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E-Commerce for the Blind and Visually Impaired

An Interactive Qualifying Project Report

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by

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Abstract

This project, with the help of the Danish Association of the Blind, establishes guidelines on how an e-commerce web site can be made accessible to visually impaired users. It is the goal of this project to offer Merkantildata, suggestions for making their web site more accessible, specifically for their e-commerce web site. The guidelines developed will be available to other companies who are interested in making an accessible e-commerce web site in the future.

Executive Summary

The main goal of this project was to critique the e-commerce web site of Merkantildata, and make suggestions of how to make it accessible to the blind and visually impaired. This was important to the Dansk Blindesamfund (Danish Association of the Blind), the project sponsors, because they are business partners with Merkantildata, an Information Technology firm. They specialize in consulting through partnerships with other companies, as well as merchandizing computer hardware and software. The DAB orders products and services from Merkantildata; therefore, it would be in their best interest to make the web site accessible in order for the blind and visually impaired at the DAB to be able to search and order products from their web site.

This report tries to cover all aspects of the project topic, including the background needed in preparation for helping those individuals gain access to e-commerce. Blindness, as well as other visual impairments, was first researched in order to get a sense of how many people are affected by this disability and inaccessibility of e-commerce web sites. Worldwide and Danish statistics of the numbers of people who are blind or have visual impairments were reported for that same reason.

Legislation was examined next to find out about the laws that protect blind and visually impaired people from being able to participate in all available opportunities. Internet services are violating the Americans with Disabilities Act (ADA) by not making web sites accessible to everyone. Denmark does not have legislation like the United States, but they do have policies that protect the disabled. Denmark's perspective towards accessibility of the handicapped is different than that of the United States. Denmark is against having legislation, like that of the Americans with Disabilities Act in

the United States, "protecting" those with disabilities from being denied the same rights as all other citizens. The Danes feel that if such legislation people will be more interested in lawsuits and dispensations and overlook the real purpose. The point that is trying to be made public is that everyone should want their web site to be accessible to everyone and it would be a good example to set forth if they market their web site as such. The disabled are not looking to have special treatment, they just want to be able to access information and tools that can be as useful to them as anyone else in the world.

Products were researched for an idea of how the accessibility of computers and/or the Internet is attained. Without these products, people who are blind or visually impaired would have to depend on others if they would like to access a computer, the World Wide Web, e-mail, e-commerce, etc. A survey was developed and distributed to blind organizations and blind individuals via e-mail in the United States to find product information and what type of problems are encountered when accessing a computer/Internet. Also, e-mails were sent to companies who sell products for blind individuals to access a computer, in order to find out whether they have any products specifically for navigating e-commerce web sites.

Consequently, JAWS (Job Access with Speech), which is a type of screen reader, was examined since it is the tool that is most prevalent in Denmark. It is the only screen reader that is both translated into Danish and can be used for accessing the computer and navigating the Internet. Henter-Joyce produces this device and a group affiliated with the DAB makes the translated script for the Danish version available.

The background of e-commerce was examined in order to better understand what it does and how it benefits the public. The security issues of shopping online needed to

be reviewed in order to make sure that an individual's personal information, such as a Social Security Number or credit card number, is secure.

The team developed an online survey to be given out to individuals at the project site, the Danish Association of the Blind, to get an idea of how the Danes feel toward e-commerce security and privacy issues. Those working at the DAB were asked to participate in the surveys, since they were easy to contact and were able to put time and effort into answering the questions. One survey was given to those who have never used e-commerce to find out why they never did so, and the other survey was given to those who have used e-commerce to find out whether they experienced any problems when shopping online.

It was determined through this survey that blind individuals could benefit more from e-commerce than any other individual since it is convenient for them to order products at home or at the workplace. Most of the sighted individuals who filled out the survey and never used e-commerce did not do so due to the fact that they like to see and feel what they are buying and also because they feel insecure with the privacy issue that goes along with shopping online. Another observation that was noticed, due to the surveys, is that those individuals who have never used e-commerce are not aware of the new developments in security of online shopping and those who have used e-commerce are familiar with them. Therefore, it also can be concluded that those individuals who have never used e-commerce have not done so because they are not educated about online shopping. The individuals who have used e-commerce have not experienced any security or privacy issues; therefore, we can assume that e-commerce is not really insecure.

The project report includes information on the World Wide Web Consortium (W3C), which began the 1997 Web Accessibility Initiative (WAI) project that was intended to specifically address the issue of Internet accessibility. As part of this project, the W3C has developed a recent version of HTML that includes accessibility enhancements along with a preliminary accessibility guidelines document for reference by web page designers. Apart from the work done towards establishing a set of standardized guidelines for web site design by the W3C and its WAI group, there are other organizations that have also set up their own sets of guidelines for web site designing. One such organization is the Videncenter for Synshandicap that developed a set of guidelines for web accessibility. These guidelines have been an integral part of making web sites accessible. However, the problems specific to e-commerce have not been as widely addressed as those of general web sites. Therefore, it was a goal of this project to make guidelines specific to accessibility of e-commerce web sites.

The process of critiquing the company's web site was done by running JAWS, the screen reader used by the blind to access computers/Internet, to experience firsthand what is read by the screen reader. The contrast of the computer monitor was lowered in order to simulate blindness for part of the critiquing process. A list of problems with the accessibility of the web site was determined by this method and by having Bue Vester-Andersen, the technical consultant at the DAB, run through the web site himself to find what types of problems he encountered. This was a good way of determining if all of the current problems with the web site had been detected since Bue is blind. If he had difficulty understanding something on the web site, it was something that needed to be addressed.

Along, with the list of problems, a list of suggested solutions was determined for each, by searching web accessibility pages and asking Computer Science professors at WPI, the Webmaster of WPI, and Bue Vester-Andersen. Additional suggestions for some of the problems were determined through further experience with the critique of the web site. With the help of Bue, the suggestions were determined to be complete and sensible.

We hope that this project serves as a starting point for e-commerce companies to "follow in the footsteps" of Merkantildata's interest in making their web site accessible. Accessibility to e-commerce websites may prove to be a vital part in the current trend for growth in Internet businesses.

Acknowledgement

We would like to thank the people at the Dansk Blindesamfund; without their presence and support our project would not have come about. Specifically, we would like to thank Mette Røhe, our liaison at the DAB, for her guidance and suggestions during this project, as well as the time she put into finding us the right resources to complete our project. We would like to thank Bue Vester-Andersen for showing us how JAWS works, his technical advice, his help in critiquing the web site, and his support during the project. We would like to thank Lars Nielsen for sponsoring our project at the DAB. Thank you to Kim Hansen and Thomas Madsen for the support with software and hardware needed, as well as with problems encountered with the network. We would like to thank Morten Hadberg for his help and enthusiasm in making Merkantildata's web site accessible. We would like to thank Frans Storr-Hansen for information regarding Denmark's policies and web accessibility. Thank you to Amy Marr, Wendy Chisholm, and Professor David Brown for technical advice on matters concerning web pages. We would like to thank Professor Vaz for his suggestions and comments concerning our project. Much gratitude goes to our project advisor, Professor Lee Becker, for his continual guidance and support throughout the entire project and insightful suggestions and comments about our project. Last, but not least, we would like to thank Professor Thomsen and Professor Pedersen for help in preparing us for this project.

1 Introduction

People who are blind or visually impaired have many obstacles to overcome, especially with new technology of today such as computers. The Internet brings information right to our fingertips. Web sites are *accessible*[1] to everyone except those who are blind or visually impaired. These people seem to have been forgotten by those designing web sites for information, business, or e-commerce. This project, with the help of the Danish Association of the Blind, is to set up correct guidelines on how an e-commerce site should be made accessible. It is the goal of this project to offer Merkantildata, suggestions to make their e-commerce web site more accessible. The guidelines that have been developed will also be available to other companies who are interested in making an accessible e-commerce web site in the future.

This report tries to cover all aspects of this project, including the background needed in order to prepare to help those individuals gain access to e-commerce. In section 2.2, blindness and other visual impairments were researched in order to get a sense of all those who need help with this type of technology. Worldwide and Danish statistics, displayed in section 2.2.3, show the numbers of people who are blind or have visual impairments.

At the same time, legislation was examined to find out about the laws that protect blind and visually impaired people to be able to participate in all available opportunities. As mentioned in section 2.4, Internet services are violating the Americans with Disabilities Act (ADA) by not making web sites accessible to everyone.[2] Denmark was

[1] See Glossary for definition.
[2] "National Federation of the Blind Sues American Online, Inc., Charges Internet Service Inaccessible to Blind," U.S. Newswire, November 5, 1999, p1008308n0018.

found not to have legislation like the United States, but they do have policies that protect the disabled as mentioned in section 2.5. Internet companies need to keep in mind that web sites should be accessible to everyone and should make changes whenever necessary in order to make this a reality.

Two of the most important parts of this paper are sections 2.6 and 2.7, describing the research that was conducted on the different guidelines for making a web site accessible to the blind and visually impaired. This research gives a better understanding of what needs to be done to make a web site accessible for everyone, and helps when critiquing an e-commerce web site.

In section 2.3, products were researched for accessibility of computers and/or the Internet. Without these products, people who are blind or visually impaired would have to depend on others if they would like to access a computer, like the World Wide Web, e-mail, e-commerce, etc. A survey, displayed in sections 3.4 and 3.5, was developed and distributed to blind organizations and blind individuals via e-mail in the United States to find out product information and what type of problems are encountered when accessing a computer/Internet. Also, e-mails were sent to companies who sell products for blind individuals to access a computer, in order to find out if they have any products specifically for navigating e-commerce web sites. Example correspondence is displayed in section 3.3.

Consequently, JAWS (Jobs Access with Speech), a popular *screen reader*[3], was examined since it is the tool that is most prevalent in Denmark. These products help those individuals to not have to depend on others for tasks that people usually take for

[3] See Glossary for definition.

granted. The Internet is a huge resource for innumerable subjects; therefore, everyone has the right to use this technology as part of his or her daily life.

In section 2.3.4, the background of e-commerce was examined in order to better understand what it does and how it benefits the public. The security issues of shopping online needed to be reviewed in order to make sure that an individual's personal information, such as a Social Security Number or credit card number, is secure.

