computer technologies, including both synchronous (i.e., simultaneous) and asynchronous (i.e., not simultaneous) instruction” (NCES, 2008).
- Incompatibility – as used in this dissertation, refers to elements of computer use which interfere with smooth or easy access to information, such as poorly designed code that cannot be interpreted by a screen reader
- JAWS (Job Access With Speech) - a screen reader developed by Freedom Scientific that provides audio presentation of text for visually impaired users.
- Screen reader - an assistive technology device that interprets computer code and reads to the user (see JAWS)
- W3C - World Wide Web Consortium, the organization that “develops interoperable technologies (specifications, guidelines, software, and tools) to lead the Web to its full potential” (http://www.w3.org/).
- Web Accessibility: a term describing the degree to which a Web page can be accessed by the user, especially a user with disabilities.
- Zoom Text - a computer application that magnifies text, adjusts background and font colors, and provides speech for the user.

Organization of the Study

This dissertation has eight chapters: Introduction; Literature Review; Method, Introduction to Data Analysis, three chapters (Barron, Betty and Ty) that present data about the three participants, and Conclusion, Discussion and Recommendations. Each chapter has an introductory section and a summary.

Personal Statement

Self-reflexivity is an integral part of qualitative research. Reflexivity is "a conscious experiencing of the self as both inquirer and respondent...as the one coming to know the self within the processes of research..." (Lincoln and Guba, 2000, p. 183).

I like to work jigzaw puzzles. The process of writing this dissertation was like assembling a jigzaw puzzle. I would look for patterns among the pieces of data, watch the scenes emerge, find those defining moments that rounded out a theme, rearrange a piece of data to illustrate its relevance, and finally, recognize the whole picture as the puzzle took shape. One of the 'pieces' of this study is my own disability, a deaf ear which I have had since birth (due to nerve damage, for which there is no remedy).

Influenced in large part by my having experienced the attitudes of others toward someone with a disability, I saw the unfairness in a Web page that presented barriers to a computer user with a disability. And in the process of studying the experiences of such computer users, I became aware

of my own biases regarding disability. “We are enjoined not only to learn as much about the context of the phenomenon we are studying as we can, but to be aware of how our biases may cloud our interpretation of the context and what we actually learn about it” (Glesne and Peshkin, 1992; Strauss and Corbin, 1990, as quoted by Pugach, 2001, p. 443).

According to Encyclopedia Britannica’s Merriam-Webster Dictionary (Grove, 1961), a *bias* is “an inclination of temperament or outlook... such prepossession with some ... point of view that the mind does not respond impartially to anything related to this... point of view.” As Hatch (2002, p. 86) noted, “researchers taking feminist, critical, or poststructuralist approaches want to be aware of their biases and preconceptions, but they see no need to set them aside.” I discovered deep feelings of anger and resentment concerning my experiences with a deaf ear that were given voice through the research process, beginning with pilot studies conducted before the dissertation. I also discovered assumptions that I had made about how I might communicate with my participants, assumptions which worked with two of the participants, but were totally off-mark with a third.

What struck me as I wrote this dissertation was that the degree of disability does not really make a difference for someone to want to appear non-disabled. My feelings about missing out because of my partial deafness, and not wanting to call attention to the fact, are no less poignant than the frustration experienced by my participants who could not access content of one sort or another on a Web page because of more extreme degrees of

deafness or vision loss. Perhaps, also, the experiences of my participants are no worse than those that a “normal” person has when faced with Web pages that take too long to download, or Web pages which are disorganized or hard to follow. The main concern should be that there is a need to raise awareness of the issues.

It was not until later in life when I had chosen a computer-related career path that I was exposed to the experiences of computer users with disabilities through several pilot studies. I have placed a description of the individuals in those pilot studies into Appendix I, Descriptions of Pilot Studies With Computer Users With Disabilities. I was teaching a blind student in a technology-for-teachers class at a local community college in Tallahassee when I first heard a screen reader read the contents of a Web page to her. I observed the frustrations she was experiencing, as the monotonous voice relayed every useless tag and ignored any informational graphic that was not labeled on the poorly designed Web page that she was viewing. My experiences in several pilot studies laid the foundation for my research interests, as I observed computer users with disabilities ranging from spinal cord injury, cerebral palsy, and traumatic brain injury to visual disabilities.

Thus, it was a natural progression to choose the topic of Web accessibility for the dissertation. The process of studying the Internet experiences of the three participants in this study helped me understand myself as well, and I have offered my self-reflections to provide further background for this dissertation.

By the time I decided to write my dissertation on the subject of Web accessibility, I chose to narrow my wide interest in computer users with disabilities to those individuals with visual disabilities, because the progression of the Web from a purely text-based medium to a highly visual medium has impacted so many visually-disabled computer users, and has presented so many implications for Web development. As a self-appointed advocate for raising awareness, I would like to work toward solving the problem of misunderstanding and lack of awareness that leads to the frustrations experienced by computer users with visual disabilities. I may be stretching reflexivity a bit, but one of my favorite quotes (I have unsuccessfully tried to identify the source) is: “apathy is the glove into which evil slips its hand.” According to Wikipedia.com, a similar sentiment is attributed to Edmund Burke: “All that is necessary for the triumph of evil is that good men do nothing.” What matters is that we at least try to correct unfairness, and this dissertation is an attempt to do that by raising awareness of the experiences of computer users with visual disabilities.

Summary

This chapter has introduced my dissertation. I have provided the background for my interest in the topic of Web accessibility. I then introduced the context of the study and the research problem, the purpose of the study and the research question, the conceptual framework, the significance of the study, assumptions, limitations and delimitations, definitions, and the

organization of the study. I have ended this chapter with a personal statement. I will present a review of relevant literature in the next chapter.

CHAPTER II
LITERATURE REVIEW

"It is often by telling stories that educators, as well as the public at large, have come to understand the needs of persons with disabilities" (Pugach, 2001).

Web accessibility is the key to whether or not a Web page presents difficulties for computer users with visual disabilities as they use the Internet. The implications of Web accessibility are wide-ranging, and while all computer users can benefit from a well-designed page and, conversely, are equally frustrated by poorly-designed pages, regardless of degree of disability, little is known about the unique experiences of those computer users with visual disabilities who depend on assistive devices to access the content of Web pages. This study examines the experiences of three of these users and will help fill the gap in knowledge. In this chapter, I present a review of the literature on Web accessibility as well as a review of the literature on computer use and visual (and other) disabilities.

The literature is very broad on Web accessibility, with authors variously describing quantitative studies of how certain Web sites meet accessibility guidelines, efforts within institutions and organizations to adopt accessibility guidelines, procedures and tools for both identifying accessibility in Web sites and making Web sites accessible (both in the planning stage and when reworking existing sites), and the general implications surrounding the lack of Web accessibility and usability. Others have addressed the societal issues

that can be said to be manifested in the inaccessibility of some Web pages, including describing the “disablist values” (Goggin and Newell, 2003) by the New Media and developing technologies. But the literature is scarce on specific accounts of the experiences of selected computer users with disabilities as they access Web pages and the perspectives of and challenges faced by computer users with disabilities in general.

Few studies have addressed the affective issues in barriers to Web accessibility, with even fewer studies highlighting computer users with specific disabilities such as the visual disabilities addressed in this dissertation. In the literature on computer use and disabilities, several studies deal with particular disabilities and assistive technology, use of specific computer-related tools by users with disabilities and their effects on such aspects as motivation, job-retention, and critical thinking. However, there are few studies that looked at one kind of disability and computer users using the Internet. The unique aspect of the issue that is explored in this study is the experiences of computer users with visual disabilities as they use the Internet.

Web Accessibility

Legislative Background

According to the creator and director of the World Wide Web, Tim Berners-Lee, "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect” (WAI, 2006, p.1). The World Wide Web Consortium (W3C), through its Web Accessibility Initiative (WAI),

has developed a list of essential components of Web accessibility (Essential Components of Web Accessibility, WAI, 2006) which includes the Authoring Tool Accessibility Guidelines (ATAG), the Web Content Accessibility Guidelines (WCAG), and the User Agent Accessibility Guidelines (UAAG). The ATAG provide guidelines for developers to produce Web authoring tools that aid the Web developer in writing accessible Web pages. The Web Content Accessibility Guidelines (WCAG) provide checkpoints and techniques to aid the Web page designer in creating Web pages that are accessible to all users (WAI Guidelines and Techniques, 2008). The User Agent Accessibility Guidelines provide guidelines for the development of Web browsers, media players, assistive technologies, and other user agents.

In the United States, the Section 508 amendment to the Rehabilitation Act (1998) mandated that Federal agencies “make their electronic and information technology accessible to people with disabilities” (Section 508, 2006). There are sixteen Section 508 Standards that closely follow the WCAG. In particular, Section 1194.22 (Web-Based Intranet and Internet Information Applications) contains paragraphs (a) through (k), eleven rules which are in line with the Priority One checkpoints of the W3C Web Content Accessibility Guidelines (WCAG) 1.0 (May 5, 1999). The five rules of the remaining paragraphs (l) through (p) refer to Section 1194.21 (Software Applications and Operating Systems) and differ from the WCAG (Infoquest, Information Services, 2002).

Demographics

The following statistics point to the significance, especially in terms of the individuals affected, of providing information not only to developers of Web technologies but to computer users as well. Worldwide, approximately 20% of all people deal with visual, hearing, mobility, cognitive or other impairments that result in disability (Goggin and Newell, 2003). Twenty-one percent of people age 65 and over, or 7.3 million people, “report some form of vision impairment” (Braille Institute, 2006). In the United States, there are approximately 54 million people, making the disabled population the largest minority group (Golledge, 2005). As described by the U.S. Department of Health and Human Services (2002), individuals accessing the Internet included 21.6% with disabilities, while individuals accessing the Internet who did not have disabilities were 42.1 percent. Similarly, 60% of individuals with disabilities “have never used a personal computer,” compared to 25% of individuals without a disability who have never used a personal computer (U.S. Department of Health and Human Services, 2002). Although usability and Web design guidelines exist for developers of Web sites to ensure that Web pages are accessible to all users, lack of awareness of the Web accessibility guidelines by many developers as well as lack of awareness of assistive technology solutions by disabled users themselves impacts especially those users with disabilities.

Assistive technologies aid over 15.4 million Americans in accessing information on the Internet, compensating “for sensory, cognitive, motor or

other impairments" (Schopp, Hales, Brown, and Quetsch, 2003, p. 168). Yet 60% of these computer users report that they receive little or no information that will help them with Internet access.

Accessibility is becoming a requirement for the federal Web sites of many countries, including France, Ireland, Italy, Portugal, the United Kingdom, Canada, Australia and the United States (Kaplan-Leiserson, 2001, p. 31). Accessibility ensures access by all users, not just those with disabilities. For instance, a design that avoids a long download time will also be beneficial to many non-disabled users who still use a 28.8 modem connection to the Internet or do not use the latest technological advances (p. 32). Kaplan-Leiserson describes the similarity between accessibility and usability: of importance to both is "initial ease of use, operational ease of use, and learnability." Universal design, a general goal in striving for accessibility and usability, means that "the designer of the piece of equipment or program has taken into account the varying learning styles and needs of potential users" (Symington, 2004).

The issues surrounding Web accessibility concern all areas of computer usability and development. Institutions of higher education use Web pages extensively in their missions, including distance education. Commercial entities use Web pages extensively. Social networking is increasingly becoming popular. The literature has promoted the beneficial aspects of Web accessibility, examined solutions to Web accessibility, or studied the degree to which selected Web sites conform to the guidelines of the W3C Web

Accessibility Initiative's WCAG and Section 508 Standards. Many authors outline the simple steps that would provide the minimum in compliance with accessibility guidelines, or use a specific accessibility tool in their studies. However, even the use of automated tools to determine the degree of accessibility of a given Web site requires additional manual checks, as the tool cannot check for subjective elements such as consistency and flow, and often leads to a false sense that guidelines are being met.

Validation Tool Bobby

In the literature, reference is frequently made to Bobby, a formerly publicly-available Web-based accessibility evaluation tool (as of February 1, 2008, Bobby is no longer publicly available - Watchfire, 2008; Vincent, 2008). Bobby was often used by researchers to obtain accessibility data for a given Web page, and was used as an evaluation tool by developers. Compliance with guidelines was indicated by the Bobby Approved logo (see Appendix H). Developed in 1996 by the Center for Applied Special Technology (A List Apart, 2008), Bobby software examined the Web page of a submitted URL for Web page adherence to accessibility guidelines. A given Web page was pronounced either approved or not approved according to checkpoints, and a logo could be applied to the Web page that designated approval in Priority 1 (most accessible), 2, or 3 checkpoints (Hackett and Parmanto, 2005, p. 283). Watchfire, a Web development company, obtained Bobby in 2002, and in 2007, IBM acquired Watchfire (Watchfire, News & Events, 2008a, 2008b).

This valuable tool for Web accessibility was used frequently, but other similar, free, tools exist, including Cynthia Says (Cynthia Says, 2008), A-Prompt (Witt and McDermott, 2002), and others listed on the WAI page (Complete List of Web Accessibility Evaluation Tools, 2008) and the Adobe Accessibility site (Adobe Systems, 2008).

Witt and McDermott (2004) described several aspects of Web accessibility, particularly the logos used by Web developers to designate Priority 1, Priority 2, or Priority 3 adherence to accessibility guidelines, with Priority 1 indicating the fullest degree of adherence to the guidelines. They conducted a study of Web sites to explore the discrepancies in the use of the logos and actual degree of compliance that indicate possible misunderstanding of the guidelines, and certainly an over-dependence on automated validation tools. The authors conducted an audit of 2,200 international and British Web sites claiming to be Bobby-approved (and containing the logo to that effect), and found that 17% of international sites and 27.5% of U.K. academic sites were not actually in compliance with the guidelines. The further audit of 80 British academic sites funded by the Higher Education funding Council for English and claiming to be Bobby-approved at the Priority 1 level (containing the Priority 1 logo) revealed the discrepancies present in accessibility testing. While major elements such as use of the alt tag to label graphics is readily revealed with automated tools, other valid issues are not revealed by the automated tools. These issues include consistency of layout, navigational ease, and contextual and language

information. The authors concluded by saying: “it is difficult to be certain whether these problems are caused by deliberate actions or are inadvertent errors, but it would seem most likely that a lack of understanding of accessibility issues is central to the issue” (p. 52). The authors called for more subjective testing of Web sites, describing the many logos that are used to claim compliance with the guidelines, and the unfortunate dependence by designers on these often-misunderstood procedures. The authors called for a “culture shift... where web developers need to consider not only how the web site will be used, but also who will use it” (p. 55).

Opitz, Savenye, and Rowland (2003) studied the degree of accessibility in each of the 50 U. S. State Departments of Education and special education pages with the Bobby tool. Sixteen percent of the state Department of Education pages and 42% of the special education pages were found to be accessible, but in all cases, minimal changes would have remedied the errors in accessibility. They described not only the legislation behind efforts to improve Web accessibility, but also the various Web-based accessibility validation tools and resources available to the Web developer as well as specific solutions for the errors described. The authors concluded that “assistance is needed to inform, educate, and support developers in creating an equal online environment” (p. 17).

A study by Flowers, Bray, and Algozzine (1999) found similarly that, in the Web sites of 250 institutions of Higher Education (IHEs) and Colleges of Education (COEs), most accessibility errors could be easily remedied, as their

results showed that 74% of the errors found were easily corrected. The Web pages were analyzed using the Bobby accessibility evaluator which yielded results in terms of the type of accessibility error (such as lack of alternative text to explain a graphic), the severity of the error (judged by three categories that correspond to the three Priorities of the W3C WAI guidelines), and how easily the error could be corrected. While such validators as Bobby are useful, such efforts should be supplemented by manual checks.

Stein (2002) used the Bobby accessibility tool to examine the home pages and College of Education home pages of 32 universities and colleges in the National Council for Accreditation of Teacher Education (NCATE) Pacific Region. In finding that 81% of the home pages and 84% of the College of Education pages failed the review of accessibility, the author pointed out that most of the errors were Guideline 1 errors (corresponding to Section 508 1194.22 Paragraph [a]). These errors are easily repaired, and include the use of alternative text to provide information about non-text elements.

Chilson (2002) conducted a similar study using the Bobby accessibility tool to examine the accessibility of the home pages and College of Education (COE) home pages of 25 universities and colleges in the National Council for Accreditation of Teacher Education (NCATE) Mountain Region. In addition, Web development policies at each university/college were examined to determine the existence of such policies as well as whether accessibility issues were considered. In particular, Web pages were examined in light of their accessibility to students with visual impairments, according to the Web

Content Accessibility Guidelines (WCAG) and Section 508 Standards. The data for each type of Web page (the university/college home page and the COE Web page) were similar: 20% of the home pages and 12% of the COE Web pages were found accessible, with both types of Web pages showing high variation between pages. Errors were mainly in the failure to follow three guidelines: Guideline 1 (text equivalents, multimedia equivalents, and redundant links for active regions of a server-side image map, WCAG Guideline 1, 1999), Guideline 10 (edit boxes and text areas in forms, WCAG Guideline 10, 1999), and Guideline 12 (use of frames, and labeling of frames). In the data about Web development policies, the data showed that 44% had a policy, but only six referred to accessibility. Among all of the universities or colleges whose Web pages passed the Bobby test for accessibility, 100% addressed accessibility in their Web development policies. Chilson described the errors that were made most frequently as being the easiest to correct - providing alternative text requires seconds to add to the code of a Web page. A further implication was described: the increase in participation in higher education by students who have visual impairments combined with the increase in use of Web pages in the curriculum mandates that all students be "provided with the same access to educational material as those without visual impairments" (Chilson, p. 74). The author called for future studies to consider the demographics of the student population, for personal interviews to be held with visually impaired

student users of the Web pages, and for efforts to be continued to develop standardized Web development polices.

Sloan, Rowan, Booth and Gregor (2000) manually scrutinized a given Web site, enumerating the accessibility errors and possible solutions. After first describing how the Web has "revolutionised the lives of many disabled people in the UK and elsewhere ... [with applications such as] online learning, speech recognition, video conferencing, email..." (p. 203), the authors describe some of the assistive technology used by computer users with disabilities: screen readers and Braille displays used by blind users, alternative pointing devices for the mobility-impaired users, spell checkers and predictive text software for the cognitively-impaired users. These and other devices facilitate the disabled users' independence in the completion of many routine tasks, and provide access to information, through computers, that was previously unobtainable. However, when a Web page is not designed to be accessible in terms of the code underlying the page, disabled users may be excluded from the information. The authors illustrate inaccessible elements on the Times Educational Supplement page as seen between March 31 and April 4, 2000 (p. 205). The accessibility errors included use of frames and unlabeled graphics, use of graphics for navigation bars, non-descriptive links, use of unexpanded acronyms, the use of color for information, the use of mouse-specific elements and scripting language and applets. The authors suggest that by making a Web page accessible, using the accepted accessibility guidelines, all users benefit, whether "designing

systems for extraordinary users in ordinary environments, or ordinary users in extraordinary environments" (p. 210). The authors conclude with a discussion of the W3C Guidelines, pointing out the importance of manually checking pages, even if using the evaluation tools such as Bobby and other accessibility validation tools. With rapid adoption of computer technology in all areas but especially education, developers and institutions must be aware of the importance of accessibility, as well as the ease with which it can be attained.