The team developed an online survey to be given out to individuals at our project site, the Danish Association of the Blind, to get an idea of how the Danes feel toward e-commerce security and privacy issues. These surveys are displayed in section 3.8. One survey was given to those who have never used e-commerce to find out why they never did so, and the other survey was given to those who have used e-commerce to find out whether they experienced any problems when shopping online.

Chapter 5 includes a list of suggestions on how Merkantildata and other companies can change their e-commerce web site to make it accessible to the blind and visually impaired, as well as a list of guidelines for an accessible e-commerce web site. A critique of Merkantildata's current e-commerce web site was done according to our knowledge on the matter, as gathered from our experiences with the background research. This included the types of technology that is now employed in the USA, the ADA standards for publicly accessible web site design, and the W3C guidelines.

2 Literature Review

This literature review tries to cover all aspects of the background needed in preparation for helping the blind and visually impaired individuals gain access to computers. Different types of visual impairments, other than blindness, were researched in order to get a sense of all those who need help with this type of technology. Consequently, the worldwide and Danish statistics of the numbers of people who are blind or have visual impairments was researched for that same reason.

Legislation was examined to make sure that there are laws that protect the blind and visually impaired and their right to equal opportunities. Internet services are violating the Americans with Disabilities Act (ADA) by not making these web sites accessible to everyone.[4] Denmark does not have legislation like the United States, but they do have policies that protect the disabled. Internet companies need to keep in mind that these web sites should be accessible to everyone and should make changes whenever necessary in order to make this a reality.

One of the most important parts of this paper is the section describing the research that was conducted on the different guidelines for making a web site accessible to the blind and visually impaired. This gives a better understanding of what needs to be done to make a web site accessible for everyone, and helps when critiquing an e-commerce web site.

Additional research on products for computer and Internet accessibility was conducted. These products allow the blind and visually impaired to independently access a computer, the World Wide Web, e-mail, e-commerce, etc. More specifically, the popular

[4] "National Federation of the Blind Sues American Online, Inc., Charges Internet Service

screen reader JAWS, was examined since it is the tool that is most prevalent in Denmark. The Internet serves as a major source of information; everyone has equal right to this technology.

The background of e-commerce was examined in order to better understand what it does and how it benefits the public. The security issues of shopping on line needed to be looked over in order to make sure that an individual's personal information, such as a Social Security Number or credit card number, is secure. This background was helpful in order to plan what should be done when arriving at the project site.

2.1 Dansk Blindesamfund

The Dansk Blindesamfund, or Danish Association of the Blind (DAB), is an all blind organization, which means that DAB is formed and run by people who are blind and visually impaired. The Association was founded in 1911 by a group of blind and visually impaired persons and has grown steadily both in terms of membership and influence. Today, it has approximately 12,000 members and twenty-three local branches throughout Denmark.[5]

The Association attempts to influence all forms and levels of decision making in government and society to help improve conditions for its members. It helps to secure the legal rights of the blind and the visually impaired, tries to eliminate discrimination, and participates in councils, committees, and advisory bodies to accomplish this goal. It also tries to make others aware of the needs of the blind and visually

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Inaccessible to Blind," U.S. Newswire, November 5, 1999, p1008308n0018.

[5] The Danish Association of the Blind, http://www.dkblind.dk/engelsk_web/indhold_uk.htm.

impaired through visits to schools, health worker institutions, and other groups who have contact with the blind or visually impaired.

The Association recommends better solutions to problems that face the blind. They offer academic and financial support for research in fields such as labor market conditions, modern technology, and research and prevention of blindness. The Association offers financial support to the blind and visually impaired, as well as to other associations of the blind in developing countries around the world. The DAB is not funded through the government, and therefore it relies totally on fundraising, legacies, gifts, and donations for its economic support. Besides financial aid, the DAB offers many services to their members such as consulting and advising, care taking, and educational and recreational activities. The Association also plays a major role in the guide dog program in Denmark. They coordinate the selection of a suitable breed, training courses, and veterinary services for the dogs.

A bi-monthly magazine, pamphlets and articles are published and distributed to its members that include upcoming events, advertisements, news, and information on issues that the DAB is currently working on. [6]

[6] Anderson, Charles R., Hamel, Jessica L., and Svendsen, Jason N., "An Accessible Web Site for The Danish Association of the Blind," An Interactive Qualifying Project Report, May 1, 1998.

2.2 Eyesight

2.2.1 Blindness and Visual Impairments

Blindness is the condition in which a person has total loss of vision. Complete blindness causes problems with the use of computers, but individuals with other visual impairments also have difficulties discerning what is on a computer screen. Legal blindness is a term that is used to define loss of vision so severe that a person can be considered "blind" for such purposes as insurance or disability benefits without having total loss of vision. It has been defined by the Social Security Administration as "a central visual acuity of 20/200 or less in the better eye with the use of a correcting lens. An eye, which is accompanied by a limitation in the fields of vision such that the widest diameter of the visual field subtends an angle no greater than 20 degrees, shall be considered as having a central visual acuity of 20/200 or less."[7]

There are a number of visual impairments, listed below, that affect the ability to see a computer screen.

- Retinitis Pigmentosa
- Macular Degeneration
- Cataracts
- Homonymous Hemianopia
- Glaucoma
- Diabetic Retinopathy
- Nearsightedness (myopia)
- Farsightedness
- Astigmatism
- Eyestrain due to constant use of computers [8]

[7] What does "legally blind" mean? http://www.mayohealth.org/mayo/askphys/qa970725.htm
[8] Eye Conditions, http://www.rsb.org.au/eye.htm.

2.2.2 Types of Visual Impairment

Retinitis Pigmentosa

Retinitis Pigmentosa (RP) is a degenerative, inherited eye condition, which affects the retina, resulting in progressive vision loss. In some cases, people with this disorder experience tunnel vision (as seen in figure 1), while others sometimes lose central vision, leaving peripheral vision intact. Other symptoms are poor night vision and difficulty with glare.

Figure 1: How Retinitis Pigmentosa affects vision.

Macular Degeneration

Macular Degeneration (MD) is damage to or breakdown of the macula, which is the part of the retina that allows us to see clearly and appreciate color. In early stages, central vision is blurred and seeing at a distance or close work is difficult. The eye's peripheral vision remains intact, but blank spots appear in the center (as seen in figure 2). This makes reading, sewing, or seeing faces difficult. Other symptoms include dimming of color vision, difficulty in judging heights and distances, and some difficulty with tasks such as pouring liquids. MD does not lead to total blindness.

Figure 2: How Macular Degeneration affects vision.

Cataracts

A cataract is a clouding of the normally clear lens of the eye (as seen in figure 3). It may vary in its severity, from a small amount of cloudiness to a dense area of haziness. A person with a cataract may have blurred vision, have difficulty with glare, and find bright lights uncomfortable. Colors do not appear to be as bright and objects look dull. Cataracts can cause blindness, but early diagnosis and treatment can prevent this.

Figure 3: How Cataracts affects vision.

Homonymous Hemianopia

This condition sometimes occurs after a stroke or some injury to the brain. It is not a condition that affects the eye. Hemianopia relates to the brain's impaired ability to receive the information transmitted to it through both eyes. The person who is experiencing it has difficulty seeing one side of their surrounding environment, or will report that one side appears different from the other (as seen in figure 4). Hemianopia may be complete or partial. In the case of complete, the person can only see to one side when looking straight ahead. With partial Hemianopia, objects appear different in clarity or brightness. Other symptoms include double vision and difficulty interpreting visual information. In some cases, the visual image may completely disappear or distort.

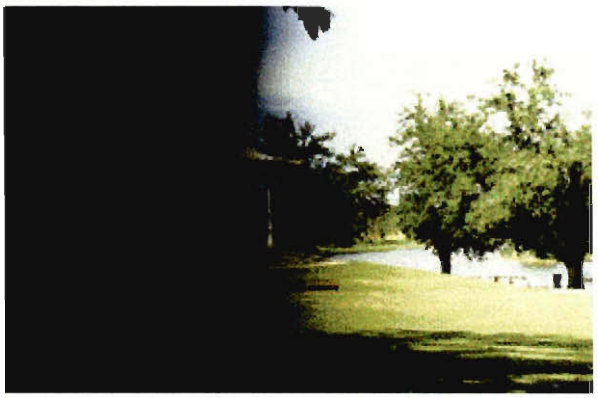

Figure 4: How Hemianopia affects vision.

Glaucoma

Glaucoma is a leading cause of blindness in many countries. If it is diagnosed early, blindness is nearly always preventable. Glaucoma is usually caused by a build-up of pressure in the eye. This pressure causes damage to the optic nerve. The optic nerve transmits nervous impulses to the part of the brain that is responsible for sight. A person's eye is normally filled with intra ocular fluid, which constantly drains and is replaced. In the case of glaucoma, intra ocular fluid is not drained away properly, or it

may be produced in large amount. This causes too much pressure in the eye and the optic nerve is damaged; therefore, blind areas in the field of vision develop. Glaucoma happens slowly, with no noticeable changes until after the damage is done.

Peripheral vision is most affected. The edge of the field of vision starts to fade, causing narrowed vision (as seen in figure 5). Glaucoma can also cause blurred areas closer to the center of vision. Some warning signs include blurred vision, seeing colored rings around lights, loss of peripheral vision, pain, and redness of the eye.

Figure 5: How Glaucoma affects vision.

Diabetic Retinopathy

Diabetic Retinopathy is caused by diabetes, although diabetes does not always lead to loss of sight. Retinopathy affects the retina, which is the back of the eye and is made up of cells that are sensitive to light. A network of blood vessels feeds the retina. Diabetes can cause the blood vessels to break and this can interfere with vision (as seen in figure 6). Blood clots and scars, which may form on the retina, block the light rays from reaching the nerve cells, thus interfering with the cells' nutrition. Complete loss of

vision occurs when scar tissue develops at the back of the eye. This sometimes can pull and detach the retina.[9]

Figure 6: How Diabetic Retinopathy affects vision.

Nearsightedness

Nearsightedness or myopia occurs when light is focused in front of the retina rather than directly on it. This leads to a naturally closer point of focus. A close object comes into focus without the lens in the eye having to work to bring it into focus. Unfortunately, the lens in the eye cannot "defocus", so the distance vision will always be blurry.

Farsightedness

Farsightedness, or hyperopia, is when the eye does not focus light strongly enough to reach the retina. Instead, light is focused behind the retina. For many people, the lens in the eye is capable of adding extra focusing. Thus, if an eye has enough focusing ability, it can focus away farsightedness, and the distance vision will be clear without glasses. However, this can take away from its ability to focus on a near object.