Other Web accessibility tools

Hackett and Parmanto (2005) found that as Web sites became more complex, compliance with guidelines decreased. The Internet Archives Wayback Machine was used to look at 45 educational Web sites in the Association of American Universities over a five-year period of 1997 to 2002. These institutions had archived sites within the period studied. The Web sites were evaluated with the Web Accessibility Barrier (WAB) Score, an evaluation method developed by the University of Pittsburg. The "new metric provides a quantitative score that provides a continuous range of values ranging from perfectly accessible to completely inaccessible. This [score] allows for comparison between web sites and assessment of changes in web accessibility over time" (p. 285). The WAB measures a Web site's accessibility by calculating how many of 25 WCAG checkpoints are automatically monitored. A high score means a Web site is less accessible; a

low score means a Web site is more accessible. A group of 22 government Web sites (ending in .gov and selected from http://www.topgovernmentalsites.com which ranks sites) were evaluated as a comparison.

Also explored by Hackett and Parmanto (2005) was the impact on accessibility of the developing complexity of Web sites through the use of emerging technologies in Web design. Many of these technologies are causing barriers for users. The authors explained the kinds of technologies that can cause the barriers for some computer users: plug-ins, Java applets, scripting languages, lack of text alternatives in the HTML code, and the use of tables for layout (p. 283). The complexity of a site was measured with a formula that took into consideration "that some components are more complex than others and pose differing levels of barriers to accessibility" (p. 286). The authors found that the WAB scores as well as the complexity scores of the educational Web sites increased over time (p. 287). Among the governmental sites, while the accessibility remained constant as expected since the governmental sites are required by law to be accessible, the complexity increased over time. The authors concluded that an increase in complexity may be independent of degree of inaccessibility.

A related study by Zeng (2004) constructed the Web Accessibility Barriers (WAB) measurement metrics to evaluate the accessibility of consumer health information Web sites. A usability study utilized a Web Transcoder Gateway (WTG) server which removed barriers for sixteen blind users real time. Accepted Web accessibility design guidelines were used as

criteria. However, the author concluded that “observational and anecdotal findings imply that only removing accessibility barriers may not be sufficient to achieve the best usability for blind Web users. One of the considerations was that users were not as familiar with the technology used (p. 124).

Harrison (2002) reviewed the Web development tools available in the design of online courseware (a system based on a server in which users need a password to upload course material, and users can access various learning activities) (p. 434). Authoring tools have been developed to aid the Web developer. The author described the W3C Web Accessibility Initiative (W3C WAI) guidelines that pertain to Web development tools such as software used in producing multimedia, tools for managing sites and Web page publication, HTML editors and other tools (p. 434). These Guidelines are the (ATAG) Authoring Tool Accessibility Guidelines 1.0 (2000).

Issues concerning the Guidelines

Examples of the problems confronting a user with disabilities when the WAI Guidelines have not been followed in the original design of the course page include issues concerning the WAI-ATAG Guideline 1 (Support accessible authoring practices, ATAG 1.0 Guideline 1, 2000): the absence of ‘Alt text’ which created barriers to the content; Harrison (2002) points out that the courseware should automatically provide a means for adding the ‘Alt text.’ The unannounced opening of a new browser window creates problems for a user with a screen reader as well as for a user with a learning disability; and

other issues include complex interface design, illogical steps in a process, the non-readability of browser buttons, text-editing note-taking utilities, difficulty in reading radio buttons, multi-frame layouts, and tools for asynchronous communication (p. 435-436) (Harrison, 2002). Harrison further describes issues pertaining to Guideline 2 (Generate standard markup, ATAG 1.0 Guideline 2, 2000), Guideline 3 (Support the creation of accessible content, ATAG 1.0 Guideline 3, 2000), Guideline 4 (Provide ways of checking and correcting inaccessible content, ATAG 1.0 Guideline 4, 2000), Guideline 5 (Integrate accessibility solutions into the overall "look and feel, ATAG 1.0 Guideline 5, 2000"), Guideline 6 (Promote accessibility in help and documentation, ATAG 1.0 Guideline 6, 2000), and Guideline 7 (Ensure that the authoring tool is accessible to authors with disabilities (ATAG 1.0 Guideline 7, 2000; Harrison, pp. 437 - 440).

Web accessibility and higher education

Accessible Web pages hold implications for higher education (Coombs, 2002). The historically significant 1973 Vocational Rehabilitation Act, in its Section 504, mandated equal educational opportunities; Title II of the Americans with Disabilities Act mandated equal communications. Both of these were passed before the Web existed, but this legislation is being reinterpreted in a more modern context. The 1998 revision of Section 508 of the Vocational Rehabilitation Act does specify that Web pages of federal agencies be accessible, but any educational institutions receiving federal

funds under the Technology Related Assistance for Individuals with Disabilities Act of 1988 are subject to the mandates in Section 508. Legislation in the states, including California, has prohibited discrimination in programs and activities, has required equal communication; and has placed "colleges and universities that receive federal financial assistance" (p. 7) under federal legislation. Thus, clearly, "colleges and universities must provide students with disabilities with access to electronic information, information technology, computers, the Internet, and the Web" (Coombs, 2002, p. 7), though discussions continue about the extent of the various legislation's impact. Coombs concludes by urging that awareness of accessibility issues be raised. University/college administrators should proactively plan for Web accessibility. "Education is one of society's great equalizers. The Internet is another. Yet both are sometimes out of reach of persons with disabilities. Each institution should take responsibility to ensure that the benefits of education and Web-based educational resources are available to all" (p. 9).

The Post Secondary Education Quick Information System (PEQIS) is administered by the National Center for Education Statistics (NCES) and measures "small amounts of issue-oriented data from ... a nationally-representative sample of institutions" (NCES, 2008, p. 1). In 2000-2001 two-to-four-year, Title IV-eligible, degree-granting institutions in higher education were surveyed about their distance learning programs. Waits and Lewis (2003) found that among 4,130 of these institutions, 56% (or 2,320) offered

distance education for any level or audience. The survey results included data about accommodations for students with disabilities, including issues of Web accessibility: Questions asked dealt with how often the institution had received requests for accommodations in the distance learning courses, and to what extent accessibility guidelines were followed in the institutions' Web pages. Almost a half of the institutions surveyed had requests to accommodate students with disabilities in the distance learning courses, and almost a fifth did follow "established accessibility guidelines or recommendations for users with disabilities to a major extent" (NCES, 2008, p. 15). A third of the institutions did not know if guidelines were followed. These data indicate the significance of the issues surrounding Web accessibility, and point to the importance of efforts to raise awareness among educational institutions.

"The Web has become such a vital part of institutional information dissemination that not providing effective access to the Web for students and faculty with disabilities denies them access to countless important resources" (Coombs, 2002, p. 4). Coombs provides an introduction to the Section 508 Standards and the W3C Guidelines, pointing out that the Section 508 Standards are mandatory for the entities covered by the law, while the W3C Guidelines are voluntary. However, any institution can use the Standards, Guidelines, and many other useful tools that are available to produce accessible Web pages as well as to retrofit older inaccessible pages. Web authoring tools (such as those in Macromedia's Dreamweaver) are available

to assist the Web developer in creating an accessible Web page. The National Center for Accessible Media (NCAM) has a tool for adding captions to video (the Media Access Generator MAGpie). The Adaptive Technology Resource Centre (ATRC) at the University of Toronto and the Trace Center at the University of Wisconsin have developed the A-Prompt Toolkit utility that repairs a Web page according to the Guidelines. Coombs referred to evaluation tools such as Bobby to validate pages for accessibility (p. 6).

Harrison (2002) called for providing alternative means by which the student can participate in the class, such as submitting assignments by email rather than through the course management system, and she describes some existing 'model' examples of accessible courseware. The Adaptive Technology Resource Centre at the University of Toronto hosts a "Learning to Learn" course on the Special Needs Opportunity Windows (SNOW) site (Harrison, p. 436). Harrison describes the E-College courseware that provides an alternative, accessible, text-based chat along with the existing java-based utility in the courseware, and the student can choose to use either utility. Sun Microsystems has offered the Java Accessibility API which allows the user to create Java applications that work with third party software such as speech recognition systems, screen readers and refreshable Braille displays (Java Accessibility, 2008). Harrison concludes by comparing the complexity of addressing challenges to Web accessibility in developing course management systems to the challenges of keeping up with general rapid

developments in Web technology - new versions of software as well as constant changes in the development of adaptive technology.

Most efforts to produce accessible Web pages at postsecondary institutions included using the Web Content Accessibility Guidelines or Section 508 as accessibility standards and automated tools for testing (Burgstahler, Corrigan and McCarter (2004). In a case study, Burgstahler et al. described several aspects of the access challenges experienced by computer users with disabilities, including the barriers to content that are created when a given Web site contains unlabeled graphics that are inaccessible for users with visual impairments, poor navigation schemes that are difficult for users with mobility impairments, or audio content that is incomprehensible by users with hearing impairments. The authors described legal issues concerning the accessibility of distance learning courses. Institutions receiving federal funds, such as educational institutions providing Internet - based education, are subject to requirements of two particular pieces of legislation. Section 504 of the Vocational Rehabilitation Act of 1973 mandated access by persons with disabilities to the institutions' services, and Section 508 of the Rehabilitation Act of 1973 (amended 1998) prohibited discrimination of students with disabilities in public programs and services. An October, 2007, legal judgment in the case between the National Federation of the Blind and Target, Inc. set a precedent for future cases of inaccessible Web pages, with a verdict that "certified the case as a class action on behalf of blind Internet users throughout the country under the Americans With

Disabilities Act (ADA), ... and held that Web sites such as target.com are required by California law to be accessible" (Disability Rights Activist, 2008).

Burgstahler et al. (2004) describe solutions that expand access to computers and telecommunications technologies for users with disabilities: Designers of online learning content can provide alternative means and accommodations, whether in Web page code or other access such as email, for delivering the content of a Web page. Adhering to principles of Universal Design and Web accessibility guidelines and standards will ensure that all students have access to a learning institution's materials. The California Community Colleges, in response to the 1998 Americans with Disabilities Act (ADA), developed a comprehensive set of distance learning guidelines for print media, audio/visual conferencing and other Web resources and software. The Michigan Virtual University incorporated accessibility guidelines into their distance learning program. At the University of Washington's Distance Learning program, the authors combined efforts with its project partners, the UW Access Technology Lab and D0-IT (Disabilities, Opportunities, Internetworking, and Technology) to create accessible online courses (Burgstahler et al., 2004; DO-IT, 2007). The authors conclude with the recommendation that "distance learning professional organizations can take a leadership role in promoting the development of accessible courses by all programs" (p. 9) and provide the opportunities of distance learning to all students.

Crowther, Keller, and Waddoups (2004) described usability testing and evaluation efforts of computer-mediated courses at the Brigham Young University. Student performance can be impaired by errors in usability, and "even considering the economic ramifications, a poor interface that prevents people from buying a consumer product has fewer serious moral and ethical implications than an interface that impairs a student's learning" (p. 293). Such usability evaluations must include *user* perspectives.

Interface Design

Other authors have addressed aspects of interface design. Lee, Chamers, and Ely (2005) studied the use of technology in corporate environments, specifically in Web-based training, or WBT. While not referring to Web accessibility in particular, the authors detailed the front-end analysis that is a necessity in planning instructional products and takes into consideration characteristics of the learner. In discussing the design of the interface and screen design, the authors specify that navigational elements, design of graphics and moving elements, and use of multimedia should be planned to optimize the learner's experience and learning. The authors stress the importance of both formative (during the design process) and summative (after the design process) evaluation to guarantee an effective learning process and product.

In designing an interface, developers should plan to allow access to the greatest number of users possible. "A significant number of user

requirements for people with disabilities apply to almost any user, given the right circumstance or task context" (SUN Microsystems, 2007).

In his book about interface design, Raskin (2000) described in his chapter, "Cognetics and the Locus of Attention," the properties of human learning and performance, and pointed out that "... many...human performance factors are independent of a user's age, gender, cultural background, or level of expertise" (p. 9) (and I would add, 'type of disability'). He continued to describe the importance of designing products which are sound both in ergonomics (the science of ergonomics deals with the sizes and capabilities of the human frame and senses) and cognetics (the science of cognetics, or cognitive engineering, deals with the study of the applicable, engineering scope of our mental abilities). A poor interface design is to blame for many of the difficulties experienced by the computer user (p. 10). The interface of any product is "the way that you accomplish tasks with a product" (p. 2). Thus the design of a computer interface includes creating accessible elements.

Further considerations

Still others have more generally described the resulting digital divide between users who can access information, and users who cannot access information. Coombs (2002) described the "other side of the divide," when writing about the expansion of the Web scene to include so many: "the digital divide has begun to shrink....People with disabilities, however, are also on the

other side of the divide, [but]...the failure to integrate the necessary design principles is causing new and needless barriers to educational success for this population" (p. 2). Coombs referred to the comparison of assistive technology's providing access to information to the ramps provided for those in wheelchairs. By giving individuals, including students and faculty, "full access to information technology" (p. 2), opportunities are opened and individuals are empowered. "Empowering people changes them" (p. 2).

A clear picture of the issues in accessibility that need to be highlighted begins with awareness:

> "Knowing whether or not a Web site is accessible by those with a disability is the first step. Developers must understand the tools and techniques that can be used to design accessible sites and to retrofit existing sites that present accessibility problems. Colleges and universities should also have a strong understanding of legislation that governs accessibility and the legal implications for higher education" (Coombs, 2002, p. 3).

Coombs suggests that the reader experience the lack of easy access to the content in a Web page by turning off the graphics display options in the browser (and refresh the page), and, without using the mouse, move from link to link with the tab key. If the page is accessible, each link (including to the graphic) will have a text label explaining the content of the non-displaying graphic. However, if the page is inaccessible, such information will not be obtainable. A screen reader only relays text, so any graphical elements must

be accompanied with text alternatives, and using Web design principles can result in an attractive, but informative, Web page (Coombs, 2002).

The W3C Guidelines have been used in designing programs in learning settings other than academia. Brown et al. (2002) of the Green Hat Interactive Research Team at Nottingham Trent University in the United Kingdom (U.K.), designed a process for developing Interactive Multimedia Learning Environments (IMLE) to address the needs of individuals who needed to learn employment based skills, and who for various reasons were not participating in economic, social, political, and cultural life (this non-participation could lead to social exclusion). The causes of social inclusion included such situations as poverty, disability, and being a member of an ethnic minority, and the learners would have a wide range of physical and cognitive disabilities. One of the team's concerns was to analyze the usability content of a prototype IMLE and identify usability problems. The outcome of these efforts was to produce the Green Hat Design Guidelines (version 1.0) for creating IMLE "to promote the development of literacy, numeracy, travel and independent living skills" (p. 597). The W3C Guidelines were referred to in constructing the Green Hat Design Guidelines, with "each design point ... given a level of priority based on its potential impact on accessibility..." (p. 593). Accessibility issues included: simpler navigation mechanisms; speech alternatives for icons, buttons, key text, images; less complex user input; choice of input devices (joystick, mouse, keyboard); options for displaying

sign language, turning sounds off or on; clear and flexible navigation; user control over speed of progression through program; consistency in interface elements (pp. 593 - 596).

Many institutions, including libraries, are instituting practices to help customers with disabilities gain access to Information and Communication Technologies. In the U.K., Gateshead Libraries completed several projects that included a talking newspaper (Access to Information and Reading Services) for their customers with visual disabilities, and various projects using Compact Disc-interactive (CD-i, which feature video, audio text and graphics) to address the needs of customers with disabilities. In addition, the library funded the addition of various assistive technologies to help the customers with disabilities, including enlargement of screen images, text aloud speech synthesis, special Web browsers that allow Web page navigation for users who are blind and partially sighted (Myhill, 2002; Jaeger, 2006). The U. S. Library of Congress devotes a Web page to its accessibility policies (Library of Congress Web Site Access, 2008).

Other studies have described relevant improvements to the computer user interface, or promoted one way or another to create Web sites that conform to guidelines, or described the physical barriers in inaccessible Web sites (Lee et al., 2005; Ratner, 2003, Sloan et al., 2000). Still others have more generally described the resulting “digital divide” between users who can access information, and users who cannot access information (Coombs, 2002; Brown et al., 2002) and the promotion of “disablist values” (Goggin and

Newell, 2003) by the New Media and developing technologies. But few studies have addressed the affective issues concerning barriers to Web accessibility, with even fewer studies highlighting Internet use among computer users with specific disabilities such as the visual disabilities addressed in this study.

The public's attitude toward Web accessibility was described by Bricout (2001) as being as uncaring as the attitude toward persons with disabilities before legislation was passed to provide equity in other areas of life. Many Web pages have been designed by technicians with little or no thought for the user whose assistive technology may not be compatible with design features of the Web page.

Roh (2004) conducted focus-group interviews and case studies with students with disabilities as well as online educators and educational support staff to explore the perceptions, problems and solutions concerning Web accessibility. A qualitative analysis of the data pointed to the complexity of the issues, including "technical problems, lack of knowledge and skills about effective instructional design strategies, unclear existing standards and guidelines, and negative attitudes and prejudices towards students with disabilities" (Roh, p. 193).

In general, good design is recommended: "Making information accessible in different ways not only opens new doors to people with disabilities, but also greatly improves the usefulness of the Web for almost everyone..." (Larkin, 2000). By highlighting the barriers that computer users

with visual disabilities face and describing possible solutions, this study will promote awareness of the issues faced by computer users with any disabilities. There is no standard disability, and a particular barrier faced by a user with one kind of disability may very well be faced also by a user with a different disability.

Learners who have some sort of disability can experience a sense of liberation while using the Internet by reaching information at their disposal (Pearson and Koppi, 2003). These computer users often use assistive technologies to provide a sometimes necessary intermediary in accessing the information sought on the Internet. But, like all communication, web-based environments must ensure that the user at the receiving end be able to use whatever tools (whether particular versions of a browser or appropriate plug-ins and assistive technology) they need in order to experience a full learning experience.

Research has documented the prevalence of barriers to Web accessibility (Brown et al., 2002; Goggin and Newell, 2003; Harrison, 2002; Sloan et al., 2000), and some litigation has contributed to a wider compliance with accessibility and usability guidelines. When principles of Web accessibility and universal design are applied to Web page design, usable products and learning environments are created, so that adaptation or specialized design is unnecessary (Burgstahler, 2005). But all too often, the designers involved in the production of these products are simply not aware

of the impact that poorly-designed learning products can have on the learning of so many individuals.

Bricout (2001) pointed out that all users are uniform in capability to use the Internet, but that a “false presumption of sameness” (p. 4) may prevent knowledge of the learning challenges and strengths of the student with a disability. These reservations point to the importance of raising awareness of the issue.

Many cases exist in which users are prevented from accessing the information on many Web sites. Educational institutions are beginning to focus on the issues of Web accessibility, and studies are being conducted not only on the degree of Web accessibility of institutional home Web pages, but also on the Web accessibility of the Web pages being used in delivering instruction. Thus, the findings of this study hold important implications for instructional designers who are producing instruction that is delivered on the Internet.

Computer Use and Disabilities

There have been quantitative and qualitative studies in both journals and dissertations that addressed both the design of Web pages and the experiences with technology of special needs computer users or teachers of special needs computer users. In discussing the implications of the WWW for computer users with visual impairments, Sears (2003) pointed out that blind computer users are in the minority compared to users with low vision.

“Because individuals with low vision typically prefer to make use of their residual visual capabilities, solutions designed for individuals who are blind are unlikely to be widely accepted” (p. 25). Users with low vision are unique, and considering additional visual impairments such as color blindness, finding solutions for inaccessible Web design is further complicated. General guidelines, however, should include organized display, adjustable font and letter size, auditory elements, effective information organization and navigation, effective contrast in colors and foreground and background, and elimination of visual clutter (Sears, 2003, p. 25).

Sears and Young (2003, p. 483) point out that “physical impairments (PIs) can all hinder an individual’s ability to physically interact with ... computing technologies....” The World Health Organization, in its International Classification of Impairments, Disabilities, and Handicaps (ICIDH) acknowledges “the complex relationships that exist among health conditions, impairments, disabilities, and handicaps..., as well as the “potentially important role of both the context and environment in which activities are taking place” (Sears and Young).

Theofanos and Redish (203, 2005) observed computer users who were blind and computer users with low vision in two studies at the Communication Technologies Branch of the U. S. National Cancer Institute. The focus was the assistive technology used and the interactions with the technology by the computer users with visual disabilities. The study with sixteen blind computer users (using screen reading software) provided

techniques for producing accessible Web sites easily accessed with screen reading software. The study with ten computer users with low vision (using the screen magnification program Zoom Text) showed that these computer users are more varied in their needs and the issues that they face are not as easily resolved. For instance, while blind computer users did not particularly need to customize the software, computer users with low vision differed in the extent and manner of the disability so "that no one solution, in terms of what colors to use, what type size to use, what screen layout to use, would meet the needs of all the low-vision users..." (Theofanos and Redish, 2005, p. 10). Nevertheless, the authors describe errors that can be remedied by the use of specific guidelines. For instance, designing with the guideline "never rely on color alone to convey functional meaning" will ensure that a low-vision computer user can access the content (p. 14). In an effort to achieve "experience equity and universal usable access for all users," the authors propose a new paradigm rather than the common one which "expects developers to add extra coding and make specific design changes.." (p. 17). The new paradigm calls for putting consideration of assistive technology at the start of design rather than as an afterthought. Individual needs would be translated automatically into individual changes in the user's Web site and the user would control how they "want information served" (p. 18).

Luengo-Filgueiras (2001) examined visually-disabled post-secondary students who were using electronic discussion mailing lists in order to personally network during job searching. The findings of this study included

the importance of Web-based (i.e., use of the Internet) discussion lists to minimize the possible isolation felt by mainstreamed students in society, and to equalize the access to news and social resources for these individuals. A similar qualitative study of human-computer interactions among novice computer users was conducted by Howard (1994), in which criteria for selection of the participants included interest in the research.

Siew (2003) studied the perceptions and motivation of secondary school students with visual impairments and the accessibility of the Internet. He stated, "...the value of the Internet rests on the perceptions and ability of students with visual impairments to accept them as valuable tools..." (p. 6). He noted that all students, whether disabled or not, "benefit from the opportunity to access the Internet" (p. 67) and are positively motivated to use new technology. This motivation includes the persistence to overcome barriers. He concluded that the impairment was not a barrier, but internal barriers, such as poor self-efficacy, or external barriers, such as availability of technology or inaccessibility of Web sites, were pertinent issues (Siew, p. 67). This study reviewed the literature of the impact of visual impairment on students and their use of the Internet. Siew highlighted the necessity for training users in technology use and added to the literature on the importance of equalizing access to the content on the Internet (p. 71).

Technology is "key to the successful retention of jobs" for workers with visual impairments (Crudden, 2002). In a study of ten individuals who had retained their jobs after vision loss, "a prevalent theme ... [was] the impact of

computer technology on job retention" (p.620). Crudden points out that stress was associated with the use of technology, in this case assistive technology. But the reasons for stress using technology without the Internet are the same as with the Internet: "they were anxious when there were delays in obtaining equipment, when they were asked to perform tasks without ample time to learn how to use their equipment efficiently, or when the equipment provided was incompatible with an employer's system" (p. 620).

A study in England of computer-based tasks by ten individuals with visual impairments found that "there are both individual and general issues associated with computer use by the visually impaired" (Douglas and Long, 2003). The authors state that "it may be important to consider the interaction between accessibility and usability, rather than thinking of them as independent concepts" (p. 149). Identifying issues is only a first step. "Getting people to recognize the issues pertinent to them and implementing change is also important" (p. 149).

Dimitriadi (2001) studied the benefits of Hyperstudio multimedia authoring by two dyslexic students. Critical thinking was encouraged and the open-ended elements of multimedia authoring motivated and encouraged the students to develop initiative and autonomy.

The appropriateness of qualitative inquiry for telling the stories of individuals with disabilities was addressed by Pugach (2001). The advent of qualitative methodology brought "emphasis ... on understanding the

complexity of a given situation and enabling a fuller consideration of the phenomenon under study" (Pugach, p. 440).

Graphical icons are prevalent in computer interface design. Scott, Feuer, Jacko (2002) investigated the relationships between the performance of 18 computer users who had age-related macular degeneration (AMD, a disease of the eye in which central vision is affected) and icon size and quantity in computer interface design. The number of icons and size of icons did affect task accuracy, while background color did not affect task accuracy, emphasizing the effect on graphical icon manipulation of visual impairment.

Among educators, the focus on making all Web-based material accessible to all students has highlighted the following statement by CAST, the Center for Applied Special Technology (CAST, 2007): "the future is in the margins." This statement refers to the benefit realized by all students, as described by Weir (2005, p. 30): "regardless of their ability, ...[when] those who are marginalized in traditional classrooms (e.g., those with learning disabilities, physical disabilities and other challenges) [are helped]. ...We discover educational methods and materials that are flexible and powerful enough to help all students..." (CAST, 2007)

The computer has provided valuable learning experiences and a means to independence for the relatively small percentage of computer users with disabilities, making available valuable information for rehabilitation efforts to promote independent living (Schopp et al., 2003). Anson (1997) commented that "computer access is required in many aspects of daily living,

[including] employment, school and leisure." For all users, but especially users with disabilities, the Internet has provided access to information that was previously unavailable (Cunningham and Coombs, 1997). The Internet and the World Wide Web have enabled people with disabilities to be on equal footing with other users, creating power due to intellect, rather than physical abilities (Cunningham and Coombs, p. 32).

Summary

This chapter has presented a review of the literature of Web Accessibility and the literature on computer use and visual and other disabilities. Many researchers such as Burgstahler (2005) and Bricout (2001) have explored the technical issues of Web accessibility, and the literature is plentiful on what to do to make a Web page accessible. Other researchers such as Theofanos and Redish (2003, 2005) have explored particular kinds of disabilities and computer use, but there are few of these more specific studies. Scherer (1996) commented on the need to “understand how technology impacts society and its members...” (p.169). The study will add to that scarce literature on the experiences of computer users with visual interest. In the next chapter, I will present the method I used in the study.

CHAPTER III
METHOD

This chapter will describe the research method used to gather data in this study of the experiences of three computer users with visual disabilities as they used the Internet. I will present the research design and procedure, participants and setting for the study, and data collection procedures (including a description of the equipment and software tools that I used in data collection and analysis).

Research Design and Procedure

The study is a qualitative design utilizing interviews and observation. Interviews included open-ended questions designed to gather the participant's experiences and perspectives.

Research Design

A qualitative research design was chosen to answer the research question: "What are the experiences and perceptions expressed by computer users with visual disabilities while accessing information on the Internet?" A qualitative method of interviews and observation would best answer my research question. Face-to-face interviews were selected, as Thomas and Pollio (2002) describe, in order to best uncover categories of meaning and to discover patterns.

I chose the qualitative research methods of participant observation and detailed interview as dictated by the problem and purpose. I wanted to "paint

a rich, full picture of the situation" (Wright, 2002-2003) and capture the feelings that were experienced by my participants, the computer users with a range of visual disabilities, as they used the computer to access the Internet and World Wide Web. Qualitative inquiry emphasizes the role of the researcher and the importance of context (Giangreco and Taylor, 2003). Hatch (2002), in writing about the study of human behaviors, has emphasized the importance of "context of natural occurrence," and I observed these participants in their typical, natural, computer settings.

Below, I will explain the various elements of a qualitative type of design. The use of the first person to refer to the researcher is an accepted practice in qualitative research. Wolcott (1990) wrote that "... the researcher's role is ordinarily such an integral part of qualitative study; ... the more critical the observer's role and subjective assessment, the more important to have that role and presence acknowledged in the reporting." Hatch (2002, p. 221) stated that "there is no pretense that the stories of the research represent some verifiable objective reality, and ... it just makes no sense to try to write qualitative dissertations in the voice of the detached, objective researcher.... [Therefore, accounts should] be written in first-person, active voice...." I was a participant with the individuals I interviewed and observed, and have included my own reactions throughout the dissertation.

Procedure

"Qualitative methods are ideally suited to providing an understanding of context and a detailed description of how practices actually work" (Giangreco and Taylor, 2003). When computer users with visual disabilities browse the Internet, what practices are at work? That is, when users cannot access the content of a Web page due to implications of a disability such as blindness, what is happening? Besides the frustrations that the user might experience, there is a type of digital divide that is created between users who can and users who cannot access all the information. Such ancillary considerations can best be described by documentation of the experiences of the user. The research question that guided this study was open-ended, and a qualitative research method allowed time to capture the participants' reflections about their experiences.

I supplemented my note-taking during observation with the use of video and audio taping for ensuring accuracy and completeness of documentation. I would tape my own comments after a session and transcribe them with the interview/observation data. The video and audio tapes were transcribed by me for use in analysis and were destroyed after transcription. As a participant observer, I gained an understanding of my participants' perspectives in the setting of accessing information on a computer and I was able to explore the feelings and interactions of my participants as they experienced the Internet.

My role as participant observer in the interviews enabled me to explain unusual instances as they occurred, and open-ended questions allowed me to pursue issues as they were revealed during the interview. I aimed for the neutrality and objectivity described by Gubrium and Holstein (2002): "the interviewer's job is to bring the respondent's full attention to the task and to encourage him or her to answer honestly, but otherwise not to shape or influence the responses." Becker and Greer (1957, p. 31) maintained that data obtained in observations should be used to clarify interview data, as a "yardstick" (p. 28) in understanding what is said and sometimes what is not said. However, interviews and observations should supplement each other – interviews can require inference, while observation concretizes inferences and verifies facts."

Miles and Huberman (1994) wrote that "prior instrumentation is usually context-stripped; it [lacks] universality, uniformity, and comparability. But qualitative research lives and breathes though seeing the context; it is the particularities that produce the generalities, not the reverse."

Quoting Shonkoff & Phillips (2000), Giancreco and Taylor (2003) referred to the "inextricable cable connections and interactions among learning, brain development, and context [that make up a learner's] unique internal...and external...environments" (p. 134). Therefore, I remained flexible during data collection, allowing context to dictate direction, though I had areas in mind to be sure and cover during the sessions.

I used both structured and unstructured interviewing. Denzin and Lincoln (2000) described structured interviewing as "capturing precise data of a codable nature in order to explain behavior within pre-established categories; whereas … [unstructured interviewing] attempts to understand the complex behavior of members of society without imposing any a priori categorization that may limit the field of inquiry" (p. 653). The research question, "What are the experiences and perceptions expressed by computer users with visual disabilities while accessing information on the Internet?" was answerable in the context identified.

A typical agenda for a session would contain:

1. Set up video and audio recorders.
2. Ask demographic questions (see Appendix).
3. Ask structured questions of Web site being visited.
4. Ask unstructured questions as opportunity arose.
5. Ask participant to visit a Web site of his/her choice
6. Ask participant to visit a Web site suggested by me.
7. Follow up with structured and unstructured questions.

During my first session with each participant, I tried to follow a certain order of steps. I soon realized that this orderly progression from one exploration to another was going to vary with each individual, and I changed my approach to a less structured approach. Therefore, although most of the Web sites that were visited are listed in Appendix G, not every site was visited by all participants. For instance, Barron chose to visit Web sites of outstanding

restaurants, while Betty chose to visit sites that were in her academic discipline. The specifics of the data collection procedures are presented below.

Participants and Setting for the Study

This study explored the experiences of three purposefully-selected participants - Barron, Betty, and Ty - who voluntarily participated in the study. Characteristics of the three participants are depicted in Appendix A. A small sample is acceptable in qualitative research. “Qualitative inquiry typically focuses in depth on relatively small samples, even single cases (N=1), selected *purposefully*. ... The logic and power of purposeful sampling lie in selecting information-rich cases for study in depth. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry” (Patton, 2002).

Each participant had unique qualities that informed my study. Each provided the rich perspective of an “insider” (Payne, 1998), personally encountering barriers on the Internet that they reacted to, sharing their perspectives with me. The purposeful sample was limited to individuals with a range of visual disabilities. The three individuals observed had visual disabilities which fell along a continuum from totally visually impaired (blind) to less extensively visually impaired. One participant was totally blind, and relied on assistive technology, including a screen reader, to use the computer. A second participant was partially visually disabled, and was able to read the

computer screen with the aid of enlarged text. A third participant was both deaf and visually disabled and relied on more assistive technology to interact with the computer. All three provided rich information about barriers on the Internet encountered by computer users with visual disabilities.

These individuals also varied in amount of experience with their visual disability, from having been blind from birth, to being partially blind and having acquired the visual disability later in life. Any secondary disabilities that any of the participants might have were considered during the study. Participants were selected from individuals who were students or instructors at a large southeastern university, who were employees of a local advocacy center, and/or who were my personal acquaintances.

The three participants were at least minimally computer-literate and interested in participating in the study. All three participants were Caucasian. In settings of the participants' choosing, I observed the participants in their usual environment as they used the computer. Communication between sessions was conducted through electronic mail (e-mail) with all three participants, and through the telephone (with two of the participants). Access to participants was enabled through contacts at a university's Office of Disability Services, through personal friends and acquaintance with the participants, and through a mutual acquaintance at a local disability advocacy center which provides computer-based solutions to its clients with disability-related challenges.

Description of Participants

Barron - Barron was a blind male of 24 years who has been blind from birth. As a fourteen-week premature newborn, he was incubated and his optic nerves and retina were adversely affected. Classified as totally blind, he could not read print or see any color or contrast, with light perception in only one eye. Barron was a graduate student in German at a large southeastern university. During my observation of Barron, he regularly used the Internet with the aid of the JAWS screen reader, preferring materials in audio format rather than Braille. Barron also used Braille light (a Braille reader) and he worked on a PC laptop with Windows Vista operating system. Barron used a Franklin language master, which possessed a dictionary and other tools useful in writing papers. He emphasized that most of the tools he used were in the laptop itself, and he regularly used the computer, at least two or three times a day. I interviewed him in his office at home.

Betty - Betty is a 59-year-old female who has had poor vision all her life. She was born with optic atrophy, in which her optic nerve was partially dead. The best she could ever see was 20-60, so she always had some visual deficit. Four years ago, she developed retinal wrinkles (scar tissue forming on the back of the eye). Because it happened spontaneously, her doctors operated, first on one eye, having caught it early enough to treat the condition, in hopes of restoring her vision. However, for unknown reasons, the operation was unsuccessful, and she lost all the central vision in her right eye. Because they did not operate on the other eye she lost vision in that eye also. She

could read only out of her left eye, and had only peripheral vision out of her right eye. Betty was an Assistant Professor at a large southeastern university. During my observation of her, she regularly used the Internet with the aid of Zoom Text, a program that enables the user to adjust the size of font and color contrast. She used a PC desktop with Windows XP operating system and a large monitor. She used the Internet all day long in her work and research. I interviewed Betty in her office at her university.

Ty - Ty is a deaf-blind male of 69 years who has been deaf all his life and has slowly lost his vision. As a child, he wore glasses and had been diagnosed with retinitis pigmentosa. At the age of 29, he was diagnosed as having Usher's Syndrome. Consequently, his visual disability has steadily worsened. He was told that he would have tunnel vision. He has partial vision, knows Braille and American Sign Language. He was very enthusiastic about the advances in technology that have helped him communicate with others. He was an employee of a local disabilities advocacy agency. He sat at a PC desktop computer with a large monitor on which he read the text that he and anyone communicating with him through the second keyboard typed. During my observation of him, Ty regularly used the Internet with the aid of Zoom Text, a program that enables the user to adjust the size of font and color contrast. To the right of the computer was a second monitor that was connected to a light scanner. Material could be magnified onto the monitor and Ty could then read it. I interviewed Ty in his office at the advocacy center.

Data Collection Procedures

After the formal IRB process was completed, informed consent was acquired at the first session with each participant. A schedule was agreed upon with the participants, and a schedule of completion dates was estimated. A research bargain, as suggested by Hatch (2002, p. 46) was established between me, the researcher, and the participants, and was confirmed at the first session. This research bargain was contained in the Informed Consent Form that each participant signed.

The participants were very interested in using the computer and vocally agreed to share their experiences with me, the researcher; thus, after the consent forms were signed and collected, the rest of the first session was an observation and interview of each participant. Eight weekly sessions with each participant were initially planned. In a previous, similar pilot study of a computer user with disabilities resulting from traumatic brain injury, in which I observed and interviewed my participant during eight sessions over a two-month period, I was able to collect enough data to accomplish my goal of understanding my participant's experience. Therefore, while I initially planned on at least two months for data gathering, I maintained a flexibility of schedule to ensure completeness of data gathering.

While I prepared a semi-structured interview protocol that focused on the users' access to and navigation through the Internet, I did not maintain a particular questioning order or content. I was looking for as great a variety of

Web site experiences as possible to use while observing the participants. I included some Web sites that have been deemed “accessible” as well as “inaccessible” by previous researchers of Web accessibility (as indicated by the Accessibility logos contained in the Web site), but generally, I did not try to follow a set list of Web sites, asking the participants to choose Web sites at times. I arranged the question categories into “early and later” phases, with certain categories repeated at each session (Appendix C lists the questions). In addition to documenting the experiences of the participants while using the Internet, I documented those instances that called for me to show the participant how to do something that they indicated they did not know how to do.

Software Tools Utilized In Data Collection and Analysis

The technical process of collecting and analyzing the data was facilitated by many of the features of computers. Both an Apple laptop computer and a PC laptop computer with several common software programs were used in completing the transcription and analysis processes. Each session was videotaped with a Sony digital video recorder and audiotaped with a Radio Shack audio recorder (which was used as a backup only). Each videotape was downloaded to the Apple laptop computer using iMovie (version 2004), and a .mov file was created of each session. These files were named by each Participant’s name and session number. QuickTime Pro (version 2007) was used to extract the audio from each .mov file into an .aif

file which was then used in transcribing. The program iTunes (version 2007) was used to burn each sound file to a CD so it could be listened to with a portable CD player or mp3 player. The transcription process was facilitated by the use of a free downloadable program, F4 (version 2007), which plays the sound file and enables the user to stop the playback at any point by a simple tap of the F4 key on the keyboard, and when it is resumed, it has backed up enough to enable smooth transcription. This program also enables control of the speed of the playback as well as fast forwarding and fast backing up. During transcription of the tapes, it was possible to move quickly through portions of the sessions that were not useful, while maintaining the context of the situation. In addition, a feature in Word (version 2003) that numbers each line of a document made it possible to quickly compare comments as I analyzed cross-category relationships. The Find feature facilitated comparing the original transcript to the individually renamed documents.