[9] Eye Conditions, http://www.rsb.org.au/eye.htm

Therefore, the implication that the distance vision will be clear but the near vision would be blurry is not necessarily true.

Astigmatism

Astigmatism occurs when the curvature of the cornea is not perfectly round in all directions. In one direction (or axis) the curvature is greater (steeper), and in the opposite direction it is lesser (flatter). The direction of astigmatism is measured in degrees from 1 to 180; 180 degrees is perfectly horizontal, while 90 degrees is vertical. Glasses correcting astigmatism add extra power in the direction needed to equalize the difference in curvature of the cornea.

Eyestrain

Eyestrain refers to a fatigue of the eyes associated with prolonged reading, near work, or reading of a computer screen. When muscles inside of the eye that control focusing are overworked, symptoms can occur. In many cases, these symptoms will not start immediately, but only after several hours of work. When the muscle in the eye becomes fatigued, the eyes may feel uncomfortable or ache. The vision may blur intermittently. A mild headache can occur if the eyes continue to work. In some cases, the muscle within the eye can become so fatigued that it cannot fully unfocus, leading to blurred distance vision. [10]

[10] Eyesight Insight, http://members.aol.com/insighteye/eye1.htm

2.2.3 Statistics

There are an estimated 750,000 blind people in the United States, which are those that have lost complete vision.[11] According to the 1990 population data from the Bureau of the Census, U.S. Department of Commerce, 8.6 million total Americans have some kind of visual impairment (3.4% of the U.S. population). Approximately 1.8 million people in the U.S. have severe visual impairments but are not legally blind.

The statistics of global distribution of blindness and distribution of blindness in Denmark are shown in figures 7 and 8. Table 1 displays the number of Danish individuals who are visually impaired.

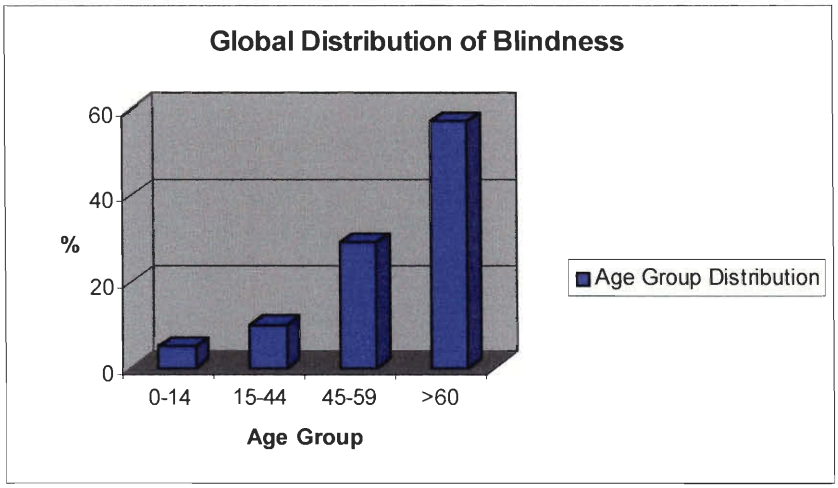

Figure 7: Global Distribution of Blindness

[11] Quan, Margaret, "Reader Opens E-Displays to the Vision-Impaired," Electronic Engineering Times, October 4, 1999, p65.

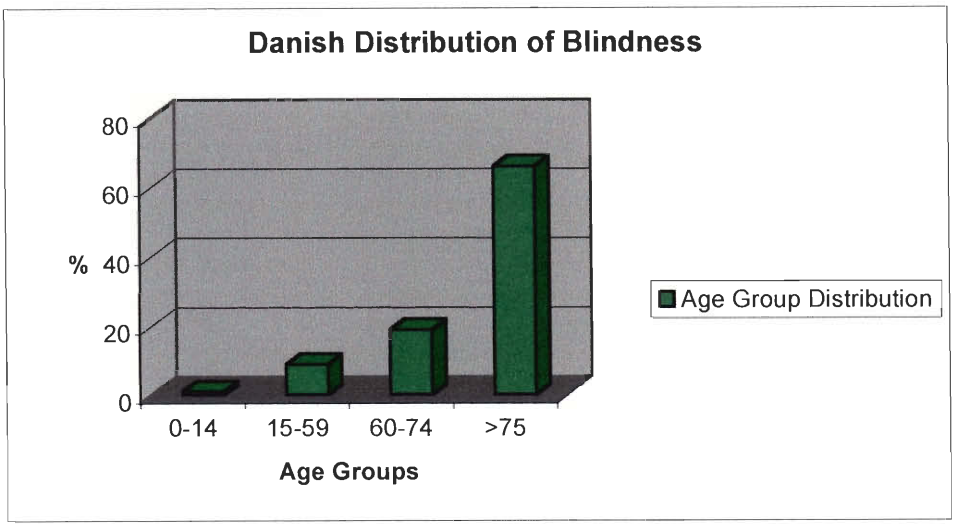

Figure 8: Danish Distribution of Blindness

Visually Impaired in Denmark	
Age Group	Estimated Visually Impaired
0-14	1,700
15-59	9,000
60-74	17,100
>75	64,100
Total Visually Impaired	92,000
Total Population	5,146,400

Table 1: Visually Impaired in Denmark

2.3 Technology

The technologies available for the blind and the visually impaired can be categorized into touch and voice recognition products for general computer access and for the Internet. These tools are listed in the following sections, which describe how the blind and visually impaired access computers and the technology available.

2.3.1 Braille

Braille[12] is a form of communication for the blind that uses raised dots as symbols for word text. Louis Braille of France invented Braille in the 19th century. It originally was used as an old French military code that employed dots to represent words and text. The code made it possible for soldiers to read instructions in the dark. Louis Braille modified the code so that it could become a language used by many blind people. There are two types of Braille. Grade One Braille is character-for-character replacement, and Grade Two Braille represents contractions, words or two letter sequences. According to Margaret Quan from *Electronic Engineering Times* the next step for inventors is to make Braille easier and more readable. [13]

[12] See Glossary for definition.
[13] Quan, Margaret, "Reader Opens E-Displays to the Vision-Impaired," Electronic Engineering Times, October 4, 1999, p65.

2.3.2 General Computer Tools

2.3.2.1 Screen Readers

A screen reader is a device that can read text from a computer screen and convert it to audio sound. One of the screen reader's limitations is its compatibility. The compatibility of the screen reader varies when used on different operating systems. Its performance may also be different when used with different Internet browsers. Another limitation is that it has difficulty making sense of *hyperlinks*[14] (shortcuts to other web sites), *tables*[15] and columns, and graphical interfaces. The price of the screen reader software varies over a wide range. This price is either to be paid by the individual blind user or an e-commerce company. Some examples of screen readers are below.

TALKS

TALKS is a system developed by On Target Marketing[16]. This is a program used by the web page writer. By including TALKS, a blind person will hear all of the content included on a web site and obtain all the information on each page by using their directional arrows on the keyboard. Once accessed, each page's content is read automatically to the web visitor. Placing the mouse over a particular "voice-prompting" icon tells the user what the topic of the section is and can perform all the navigation. The advantage of TALKS audio navigation system is that it can be created from the ground up in a new web site or added as an overlay into an existing web site.

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[14] See Glossary for definition.
[15] See Glossary for definition.
[16] "On Target Marketing," www.ontargetmkt.com/main.htm

Betsie

Betsie[17] is a program developed by the Royal National Institute for the Blind (RNIB). This program is used in the BBC online network. Every web page in this network is programmed with Betsie. Betsie is a screen reader, which enables the blind and visually impaired to access the web site. Before the web page is displayed, Betsie will make various changes in the *HTML*[18] code of the page and remove all *images*[19] and unnecessary formatting. The page that gets sent will be the text content of the page, with all of the links moved to the bottom. One of the limitations of Betsie is that it has not been possible for the BBC network to offer a full text only version of the entire Internet at this time. Betsie will only work with BBC sites.

JAWS Version 3.5

JAWS[20] stands for Job Access with Speech, which is a screen reader developed by Henter-Joyce, Inc. JAWS is a software program designed to work with a voice synthesizer to help the blind and visually impaired to gain access to computer and the Internet. By streamlining keyboard functions, automating commands, and eliminating repetition, JAWS allows the operator to navigate faster and easier. JAWS has the built-in Smart Screen Technology. Smart Screen is the hands-off screen reading technology that allows JAWS to speak any program automatically. It intelligently looks at the screen and determines what to speak, so unfamiliar applications can be used immediately. Menus, dialog boxes and help files are spoken without the need for user set-up. JAWS announces each time a new window is opened or closed, and whenever an application window is

[17] "Betsie Home Page," www.bbc.co.uk/education/betsie
[18] See Glossary for definition.
[19] See Glossary for definition.
[20] "Henter-Joyce, Inc.," www.hj.com

active. JAWS can present text continuously, word by word. It can also spell out words, character by character, with different pitches of sound to distinguish upper and lower case letters. JAWS also recognizes tables and is able to read cell by cell. JAWS can also read *forms*[21], but with some difficulty in notifying the user on multiple-choice questions. The JAWS cursor restriction feature has separated levels, related to where the cursor will be able to move on the computer screen. This feature confines the cursor within the window of focus. This will help the blind and visually impaired user to maintain the oriented navigation. Along with the built-in dictionary manager, users can add new words and edit JAWS pronunciations. JAWS also features a configuration manager, which allows the user to change the way texts are spoken.[22] With this feature, JAWS will be able to announce specially formatted text such as date and price. JAWS version 3.5 is a 32-bit application. This means that it is compatible with the features available in Windows 95/98 or Windows NT 4.0. It also supports other software synthesizers and *Braille displays*[23]. JAWS features support for Internet Explorer, including the ability to reformat complex web pages and list links alphabetically in an easy-to-use list box. JAWS includes the software on CD-ROM, a print quick start manual, a quick reference guide in print and Braille, and basic training audiocassette tapes. JAWS for Windows will install its own software speech synthesizer that works with a Microsoft Windows 95/98 or Windows NT sound card. This synthesizer features support for eight languages, including U.S. English, British English, German, Italian, French, Danish, Castilian Spanish and Latin Spanish. A complete catalogue and price list is available at

[21] See Glossary for definition.
[22] NanoPac, Inc. JAWS, http://www.nanopac.com/JAWS.htm
[23] See Glossary for definition.

http://www.hj.com/Commerce/purchasingoptions.html. A list of JAWS and keyboard commands is in Appendix F.