I preferred to use these hands-on methods rather than using an electronic research tool as I felt that I had more connection with my data, and, indeed, I frequently discovered pertinent relationships between the data through this process. By using my system of saving the transcripts by category and participant, I could quickly refer to the original transcript to confirm my interpretations in the context of the occurrence. Rather than employ a software program that would automatically categorize or code my data, I preferred to create my own system as the data revealed the categories:1) interactions of the participants with the computer and the

Internet in general; 2) personal characteristics of the participants such as sense of humor that was evident during the sessions; 3) strategies used by the participants to find solutions to barriers encountered; 4) personal feelings and opinions of the participants; 5) description of particular design features of Web pages; and (6) communication between the participants and myself. I then duplicated my original transcript of each session with each participant (24 original transcripts) six times, naming each document by category, so that I had documents for each participant per session in each category. As I read and re-read the data, I added comments, highlighted pertinent sections, and noted overlaps between categories. Thus, I was able to confirm my thoughts as well as to concretize relationships between categories and comments.

Summary

This chapter has described the research method used to gather data in this study of the experiences of three computer users with visual disabilities as they used the internet. The chapter presented the research design and procedure, assumptions, rationale, participants, setting for the study, and data collection procedures. In addition, the equipment and software tools that were used in data collection and analysis were described. In the following chapter, I present the analysis of the data.

CHAPTER IV
INTRODUCTION TO DATA ANALYSIS: CATEGORIES OF MEANING

This chapter will introduce the analysis of the data from this study on the experiences of computer users with visual disabilities. I will first describe my approach to data analysis. I will then comment on the six categories of meaning that emerged from the data and best describe these experiences. The six categories of meaning are: (1) interactions of the participants with the computer and the Internet, (2) personal characteristics of the participants, (3) strategies used by the participants, (4) personal feelings and opinions of the participants, (5) design of Web pages, and (6) communication between the participants and myself. In addition, I comment on the mutuality between me and my participants, and the commonalities among the three participants. The three subsequent chapters (Chapter 5, 6, and 7) will be devoted to telling the stories, through my interpretations of the data, of the three individuals with visual disabilities as they used the Internet.

My research question was: “What are the experiences and perceptions expressed by computer users with visual disabilities while accessing information on the Internet?” In order to follow “data where they lead” (Hatch, 2002), and glean meaning from the experiences of my participants, I adapted one of Hatch’s data analysis frameworks. By using an inductive approach to collecting data, I started “with specific elements and [found] connections among them” (Hatch, p. 161), thereby identifying those categories of meaning

and noting patterns. Therefore, the participants provided the specific data from which categories emerged: according to Creswell (1998), “the qualitative researcher works inductively, such as when he or she develops categories from informants rather than specifying them in advance of the research” (Creswell, p. 78).

My overall goal was to collect data that would describe the experiences and perceptions of my participants. Within that overall goal, based on categories that had emerged from the data in prior pilot studies, I sought data that indicated categories and patterns related to dimensions such as interactions with the computer, personal characteristics and feelings, sense of humor, and design issues. These and other categories were expected to emerge from the data. As described by Hatch (2002, p. 200) I have displayed excerpts of data to support my findings, and have discussed particularly illustrative instances of the particular category discussed. I have discussed patterns within the categories that emerged from the data.

Anfara, Brown, and Mangione (2002) explored an aspect of qualitative inquiry that often presents doubts: methodological rigor and analytical defensibility. The authors offer one solution, to provide “public disclosure of the process” (p. 29). Thus, I have provided ample evidence of my process of collecting data, so that the patterns that emerged are clearly justified for the reader.

My interpretations of the findings have been influenced by the data, as well as by my own experiences with disability. My expectations included

observing participant reactions to using the Internet and possibly encountering barriers; my own introduction to attitudes and approaches (that I had possibly not encountered or anticipated) regarding the particular situation of individuals with visual disabilities interacting with computer technology, each in his/her unique way. I also expected to gain insight into certain practices in computer and software design from the perspective of the participants' experiences.

Appendix G contains some of the Web sites that the participants visited. While I did not try to present the Web sites in any order or consistency among participants, each participant did visit a variety of sites - governmental, non-profit, educational and commercial areas. Not all sites were visited by all participants.

Categories of meaning

Six categories of meaning emerged from the data analysis. The categories are: interactions of participants with the computer and the Internet, personal characteristics of the participants, strategies used by the participants to find solutions to barriers encountered, personal feelings and opinions of the participants, design features of web pages, and communication between the participants and myself. In the following sections, I provide examples of the data within each category.

Interaction of participants with the computer and the Internet

When observing the participants' interaction with the computer, I was interested in the varying degree of interest that the participants showed in using the computer. None of the participants acted like he or she particularly liked using the computer; rather, they knew it was a useful tool that they must learn to use. Each participant commented on this point: Barron explained that he only cared about the computer as a tool to use to accomplish what he wanted to accomplish. Betty clearly indicated that she uses the computer because she has to, not for fun, at one point explaining,

> *... It's the same dimension as last time; the white on color is a little harder to see...but I don't think there is anything I use there much, and then ...I probably don't use it much because I have more trouble reading it. You're more inclined to use what you can easily see.*)

Ty commented that he does not use the Internet because most of the time he has so much difficulty.

Another aspect of interaction that I observed was degree of familiarity with the computer or given Web site. Both Barron and Betty illustrated the situation in which familiarity with a given Web site minimizes the frustration that any inaccessible features might present, however much they might have resented the difficulties when first using the page. On one such site, Barron explained that if he knows that the site has headings, for example, he would

know what to do to find the information. More than once, when I asked Betty what she thought of a site, she would preface her comments with, *"well, for me, it's pretty familiar."*

All three participants mentioned or illustrated the element of time as affected by having a disability. Betty often mentioned the need to spend her weekend time at home working on the Internet to complete a task that took her too long to finish at work. I observed Ty while he went through the process of putting a URL in the address bar of the browser, finally succeeding, after twenty minutes of maneuvering, copying, pasting, fixing typos, and chasing the cursor. At one point, Ty was explaining how a Web page with too much text puts him to sleep - he motioned that the longer a page was, the more he felt like sleeping, as he gestured with his face on his hands. Because of the disability more time was needed to accomplish seemingly simple tasks.

Personal characteristics

Personal characteristics of the participants included manners, helpfulness, sense of humor, energy and determination. Courtesy and consideration were characteristics exhibited by all participants. Barron would immediately remedy any situation if he thought it was bothering me (such as enlarging the window of an application so I could better see it). Ty would worry about boring me or having his health interfere (at one session, he

actually *apologized*, typing, *"I am sorry my performance is down today,"* when the retina of his right eye was bothering him). During our first session, Ty presented a folder to me on which he had attached a Braille label with my name. Betty would constantly comment that we should do what would help me with my study.

All three participants volunteered from time to time that they were glad to be helping - whether helping me, or helping in general. Barron said he felt good about doing this and felt that he was making a contribution, "*You know, I like doing this..., because I feel like I am contributing something*."

Betty expressed her desire to help with the dissertation process, especially to help returning "non-traditional" students (like myself):

> *I really am always glad to a. help students, and, b. returning older adults; because I just feel more of an affinity with them; ... they are the ones [who tend] to struggle more ... and have to catch up. ... [They] I always feel like the younger ones are so much smarter and I keep reminding them it's not a matter of smarter because they've got the persistence that takes them and that's what they need.*

Ty would constantly have something to show me or give me that he thought might interest me or help with the study. He brought me the manual for Zoom Text for me to look over one time, and referred me to relevant Web sites at other times.

I have pointed out the instances of humor in the participants' individual chapters. As Betty was reviewing a Web site for me, she pointing out the various elements that she liked or not, and she said: "*It's pretty user-friendly in terms of putting in your author, your title or your ISBN number...except for the fact that I'm not getting the results I want...(laugh).*" Barron tended to provide more spontaneous humor than the other two participants: in a search on a travel site for a hypothetical flight to Moscow from the U. S., he expressed mock surprise when he found that there were 'no one-way flights' to this destination. Ty would jovially comment on my cinematographic skills as I was videotaping the interview ("*Hahaha you are a good filmmaker!*".

Strategies

Each participant had developed unique strategies to deal with some of the barriers to Web accessibility that they encountered as well as to deal with other computer-related tasks. Ty would employ the "at" (@) symbol for a period in his typing, so that he could see the end of the sentence. When he needed to look at a Web site, he would print the page, and then use the scanner to enlarge the content so he could see it. Barron was proficient in the use of the JAWS screen reader, and knew many shortcut keys that enabled him to move quickly through whatever he was doing on the computer. Especially in the case of an accessible page, the presence of correctly-designed headings enabled him to move quickly through the page. Betty had

devised a way to prop her keyboard up on books so that she could see it and have it close to her.

In a sense, there is yet another strategy that the participants all exhibited: the glaring evidence of non-strategy (my word) when confronted with inaccessible Web pages. That is, if a given Web page was too hard to use, they simply avoided it unless they absolutely had to use it. Frequently, I would ask the participant, "if you were accessing this page without my telling you to, what would you do?" and he or she would respond that they would have ignored the page rather than put themselves through the unpleasant experience of encountering known barriers. As Barron discovered a live chat that was accessible on a particular Web page, he explained that he rarely used online chats, because *"the last time I tried it, in fact the reason I haven't done too many lately is because the last time I tried to use them I wasn't having such a great experience."* The other side of that issue was that with a page that they did have to use, they were familiar enough with it to get around and use it, however unpleasant it might be, as a result of sheer determination and perseverance.

Personal feelings and opinions

The category of personal feelings and opinions includes personal preferences, when mentioned, of the participants. Barron was the most likely to offer an opinion; Ty was next most likely to offer an opinion, and Betty had

to be drawn out to give her opinion. Yet all three appeared not to want to seem to be complaining.

Barron often expressed his impatience with a feature of a Web page that was not accessible to the screen reader, and volunteered his opinion about related information. He pointed out that a problem such as a page's timing out was a problem regardless of disability - *"for the same reason it's a problem for everyone else."* At one point, he volunteered that not only was the Web site of a particular (and nearby) amusement park not too accessible, but public transportation to that particular amusement park was non-existent. Later in the sessions, I had expressed my observation of the difference between him and my other two participants as to the experience of each with loss of sight. Barron had blind all his life, so had no particular reason to be bitter about what he could no longer see, whereas both Betty and Ty expressed bitterness about tasks that they could formerly do but could not now do.

Betty shared deeper feelings of personal challenge related to her disability and health. Work-related stress directly related to her computer use, and the time-consuming ordeal of confronting inaccessible sites, adversely affected her health, and she became seriously ill before the doctors could identify an underlying sleep deprivation situation and provide solutions.

Through the information provided to an interviewer whose 'conversation' with Ty took place through an interpreter, Ty revealed his feelings of loneliness for old friends who had passed on, who had shared his

disability of deafness. He also expressed his impatience with a site that was too busy, or had too much confusing text or color. On more than one occasion, Ty would throw up his hands in evident frustration. At the first session, Ty discovered that someone had used his computer and left the Microsoft Word Show/Hide marks activated. At first I did not understand what he meant when he asked how to delete the hyphens. Once I realized what he meant, I showed him how to deactivate the feature. His relief was evident:

T- Yes, I missed to set up avoid all hyphens.

[Ty shakes head - no; throws up hands]

H- What is happening?

[Ty puts his hands out; opens menu on toolbar]

T- I don't like all hyphens and

H - OH!!! I'll show you - that is a "Show/Hide" - watch me.

[I go to his computer and pull up the View menu to find the toolbar icon to remove the Show/Hide marks on the screen]

T- BETTTTTTTTER!

T -I guess someone used my PC I guess why I puzzled my system was messed up. Someone should not touch my system.

Design

Appendices D (Design Features Pertinent to Blind Computer Users Using JAWS) and E (Design Features Pertinent to Low Vision Computer Users) list the various design features that were pointed out in this study, or probed for with my unstructured questions. I have pointed out the most salient comments by my participants in their respective chapters. All three commented consistently on their simply ignoring a Web page that presented difficulties, as I have described in Strategies above. Each encountered barriers that were both disability-specific, and of a more general nature: Barron would have difficulty with the incompatibility of JAWS and Flash presentation; Betty would not be able to read certain combinations of colored text; Ty would abandon a page with too much text, or with text that was too small. The issue of design is present throughout the study. I have pointed out instances of both accessible and inaccessible design, and I have provided the reactions of my participants to these instances of design in Web pages

Communication

The category of communication emerged early in the data analysis and was consistently present as I reviewed the transcripts. While I communicated with Barron and Betty by voice, I used a keyboard to communicate with Ty. We shared a computer monitor on which we would read what the other had typed. Therefore, it was impossible to “carry on a conversation” with easy give and take, as easily with Ty as it was with Barron and Betty.

In a similar way, the participant's use of computer-related vocabulary was a pattern that emerged: Barron would refer to 'documents' but I wondered if he did not realize that a document can be in different forms, whether a Web page, a Word document, or a PDF document. Furthermore, he did not seem to realize that any document can contain hyperlinks, and so can probably be made to be interactive, in which the user can add information or edit information. Similarly, Betty referred to 'Web page' as an informational document on the Web, but did not consider an email message to be a document as well. Ty referred to "Internet owners" when he was discussing wanting to have his own Web page. Generally, however, the participants were at about the same level of computer literacy. I have elaborated on Ty's communication styles in his chapter. My interpretation of Ty's data is especially influenced by my lack of knowledge about Deaf culture, as I have explained in the Discussion chapter.

At another point, I wished there had been a way to record JAWS separately during my sessions with Barron. Often my or Barron's comments were drowned out by JAWS, making transcription both more difficult and possibly incomplete. When I asked Barron if the cursor was supposed to follow along with JAWS, he responded 'no,' and explained that there was no relationship between the mouse cursor and JAWS. Thus, the task of transcribing was sometimes complicated by my not knowing where to look quickly when reviewing the Web pages we examined.

I frequently asked each participant if they had any suggestions about how I might otherwise ask questions in order to gather their experiences on the Internet. Barron and Betty straightforwardly gave me their answers. I was less successful in getting feedback on what to ask with Ty, but I believe this challenging aspect of interviewing him was caused by my questioning format (in addition to the speed of my typing as noted above): I tended to ask more than one question at a time, as I was typing the text on my keyboard that he would read on the monitor and respond to on his keyboard. I felt least successful in achieving the communication I wanted with Ty.

Mutual Benefits

Throughout the process of observing these three individuals, I realized how mutually beneficial my relationship was with each of them. While overall, they were helping me with my research study, I was also helping them by sharing bits of my own expertise, computer literacy. I also made a great effort to concentrate on Web sites that would be not only of interest but also useful to these individuals.

For example, because I knew how anxious Barron was to be successful in his pursuit of the Master's Degree, I asked him to review the Web site for the graduate school of his university. He commented, *"I had better become familiar with this information,"* indicating that it would be useful to him. At another point, he was exploring the synchronous live 'chat' feature of a commercial Web site, seeking help on a product, fully expecting it to be

inaccessible (*"I will be stunned if it works"*). As he entered his comments and received a response, he commented, *"this chat is completely accessible; I am completely stunned....Most of the chat clients have been completely inaccessible."*

I learned many things from Barron about perception of computer concepts. While a sighted person refers to a Web page as 'top, left, right, bottom,' JAWS simply reads everything in the order in which it is situated on the page, treating the page as one continuous document, depending on properly designed headings to orient the listener. Thus, for me to ask Barron to look at something on the left of the page was useless, as he listened for what would be before or after something, not on the left or right of the Web page.

I was able to help Betty with pointers in using Blackboard, a course management system used by the university, as she reviewed Web sites to use in updating her course on the system. In reviewing book publishing Web sites, I was able to use sites that she was going to have to research anyway. During my observation of Betty, I learned more about features of the magnification program Zoom Text and the accessibility features in Microsoft Windows software, as well as more about how color is perceived by a user with low vision. Betty would save me an email or other informational material about a particular grant or project that we had been talking about, as we shared our interests in writing grants.

I was able to share my expertise in teaching computer literacy with Ty, who thanked me for telling him about some keyboard shortcuts. I think I was able to help him by introducing him to some Web sites that he had not seen - especially since he preferred to get his news from sources other than the Internet. During my observation of Ty, I learned more about American Sign Language.

I learned that, again, perception is different for each individual. In this case, my deaf/blind participant reacted in ways that I would not have predicted. For instance, I would ask a question, expecting a direct answer. Instead, Ty would respond on a subject we might have started talking about many subjects ago. I finally realized (as he notified me) that apparently, I was asking too many things at once, and he preferred to respond to one subject until he had nothing more to say. I realized later that all of my communication with Ty was affected by my lack of knowing ASL, as well as aspects of Deaf culture that impacted our experiences together. I have addressed this aspect in the final chapter.

Commonalities

I observed several commonalities among the participants. Each participant appeared to want to avoid being seen as complaining, in general. A corollary to this attitude would be a quality that all three participants exhibited, and one that should be understood universally: none of them wanted to be “lumped” into a category (being disabled). Barron had made

several comments about wanting to be able to do anything anybody else could do, and specifically, when I asked him if he had had any dealings with some of the Web accessibility experts who were blind themselves, such as Dr. Norman Coombs (CEO of EASI - Equal Access to Software and Information), he replied: *"Frankly no, I consider myself to be first and foremost a German scholar and I solve accessibility issues on a need to be solved basis; it's not something I want to make a career or even a hobby of."* Barron clearly did not want to emphasize his disability, as I elaborate in the chapter about him.

Betty reminded me so much of myself (not admitting my disability for so long) when she was discussing why it took her a while to start using her assistive technology, Zoom Text. I had just asked her "*And how long have you used it?* She replied:

> *Less than a year; I was a stubborn old coot and decided ... I would just charge along with what I had, and it just really got to be a struggle. So I finally broke down, went to the Low Vision Center and they gave me Zoom Text, and our Disability Services here provided it for me. So, I just didn't know what to ask for ... and it is wonderful.*

While Ty had been most helpful and sharing of any thoughts that he thought might help me, he clearly was ready to move on to another topic after a fairly lengthy discussion we had been having about his disabilities (and mine) and thoughts on what doctors did and did not know about it all. He

ended the conversation definitively with, *"That is all; let us quit about deafness...Smile!"* I 'took the hint,' and went on to another topic.

Each exhibited independence and determination. All three participants clearly indicated that if a Web site is not accessible, they simply ignore it, unless it is something they have to use. I refer to this aspect of their coping in the Strategies section.

Betty and Ty, having lost their vision later in life, seemed bitter about having lost the abilities to do what they used to be able to do. Ty missed being able to draw as he once did; Betty used to be the one in her family who would search for travel arrangements online, and missed being able to do that easily. Barron, however, having never had sight, commented that he had a different perspective, since he had no reason to regret not being able to do something that he had never done.

Summary

This chapter has introduced the analysis of the data from my study on the experiences of three computer users with visual disabilities. In describing these experiences, I have commented on the six categories that the data revealed: (interactions with the computer, personal characteristics, strategies used, personal feelings and opinions, design of Web pages, and communication). In addition, I have commented on the mutual benefits I feel were generated between the participants and me, and some of the commonalities I noticed among the three participants. The three following

chapters (Chapters V, VI, and VII) will be devoted to telling the stories, through my interpretations of the data, of the three participants as they used the Internet.

CHAPTER V
BARRON

...These text fields are not only not labeled, but the numbers they're using to denote the text fields are out of order. ... Well, I can tell you, if I had to fill out this form, and I do, I would get a sighted person and a piece of paper. I'd want a paper form.

Barron is a blind male of 24 years who has been blind from birth. As a fourteen-week premature newborn, he was incubated and his optic nerves and retina were adversely affected. Classified as totally blind, he could not read print or see any color or contrast, with light perception in only one eye. Barron was a graduate student in German at a large southeastern university, and regularly used the Internet with the aid of the JAWS screen reader, preferring materials in audio format rather than Braille. I interviewed him in his office at home. He also used Braille light, a Braille reader. He worked on a PC laptop with Windows Vista operating system and the Office 2007 Suite. He used a Franklin language master, which possessed a dictionary and other tools useful in writing papers. He emphasized that most of the tools he used were in the laptop itself, and he regularly used the computer, at least two or three times a day.

In providing examples of the participant's words, I will sometimes provide my questions as well. I have used a shortcut system, with "H" being my words, and the participant's initial being the participant's words.: Example:

H - "What do you think of that graphic?" B - "JAWS didn't recognize the graphic."

Barron - Interactions

Barron did not love computers. He saw technology as a means to an end, albeit something he depended on constantly, and he explained that now, being thoroughly used to using JAWS, he only notices it when something goes wrong. He told me that he had really begun to use computers in high school, when he was taught JAWS. Once he was in college, he was on his own, so he considered himself basically self-taught in the use of computers. He had taught JAWS to other users, and occasionally would refer to the best way to learn to use the program. He saw himself primarily as a scholar and did not care to be active in any of the organizations for accessibility.

Generally, Barron had few problems using the Internet. His preference was for the Internet Explorer browser. Early in the sessions, Barron had mentioned that he had deleted the Firefox browser because he found it inaccessible (*"one of the problems I had with Firefox, I was not able to bring up the address bar..., whether it was something I just don't know, or something I wasn't able to do with my software..."*). He preferred Internet Explorer: *"...because number one I'm familiar with it and number two it's the one that has given me the least problems over the years."* When I asked him to elaborate, his answer was: *"accessibility, versatility, I'd say, things I can do*

with it. Supposedly Firefox is reasonably accessible but I'm an Explorer fan, personal preference and that's fine."

His high level of computer literacy certainly contributed to his ease of navigation. He would describe each step of his browsing a Web site to me. For example, as he was looking for a particular listing in a site on locating old newspapers, he provided his commentary:

> *...And so I hit F to search for form fields which are text entry boxes, and I click on the search pages; now that's a guess....let me get past the breadcrumb trail...Aha! This looks like the page I want ... The newspapers are listed in the drop-down box. ...If this drop-down box is accessible, it will allow me to move freely up and down the newspapers using my arrows. ...Well, this is like, this here, reminds me of most database searches that I've seen. I can be as specific or as general as I want. ... Well, we've narrowed it down to this particular newspaper ...1907*

When I asked him, *"Is there anything else about it that you particularly liked?"* he said,

> *I like the fact that everything, ... all the combo boxes are accessible. I like the fact that it's arranged in a logical way, and I'm sure you've seen some databases that are not arranged in any fashion that makes any sense. This one is; I expect to select certain things*

before others, and this entering key words is about where I would expect it to be.

At this point, I ask him, *"As far as this particular page is concerned, would you say you are having any particular problems?"* He replied, *"I'm having no problems. If I had, I definitely would have told you."*

He volunteered that education sites should be accessible, and generally are, as he had discovered in pursuing his educational plans. I was interested in whether they were, having read that higher education sites that increase in complexity also become more inaccessible (Hackett and Parmanto, 2005). When he browsed his university's site, searching for a topic I had suggested, he did not have too much trouble and he described the steps he took, as he did on the Web page above. He would comment on the arrangement of the content on a page from time to time (such as having links go to another link rather than to the desired target immediately). He also encountered inaccessible forms, which I have described below under Design.

He was clearly proficient with JAWS. I watched in admiration as he deftly maneuvered around a given Web site. He said more than once that he did not waste time on a site that was not giving him the information he wanted when he wanted it, regardless of reason. On the other hand, if he knew he needed to find a particular piece of information, he would listen to an entire site: To my question about whether he would ever read an entire site, B replied, *"Oh absolutely, if I had no idea what it was, I would listen to it*

thoroughly, which I have, but if you want to find this information, this is where it is and that's how I got to it."

When he was browsing for a particular page, he sometimes had to go back to a previous page. He said that one of his favorite keystrokes was the Back key: *"One of my favorite key commands because I know I was just there...."*

When he first encountered an inaccessible pdf file, Barron was expressive:

> *JAWS: reading untagged document dialog...*
>
> *B - Whoa!*
>
> *JAWS: the two-page document is untagged and must be prepared for reading, while the document is being analyzed, your assistive technology will not be able to interact with this application... combo box...*

At this point, I asked him, *"What are your reactions?"* and he smugly responded, "Y*ou don't want to hear them...,"* indicating that he was displeased. However, that particular document was, in fact, to be readable, accessible and interactive, to Barron's surprise, as he followed a link in the pdf to an informative page:

> *... but it was a 50-50 shot whether we would be able to read this particular document depending on how it was tagged. ... I clicked on an interactive link in pdf*

document; that's interesting. ...I'm used to documents just being ... documents and not all accessible.

Barron - Personal characteristics

One of the patterns that the data revealed was a sense of humor. Of the three participants, Barron seemed to enjoy the sessions the most, several times playfully setting JAWS to a foreign language or accent, and often providing humorous comments. He would change the JAWS reading setting to German, Spanish and several British accents. When I was asking him about how he acquired his disability, he humorously muttered, *"on sale."*

When I told him we were going to go to a 'mystery site' (his university site), he said, in mock surprise, *"I'm not familiar with that; is it a university?"*

At one point, having encountered a problematic page, I had asked about his reactions, and he had told me I would not want to hear *that* reaction, but then subsequently as he read on about a $30 graduation application fee, he comically said, *"I've got a reaction to that!"* While he was reading a page that stated that "as a graduate student you are bound by the policies listed...," he commented sarcastically, *"tell me about it."*

Barron - Strategies

Barron's overall strategy in using the Internet was to rely on his memory for URLs. I asked him about his use of bookmarks. I was surprised to hear that he did not use them, relying instead on his (outstanding) memory (*"I used to know the keystroke but since I never do it.... There is a keystroke in*

JAWS for it...."). He did not depend on the drop-down list of URLS that browsers provide when returning to a particular site.

Another pattern that the data revealed was familiarity with a site. Repeatedly, Barron commented on how his familiarity with a given page did make a difference in how he used it. He commented on strategies that he would use if he were familiar with the site. For instance, talking about using combo boxes (from among which the user chooses in interacting with a site), Barron stated, *"So, again, if I had known the website I might have gone there first. And there aren't very many states in here, but that's not a problem."* At another point he said, *"If I knew it was a Heading...,"* indicating that the page was not accessibly marked up with headings properly labeled.

On a page that contained forms he needed to fill out, he used a strategy for finding the forms: *"So, presumably there is a link for forms somewhere on this page, and I want to make my life simple, and I'm going to do a search for forms..."* Once he found the form, it proved to be inaccessible. He had commented throughout the sessions that when encountering inaccessible elements, his last resort would be to ask someone sighted to help him.

Barron - Personal Feelings and Opinions

Barron would not hesitate to provide his opinion, in general. I asked him what he liked to do when he 'surfed' the Web:

"Well, let's say there is something in particular I want to know; let's say there's a line of poetry that I wanted to know where it came from. I know I read it somewhere. That is something I would do." He then used his search engine of preference, Yahoo.com, and walked me through the steps as he found the information.

He volunteered that spelling errors on a university web page did not look good: *"they also need to correct their spelling and grammar; this does not look good for a university: 'successully' completed??"* Similarly, he would often point out other typos on Web pages.

When he was browsing a game Web site, he commented that he wished more sighted people would use the game sites that were created for the blind users. He said that there are still several good ones on the Web. I had asked him about one that he had called up:

> *This site here, it's not much more that they could do to it. ... because of who it's designed for. I mean, sighted people can certainly use this site, and I wish they would, it would make it more enjoyable. ...Unfortunately, when sites like this are designed by the blind for the blind, the blind are the only ones that tend to use them, so even though this is a perfectly accessible community, only the blind are using it so I don't use it much. ... I have a reason; ... given that they do, we accept that premise, that people do interact online, the simple fact is that the blind are not a self-contained*

community or at least they shouldn't be, they are part of a larger whole, and so if you're going to have a network like this where people can get together and exchange ideas and everyone gets online and chat and communicate, then it makes sense that sighted computer users should be reached out to and brought into this sort of thing.

Barron - Design

Search engines such as Google.com and Yahoo.com were equally accessible. In fact, Barron commented, "*I find the Web to be generally accessible...."* Barron described the situation as:

The big commercial shopping sites are going to be accessible number one because they are bigger, they attract a much larger audience, so if they were inaccessible they'd be quickly criticized and it would be a public matter, so Amazon is going to keep itself accessible; eBay is going to be accessible, Audible is going to be accessible and all that sort of thing.

Barron was very explicit about design features of Web pages that were or were not helpful to him. I have related his description of the accessibility of pdf documents in the section on Communication.

Throughout the sessions, he would comment in detail about something not being accessible. Having encountered an inaccessible Flash file, he

commented, *"Irritating...well, I apparently do not have the Flash movie....I wonder if I did what, because Flash is not generally JAWS accessible...."* I asked him, *"...If you were determined to find something on this website, what would you do?"*), and he replied:

> *"Well, if I was really determined to find something on this web site, I'm guessing that all the material, the newspaper material on the website is inaccessible because of this but I would, since I don't know that, I'm going to click on another result at random and see if I get the same message."*

Similarly, when he liked a Web site that was easy to use, he was expressive:

> *"I would say as a blind researcher, finding information from this website I could most likely get it, ... the exception being the Flash-based archive material...; in all fairness, I don't have a Flash player on here so I don't know that it wouldn't work. I'd need to test it on a machine that does have Flash....But other than that, the website is perfectly accessible, the combo boxes are usable and edit fields are set up properly so that I can enter data and retrieve data, activate..., the pdf documents are accessible - which is extremely rare. In all, this web site is rare."*

As he was confronted with an inaccessible form to fill out on one page, he analyzed the Web page:

> *[JAWS: ...field 3 required edit; text field 4 required edit]*

...those need to be labeled...I'm just using my down arrow to read it line by line; ...I don't know if that applies to these text boxes here...dates submitted, that's obviously a well-labeled field...last, first, middle, what is this. I'm guessing last name, first name, initial, but it needs to be relocated, because those are the proper tags for those three text boxes...; [later in the form] ...because of the labels, the labels are all here, they're just not attached to the text boxes.... city, state, zip, there should be a an edit field there for that; either that or the state needs to be a combo box like it is on any other occasion. ...these text fields are not only not labeled but the numbers they're using to denote the text fields are out of order...

Barron's final comment on this particular episode, was,*" Well, I can tell you, if I had to fill out this form, and I do, I would get a sighted person and a piece of paper. I'd want a paper form."* I commented, "Either that or someone would have to type it for you." And he added, *"They would have to, with this looking like this, oh, yeah..."*

Barron went to a Web page for a famous restaurant and was unable to access the menu because it was contained in a Flash document that JAWS could not interpret. At the restaurant home page, one of the links was to a map. Barron explained that "it tells me there's a map there but JAWS won't touch it." He commented as he browsed the site:

Inside the Flash document are a series of buttons...I have no idea what these buttons do;...they bury information in this Flash presentation such as ...dress code, business casual...I'd literally have to go through line by line. ... [music begins playing] the sound, I can't shut it off and it sort of interferes with the speech software.

[I ask him what he sees as he clicks on the link to the menu]

... I see nothing [JAWS dings as Barron clicks, indicating it can go no farther]. Now THAT is an inaccessible Web site, completely and utterly.

As he was browsing a Web page that was used for signing up for workshops, he tried to register for a workshop:

[JAWS - ...or choose a workshop... one of twelve out of table....]

B - it doesn't tell you what they are.... I have no idea what these were....so far, I have no idea what these workshops are: the combo box doesn't give a title, at least nothing beyond the number of workshops.... I have no idea what those abbreviations mean.... It doesn't say what the check... the table is not accessible

The most troublesome barriers in using the Internet for Barron were Flash items, pdfs, inaccessible forms, self-refreshing pages, timing-out functions in databases, and captchas.

Barron - Communication

I communicated with Barron by simple conversation. Barron used JAWS, a screen reader, which had to be loud enough for him to hear. As a result, however, JAWS frequently drowned out what was being said by either me or Barron. At one point in the transcripts I noted, *"it was hard to hear anything but JAWS,"* and noted at other points as well that "I could not hear because of JAWS." I did not try to transcribe everything that JAWS read, since I was not focusing on JAWS itself in the study. And since I knew which Web pages were being worked with, I was able to listen to the tape several times and follow enough of the JAWS reading to determine that I had not missed important points.

Barron was very adjusted to using vocabulary that sighted people use, such as "looking at the page," or "seeing the menu." Therefore, I frequently would ask him to "look" at a certain area of the Web page, or ask him what he "saw" on a certain page.

Barron was the most opinionated (constructively so) of the three, often stating such ideas as: *"it would be a good idea that any incoming faculty be required to go through such a course,"* or *"This is something that most university faculty should be required to take...."* as he reviewed Web sites that were designed to educate people about Web accessibility.

At one session, when I asked him what he thought about the sessions so far, he answered,

...We've covered a lot of different types of web sites, everything from archives to interactive game sites; I'd say we've done a pretty decent survey of the Web....I don't really have any that trouble me. The makers of JAWS have done a very good job of keeping up with the developments in the Internet, so there aren't as many problem areas as there would have been 10 years ago. But then again the Internet wasn't what it is ten years ago.

Oral communication with Barron was certainly the most straightforward, as he would, in detail, answer my questions, often expanding into further explanation. The most direct (and satisfying) answers to my questions about how accessible a Web site might be came from Barron. For instance, when Barron and I were encountering a particularly accessible pdf document on one of the Library of Congress Web pages, he not only replied 'yes' to my question about its accessibility, but proceeded to explain what made a pdf document accessible or inaccessible, and offered his evaluation: *"...which most pdfs are NOT accessible because most pdfs are simply scanned by a document scanner and saved as pdf files and then uploaded to the Web. This document was probably created and tagged with accessibility in mind. This document is rare."*

Similarly, when commenting on another Library of Congress page which he found very accessible in response to my question, "Is there anything about it that you particularly liked," Barron said:

I like the fact that everything is, all the combo boxes are accessible. I like the fact that it's arranged in a logical way, and I'm sure you've seen some databases that are not arranged in any fashion that makes any sense. This one is; I expect to select certain things before others, and this entering key words is about where I would expect it to be.

When looking at the Web page for the East Tennessee Technology Access Center, he offered, *"no complaints; again, I would have expected this web site to be accessible, and the fact that it is, is not surprising; all the graphics are labeled, it's text-based..."*

Barron patiently reminded me, when I asked him to *"look at the graphic to the right of the paragraph such-and-such,"* that a Web page was not 'right, left, beside, etc.' for him, but rather, items were simply in order. My notes at the session when I first made this communicative blunder are:

Barron mentioned that the frame of reference is important; look at position of something on a page: rather than left, right, use top, middle or bottom. JAWS treats the page as one document. Also, headings are important. He can find something by the heading size.

Similarly, Barron explained that *"what I'm hearing and what's on the screen are actually out of sync..... It's designed that way, but in order to understand you'd have to ask ...the Freedom Scientific [producers of JAWs] engineers."*

A completely unpredictable (and whimsical) situation arose with Barron during one of the last sessions. He was unaware of the situation, not being able to see what had happened. His monitor settings had somehow been set so that the picture on his monitor was on its side (evidently this setting enables positioning projectors on their sides). Therefore, for me to follow along as he moved through a Web site, I had to turn my head to the side. I did not enjoy this experience, but it was certainly a direct indication of how little it mattered to Barron what any given Web site looked like (only what it sounded like according to the underlying design). He had asked me if it bothered me, though he did not know how to fix it. Fortunately, at the end of that session, I played around with the display settings and was able to adjust the monitor so that the display was right-side up (again, he did not care...).

This chapter has presented the data analysis for Barron. Barron was proficient in the use of the screen reader JAWS on the computer, yet he saw computers as strictly utilitarian. He preferred IE to Firefox; he was highly computer-literate and articulately described the elements of the Web page that he encountered. His sense of humor mirrored his comfort level with a computer. He would offer his opinion of the accessibility of a page. He considered himself a scholar above all.

CHAPTER VI
BETTY

I hadn't realized the prevalence of [difficulties on the Internet] until I had my vision loss..., and now it just seems like I can't go to any program, any site without running into it; it's just real prevalent.

Betty is a 59-year-old female who has had poor vision all her life. She was born with optic atrophy, in which her optic nerve was partially dead. The best she could ever see was 20-60, so she had always had some visual deficit. Four years ago, she developed retinal wrinkles (scar tissue forming on the back of the eye). Because it happened spontaneously, her doctors operated, first on one eye, having caught it early enough to treat the condition, in hopes of restoring her vision. However, for unknown reasons, the operation was unsuccessful, and she lost all the central vision in her right eye. Because they did not operate on the other eye she lost vision in that eye also. She could read only out of her left eye, and had only peripheral vision out of her right eye. Betty was an Assistant Professor at a large southeastern university. During my observations of her, she regularly used the Internet with the aid of Zoom Text, a program that enables the user to adjust the size of font and color contrast. I interviewed Betty in her office. She used a PC desktop with Windows XP operating system and a large monitor. She used the Internet all day long in her work and research.

In providing examples of the participant's words, I will sometimes provide my questions as well. I have used a shortcut system, with "H" being my words, and the participant's initial being the participant's words.: Example: *H - "What do you think of that page?" B - "The font is too little."*

Betty - Interactions

Betty was proficient in using the computer, and very familiar with certain Web sites that she used often. I discovered the element of familiarity to be key to the way my participants interacted with a Web page, providing one way to compensate for the inaccessibility of it. The more familiar Betty was with a given Web site, the more quickly she could maneuver around it, regardless of accessibility issues. This would seem obvious, but the issue of time is key to understanding the frustrations that these participants experienced. Because of her disability, Betty had to spend much more time than the average computer user would need maneuvering the Web page, *"All those resources that we had.., .[I] have to hunt and peck."* After one page on which the color was not good, she added that, *"well, the color isn't good but you just sort of learn where to go...."* She also needed to concentrate more fully on the task: *... I have to concentrate...if someone is talking to me, I will often lose my train of thought and not do it, especially if it's something I haven't used and I need to think where was it that I, ...what was my chain of command...this was easy.*

In addition, she had to take the time away from work to complete her tasks: " *...So I had to go back over the weekend and spend considerable time hitting one button after another and basically going through their whole web site to find what was there in order to find what I wanted. But the time you spend doing that on your weekend is the time you don't have to do something outside."*

Related to the issue of familiarity and time, the issue of time to learn a new program was a concern for Betty. She frequently referred to the aspect of computing that contributes so much to success in computing: taking the time to read manuals, experiment with features, browse the Web for ways to do things as well as finding out how to use certain sites. And she spoke frankly about not having the extra time to pursue these solutions as one of her biggest frustrations. Her disability certainly exacerbated this issue.