The technical compatibility of JAWS for Windows, Version 3.5 is listed below.

System Requirements:

- Windows 95/98 operating system, or Windows NT 4.0
- Windows 95/98 or Windows NT compatible sound card
- 30 MB of available hard disk space required
- VGA or higher-resolution video adapter (Super VGA 256-color recommended)

JAWS is designed to work best at 800 by 600 pixels resolution and 256 colors depth. Below is a list of compatible video cards:

- 3DFX Voodoo3 3000
- ATI 3D Rage II C
- ARI All-In-Wonder Pro
- ARI Xpert 98
- ATI Rage Fury
- Cardex S3 Virge DX
- Cardex S3 Savage 3D
- Diamond Monster Fusion
- Diamond Fire GL 1000 Pro
- Diamond Speedstar A50
- Diamond Viper V330
- Diamond Viper V550
- Diamond Viper V770
- Diamond Stealth II S220
- Diamond Stealth II G460
- Diamond Stealth III S540
- Matrox Productiva G100
- Matrox Millennium G200
- Matrox Millennium G400
- STB Velocity 128
- STB Velocity 4400

The following is a list of synthesizers supported by JAWS for Windows:

- Eloquence for JFW (Win NT or 95/98)
- Accent PC (Win 95/98 Only)
- Accent SA (Win NT or 95/98)
- Apollo 2 (Win 95/98 or NT)
- Artic 215 (Win 95/98 Only)
- Audapter (Win 95/98 Only)
- Braille 'n Speak (Win NT or 95/98)
- DECtalk Access32 Software (Win NT or 95/98)
- DECtalk Express (Win NT or 95/98)
- DECtalk PC/Express (Win 95/98 Only)
- Doubletalk LT (Win 95/98 Only)
- Doubletalk PC (Win 95/98 Only)
- FlexTalk Software (Win NT or 95/98)
- Infovox (Win 95/98 Only)
- Keynote Multi Media Software (Win 95/98 Only)
- Keynote Hardware/SSIL (Win 95/98 Only)
- Reading Edge (Win 95/98 Only)
- Microsoft Text-to-Speech Engine
- Multi Voice (Win 95/98 Only)
- Text Assist/Sound Blaster (Win 95/98 Only)
- Sounding Board (Win 95/98 Only)

Below is a list of supported Braille displays:

- Alva Model 1 40 (Win 95/98 only)
- Alva Model 1 80 (Win 95/98 only)
- Alva Model 2 40 (Win 95/98 only)
- Alva Model 2 80 (Win 95/98 only)
- Alva Model 4 40/80
- Alva Satellite
- Braille Lite 18
- Braille Lite 40
- Braille Window/CombiBraille
- Braillex EL All Models
- Braillex 2D Screen
- Braillex Compact/Tiny/2D Lite
- ECO Braille
- Frank Audio Data
- Handy Tech
- PowerBraille 40
- PowerBraille 65/80
- RBT40 (Rabbit)[24]

[24] Henter-Joyce, Inc. JAWS Technical Support, http://www.hj.com/TechSupport/TechSupport.html

2.3.2.2 Touch Display

The Braille Reader

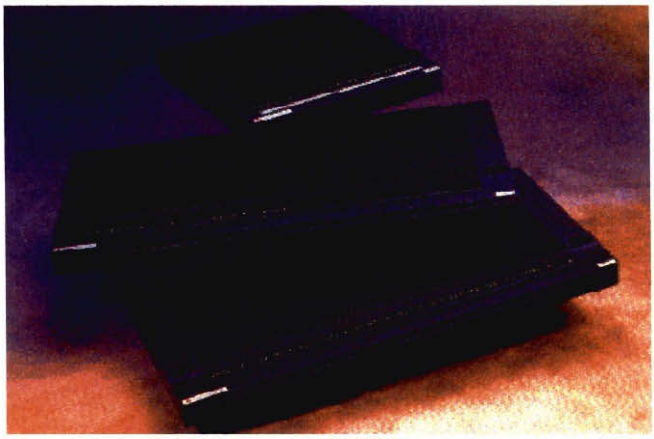
The alternative way for the blind to gain access to Internet is to translate the text into Braille. The Braille Reader was designed by the National Institute of Standards and Technology's Information Technology Laboratory to make text displayed on electronic devices more accessible to the blind and visually impaired. It takes text displayed on an electronic book or personal digital assistant (PDA) and converts them, via Labview software, into Braille. The next step for inventors is to integrate with, or attach to, other reader devices and computers.

By printing out the Braille, the blind will be able to read the page. There are various types of text-to-Braille translators compatible with different operating systems and web browsers. However, this method has many limitations when assisting the blind in e-commerce. One of the limitations is that the translator and the Braille printer cannot process any graphical information. The translator and the Braille printer also have trouble processing any table and text in column form. Another limitation is that it requires additional hardware. In the trend of using portable phones and computers, this is a major disadvantage.

A digital signal is sent to a relay board and transducer board, which trigger a solenoid to create a Braille symbol. The solenoid interacts with a wheel, which has Braille cells placed along the edge. Then twelve actuators inside the wheel are triggered which write dots on the cells as the wheel turns. The user places their two fingers on two exposed Braille cells and reads the Braille as the wheel moves. The compact wheel format allows for long lines of text to be read continuously, which is important for Braille

users who normally read about 120-125 words per minute. Two inventors have filed for a patent but no company has stepped forward to produce the device as of yet. [25]

PowerBraille



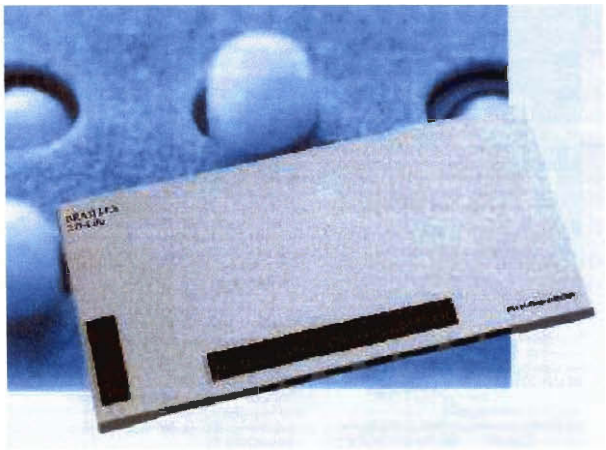
The PowerBraille is a refreshable Braille device developed by the Magnifying Center. It instantly transforms screen information into 8-dot refreshable Braille. Available with 40, 65 or 80 cell displays, the Power Braille provides access to computer platforms. The Touch Sensor Strip routes the cursor to any character on the Braille display with the touch of a finger. In Windows, the Touch Sensors instantly move the mouse pointer to the desired location. Thumb controlled rocker bars allow users to move effortlessly around the screen while simultaneously reading text on the display and provide for independent movement of displays and cursor. Dual window display mode allows users define two Braille "windows" to display information from different screens at the same time. The user can then monitor the status line while simultaneously editing text, and

[25] Quan, Margaret, "Reader Opens E-Displays to the Vision-Impaired," Electronic Engineering Times, October 4, 1999, p65.

configure the system to receive Braille, speech, or both. The PowerBraille display can be ordered at:

http://www.magnifyingcenter.com/cgilocal/store/commerce.cgi?product=BrailleD

BRAILLEX 2D Lite



Introduced in 1975, BRAILLEX was the first electronic device in the world that made use of a refreshable Braille display developed by F.H. Papenmeier, a German company. BRAILLEX 2D Lite offers blind people an optimum access to the information on the screen. Its most important feature is the ability to display the structure of the complete computer screen at one time. In addition to the conventional 40 cells Braille display, it features a vertical display that represents every computer screen line with 4 dots. With a touch over a 3¼" display, the user can fully appreciate the screen layout. Methodically, with BRAILLEX 2D Lite the screen access by blind people becomes more similar to the approach that sighted people's use. They first look at the data structure as a whole, then locate the place which attracts their interest, and only then they start reading.

BRAILLEX 2D Lite Plus supports, moreover, the communication of blind and sighted people, as the sighted can read the contents of the Braille display on the integrated LCD. The complete catalog and price list is available at:

http://www.sighted.com/braille.html#menu

Hard And Software Requirements:

- PC with a free serial interface
- Operating systems: DOS; optionally Windows and OS /2

Technical Specifications:

BRAILLEX 2D Lite

- 40 cell 8 dot piezo Braille display with integrated cursor routing keys, 13 cell vertical display
- Screen reader program for DOS (optional for Windows and OS/2)
- Power supply 115 or 230 VAC
- Dimensions: 55 x 26.5 x 2.6 cm (21.5" x 10.5" x 1")
- Weight: 4.5 kg (9.9 lb.)
- BRAILLEX 2D Lite plus
- As above, but with integrated 102 key PC keyboard and 40 cells LCD
- Dimensions: 55 x 26.5 x 6 cm (21.5" x 10.5" x 2.4")
- Weight: 5.7 kg (12.5 lb.)

PAPENMEIER Braille Displays Price List (in German currency)

- BRAILLEX Tiny 5649.00
- BRAILLEX 2D 80 14075.00
- BRAILLEX EL 2D 40 6842.00
- BRAILLEX EL 2D 66 11380.00
- BRAILLEX EL 80 11680.00
- BRAILLEX Compact 10120.00

2.3.2.3 Voice Input/Output

Emacspeak

Emacspeak[26] is a module that makes the standard Emacs editor speak individual characters, words, lines, or the whole screen. It allows users to create and edit files with speech feedback, run other programs, and verbalize their output, as long as they have a voice synthesizer. Emacspeak works with standard text user interface, not the X Window graphical user interface. It can read a current sentence, column, or the contents of the current window. It can also verbalize keyboard input as individual characters or whole words. The voice rate and other parameters can be changed, as well as having the program speak all, some, or no punctuation.

Emacspeak currently supports the DECtalk Express speech synthesizer from the Digital Equipment Corporation, which is a portable, battery-powered synthesizer that has an unlimited vocabulary. It attaches through the serial port to the computer and has nine natural-sounding voices.