She recognized issues that basically had nothing to do with her disability, such as the search for a certain book: *"I looked up the research book; was stymied by an old [title that I couldn't find]; ... the new edition has a new name; I didn't recognize it because it was a whole, another name; same author you can't count on it being the same book...."* But such poor design of a marketing effort is part of the Internet scene, so I mention it to point out that challenges exist anyway, but a person's disability can add to the frustration.

In a separate, equally frustrating, search for an item, she said,

> *But that's got nothing to do with vision as much as the page setup and if you can't put in, I think we put in key words,*

and if you can't find it then the only way to do it is spend time going through things one after another and figuring out what the heck they've got on there...so that's got nothing to with vision..."

She made several references to the time and effort it took her to look up information that might help her deal with her disability: "... *it's always learning where to go, and on those huge organizations like AARP, finding what you want is hard. ... It's just a matter of spending enough time to hunt around till you find the words."*

Betty kept all the icons on her desktop set large through Windows settings. She used Zoom Text settings to enlarge her cursor and pointer. However, she pointed out that when using the large cursor, underlying text or objects on the screen were obstructed, yet a too-small cursor prevented precision with the mouse. Drop down boxes could be difficult: *"well, they're... more an issue of whether I can read getting boxes to pop up - more text sensitive... with large cursor; I won't click on the one I meant to."* She had set the cursor to be large and it interfered with the small text in the drop-down boxes. The larger icons that Betty used would get comments from others; "*Others will tell me that my icons look a little fuzzy to them, and I just tell them that's my world. They keep wanting to shrink the icons- because they want high resolution, but high resolution I can't see ...."*

Zoom Text had a text-to-sound feature which Betty sometimes used. She said that if it would work on any content, it would save her the time and

effort to go into Zoom Text and "kick up the font," but since she cannot depend on its doing what she needs, she turns off that feature (*"since it doesn't do it I shut it off because it drives me crazy."*) She preferred not to use the voice aspect of Zoom Text because it would not read her email out loud. We went through the motions and tried to get the voice aspect to work. It was not reliable enough for her to want to use it. She did admit that it was probably a matter of reading the manual to learn how to use the various aspects of the program, but finding the time to read anything other than what she *had* to read was the challenge. Betty was the only one of the three who consistently talked about the time element of using technology, although all three referred to the time element in some way.

The computer was used by Betty for her teaching and research, mainly. One of the first things we did was to search on a Web page for a particular edition of a textbook that she needed to know about. She remarked about the difficulty of hunting for books by using the ISBN. I had asked her if she had the ISBN of the book. She answered, *"Well,... the problem with that is the ISBN is usually pretty small and they are often too hard for me to read."* I asked her, "D*o you use any kind of magnifier?"* She answered, "Y*es - I do have one in my backpack, but you see, it's kind of a hassle to go get it and pull it out...."*

Betty described how she would ask her students to print out their PowerPoint slides for her, as, often, she simply could not read things on the screen: *"Yes, it's entertaining; they've got gorgeous colors; ...I want them to*

make them interesting...all the bells and whistles and it's a lot of fun, but some things are hard to read."

I asked Betty what she first looked for on a Web page. She said that she tried to see "*how much of it is easy for me to look at without having to really get in close to check out."*

My interviews with Betty yielded a full report of the fonts (see the Design section below and Appendix D for a complete listing) that were hard for her, as a person with low vision, to read and see: *"...Really light blue [as she peered into the screen]... this CSPN would be a real challenge... more blue and white on blue; pretty in pastels, very difficult to read."* I asked her if she ever used the Tab key to move through the page and she said she never did that. Betty would frequently comment on the font of a page, and we talked about when she would blow up the font size, explaining why she does not keep the font size large enough at all times: *"if we put it up to 1.25, it involves a whole lot of scrolling"*

When I asked her if she ever went to the Internet for fun, just to play around, she replied that she did not have the time to do that. I asked her about whether she used the travel sites. She used to, before her vision worsened, but now someone in her family did most of it. However, she did *"...want the best ...price, it just takes longer...."*

It seemed that the issue of how long it took Betty to do things because of her low vision could not be avoided. At one point, we were talking about

two online classes that she was preparing on the Blackboard (BB) course management system, and that I was able to help her with:

H - These are two classes you've been working with all semester, so you are very familiar with everything you have on there? ...From the standpoint of your eyes, how easy was it to set up ?

B - I spent this summer learning the ins and outs of BB with the manual...

She did think some of her frustration could be due to the way she searched a Web site in one instance when she was trying to find a particular book:

Yes, well, my frustration is that I can't find the book...which is totally irrelevant...

H. That's purely content related? Or maybe the ways you search the web site?

B - Probably more than likely the way I search the web site.

However, as we discovered, the problem was actually in the incomplete content of the publisher Web site that she was searching.

She talked about the advantages of having material available online:

H - so as a rule would you rather read off line than online; print something out and read it?

B - It depends; papers are easier for me to proof definitely...but especially anything that is very fine print

because on some things I haven't learned how to crank up the font or they get cut off if you try to [blow up] ....

Betty preferred to print out online material and read it:

"Reading on screen, maybe some getting older and wear glasses, find that reading on screen is tiring. I read papers. I can, but I don't see my typos real well. I tell my students to expect typos. I can proofread well on paper."

Betty - Personal characteristics

Betty commented on her recent (four years ago) increased loss of vision:

So, having been somewhat low vision before, it was in some ways a much easier adaptation for me than many; I had always preferred the bus; I could drive; I really didn't want to; I didn't like to drive after dark; now it's easy; I just don't do it.

When I was asking the demographic questions about her level of computer literacy (*"can you turn on the computer, open an application, compose, save, and retrieve a document, send email and browse the Internet?"*), she said she was computer-literate: *"by that definition, yes ...like many of us, you want your grandkids to show you the bells and whistles of anything that you can't figure out as it changes."*

I found that I had to frequently ask for elaboration when Betty was looking at a page. For instance, at one page that was supposed to be accessible, she said, *"...looks good... [but then] ...the color, not so hot, ... [and, continuing], ... a nice dropdown, much easier to read even though white, high contrast."*

I wondered whether Betty used binoculars. She did: *"yes, [I keep them under my seat [in the car]. If I knew where it was I could see."*

Betty - Strategies

Betty would take her glasses *off* when looking at a computer. She commented, *"I take my glasses off to read basically anything. My glasses are only for distance. It drives people crazy because they usually do it the other way around, but I've met some other people who do the same."* I followed up with, *"So you have to be that close - about 8 inches away...?"* and she replied,*" about a foot now, it's too fuzzy...."*

When commenting on some graphics on a page, she said that she usually just glanced at them and then, if *"that's hard to read, it's not a big priority...."* This, of course, was another example of how she simply ignores a Web page that is too hard to use. I continued to ask her on that page, *"So basically, like most of us, you're going to a certain site with a specific purpose in mind."* And she replied, *"...trying to do what....haven't got time to browse."*

The issue of time was a concern of Betty's - a search that took so much time because she could not move through it quickly was a waste of her time.

Betty - Personal feelings and opinions

She wanted to know how one is supposed to know about the tools available, if one does not, indeed, spend all one's time browsing the Internet. The anxiety that is caused by not knowing how to use something, or what it even is, is a trait that was voiced in a study of individuals with visual impairments who retained their jobs after loss of vision (Crudden, 2002).

I wanted to ask her if she had any other thoughts to share with me:

"It's a very tiring process. ...It's reading what you can; it's just, it's fairly exhausting so a few hours and you need to get up and do something else; or if I push myself, but it's, it's hard work and people that do it for fun; I guess if you were just looking at pictures or something like that, it would be fun, but... trying to do a very simple thing like finding those documents I wanted..., I have to go home this weekend and spend more time because it wasn't going to be an easy hunt; it was going to be time-consuming [she points off her fingers as she speaks] - the assignment I was going to learn [gestures quotation marks with fingers], the [resource I was looking for]... (she throws her hands up)

and if I hadn't had this downloaded it would still have been quite the process, so. Yeah, it's a time-consuming job.

All three participants mentioned that in general, they would not go to - or spend time on - a Web site that presented barriers. Yet, they were pragmatic about recognizing that if they absolutely *had* to use it, they would, however unpleasant. As Betty said when I asked her about a certain page; "*you do what you got to do."*

People who tried to help her would enlarge her fonts, but before she used Zoom Text, this practice was problematic:

H - ... is that fairly easy to see?

B - yes; again, Zoom Text has been enormously helpful. They tried to kick up fonts for some things, but you kick up your fonts so your Word documents are larger but then you go into any web site or your email and it's too small and I couldn't read it, and so making it the same across all the things you use on the computer was one of the difficulties I struggled with for years ...

Betty repeatedly commented on the color combinations that presented such difficulties for her: *"this stuff, navy on blue is hard to read, well, even black and orange is hard to read; the brighter the color generally, the harder it is to read anything.*".

Betty - Design

Betty was not as opinionated as Barron, but had definite answers when I asked her about the various Web sites. If I were to sum up her comments about using the Internet, it would be "font size and contrast."

As with any person who has difficulty seeing small print, Betty also avoided situations where small print was an issue. When I had asked her if she used the ISBN of a book in searching for the book on the Internet, she commented: *" the problem with that is the ISBN is usually pretty small and they are often too hard for me to read."*

Betty told me that she had resisted searching out help when her vision first worsened, and when she did begin to use Zoom Text to enable her to work more efficiently, she was delighted by the difference:

> *...It's wonderful.... There are a number of things on the Internet that are difficult. One is that people do love to use their colors, so they will have white on violet; I can't read that. One of the defaults for emails is blue, and so a lot of people like to send me their emails in blue; I can't read that either. So it is nice that my Zoom Text allows me to turn it to black and white, So it's easier for me to read these blue emails that I get.*

Throughout the sessions, Betty would consistently talk about the colors that made it hard for her to see. Appendix E lists the design features pertinent

to low vision computer users that were disclosed in this study. The following responses were made from time to time regarding issues of font color:

> *"pink on blue - I always failed the color-blindness tests..., but I think that is pink on blue...black letters pink tabs on a blue background...; now, again, blue on blue, not so good; it's pale blue; well, it's not pure white, I'd guess it's probably pale blue; I think there is some color in the background...; this one is Ok, not great; black on pink isn't real easy*; *easy to read logo; ...why I don't like this one: an even lighter blue which is... I find quite hard to read. The white on it, as it gets to be gray on bottom and it's small, really hard to read, looks cool; people love their colors..., white on blue, black on pink, navy on white not easy.... I wish they wouldn't do blue there. ...* this one; *... black on white, and sometime that helps with blue; ... a black and white scheme, and gray is in that...* white *... on black's not bad, but PowerPoints - they like to put yellow on blue*

Other comments she made about color schemes were:

> *"it's pretty good, except again, they've got white on pale, so that's - basically I can't read it, ... and in this case, when I can't even read it, I usually ignore it, unless I really really know I have to read it...."*

She said that pdfs sometimes gave her trouble - it depended on the creator and color scheme. When I asked her about how hard certain dialog boxes were, she said she was used to those, and used them because she had to.

Betty - Communication

I communicated with Betty as well through simple conversation. While she was the easiest to communicate with, considering interference from other sources, her manner of answering was short and to the point, as I commented to her (and she agreed). I often asked her to elaborate on her answers.

This chapter has presented the data analysis for Betty. Betty was proficient on the computer and used Zoom Text to interact with the computer, enlarging fonts and controlling colors. Her most frequent complaint was the font size and color schemes of inaccessible Web sites. She spoke often of how time was a challenge to her, as her disability made it necessary for her to take much longer to do things on the computer.

CHAPTER VII
TY

"That is all; let us quit about deafness....Smile!"

Ty was a deaf-blind male of 69 years who has been deaf all his life and has slowly lost his vision. As a child, he wore glasses and had been diagnosed with retinitis pigmentosa. At the age of 29, he was diagnosed as having Usher's Syndrome. Consequently, his visual disability has steadily worsened. He was told he would have tunnel vision. He has partial vision, knows Braille and communicates with American Sign Language. He was very enthusiastic about the advances in technology that have helped him communicate with others. I interviewed Ty at his office in a local disabilities advocacy agency, where he is an employee. He sat at a PC desktop computer with a large monitor on which he read the text that he and anyone communicating with him through the second keyboard typed. To the right of the computer was a second monitor that was connected to a light scanner. Material could be magnified onto the monitor and Ty could then read it.

In providing examples of the participant's words, I will sometimes provide my questions as well. I have used a shortcut system, with "H" being my words, and the participant's initial being the participant's words. Example: *H - "What do you think of that page?" T - "The font is too little."*

Ty - Interactions

During my observations of him, Ty used Zoom Text, a program with tools for magnifying the content of a computer document. In addition, the program provides text-to-speech capabilities, and - more relevant for this participant - will adjust the color contrast to the user's choosing. Ty usually viewed text as white on a black background.

He used Juno.com for email, and wanted to show me "my Juno features": he was very proficient using the email program. He would select Appearance/Text to choose the size of the text, unless Zoom Text was being used. He then would explain Zoom Text to me, adding that he was still learning the program. He loved Zoom Text, which enabled him to change the color scheme of the screen to white text on black background, the easiest combination for him to see. His enthusiasm included his wanting to offer a Zoom Text training workshop.

Ty was also very enthusiastic about American Sign Language and had taught it to several different individuals. At the time of the study, he was teaching ASL to a senior citizen.

Ty mentioned to me that he did not go to the Internet very much because it was so hard for him to see the content. I did not realize this until after a few sessions, and I changed my initial plan to ask him to pick out Web sites from a list I suggested to a less formal plan, as browsing the Internet was *not* one of his usual tasks. He would often voice strong statements (*"I use Zoom Text program but hard to on website pages.")* about his not using

the Web very much. Once I began asking him to go where he wanted to go, I felt like we were less at odds. I commented in my notes, *"...it was a good idea to let him do his own thing because he got to show me everything he wanted to show me and maybe more,...later."*

His standard routine during the sessions included the process of writing something using large font in Word, selecting all the text, going up to Format and changing the font to a smaller font, copying the text, opening his email, addressing the email and pasting the adjusted-for-size text into the email. Occasionally he had trouble finding the icon at the top of the page, or the menu item of something he was trying to do. Ty would often print off a hard copy of a Web page, bring it back to the desk, and use the magnifying glass or scanner to read the page.

The process of getting into a Web site was a lengthy one: Ty would open the browser, hunt for the address bar for several minutes, type the given URL into the address bar of the browser, have an error in the URL which at first was not obvious, try again, hunt for the "go" button, and finally get it. For at least *two minutes*, he peered at the message I had typed about going to the web site, including the URL. I had asked if he could copy and paste, a step that might have saved him time. He would run his finger along the words, trying to read them. Then *twenty seconds* later, he had opened the browser and located the cursor in the address bar. Over another *forty seconds*, he went back to the text we had typed, peered at the URL, and returned to browser, hunted for the address bar, and relocated the mouse in the address

bar. He gestured that he could not see it, squeezing his thumb and forefinger together to indicate the font was too small.

At that point, I took over the mouse and typed in the URL, inadvertently missing a typo, so more time went by as we noticed it was not the page we were trying to find. I typed “may I try to find it?” and he nodded his head. At this point, almost *five minutes* from the time we started the process, he typed, *“you see why I [am frustrated with] most ...website home pages [with their] small fonts, links?”* I finally took my hard copy of the URL and I asked him to scan it so he could read the URL, and he focused on the URL and turned back to the computer to correct the typing. After another false start, we both realized that a letter had been left out (the “h” in the word “schools”) and we did both laugh. He went back to the scanner and, letter by letter, typed in the URL. But the entire process, something that should not take more than a few seconds, lasted over *ten minutes*, and that does not count the ensuing ten minutes that he spent reading the document.

At the same session, I did not understand what Ty was doing when he reached for a lap pad, but when someone brought the printout from the printer, I realized he had printed it out so that he could then rest it on the lap pad and use the scanner to magnify the contents of the page so he could see them, line by line. By that point, I had seen everything I wanted to see about that particular search and wrote him a note to return to the Word document so I could “talk” to him.

Ty was most interested in showing me all the things Zoom Text (by ai-squared) would do, sharing the manual and information from the Web site with me. From time to time, Ty would use a magnifying glass to enlarge something on the screen. Ty seemed to be unaware of keystroke shortcuts. I was able to tell him about the cut and paste keystrokes for which he later thanked me. At one point, his computer froze. Not being able to tell what was happening, he could not do anything. It apparently fixed itself, but I was able to observe another frustration for him (or anyone).

Ty - Personal characteristics

One of the first things that I noticed about Ty was his considerate nature. At the first session, he had prepared a folder with the signed consent form, labeled with my name in Braille. He routinely printed out the day's typed "conversation."

When I focus on Communication below, I discuss Ty's eagerness to talk about what interested him. But one of his personal characteristics was his genuine desire to share something he thought would interest me. I am still not sure how I managed to miscommunicate the purpose of my study (observing and interviewing him while he used the Internet rather than having him teach me about various things such as Zoom Text and ASL), but he never failed to have something for me, whether a manual for Zoom Text, illustrations of ASL, a printout of a Web site of interest, or to tell me about a new device, such as the Zoom Text Keyboard that he had just had provided

to him. I was very appreciative of his efforts. Ty had his mouse cursor as a large arrow which showed a trail as he moved around the screen.

Ty would use many gestures in expressing his thoughts. At one point, he was letting me know that a Web page with too much text on it would put him to sleep - he pantomimed falling asleep when there was “too much reading.” At other times, when something was not working, he would throw up his hands in desperation. Unfortunately, this happened several times, usually when he simply could not read a too-busy, colorful, page (until he adjusted the text with Zoom Text).

As we were talking about the fact that I was typing “too fast,” he volunteered that he “can’t rush to type messages on email messages,” since he “must carefully spell all corrections before” sending emails to “low vision users” and wants to avoid being careless with “users who are mostly sighted.” This conversation was indicative of Ty’s thoughtful nature.

His co-workers at the center where he worked described T as very organized. He was used to having everything in its place, and would be the first to notice if anything was different. One day I left my purse beside the chair I had been sitting in. He noticed (before I had left) and brought it out to me.

Another time, he was typing and the Word document was displaying the Show/Hide marks and he did not know how to remove them. It took a while for me to understand what he was talking about, but when I did turn them off, he was very relieved. He was upset because as he said, someone

else had been using his computer and had not put it back the way he had left it.

I have mentioned that all participants exhibited a strong sense of patience. Ty would patiently read the page and patiently look for the item he was seeking. As described under the Interaction section, I watched him maneuver through the process for at least five minutes before he finally expressed that he could not see the text.

Ty showed his humor on numerous occasions. One day, the computer was set to type sign language symbols during which the font is considerably raised so the symbols are visible. When I started typing, huge letters appeared, of course. Ty started laughing, explaining what had happened. It was my first experience with this tool - I did not realize that one can type 'in' sign language. Throughout this experience, I was reminded about how much there is to learn.