[26] "Emacspeak – A Speech Output Subsystem For Emacs," www.unix.digital.com/demos/freekit/html/emacspeak.htm

Dragon NaturallySpeaking® Essentials 4.0

Dragon NaturallySpeaking Essentials 4.0[27] is software developed by Dragon Systems, Inc. Dragon Systems, Inc. founded in 1982, is a leading worldwide supplier of speech and language technology, including award-winning speech recognition software. Dragon NaturallySpeaking Essentials 4.0 can dictate into virtually any Windows application, including Microsoft Word 97 & 2000, Corel WordPerfect 8 & 9, America Online, and Lotus Notes. Simply click on the *Dragon NaturallySpeaking* button to load the program, and then click on the microphone icon. Now speak naturally into the included headset microphone at up to 160 words per minute. The words appear immediately in e-mail, word processing documents, Internet chat rooms, and Instant Messaging programs – the user can also navigate the Internet by voice.

Top Features

- HIGH ACCURACY - *PC Magazine* reported *Dragon NaturallySpeaking* "achieved 98 to 99% accuracy" in competitive testing!
- BROAD COMPATIBILITY - Dictate into virtually any Windows application, including Microsoft® Word 97 & 2000, Corel® WordPerfect® 8 & 9, America Online®, and Lotus® Notes®.
- FAST SETUP - Learns your voice in just a few minutes so you can be up and running quickly!

[27] "Dragon NaturallySpeaking Essentials 4.0," http://www.dragonsys.com/products/naturallyspeaking/essentials/index.html

- INTERNET-FRIENDLY - Browse the web and use hotlinks by voice, when using Microsoft Internet Explorer 4.0 & 5.0. Talk into chat rooms at up to 160 words per minute!
- VERY LARGE VOCABULARY - A vocabulary of 250,000 terms and more than 160,000 active words assure that: What you say is what you get.
- CONTROL YOUR DESKTOP - Open applications from the Start menu, switch from one application to another, and give commands like "Start Internet Explorer" by voice.
- TEEN VOICE MODELS - Special teen voice models are included so it's easy for young adults to talk into chat rooms and get their homework done easily.
- MULTIPLE USER SUPPORT - Different users can share the same program by creating and storing their voice files on the same computer.

2.3.2.4 Other Software

Puff

Puff[28] is an X Window-based screen-magnification software intended for people who cannot read text at the size that is usually displayed. Puff automatically tracks and follows the mouse pointer, magnifying the portion of the screen around the cursor. The program is capable of magnifying both text and graphics. A visually impaired user can obtain Puff, a 33-KB program, from the Trace Center[29] software library.

BLinux

BLinux[30] enables visually impaired users to install and run Linux on their systems. A simpler method of use is the installation-specific HOWTO documentation files that are printed in Braille and recorded on audiotape so that the user does not need a second computer to read the online documents. Once Linux is running, the user can use the on-line HOWTO files to find the formats that can be handled by speech software and

[28] "UNIX/X Window System Software Toolkit," http://park.org/Guests/Trace/pavilion/unixshar.htm
[29] "Trace Research and Development Center," http://trace.wisc.edu
[30] "Blinux – What's That," www.hzo.zubenet.de/blinux

screen readers. The designers working on BLinux will continue to add features previously unavailable under Unix. Some examples of the new features are support for Braille and speech, a web browsing facility, etc. Users can find the source code on BLinux's archive site.[31]

2.3.3 Internet and the Blind

Current technology is unable to display Braille on the computer screen, so the blind cannot rely on their sense of touch to read from the computer monitor. Without the sense of touch, they have to rely on their hearing. Screen reader technology is available which reads the text material aloud, enabling the blind and visually impaired to receive the information. This also enables the blind and the visually impaired to use e-mail, mailing lists, and gain access to newsgroups, which are the essential parts in e-commerce.

The fundamental problem arises with the increasing dependence of the World Wide Web on a graphical user interface (GUI). This is due to the limitation of the screen reader that cannot voice graphics. Unless the graphics are "tagged" with a text description that must be added during the design of the page, the graphical information will remain inaccessible to the blind. There are also hypertext links on the web page, which link to other pages where additional information can be found. If these links are graphic buttons or other images, they are useless to the blind. The tendency of e-mail authors to extract faxes in the form of graphic images in their e-mails creates another problem. For the same reason, because faxes are re-produced in graphic form, they are not accessible to screen readers and, therefore, to the blind user.

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[31] Lazzaro, Joseph J., "Unix Helps the Disabled," Byte, April 1997, v22 n4, p51(2).

The layout of the page can also be a problem if the information is displayed in table or column form. Screen readers generally read from left to right across the line, and from top to bottom. This makes tables and columns almost impossible to decipher.

Simply Internet 16 bits

Simply Internet 16 bits is a freeware offered by EconoNet International, Inc. Simply Internet is a suite of 16 bit applications that will run on any version of Windows, including 3.1, 95 and NT (Simply Winsock does not support TCP/IP on Windows 3.11). This company has integrated all its Internet utilities in a single package called Simply Internet. This package includes an e-mail client, a Telnet client and a Winsock Dialer (RAS). All these utilities are speech friendly and speech enabled using the SSIL driver interface (most Synthesizers support this interface standard). This means that the screen reader is not required to use these. The only required hardware is a Speech Synthesizer or a Sound Blaster card with Text Assist. The three applications included are called Simply Mail, Simply Telnet and Simply Winsock. Simply Mail has advanced features for filtering of List Servers and it has support for aliases and multiple file attachments. Simply Telnet is a Telnet client with vt100 emulation. It has some special features that will make it a great tool for visually impaired people such as *interactive talk* of the arriving data, which is the ability to read the current line with a single keystroke and the ability to set the cursor in local mode and browse through the current screen. Simply Winsock is a dialer that uses the Remote Access Service (RAS) interface to control the Winsock connection (also known as Dial Up Network in Windows 95). Unfortunately, it will only be of use for people using Windows 95 and Windows NT4 since Windows 3.11 does not support TCP/IP over RAS. With this application, the user can dial the Internet and establish the Winsock connection needed by Simply Mail and Simply Telnet. The

user can create multiple connection profiles and save the user name and password for each of them. It gives the user direct feedback of the connection process, has redialing capabilities for busy signals and automatically detects when the connection is lost. The free functional copy of Simply Internet 16 bits can be downloaded at http://www.econointl.com/simply/simplyi.htm

IBM's Home Page Reader

The International Business Machine Corporation (IBM) has been testing a talking browser, Home Page Reader for Windows, which is designed to help the blind access the Internet by reading the pages out loud. Before Home Page Reader, many blind and visually impaired people used "screen reader" to access information online. Even though the screen reader has the ability to read the screen out loud with a Netscape Communications browser, it is less effective due to the fact that it has trouble making sense of hyperlinks (shortcuts to other web sites), tables and columns, and graphical interfaces.

IBM's Home Page Reader can only read the HTML mark up language, which is used to design most web sites. Therefore, this software can read HTML *tags*[32] to locate text on following pages, tables and columns, and understand the links to other web sites. When using IBM's ViaVoice OutLoud text-to-speech software, the user hears the text being read in a male voice, while a female voice signifies a link. Home Page Reader cannot recognize graphics, but it can read a description of the graphics if the designer provides one.

In order to navigate the web, the program allows the user to use the keyboard for instructions, such as to read a line or paragraph at a time or fast-forward, by using the

number keys. This is useful because blind and visually impaired persons have difficulty using a mouse. This program also lets its users bookmark web pages and send and receive e-mail. Through the use of this program, users have an easier time reading the information on the screen instead of worrying about analyzing the page layout and structure.

The Home Page Reader was developed at IBM's Tokyo Research Laboratory. They introduced Japan's version of the program in October 1997 and the English version in January 1998. IBM hopes to introduce a version that understands pages with Sun Microsystems, Inc.'s *Java*[33] programming language in the near future.[34]

Price list for IBM Home Page Reader for Windows

- Homepage Reader for Windows V2.5 – Program Product US$149.00
- Homepage Reader for Windows V2.5 (15 MB) US$129.00
- Homepage Reader 2.5 French (27 MB) US$129.00
- Homepage Reader 2.5 Italian (28 MB) US$129.00
- Homepage Reader 2.5 German (25 MB) US$129.00
- Homepage Reader 2.5 Spanish (25 MB) US$129.00

IBM ViaVoice Millennium Web Edition

IBM ViaVoice Web Edition allows users to navigate the Internet with voice commands such as "surf the web", or "Go to Favorites". It is compatible with America Online 4.0, Microsoft Internet Explorer 4.01 or greater, and Netscape. It also provides an

[32] See Glossary for definition.
[33] See Glossary for definition.

easy way to send and receive email and instant message, and participate in online chats by dictating a built in text-to-speech function for reading back text on the user's screen, including web pages and e-mail. It also has support for multiple users. The complete software specification and minimum system requirements are available at http://www.computernerdz.com/viavoice-web.htm.

WebSpeak by The Productivity Works, Inc.

WebSpeak is another Internet browser for users who need to access the Internet in a non-visual, auditory manner due to blindness or visual impairment. WebSpeak is designed by The Productivity Works, Inc., specifically to access information on web pages and to translate that content into speech. The user can read through a document based on the contents, not having to deal with scrolling or analyzing the structure displayed on the screen. Productivity Works envisions "keyboard literate blind users, sighted and non-sighted quadriplegics, mobile workers needing access to web-based information by telephone, and workers who need web access in a hands-off manner" will use WebSpeak.[35]

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[34] Tessler, Joelle, "E-COMMERCE / IBM Seeing Need to Help Blind Use the Internet", Newsday, November 16,1998, ppC07.

[35] "WebSpeak Overview," www.prodworks.com/pwwovw.htm

The logical structure of WebSpeak is shown in the figure 9 below:

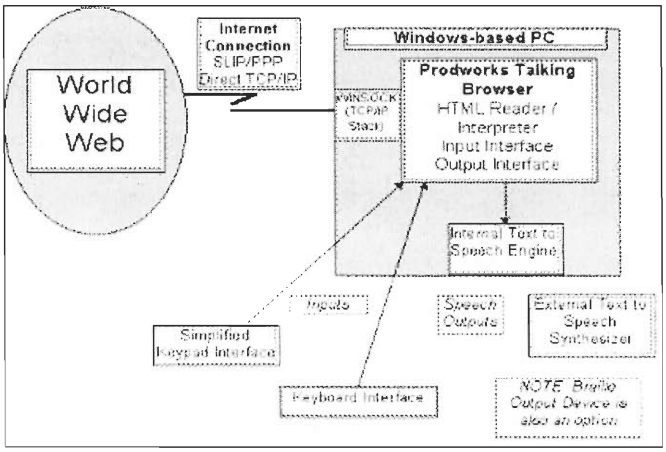

Figure 9: Logical structure of WebSpeak.