At another session, he typed, *"Did you know that I am PhD?"* I answered, unknowingly, *"What is your degree in? I did not know."* And he interrupted my typing to say,*"hahahaha...I am PHysically Deafness! Ah, another inside joke!!!"*

Ty would refer to himself as a "fighter" throughout the sessions. When his eyes were especially bothering him, he said he was a "vision fighter!" And he would *"overcome my disabilities!"* At another point, referring to his use of the computer in spite of the difficulties, he said, *"Deaf-Blind Technology is a fighter!"*

Ty had explained that he had been interviewed by a local radio station for a segment on Helen Keller Deaf/Blind Awareness Week. I had received permission from Ty to ask the radio interviewer if I could see the transcript of the interview, since I was interested in the information and would be asking him anyway. The interviewer had the advantage of an interpreter, so the questions and answers were direct. The interviewer, also, had wanted to talk about the challenges Ty faced, and she, also, remarked on his positive attitude. One of the questions asked was if it was ever frustrating to have lost so much of his sight, and he answered with a description of the media he uses that has compensated for his lost vision (closed caption TV, the computer, newer technology), but that frustrations he still has include loneliness. He misses the deaf-blind friends who have passed away. I wondered if it was his loneliness that might account for his eagerness to pursue so many avenues of conversation.

Ty - Strategies

Ty had invented a strategy to use so that he could tell when a sentence ended, since periods were too little for him. He would use the "at" (@) symbol as a period. I did not know what he meant when he first mentioned it, but I caught on, and thereafter would end my sentences with the symbol. He was proud of having invented this strategy and wanted a name for it. He also said I should mention it in my dissertation.

I have mentioned his routine to type in one font size, large enough to see, then when transferring the message to email, he would change the font, go to the email, and copy and paste the message into the email. Therefore, I had a verbatim record of our "conversations."

Ty - Personal feelings and opinions

Ty would occasionally express his frustration at losing his sight. After one exchange about the accessibility of a site, he said, "I wish I could ...see 20/20!" At another point, as we had discussed 'our' deafness, including what doctors may or may not know, he abruptly typed *"let's stop about deafness..."*; but he ended it with *"Smile!"* so I gathered he was trying to be pleasant about it. As with the other participants, Ty exhibited a positive attitude throughout the sessions.

He would frequently communicate at length about how he felt about Zoom Text. He thought it was "the best."

Ty - Design

I had the most difficulty eliciting design comments from Ty. He had commented near the beginning of the sessions that he rarely went on the Internet because he could not see the pages well. I would sum up his thoughts about using the Internet with "font size."

Repeatedly, Ty would comment on the hardship of trying to read pages that had too much text on them. Regarding looking at a site that I had asked him to spend some time at home looking at, he told me that the information

was hard to find because of the amount, and he commented that library pages had long lists of information, so he did not like them. Consistently, he would point out the small size “fonts, photos, too small prints” aspects of inaccessible pages. He did not like trying to navigate around a Web page, as the fonts of the links were usually too small for him to see. He usually would go to Web sites only if he needed “to find some information and sign up or print some information....”

Ty - Communication

As described, I communicated with Ty by the use of two keyboards connected to a computer and one large monitor. He would type his comments which we would read on the monitor, and then I would type my replies which we would look at on the monitor. He would look at the monitor with the aid of the Zoom Text program and other magnifying tools.

Frequently, he would start typing before I was through with my thought or I would start typing before he was finished with his thought. I referred to this in my notes as *“we fight our cursors sometime.”*

He would frequently turn away from the computer to find something that he was telling me about, turn around to me and hand it to me, then go back to the keyboard, and type his comments. He once wanted to tell me more about Zoom Text, and he gave me a print out of something he had seen on the Web that might interest me.

Between sessions, we communicated via email. However, even that medium was not reliable, as he sometimes did not check his email until he was in the office, which was only three days a week. On one occasion, I arrived to interview him and discovered that he had sent me an email telling me that he was having trouble with his good eye and asking to make it the next week. Thus, the inability to pick up a telephone and confirm plans complicated the already challenging and inefficient method of communication that we were using.

It was most challenging for me to communicate with Ty, and I frequently made notes to myself about how frustrated I felt (not to mention guilty that I could not apply myself and learn enough American Sign Language to "hear" or "say" more). My notes were full of references to this challenge:

> *...quite a challenge; he would go to show me Zoom Text or the document, and I couldn't really respond to him.... At one point, the text was not wrapping, and ... I didn't know how to go back and say, 'well, let me say something ....' Then when I went back, when he went back to email and I put it in, he thought he knew what I meant, he went back to the Web site which of course didn't have the text wrapping, so I don't know exactly what to do; I 'm going to have to come up with a way....*

My communication with Ty was affected by aspects of Deaf culture such as his use of ASL as his first language, while my first language was

English. ASL is more the language of the deaf than is English (Harris, 1995, p. 2). I was at a disadvantage in communicating with Ty because I did not know ASL, and I believe that Ty was at a disadvantage in communicating with me. Even if he had once used lip reading, he could no longer see well enough to follow a conversation "orally." With Betty and Barron, I could speak and hear, but with Ty, I was dependent on the keyboard for communicating. Deaf culture research is clear on the intense debate over how to educate and communicate with the deaf: whether to use an oral/aural method using lip-reading and hearing amplification, or to use sign language (p. 2). The classification of deafness itself as a disability (p. 14) and the development of a Deaf Identity (p. 17) are also debated.

When I had questions to ask of Ty, I tended to type more than one question at once. I realized that there was more chance of my getting my answer if I only asked one at a time, but I realized this well into the sessions, so had to do a lot of backtracking or just plain abandoning of certain questions.

At other times, I would ask a question about something he had typed, but for whatever reason, he did not address it. At one point, I asked *"Could you say more about how you began to use the computer, please?"* That thought was interrupted by the finish of the prior conversation, so I asked again, *"Could I ask about your use of the computer?"* He responded *"Whatever you want me to do on Internet?"* and I said, *"...I need some information about how you use the computer - how long have you been*

computer-literate?" and he responded, *"I really hate all fancy colors and fonts on Internet. Stupid Internet designers?"* so while it was not what I had asked, the information *was* valuable data. Nevertheless, it was disconcerting not to be able to follow a single train of thought through.

At another point, he had commented on a site that I had given him to review at home, and he really liked.

T - "The story was wonderful!

H - Good - I thought you might be interested!! But what do you think about the accessibility of the site?

T - I wish I could use [the] Google Accessibility which is better with] other online browsers] like AOL. [I don't include JUNO.

H - What do you mean - that you cannot use Google Accessibility Tools? What are they?

G - I haven't decided to sign up with Google yet.

H - ...What does the Accessibility Google do?

T - Good information clearly not much fancy fonts, etc.

And this point he went into the Google search engine and realized that the page he was talking about was not there.

Ty often volunteered information about a topic that interested him, but that he thought might interest me. I was grateful that he shared these topics with me, but sometimes it was hard to get back on task. For instance, he told me that USA Today had announced that the Briefing Dailies were going to HTML instead of text. He wanted to complain about that. When I asked him to

describe the situation, he started talking about “Internet owners” and then we were off on a thread of conversation about “Internet owners” not having to focus on blindness and how sad that was. The conversation rolled back around to fonts, and I asked him what the best font size was for him. He replied telling me about his deleting JAWS and welcoming Zoom Text, calling it *“the world’s BEST technology to all blind users.”* Then he started going through the keys he uses on the keyboard to enlarge his text with Zoom Text. At any point during the interviews, there were always at least two other topics that I could have pursued, and I was interested in reviewing the transcripts that, some way, we ended up talking about all the issues that I was sometimes frustrated about because I did not think I was getting answers. I was able to do this by backtracking during subsequent interviews.

I did, however, realize after a few interviews that I was getting the most direct answers to my questions when Ty could talk about something he liked to talk about. For instance, when we were talking about his ASL clients, I asked how they communicated. He gave a detailed answer, *“Yes, we are keyboarded together to communicate exchanges”* and he proceeded to describe in detail the best way to learn ASL and, furthermore, did I know that President George Washington was deafened, and that there were several U. S. presidents who had been deaf?

As I was transcribing the tapes, I realized that Ty was politely going through the Web sites I asked him to, even when one of them was nothing but a list of names and addresses in text. But I had originally told him that I

wanted to watch him as he used the Internet, and he had proceeded to do just that. I was regretful that I had wasted so much of his time in one session and it was after that that I began targeting individual interests in choosing Web sites.

I did discover early in the sessions that I could write out a question or request on a piece of paper and he could magnify it on the scanner monitor. I wrote to myself, *"I'm beginning to get the hang of when to distract him to the scanner to read a note I give him...."*

Also, Ty's vocabulary was unique and I did not always know what he meant, although it was usually the vocabulary of his humor and personal references that I could not understand. For instance, *"WOW, you should be a BRAVO"* (possibly because I was talking about having completed five interviews at that point...); " At other times he would refer to our sessions as talk show sessions. I perceived an underlying reason for my having such difficulties communicating with Ty: my own insufficient knowledge of Deaf culture. I did not know ASL, which was probably Ty's first language (I did not ask him). I had assumed that he was as 'fluent' in English as I was. I put us both at a disadvantage by not planning for this aspect of communication.

This chapter has presented the data analysis for Ty. Ty was proficient for what he needed on the computer, although I remarked that he had not learned such basics as copy and paste with the mouse rather than the menu.

CHAPTER VIII
DISCUSSION AND RECOMMENDATIONS

The real problem of blindness is not the loss of eyesight. The real problem is the misunderstanding and lack of information that exist. If a blind person has proper training and opportunity, blindness can be reduced to a physical nuisance.

NFB (2007) - *http://www.nfb.org/nfb/Default.asp*

This chapter will present my discussion of the data analysis along with conclusions and recommendations that I have to offer. As is usual in qualitative research, I had much more data than I could include in this dissertation, but the process showed me the possibilities present in taking the data and interpreting according to one's research question. Hatch (2002) described the process as "organizing and interrogating the data." (p. 148).

Discussion

During eight sessions each, I observed three individuals with visual disabilities while they interacted with the content of Web pages on the Internet. Based on a critical perspective, my analysis of the data confirmed what the literature had described; but I also discovered something about myself that will help me in future research projects. I expected to gain insight into aspects concerning my participants, such as: interactions with the computer and the Internet as they encountered barriers, their unique ways of experiencing the Internet; their levels of computer literacy; their feelings and

coping strategies; and issues of health. The categories of meaning that the data yielded were: (1) interactions of the participants with the computer and the Internet, (2) personal characteristics of the participants, (3) strategies used by the participants, (4) personal feelings and opinions of the participants, (5) design of Web pages, and (6) communication between the participants and myself. This discussion is framed around those expectations and categories of meaning as well as additional insights that I gained during the study.

Interactions

All three participants clearly expressed that their use of the Internet was for necessity rather than a preferred way to find information. Betty described how she would not go to certain Web sites unless she had to; Barron simply avoided difficult sites, and Ty was not familiar with the Web in general because it had presented such difficulties for him.

I have commented on Ty's frustration when the page he was looking for could not be found, though he had just been on it the previous week. "A significant number of user requirements for people with disabilities apply to almost any user, given the right circumstance or task context" (SUN Microsystems, 2007). *A*t times, what appeared to be a barrier to Web accessibility (due to poor Web page design) was also a function of the user's level of computer literacy or knowledge of technique: I observed Ty as he kept trying to copy a URL into the address bar by hand instead of copying

from an email using the keyboard shortcuts, Ctrl-C for copy, and Ctrl-V for paste. The difficulties that his low vision was already presenting were aggravated by the potential for error that he was experiencing.

Personal characteristics

The data produced rich descriptions of the experiences of my three participants as they used the Internet. I observed a common positive attitude of perseverance and determination in spite of barriers. Betty would only discuss any difficulties she might be having if I asked her - and she expressed the thought that we do what we have to do.

I have pointed out the instances of humor in the data analysis. Barron tended to provide more spontaneous humor than the other two participants. Perhaps this is related in some way to the two issues of age (Barron was 24; the others over 50), and years of having the disability (Barron had been blind all his life, the other two participants lost their sight later in life). That would be yet another topic for future study.

In Betty and Ty's cases, I believe that the reality that neither had been born with their visual impairments contributed to the kind of reactions I observed. Barron had been born blind, and had no reason to miss what he might have once seen. Betty and Ty, however, had both had eyesight before losing it, and I noticed on more than one occasion the bitterness each felt, although generally, their good humor prevailed. Betty had had health concerns that were aggravated by the frustrations she experienced daily, as

she dealt with the stress of work and poor health. Ty voiced his wish that he could see “20/20,” and the loneliness he sometimes felt, having lost friends who had passed on but had had similar disabilities.

My participants often would volunteer helpful information: Barron would frequently include in his evaluation of a ‘good’ site (containing information on Web accessibility) a comment that every faculty member should have to take such a course; Betty earnestly remarked that she wished that information about helpful tools had been more widely available; Ty was constantly advocating for more instruction in Zoom Text, and would tell me about certain Web sites that he thought were accessible.

My participants demonstrated that when facing barriers on an inaccessible Web page, it may not be worth the effort to try to access the content. Each participant clearly voiced their simple ignoring of a Web page that presented difficulties. As Sloan et al. (2000) reminded their readers, when a Web page is not designed to be accessible in terms of the code underlying the page, disabled users may be excluded from the information.

Feelings and opinions

Of the three participants, Ty and Betty exhibited the physical demands that result from the difficulties they had using the Internet. Ty’s weakening vision was especially affected and he had to stay away from the computer at times. Betty expressed the overwhelmingly tiring aspect of having to

painstakingly search for the content she needed, especially when faced with small fonts and inaccessible colors.

Betty told me that she had resisted searching out help when her vision first worsened, and when she did begin to use Zoom Text to enable her to work more efficiently, she was delighted by the difference.

> *...It's wonderful.... There are a number of things on the Internet that are difficult. One is that people do love to use their colors, so they will have white on violet; I can't read that. One of the defaults for emails is blue, and so a lot of people like to send me their emails in blue; I can't read that either. So it is nice that my Zoom Text allows me to turn it to black and white, So it's easier for me to read these blue emails that I get.*

These data tie in with Betty's wondering why she had not heard about Zoom Text earlier. The relative scarcity of information about solutions, such as Zoom Text, for computer-related difficulties, was an issue with Betty and Ty. Betty frequently asked why people had not heard about these solutions. Ty continuously talked about the need for workshops for Zoom Text locally and statewide. As Schopp et al. (2003, p. 168) described, many computer users with disabilities receive little of no information that will help them with Internet access. Betty, especially, talked about the efforts that others had made to help her situation. Before she discovered Zoom Text, efforts would be made to

kick up fonts for some things, but you kick up your fonts so your word documents are larger but then you go into any web site or your email and it's too small and I couldn't read it, and so making it the same across all the things you use on the computer was one of the difficulties I struggled with for years.

Such efforts by others, while well-meaning, illustrate lack of awareness of the experiences of such users.

Some of the frustrations that the participants encountered are similar to those encountered by any computer user. All three participants commented on the problems they sometimes have with illogical order or arrangement of content, examples of issues that would be universally problematic. Barron voiced one of these issues when he mentioned that he did not like the feature that caused the Web page in some library research pages to time out. He added that he did not like it for the same reason that anyone would not like having to re-enter one's information, breaking a train of thought and taking more time to complete the task. At one session, Betty was searching on the Internet for a particular text book. She was frustrated because (as she learned later after a lengthy and futile search on what should have been the logical page, the publisher's site), the title had changed, costing her considerable time and effort. Other difficulties encountered were non-computer-related, such as the ISBN numbers in the book that Betty was searching for and were too small.

Strategies

Each of the participants exhibited strategies that were unique to their situations. Barron's good memory was a strategy in itself, as he would rely on his memory in copying in URLs or entering information into a form. He used properly designed headings to help him skim through a page when searching for a piece of information. Ty had devised a method to help him see small punctuation marks - the "at" (@) symbol was used in place of the period.

Design

The Web still has Web sites with barriers to Web accessibility, as the literature has indicated. My participants all encountered a variety of barriers which included: inaccessible Flash files; background colors that were confusing*;* font sizes that made the text illegible; inaccessible forms. These barriers were often mentioned in the literature (Harrison, 2002; Hackett & Parmanto, 2005); Sloan et al.(2000).

Of the Web sites that my participants visited, the most accessible were the commercial and university Web sites that were most likely viewed by the greatest number of users. Barron had remarked that because of the demand by users, large commercial Web sites were going to be accessible.

Many perceived barriers are due to design of a Web site's content, rather than Web accessibility infractions. Betty mentioned how frustrated she was when she could not find a particular book. She discovered that the Web site itself did not contain complete information about the book. Barron had

mentioned not liking the feature of Web pages that cause the page to time out, but he commented that it was for the same reason anyone else would dislike this feature.

I have presented instances of the barriers in the chapters dealing with each participant. Such barriers as too-small font, or unlabeled forms, or others described in the study, are directly related to the design of a Web page. The most problematic barriers for each participant, as summarized by each of them are as follows: for Barron, inaccessible pdf files, Flash embedded in Web pages, and inaccessible forms and captchas; for Betty and Ty, font sizes and color contrast. Appendix G lists the names and URLs of most of the Web sites that the participants experienced and shared with me. Although a variety of sites from commercial, governmental, educational, and non-profit groups were used, all participants did not view all sites.

Perhaps the study indicates the acceptability of many Web sites. Barron commented, *"I find the Web to be generally accessible."* But this contrasted with Ty's strong statements (*"I use Zoom Text program but hard to on website pages.")* about his not using the Web very much, especially because of the small size of the font, the distracting elements such as poor color contrast and graphics, and blinking text. Betty commented as well about the illegible color combinations on most of the sites she visited in our sessions (*"this stuff, navy on blue is hard to read, well, even black and orange is hard to read; the brighter the color generally, the harder it is to read anything.*".

In asking my participants to look at Web pages, I made the effort to use Web sites with and without the W3C Conformance symbols. These symbols indicated that the page had been designed according to the W3C guidelines. However, Ty's search on one such Web site certainly revealed that it was not accessible for him. Nothing was clearer to me during my research that the word "accessible" does *not* mean accessible to all viewers. Something that was accessible for the JAWS screen reader and gave Barron no trouble was not necessarily accessible to my low-vision participants to whom size of font and background color were serious concerns. The many variations in the barriers themselves as well as the impacts on users make a one-size-fits-all solution for Web accessibility impossible.

Communication

The role of communication played a key part in my observations. In addition to the 'language spoken,' the mode of communication impacted my findings. I communicated with Ty through a second keyboard. Having to type, rather than just speak, directions created a situation where typos or other miscommunication were possible. Ty was not familiar with such shortcut keys as cut and paste which might have facilitated the task of entering a URL. In asking Barron and Betty to review a certain page, I merely had to say or spell the URL and they could type it into the address bar of the browser. I had more unanswered questions from Ty than from Betty and Baron. When analyzing my communication with Ty, I gained insight into how he communicates. I

realized that I did not know enough about the Deaf culture to understand some of the vocabulary he used, although I was able to use the context of the conversation to get meaning. I was to learn that English is not the first language of the deaf, and as I did not know ASL, I had placed us both at a disadvantage for communicating. At one point, when he said, *"That is all; let us quit about deafness...,"* he was likely expressing his impatience with the assumption that he was disabled, as deafness is not a disability in Deaf culture (Harris, 1995, p. 191).

Similarly, in communicating with Barron, I gained insight into how he viewed aspects of the computer. I would ask Barron about something on the "right side of the Web page," he would remind me that from his perspective, there is no 'left' or 'right' side of the page, only 'beginning' and 'end.' With both Ty and Barron, I used, in essence, a different language from what my participants used. In Ty's case, I failed to recognize cultural aspects; in Barron's case, I used meaningless terms. As much as a foreign language presents unfamiliar terms to the person who does not know the language, so the discrepancy between the vocabulary of a more computer-literate person presents communication problems. In this sense, while I felt my participants were minimally computer-literate, computer literacy was a consideration.

The ease with which I communicated with a participant impacted my interpretation of the data. Ty relied on sign language to be "heard," yet I could not "hear" him because I did not know American Sign Language. While we communicated via a keyboard and email, the more direct communication

through give-and-take that would be desirable during an interview was not possible. I was fortunate to be able to review Ty's answers in an interview between Ty and a local radio interviewer who had an interpreter in the interview. I did discover halfway through the sessions that I could write on a sheet of paper, get his attention, and he could use the scanner that magnified my message so he could see it. My notes to myself included my frustration that I could not engage in free exchange of ideas with him, as I could with the other two participants.

As I interviewed Barron, and then transcribed from the tape, the conflict between listening to our voices and JAWS reading the content was distracting. Since I was not studying the content of the Web pages (but rather whether the participant could access it), I did not try to capture JAWS sounds, but it was one more instance of something that interfered with communication and a smooth documentation of the interview. My listening conflict with JAWS was similar to my problem with Ty. In both situations I needed to figure out a way to get my own comments in without disrupting their flow of conversation. With Barron, he needed to be listening to JAWS so that he knew what he was 'looking at.' With Ty, he was on-task at the keyboard. Neither would necessarily be aware that I had something to say unless I got their attention.

What are the experiences of computer users with visual disabilities using the Internet? The data from this study certainly support my title's first statement: When the Disability Is Not the Problem. That is, the three individuals I studied were not lacking coping skills due the disability, but

rather, inaccessible elements in the Web design of some Web pages were presenting such obstacles to their accessing the content, that even their coping skills - patience, computer literacy, familiarity with a Web page, perseverance - were insufficient to ensure a non-frustrating experience on the Internet. The study provided a user perspective called for in the literature. Chilson (2002) and others called for personal interviews in exploring the accessibility of higher education Web pages. The difficulties that each of my participants did experience on the Internet during the sessions of interviews and observation with me were due to elements in the design of the Web pages that they examined. Appendices D and E list the barriers that were encountered, barriers that have been described frequently in the literature. Yet solutions are available, and Opitz, Savenye, and Rowland (2003, p. 30) pointed out that "assistance is needed to inform, educate, and support developers in creating an equal online environment" (p. 17).

In response to my request for feedback about our progress through the sessions, Barron pronounced it *"a pretty decent survey of the Web"*; Betty stated that the way I was conducting the study was *"the only way to do it...,"* and although Ty did not directly comment, his comments did also "contribute to the conversation" (Hatch, 2002, p. 221) about Web accessibility. As with the accessibility movement at large, improvement is ongoing. Barron was pleasantly surprised to discover an accessible document, a pdf file that JAWS could read, when he had been used to pdfs that were inaccessible. Likewise, he remarked how 'stunned' he was at the accessible chat that we explored at

one point. I believe that the “equal online environment” that Opitz et al. (2003) described is becoming closer to a reality, as advocates for awareness work toward helping “inform, educate, and support developers in creating an equal online environment” (p. 17).

Recommendations

The discourse on Web accessibility is truly a subset of the discourse on accessibility. Accessibility is all about recognizing the needs of others. The participants of this study showed me that there are barriers on the Web, and our conversations confirmed that awareness - of accessible Web design, of assistive technology solutions, of the cultures of others - needs to be raised. Witt and McDermott (2004) had pointed out that whether or not “these problems are caused by deliberate actions or are inadvertent errors, ... it would seem most likely that a lack of understanding of accessibility issues is central to the issue” (p. 52).

There are still many barriers to Web accessibility due to poor Web design; this situation has been described in the literature, and clearly confirmed in this study. In addition, the study has demonstrated aspects of disability that are also described in the literature. Each participant’s disability impacted not only his/her experiences while using a computer on the Internet, but also each participant’s perspectives and daily life. The study has confirmed the continuing need to “understand how technology impacts society and its members...” (Scherer, 1996, p.169).

Recommendations for Practice

Institutions of higher education should continue to explore alternative instructional tools and methods (such as described by Harrison, 2002) in order to provide for the students with disabilities who require adaptive and assistive technology in pursuing their studies. In Barron's case, the university library had provided a unique Web site for him to use in downloading research articles that had been scanned so that his screen reader could interpret them and he could access the content of the articles for his research.

Assistive Technology

This study is a reminder to provide information about the availability of assistive technology to users who need it, including that majority of people with disabilities who reported not receiving information about how their Internet access could be facilitated (Schopp et al., 2003). Scherer (1996) described the situation as follows: "...You can't want something you've never seen or heard of, so we need to expose people to the equipment so they can be informed consumers and make up their own minds about wanting it and using it" (p. 148-9).

These individuals displayed common frustrations with technology that does not work satisfactorily, especially elements of a Web page that cause a waste of time and effort. Universal Design, which refers to creating products that can be used by as many users as possible, could be the overall solution for achieving the "ease of use... and learnability" that Kaplan-Leiserson (2001) highlighted. Raising awareness of the experiences of all computer users,

including those with visual disabilities, will contribute to filling the gap in technology use between those users who can and the rest of the users who "ought to be able to" access the information on the Internet.

The data in this study concerning design of Web pages could have been a work in itself, as the three participants identified feature after feature that could have been more accessible. The literature has documented the availability of tools to use in achieving Web accessibility (Opitz, Savenye & Rowland, 2003; Flowers, Bray & Algozzine, 1999; Stein, 2002; Chilson, 2002; Sloan et al., 2000; Hackett & Parmanto, 2005). A similar study could follow users with visual or other disabilities through a usability study, not only with Web pages, but also one in which interaction with a computer in general is examined.

A future study could address the actual obstacles to universal Web accessibility, providing context-sensitive solutions. While there have been many such studies already, the technology is constantly changing, and such a study will continue to be relevant because of the simple fact that the variety of 'glitsy' developments in technology has presented, and will continue to present, difficulties for so many users. Yet I believe that designers could be trained to follow the basic guidelines that result in accessible Web pages, an inevitable result when, as a classmate who was a programmer herself commented, *things are done right, like they are supposed to be*.

As relevant as any issue is the usefulness of this study to the field of instructional design, as designers produce distance learning and other online

learning products. Future studies of learner characteristics should include highlights about online learners with disabilities. This necessity to train users in the use of assistive technology has been highlighted by Zeng (2004) and others, and voiced by two of my participants.

I thought constantly about a question that I was asked by a Web developer about ensuring the accessibility of his Web designing: *What do I need to do? - Just tell me and I'll do it.* The answer can be found in the findings of this study. The study has contributed to those efforts to raise awareness of *what they need to do* to ensure accessible Web sites. *They need* to design Web sites with font that is adjustable by the user; *they need* to provide alternative content for documents like inaccessible pdf files, or make them accessible; *they need* to limit the amount of text on a screen to a minimum; *they need* to use appropriate color combinations and contrast; *they need* to think about accessibility when designing Web pages. And, of course, *they need* to educate the users in how to interact constructively with Web pages, whether through knowledge of techniques, or use of assistive technology. Fortunately, there are many resources about Web accessibility, on and off the Internet itself. Unfortunately, too many designers are unaware of the issues, or have not chosen to ensure accessibility in their Web pages - and will not until they *have to*, as in the case of U.S. Federal agency Web designers, who must, by law, follow the Section 508 Guidelines.

Recommendations for Research

There is a need for more research in this area. For example, future studies could highlight the experiences of other kinds of disabilities and computer use, or simply replicate this study but concentrate on the interaction with computer hardware and software, or the design of the computer interface itself, rather than just the Internet. From an even more subjective point of view, future studies could focus on the feelings of the participants.

Communication

In addition, future studies could look at the ways we communicate when using a computer, both from the standpoint of feelings, and from the standpoint of interaction. I experienced frustration when I could not simply wave a hand or start talking for Ty and Barron to hear me. Furthermore, I would have benefited from guidelines for using two keyboards and email to communicate, as I did with Ty. A future study might establish the preferred 'language' of the participants, and enable a more context-sensitive perspective.

Concluding Comments

We look at the world through our own eyes, ears, smell, touch and taste. I wanted to show someone else's view of the world of the Internet, as "seen" by three individuals with a range of visual disabilities. If the experiences of such computer users can be understood, maybe the experiences of computer users with other disabilities can be understood, and

with this understanding, computer products, including Web pages, can be designed to be as accessible as possible.

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APPENDICES

APPENDIX A

Characteristics of Participants

Participant	***Age***	***Gender***	***Type of visual disability***	***Adaptations or assistive technology used with a computer to access the Internet***	***Level of Education***
Barron	24	M	Blindness from birth	JAWS with a Toshiba PC laptop;	Master's Graduate Student
Betty	58	F	Low vision all her life, lost more vision in last four years	Zoom Text with a PC desktop	Ph.D.
Ty	69	M	Usher Syndrome: gradual decline of sight	Zoom Text with a PC desktop	Bachelor's Degree

APPENDIX B

Consent Form

Proposed Informed Consent Form:

I am Harriette L. Spiegel, a doctoral student in the Department of Instructional Technology, Health, and Cultural Studies in the College of Education at the University of Tennessee, Knoxville.

Thank you for voluntarily participating in my doctoral research entitled "When the Disability Isn't the Problem - Experiencing the Barriers to Web Accessibility: A Study of the Experiences of Computer Users With Visual Disabilities Using the Internet." The benefits of the study are that awareness of Web Accessibility, the degree to which a Web page is accessible by all users, will be raised by bringing attention to the actual experiences of computer users with disabilities.

Please read this Informed Consent Form and enter your name at the bottom of the page if you agree to the statements in this form. Please enter your initials at the bottom of this first page.

- You may withdraw from this study at any time.
- You agree to be interviewed and observed as you use the computer and answer questions that I ask regarding your experiences using a computer, especially on the Internet. I will be observing your actions and reactions as you use the computer to access Web pages, and I will be interviewing you to explore your experiences as you use the computer on the Internet. If you wish, you may provide any information that is relevant to the study. This information will be analyzed with the rest of the data collected.
- In order to identify these experiences, I will be observing and interviewing you for approximately an hour at a time, and for at least eight sessions (during approximately two months), with weekly sessions initially planned. You and I will establish a schedule for these sessions.
- All data collected from this study will be qualitatively analyzed and the results will be presented in a doctoral dissertation.
- The identity of the participants will remain confidential. The sessions will be videotaped and audiotaped and transcribed by me and the videotapes and audiotapes will be destroyed after transcription. The video camera and audio recorder will be started and stopped by me so that no other individual will be present. I am the sole viewer of these tapes. By videotaping each session, I will be able to record accurately any keyboard or mouse actions taken by the participants while using a computer, and these movements can be captured by the video camera. Furthermore, it is important to capture all movements, body language, or statements made by the participants, and a videotaping and audiotaping of the sessions will enable me, the researcher, to include all relevant data in my analysis.

initials_____

APPENDIX B, continued

Consent Form

- There is minimal risk of harm or discomfort to you related to the observation and interviews that will be conducted. None of the procedures that I will conduct are experimental in nature. You will be observed and interviewed while you use a computer in a location of your choice. The information in the videotapes and audiotapes will remain confidential and will be stored securely. Nobody besides me will have access to the videotapes and audiotapes, nor will they be used for any other purposes besides my transcription and use of data in the study. No reference will be made in oral or written reports which could link you to the study. The videotapes and audiotapes will be destroyed after transcription, and the transcripts will be stored in a secured location at the University of Tennessee and destroyed after three years.

You may verify this study at the Office of Research, University of Tennessee, (865) 974-3466. My Dissertation Committee Chair is Dr. Edward Counts, Professor, Instructional Technology, Health and Cultural Studies, (865) 974-4246.

Thank you for your participation,

Harriette L. Spiegel
Ph.D. Candidate, Instructional Technology
University of Tennessee at Knoxville

Please enter your name below.

_____

Please enter your signature below if you agree to participate with videotaping/audiotaping.

_____

Please enter your signature below if you agree to participate without videotaping/audiotaping.

_____

DATE _____

APPROVED
By Brenda Lawson
MAY - 4 2007

APPENDIX C

Interview Protocol

Structured questions concerning criteria for selection of participants:

A. Do you have a visual impairment?*

B. How did you acquire the disability?

C. How long have you had the disability?

D. Do you use a computer to access the Internet at least three times a day?

E. Are you over the age of 18 years?

F. Are you computer-literate? Can you turn on the computer, open an application, compose, save, and retrieve a document, send email, and browse the Internet?

*As defined in the Americans With Disabilities Act of 1990, Sec. 12102. Definitions, (2) Disability (A) - http://www.ada.gov/pubs/ada.htm#Anchor-Sec-49575: The term "disability" means, with respect to an individual (A) a physical or mental impairment that substantially limits one or more of the major life activities of such individual."

As defined on the Web site for the National Federation of the Blind, low vision is "...chronic disabling visual impairments that cannot be corrected with glasses, contact lenses, or medical or surgical treatment. Most people who consider themselves blind would be included in this broad-reaching definition of low vision."

(http://www.nfb.org/Images/nfb/Publications/bm/bm06/bm0610/bm061005.htm

Structured questions to gather basic demographics:

G. What is your age, gender and race?

H. What is your highest level of education?

I. What adaptations or assistive hardware or software do you use to assist you in accessing information on the Internet? Please describe these items in detail.

J. Describe how you use these adaptations or assistive hardware or software to cope with frustrations or barriers on the Internet.

K. What strategies do you use to cope with frustrations or barriers on the Internet?

Unstructured or open-ended questions to use when probing during observation and interviews:

L. What information would you like to find in this Web site?

M. What do you like about this Web site?

N. What do not like about this Web site?

O. How easy is it for you to navigate this Web site - what makes it easy?

P. How hard is it for you to navigate this Web site- what makes it hard?

Q. What is your overall impression of this Web site? Please explain.

R. What would you change about this Web site and why?

APPENDIX D

Design Features Pertinent to Blind Computer Users (Using JAWS)

Design Feature - Challenging	***Design Feature - Desirable***
untagged pdf documents	tagged pdf documents
drop down boxes that do not allow use of mouse	combo boxes accessible
Flash content	logical arrangement of content
inaccessible forms (text fields not labeled)	forms with text field labeled
inaccessible browsers (Firefox)	
unlabeled graphics	labeled graphics
captcha	
Blackboard features	
breadcrumbs	
colors (blue)	

APPENDIX E

Design Features Pertinent To Low Vision Computer Users

Design Feature - Challenging	***Design Feature - Desirable***
font size too small, including links and drop-down boxes, ISBN numbers	big type
light blue; white on blue	Drop down box with white, high contrast
pretty in pastels	black type on white background
drop down boxes with large cursor	pdf files without color
light colors	minimal graphics
too much text on a Web page	
lengthy content, too much scrolling	
graphics hard to read	
white text on pale background	
blue on blue	
black on pink	
navy on white	
white on blue	
yellow on blue	

APPENDIX F

Computer Programs And Tools Used By Participants

Program Name	***User***
Zoom Text	Betty and Ty
JAWS	Barron
Doc Reader	Ty
Google Accessibility toolbar	Ty

APPENDIX G

Web Sites Visited

Web Site Name	***URL***
Chronicling America: Historic American Newspapers (BETA)	http://www.loc.gov/chroniclingamerica/
The University of Tennessee at Knoxville	http://www.utk.edu
SeniorNet	http://seniornet.org
Amazon (English and German)	http://amazon.com
Orbitz	http://www.orbitz.com/
Expedia	http://www.expedia.com/
Iowa City Public Library	http://www.icpl.org/community/elected/schools.php
LowVision.com	http://lowvision.com
Cracker Barrel	http://www.crackerbarrel.com/location.cfm?state=TN
Lippincott, Williams and Wilkins Publishers	http://www.lww.com/index.html
ETTAC	http://www.discoveret.org/ettac/index.htm
PubMed	http://www.ncbi.nlm.nih.gov/sites/entrez
MedLine	http://medline.cos.com/
UTk Libraries	http://www.utk.edu/librariesandtech/
Gateway Computers	http://www.gateway.com/
EASI	http://www.rit.edu/~easi/
Sparks SteakHouse	http://www.sparkssteakhouse.com/
Lawry's	http://www.lawrysonline.com/

APPENDIX H

Logos Used by Web Sites to Indicate Compliance with WCAG: Bobby and Priority Logos



Bobby logo: Web Accessibility Icons and Graphics at

http://aware.hwg.org/tips/icons.html Bobby is no longer freely available (Feb. 2008)



http://www.w3.org/WAI/WCAG1AA-Conformance



http://www.w3.org/WAI/WCAG1AA-Conformance



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Guidance for using these logos on a Web site are found at the W3C WAI "W3C Web Content Accessibility Guidelines 1.0 Conformance Logos" at

http://www.w3.org/WAI/WCAG1-Conformance

APPENDIX I

Descriptions of Pilot Studies With Computer Users With Disabilities

I was teaching a blind student in a technology-for-teachers class at a local community college in Tallahassee when I first heard a screen reader read the contents of a Web page to her and I observed the frustrations she was experiencing, as the monotonous voice relayed every useless tag and ignored any informational graphic that was not labeled on the poorly designed Web page that she was viewing. Around the same time, I became aware of the issues surrounding the accessibility of the Internet I can thank Dr. Lou Schwartz, of the Florida State University faculty, for his enthusiasm for the "Bobby Approved" icon which at the time (circa 2000) was a standard for validation of Web Accessibility. In subsequent technology for teachers/Web design courses, the use of "alt tags" to describe graphics in designing Web pages was encouraged - but that was the extent of my awareness or acknowledgment of Web accessibility.

My interest intensified in the last few years, when volunteer work with the East Tennessee Technology Access Center and pilot studies in research classes enabled me to observe computer users with a variety of disabilities, including spinal cord injury, cerebral palsy, traumatic brain injury, and visual disabilities, as they accessed content on the Internet, including distance learning classes. I observed a computer user with paraplegia due to a spinal cord injury speak into the computer using the speech-to text program, Dragon

Dictate, and wrestle with inaccessible Web page code in a distance learning class he was taking. The only motion he could control was a slight tilt of his head which controlled his wheelchair. This individual was outfitted with a headset and microphone, and, using the Dragon Dictate program, he would speak into the computer to manipulate the cursor and perform actions to access the information on a Web page. Among other difficulties, this individual was confronted with Web page design that did not allow ease of navigation, requiring, instead, mouse action for completing most tasks (distance learning pilot study with ETTAC and SEDBTAC, 2003).

I observed an individual with cerebral palsy maneuver the inaccessible code of a community college web site as he tried to register for classes. His mobility was so severely restricted that he used the computer with one knuckle at a time, swinging his good arm over with great effort (volunteering with ETTAC, 2005).

I observed an individual with traumatic brain injury as he struggled to read Web pages that were disorganized and wordy. His sense of humor came through when he commented that even older computers had more memory than he now had (pilot study, 2004). But he also emphatically voiced, in defiance of the attitudes of others toward his disability, a universal sentiment: “I am just like anyone else!” (class project, 2004).

I observed an individual with low vision struggling with the poor design of Web pages that she could not read. She was confronted with the challenges of a distance learning course that had no links to explanatory

resources, or Web pages that had no mechanics for the user to adjust font size. This individual also complained about the assumption seemingly made by Web designers that the user understands all technical language (distance learning pilot study with ETTAC and SEDBTAC, 2003). I observed the frustration, time demands, and waste of effort that poor Web accessibility demanded of these individuals.

VITA

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