Overview of Functionality

WebSpeak has the following key functions:

- Direct support for speech output through understanding the HTML itself (HTML Interpreter and Presentation Rule base).

- Simplified character-oriented presentation of the web page information that includes synchronization of audio and display when reading page elements as well as user controlled font size to give a large character display for low vision users.

- Simple command structure for interacting with both WebSpeak and the information content of the web pages as well as automatic recognition and identification of headings, links, forms and other major page attributes.

- Browsing of the web page structure and links without having to go through the text itself.

- Support for reviewing an *element*[36] of a page, e.g. a paragraph, one word at a time and being able to spell out, character by character, any word.

- Support for tables, client-side images, and forms to allow full user interaction with applications and search engines on the web, e.g. Alta Vista, Yahoo, InfoSeek, etc.

- Support for server-side security.

[36] See Glossary for definition.

- Reading speeds that may be set dynamically.
- Support for multiple speech engines, both internal and external.
- Support for special file types and functions including: MAILTO, Audio, Real Audio, Video (audio portion).
- Searching for text within a web page and a special interface to the Alta Vista search engine for simplified specification of search topics across the web.
- Creation and maintenance of a list of favorite web pages as well as automatic loading of an initial page on execution.
- Fully accessible History List.
- Support for Proxy Servers to allow users on a LAN to get into Internet through a firewall.
- Support for browsing web pages locally, including following links to local and web-based pages.
- Support for saving web pages locally in either HTML or straight text formats.

WebSpeak/PLUS is available for $150 per copy, with discounts for large orders and for organizations specifically for the Blind and Visually Impaired. There is also a version called WebSpeak/NC at no charge for a blind or visually impaired user's personal use, only as long as the user pays an annual fee of $50 for support, maintenance, and upgrade services. [37]

[37] "WebSpeak Overview," http://www.prodworks.com/pwwovw.htm.

2.3.4 E-Commerce

2.3.4.1 E-Commerce Defined

Electronic Commerce, also frequently referred to as Internet Commerce, is increasingly and undeniably becoming a mainstream component of global trade and economics. In 1996, US Internet purchases totaled an overwhelming $500 million. At its current growth rate, Internet sales are expected to reach $100 billion by 2000. These figures do not include the vast number of consumers that purchased offline but had conferred with the Internet beforehand.[38]

Sales and purchases over the Net are growing rapidly. Specialists see three key hurdles that need to be overcome before the Internet becomes a major means for commerce. As time passes, more of these obstacles are disappearing. First is the attractiveness of the products that are offered over the Internet. This is referred to as the *content*. Today, nearly everything from books and cosmetics to automobiles and vacation packages can be purchased online. Second is the *convenience* with which consumers can make the purchases. While the list of superb user-friendly e-commerce websites is endless, very few of these many websites provide strategic *interoperability* and this is deemed to be essential before e-commerce can be considered *fully convenient*. Admittedly, a number of search engines are getting very close to being able to call themselves convenient, but it is believed this is one aspect that will take considerably longer to realize. The final hindrance may be the most important of the three and that is *confidence*. The one impediment that the Internet has had to face constantly since the onset of e-commerce is the security issue. Credit providers have traditionally acted as the

intermediary between the merchant and the consumer. This implicitly requires all transactions conducted online to be secured. Yet this problem is proving to be increasingly more difficult with time.

It is felt that truly robust e-commerce will inevitably require *interoperability*, a term that repeatedly comes up in any current discussion on Internet Commerce and its changing architectural infrastructure. There are a myriad of e-commerce firms each focused on innumerable different products. A problem arises with the incompatibility among the applications and frameworks that these different merchants employ and that cannot interoperate or build upon each other[39]. The large variety of security and payment options that have now become widespread over the Internet serve more to confuse the consumers than to attract business. Of course, moves are being considered to integrate most of the frameworks by some major companies like IBM, Microsoft, Netscape, Oracle and Sun. However, the process is proving to be lengthy and time-consuming.

2.3.4.2 E-Commerce Activity

As newer e-commerce companies are starting out, most are simply adjusting themselves to one of the structural patterns already available in the market. To do this, the firms must first select a business model and framework for evaluating applications and then select effective strategies for investing in e-commerce. The enterprises must consider issues such as outsourcing, whether to build the e-commerce application in-house or purchase one off the shelf, and what hardware and software technologies to

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[38] Scott Hamilton, "E-Commerce for the 21st Century", Pg. 44, IEEE Computer, May 19997

[39] Tanenbaum, Jay M., Choowdhry, Hughes, "Eco System: An Internet Commerce Architecture", Pg. 48, IEEE Computer, May 1997

consider in the decision-making process. Currently, three distinct business models have been identified in the Internet Commerce area.[40]

First, is the *e-broker* model. Such a firm essentially acts as the middleman between the actual supplier and buyer. It is a marketing specialist whose suppliers specialize in production planning, inventory management and the specific product being offered. The e-broker simply provides specialization across the supply chain from manufacturers to customers. One of the most popular e-brokers today is *Amazon.com*. This format of business makes a compelling argument for outsourcing. The e-broker adds no value to the product; it simply buys the finished good from suppliers (outsource) and resells it.

The second e-commerce business model is the *manufacturer*. These are those enterprises that add value to the product they sell. They achieve this through the internal manufacturing process – by either developing a product from scratch or enhancing an existing one. This category of e-commerce firms includes name like Dell Computers. One of the primary advantages of such a business structure is the elimination of the middleman concept. The *manufacturer* capitalizes on the idea that there is much more profit for everyone – the seller as well as the buyer – in direct selling.

The third of these is the *auction* model. In this one, potential buyers submit a bid and the product is sold when the supplier accepts a bid. The suppliers are considered clients and the auction site's job is to connect the client with someone interested in the services or products. One of the firms at the forefront of this category is *Priceline.com*. The main source of income for these firms is the small service fee that they charge the

[40] Jutla, Dawn, Bodorik, Hajnal, Davis, "Making Business Sense of Electronic Commerce", Pg. 67, IEEE Computer, March 1999.

sellers when a sale is made. Of course, to make such a business successful the company must maintain a large database since it may have to serve a wide variety of consumers.

Electronic Commerce is by far the most extensive application of *information technology*[41] to support business processes and the exchange of goods and services[42]. It is estimated that by this year the Internet's usefulness will capture nearly 377 million users. Doing business over the Internet is definitely one of the best way to conduct business in the *wired world* today. It only makes sense, therefore, to attempt to make Electronic Commerce more accessible to as much of the population of the world as possible and in any way possible.

Most people think e-commerce means online shopping. Web shopping is only a small part of the e-commerce. The term also refers to online stock and bond transactions, buying and downloading software without ever needing to go to the store. In addition, e-commerce includes business-to-business connections that make purchasing easier for big corporations. However, online shopping represents the most common usage in e-commerce. According to a report from Nielsen Media Research and CommerceNet in 1998, 78 million people used the web during the first six months of 1998, and 20 million of those users made online purchases. This is a 100% increase from September 1997. According to Forrester Research, as of year 2000, it is expected that online purchasing will generate nearly $7 billion in sales[43].

The most well-known and common media for e-commerce is the Internet. Within the Internet, the World Wide Web, newsgroups, and mailing lists are used to bring the

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[41] See Glossary for definition.
[42] Kambil, Ajit, "Doing Business in the Wired World", Pg. 56, IEEE Computer, May 1997
[43] "We Can Steer You Toward Success with Internet Commerce", www.hotwww.com/hotwww/ecommerce/e_commerce.htm,

products to the consumers. E-commerce corporations would design web pages providing information for the online shoppers. This information includes text description, product images, related product links, and more. Online users can make a purchase with just a few clicks.

The following figures (Figures 10 and 11) display a daily snapshot of buying activity on the Internet. The two charts provide estimates of the number of U.S. home-based Internet users who made purchases during each day from over 600 retail stores. This does not include travel, financial service, or auction transactions.

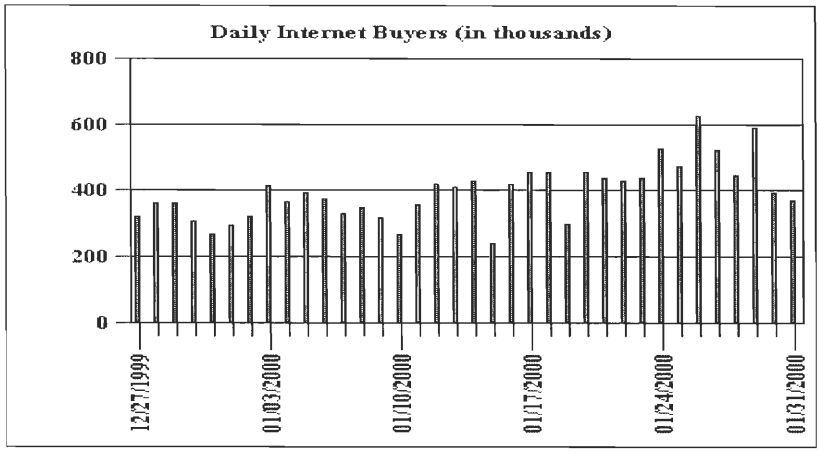

Figure 10: Daily Internet Buyers from December 27-January 31, 2000

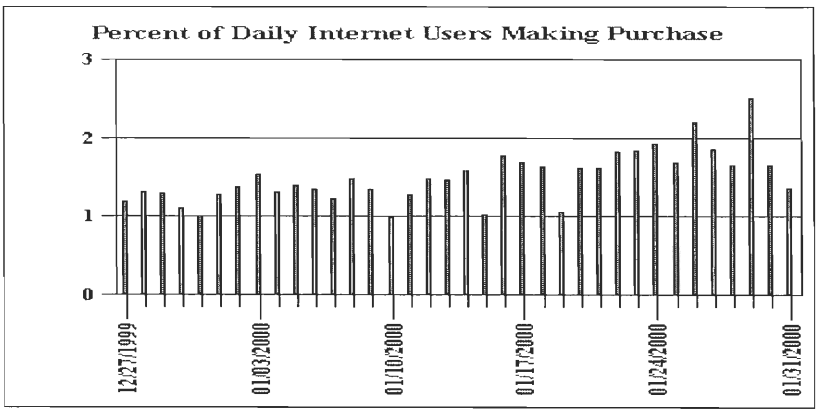

Figure 11: Percent of Daily Internet Users Making Purchase from December 27-January 31,2000

Top E-Commerce Sites

Sites with the highest number of unique visitors on average for the 5 weeks of the holiday season (11/22/99 - 12/26/99):

	Ave. Unique visitors for 5 weeks
Amazon.com	5,693,000
Ebay.com	4,073,000
Etoys.com	1,662,000
Barnesandnoble.com	1,522,000
Toysrus.com	1,486,000
Buy.com	1,427,000
Cdnow.com	1,416,000
Egreetings.com	1,116,000
Expedia	1,019,000
Travelocity.com	934,000

Table 2: Media Metrix, Inc.'s Weekly Flash Report on the metered Internet behavior of more than 50, 000 users.

E-commerce success indicators
Satisfying the Customer

Top characteristics influencing customers' return to e-commerce sites:

- Best price: 98.1%
- Timely order fulfillment: 96.2%
- High security: 94.9%
- E-mail confirmation of order: 91.1%
- Order-tracking capability: 89.7%
- Wide selection of merchandise: 89.4%
- Responsiveness to phone or e-mail help requests: 88.3%
- No sales tax: 88%
- Easy-to-understand terms and conditions: 87.7%
- Frequent buyer / user discounts: 84.6 %
- 24/7-customer service: 82.6 %
- Easy access to information or purchase-related questions: 82.5%
- Delivery options: 80%

Source: Survey of 1,197 Internet users conducted by Net Effects Systems, Inc.

Why Sites Lose Customers

Usability tests of top e-commerce sites, from eToys.com to LLBean.com, revealed:

- 39% of test shoppers failed to complete a purchase because of site errors and confusing navigation
- 56% of buying attempts were thwarted by failed search attempts

Source: "Holiday '99 E-Commerce: Bridging the $6 Billion Customer Experience Gap," Creative Good's usability report on ten e-commerce sites.

2.3.4.3 Security and Privacy Issues for E-Commerce

The Internet is remarkable and powerful in its ability to bring together the world. However, despite the expediency that the World Wide Web provides for information exchange and computer connectivity, there are inherent threats that come with it. The Internet is basically made up of server machines and client machines[44]. The client machines are the user ends; these machines send out packets of requests to the server machines that then collect the requested information and send it back to the respective client machines. Unfortunately, during the entire process of handling data between clients and servers, other computers that are also connected to the Internet have easy access to the information that is being passed. Thus, it is necessary to somehow secure the information passing between server and client to ensure the client's rights to secure information exchange. At the same time, it is also possible for other computers to connect to any other client machine and retrieve specific information about that computer, thereby undermining the client's privacy on the Internet. Thus, with the advancement of the Internet these issues with security and privacy have become unavoidable.

Technically speaking, *security* refers to techniques for ensuring that data stored in a computer cannot be read or compromised. Most security measures involve data

[44] Safety and Security on the Net, http://www.nwnetworks.com/sands.htm

encryption and passwords. Data encryption is the translation of data into a form that is unintelligible without a deciphering mechanism. A password is a secret word or phrase that gives a user access to a particular program or system.[45] Privacy in everyday life is a common matter. However, on the Internet, privacy is much scarcer. Messages are sent as clear text, so that everyone with little hacking knowledge can read them, and there is no built-in way to prevent a person from forging another person's name.[46] There are several programs available that can be employed to help protect the privacy and security of information exchange, but they are not completely foolproof.

Many e-commerce web sites use Secure Sockets Layer (SSL) technology to encrypt the credit card information that customers send over the Internet. These sites usually inform their clients that they are using this technology. A different security technology, which works on different principles, is Secure Electronic Transaction, or SET, technology. SET or SSL technology is designed to make connections secure. As for privacy issues, web sellers are not (yet) required by law to respect the privacy of people who shop and/or order from their sites. This means that the seller may collect data on which site pages a client visited, which products the client buys, when the client buys them, and where the client ships them. Then, the seller may share the information with other companies or sell it to them. As a result, the unsuspecting client might get more direct-mail advertising, spam, or calls from telemarketers.[47]

Among the software that is available to help protect a user's privacy and secure data transmission over the Internet is the PGP. PGP or Pretty Good Privacy[48] is a

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[45] Webopedia: security, http://webopedia.internet.com/TERM/s/security.html
[46] Privacy and anonymity on the Internet, http://www.stack.nl/~galactus/remailers/index-privacy.html
[47] Safeshopping.Org, http://www.safeshopping.org/index.html
[48] Computer Security and Privacy, http://www.obscure.org/~jaws/security.html

powerful cryptographic product family that enables people to securely exchange messages, and to secure files, disk volumes and network connections with both *privacy* and *strong authentication*. *Privacy*, in this case, means that only the intended recipient of a message can read it. By providing the ability to encrypt messages, PGP provides protection against anyone eavesdropping on the network. Even if the information is intercepted, it is completely unreadable to the snooper. *Authentication* identifies the origin of the information and certifies that it is authentic and has not been altered. Authentication also provides an extremely valuable tool in network security: verification of the identity of an individual. In addition to secure messaging, PGP also provides secure data storage, enabling the client to encrypt files stored on the local computer.

The Role Based Access Control and the IPsec projects are among the more recent technologies being developed for Internet security and privacy. The National Institute of Standards and Technology (NIST) is supervising both of these projects.[49] *Role Based Access Control* (RBAC) is a technology that is attracting increasing attention, particularly for commercial applications, because of its potential for reducing the complexity and cost of security administration in large networked applications. The *NIST IPsec Project* is concerned with providing authentication, integrity and confidentiality security services at the Internet (IP) Layer, for both the current IP protocol (IPv4) and the next generation IP protocol (IPv6). Current efforts are concentrated on IPv4 because of the high level of interest in fielding Internet security technology as rapidly as possible. Implementing IPsec requires modifications to the system's communications routines and a new systems process that conducts secret key negotiations.

[49] Computer Security Resource Clearinghouse, http://csrc.ncsl.nist.gov/

"The W3C is involved in the development of several protocols that relate to web security. Presently, the main area of work is on the signed-XML proposed activity. Other related activities include the HTTP/1.1 protocol and e-commerce. The W3C also produces software reference implementations that demonstrate the use of security measures. The IETF/W3C have created a joint working group to address XML Signatures. The Digital Signature Initiative released a recommendation on 27-May-1998. This specification permits digital signatures to be associated with PICS labels (a web annotation system.) The HTTP/1.1 protocol includes a much-improved scheme for authenticating the identity of users known as Digest Authentication. The W3C is involved in several initiatives in the realm of electronic commerce and secure payments"[50].

For more information and for answers to specific question, it is advisable to visit the following FAQ web page of the World Wide Web Consortium: http://www.w3.org/Security/Faq/www-security-faq.html.

2.3.4.4 Products for Developing E-Commerce Sites

Developing e-commerce web sites for the blind and visually impaired requires special products designed for providing accessibility to the Internet. The following companies are beginning to take steps toward specializing in creating e-commerce web sites for e-commerce companies.

[50] W3C Security Resources, http://www.w3.org/Security/

COMPAQ

Compaq helps businesses to develop individualized e-commerce solutions through Compaq's NonStop E-business services. Compaq offers e-commerce products and lifecycle services for companies of all sizes. Cooperated with Click Interactive's Click Commerce extranet software, Click Interactive will market other Compaq NonStop e-business offerings including integration, infrastructure and outsourcing services in conjunction with Click Commerce. Compaq also offers Business-to-business services for end-to-end e-commerce solutions, including electronic data interchange (EDI) with suppliers, electronic procurement systems, security, and back-end applications and database integration. For business-to-customer, Compaq leverages electronic storefronts and services to help Internet Service Providers (ISPs) and Network Service Providers (NSPs) host web storefront solutions for their customers.[51]

IBM

With scalability, security, and reliability built in from the ground up, IBM e-commerce solutions are designed to enable businesses to conduct business-to-business and business-to-consumer Internet transactions. IBM has accumulated expertise in a range of industries from years of working with financial institutions, utilities, governments, and manufacturers. IBM can provide end-to-end e-commerce solutions that integrate with the business's customer service and supply chain management (SCM) systems. They will fit into any environment, so the business can easily build on existing hardware and software. IBM offers the following scalable end-to-end e-business solutions for e-commerce:

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[51] "Electronic Commerce Solution, Compaq", http://www.compaq.com/services/internet/commerce/index.html,

- Commerce software solutions (web servers, applications servers).
- Services for consulting, systems integration.
- Integration/IFS relationship.
- Billing & payment server solutions.
- Payments expertise through Banking ISU (wholesale/retail/payment instruments).[52]

InSites Web Design

From personal pages to complex corporate sites, inSites offers a complete spectrum of web design options. InSites specializes in:

- HTML authoring: including advanced HTML features.
- Graphic design: layout, image creation, custom illustration.
- Web programming: custom JavaScript and CHI/Perl scripting.
- Web databases: customized database-driven web sites.
- World Wide Web needs analysis, consulting, and training.

InSites has developed a set of intuitive online tools, which allow administrators to easily update areas of their sites with no html knowledge. An example would be if the administrator wishes to add a press release to the site. In this example, the administrator would log in to the password-protected site, choose the "add new press release" option and insert the press release into the input form. The many advantages of a self-maintained site include:

- No site maintenance costs.
- Zero time constraints for time-sensitive data/text.
- Complete control over changing content of site.
- Data consistency across entire site.[53]

[52] "Product and Service, IBM", http://www.ibm.com/e-business/services/

[53] "Services, InSites Web Design", http://www.insites.ca/about.htm

Web Vision 2000

Web Vision 2000 is a full service Internet resource company. Web Vision 2000 offers everything from Dial-up access, to web page design to the hosting and Internet promoting of the web site. Web Vision 2000 staff consists of professionals in the fields of Java, Perl, Database Programming, Search Engine Registration, E-Commerce, and Streaming Audio/Video. Web Vision 2000 offers several pre-packaged pricing plans, from personal home pages to complete corporate web sites. Below is a table of Web Vision 2000's services:

$500.00	Five pages, background image, company logo, six custom graphics, two icons, hit counter, two e-mail links, four hyper links.
$950.00	Eight pages, background image, company logo, ten custom graphics, four icons, two e-mail links, eight hyper links, guest book, hit counter.
$1,350.00	Ten pages, background image, company logo, twelve custom graphics, six icons, three e-mail links, eight hyper links, guest book, hit counter, and form page for feedback or requesting information.
$2,200.00	Fifteen pages, background image, company logo, eighteen custom graphics, eight icons, five e-mail links, twenty hyperlinks, guest book, hit counter, form page for feedback or requesting information, shopping cart with up to 5 pages of products.

Table 3: Web Vision's Services

2.4 Legislation: The Americans with Disabilities Act

2.4.1 Section 508: Electronic and Information Technology

Section 508 of the Americans with Disabilities Act (ADA) requires that federal agencies' electronic and information technology be accessible to people with disabilities, including government employees and members of the general public. It establishes requirements for any electronic and information technology developed, maintained, procured, or used by the federal government. This covers computers (hardware, software, and accessibility to web sites), fax machines, information/transaction machines (ATM's and fare card machines), copiers, telephones, and other equipment used for transmitting, receiving, using, or storing information. The only exemptions from these requirements are national security systems.[54] The text of Section 508, as of March 2000 is provided in Appendix A.

There have been lawsuits filed against Internet companies due to the inaccessibility of their web sites to the blind and visually impaired. One example of this is the National Federation of the Blind's (NFB) suit against American Online, Inc. (AOL). On November 5, 1999 nine individuals from NFB, all of which are blind, filed a suit in the U.S. District court for the District of Massachusetts against AOL because its inaccessibility to the blind is violating the Americans with Disabilities Act.

The lawsuit specifically states that AOL, unlike other Internet service providers, "has designed its AOL service so that it is incompatible with screen access software programs for the blind."[55] The suit was filed to compel AOL to redesign its service to

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[54] Department of Justice, http://www.usdoj.gov/crt/508/508home.html.

[55] "National Federation of the Blind Sues American Online, Inc., Charges Internet Service Inaccessible to Blind," U.S. Newswire, November 5, 1999, p1008308n0018.

allow blind people to have independent access through screen access software. In order for the screen access to work properly, the commercial software must:

- Provide text labels for all graphics
- Permit keyboard access to all functions
- Move the focus whenever the keyboard is used
- Rely upon standard Windows controls, such as dialog boxes, list boxes, edit boxes, etc.

Currently, AOL service users run software that has unlabeled graphics, commands that can be activated only by a mouse, and custom controls painted on the computer screen. Despite the efforts of the NFB, AOL has steadfastly refused to modify its software in order to ensure compatibility with screen access technology for the blind. This in turn is violating the ADA's "reasonable modification" requirement. There should be no reason why AOL does not fulfill this requirement since the technology is available, it will not alter the nature of AOL service, and will not be a financial burden on them.[56] AOL refutes this lawsuit because their next version, to be released tentatively in November 2000, will be accessible to the blind and visually impaired. The National Federation for the Blind feels that this is not an excuse for the current inaccessible Internet service provider because they have been contacting AOL about this problem for the past two years.

[56] "National Federation of the Blind Sues American Online, Inc., Charges Internet Service Inaccessible to Blind," U.S. Newswire, November 5, 1999, p1008308n0018.

2.5 Danish Perspective on Accessibility for the Visually Impaired

Denmark, and specifically the Ministry of Research and Information Technology, is presently working on implementing a Network Society. This policy is entitled "Digital Denmark." The Danes believe that all citizens and enterprises should have quick, easy access to the Internet, and all citizens should feel comfortable with the technologies, so that they do not opt out of using them in advance. Being on the Internet should be as natural and easy as using other daily tools such as "switching on a light." This policy includes all citizens; therefore, considerable work is being done to make sure that Internet is accessible to the disabled.[57] One objective of the Digital Denmark Policy is to have Denmark as an E-Commerce Nation. Denmark plans to be one of the five countries in the world that have the largest e-commerce turnover per inhabitant in 2003, and will be able to offer competitive outline provisions for enterprises in the network society.[58]

Due to this increase of Internet usage in the country, it is even more important, to set guidelines of how people can and should design their web sites in order for it to be accessible to all of the citizens of Denmark. The policies that are stated are to be implemented in the year 2000. By 2003, the latest, Danish public administration seeks to provide the best and most efficient public service in the Nordic countries with the help of digital administration. The Ministry of Research and Information Technology will draw up a situation report on the *IT*[59] initiatives that will benefit the disabled. The objective is to compile these initiatives and propose new initiatives in connection with the Ministry for Research and Information.

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[57] "Realigning to a Network Society," http://www.fsk.dk/cgi-bin/doc-show.cgi?doc_id=20746
[58] "Digital Denmark- Conversions to the Network Society," http://www.fsk.dk/cgi-bin/doc-show.cgi?doc_id=23026.
[59] See Glossary for definition.

A summary of the ideas in "Realigning to a Network Society" is located in Appendix G.

Denmark is against having legislation, like that of the Americans with Disabilities Act in the United States, "protecting" those with disabilities to have the same rights as all other citizens. This is because they feel that people will be more interested in lawsuits and dispensations and overlook the real purpose. The point that is trying to be made public, is that everyone should want their web site to be accessible to everyone and it would be a good example to set forth if you market your web site as such. The disabled are not looking to have special treatment, they just want to be able to access information and tools that can be as useful to them as anyone else in the world.

2.6 Guidelines for Accessible WebPages

The computer user interface is the fundamental area of focus when addressing the provision of universal access to information today.[60] A trend has developed toward primarily utilizing graphical displays of information and neglecting the textual presentation of the same material. Problems arise in two situation, first when a text-based browser attempts to access the graphical information and second, when a visually impaired user attempts to use devices such as screen readers to read the information. Unless graphical data is accompanied by textual descriptions, the information cannot convey to a blind or visually impaired user. A screen reader cannot verbally decipher the graphical images unless the author of the web page has provided an HTML *ALT*[61] form of textual description.[62] Work that has been done specifically in this area includes a system of appending information about the documents themselves to the HTML formats

[60] Anderson, Charles R., Hamel, Jessica L., and Svendsen, Jason N., "An Accessible Web Site for The Danish Association of the Blind," An Interactive Qualifying Project Report, May 1, 1998, chapVI, pg.25
[61] See Glossary for Definition.

on the web. The appended information – called meta-information – is then available to be read by screen readers. The meta-information appears in the form of summaries of all links and section headers in the document. In addition, every link, title, form-input element and graphic is labeled with text describing the item so the visually impaired user using a screen reader will be able to identify a particular element. The system developed is called WAB: World Wide Web Access for Blind and Visually Impaired Computer Users.[63]

In 1997 the World Wide Web Consortium (W3C) began the Web Accessibility Initiative (WAI) project that was intended to specifically address the Internet issue. As part of this project, the W3C has recently developed a version of HTML that includes accessibility enhancements along with a preliminary accessibility guidelines document for reference by web page designers.[64] In initial stage, the WAI group sought solutions to the most common habits of web page authors that create accessibility difficulties for users of screen readers, audio browsers and text-based browsers. The problems identified included misuse of HTML elements to perform layout and formatting, badly structured web pages that make navigation difficult and the heavy use of graphics without alternative text descriptions.[65] The newly developed HTML 4.0 contains elements for structuring and formatting the layouts of web pages that could substantially improve accessibility to the pages. [66]

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[62] Anderson, Charles R., Hamel, Jessica L., and Svendsen, Jason N., "An Accessible Web Site for The Danish Association of the Blind," An Interactive Qualyfying Project Report, May 1, 1998, chapVI, pg.28
[63] Kennel, Andrea, Perrochon, Louis, Darvishi, Alireza, "WAB," SIGCAPH Newsletter 55 (June 1996) pg. 10-15.
[64] "Guidelines for Accessible Web Authoring Become a Recommendation," http://www.w3.org
[65] Anderson, Charles R., Hamel, Jessica L., and Svendsen, Jason N., "An Accessible Web Site for The Danish Association of the Blind," An Interactive Qualyfying Project Report, May 1, 1998, chapVI, pg.31
[66] "W3C HTML 4.0 Specification," http://www.w3.org/TR/1998/REC-html40-19980424/

Apart from the set of standardized guidelines for web site design developed by the W3C and its WAI group[67], other organizations have also established their own sets of guidelines. One such organization is the Videncenter for Synshandicap.[68]

The opposition to the usage of *frames*[69] on a web page stems from the fact that screen readers have a hard time discerning what is on that page. Since screen readers only read complete rows at a time on the screen, a blind and visually impaired user can easily get disoriented when the screen readers skip from frame to frame as they read. The same difficulty arises with structures such as fill-in forms, tables and columns. Reading difficulties also arise with fancy text attributes including underlining, italics, all capitals, and blinking – as was brought to attention by Mette Røhe of the DAB. Text coloring has also been a major issue, Mette stated that; while fancy colors may be attractive to sighted users, contrast is the more important aspect as far as visually impaired users are concerned. In terms of the layout structure, bulleted lists, and more specifically, numbered itinerary have been most helpful in conveying information on the structure of the document. The necessity for alternative text descriptions cannot be stressed enough. Bue Andersen of the DAB strongly feels that these descriptions become especially useful when viewing movie files, sound files, scripts, graphics, banners and other elements that are generally not represented in the *ASCII*[70] format; most of the text on a document is stored in this standard code form and is usually easily read by screen readers. Finally, *imagemaps*[71] require users to scan over a graphic item with the use of a mouse and click on a link that is hidden behind a part of the image. Visually impaired users cannot access

[67] "WAI Resource: HTML 4.0 Accessibility Improvements," http://www.w3.org/WAI/References/HTML4-access

[68] "Videncenter For Synshandicap Web Accessibility Guidelines," http://www.visinfo.dk/viis/default.htm

[69] See Glossary for definition.

this since they cannot use the mouse. Hidden links or non-descriptive links such as those that simply say "Click Here" without a textual description of the destination can be equally confusing for a blind user who cannot see what is the function of the link. The overall layout of a web page also affects the accessibility of the page in many ways. For example, it has been suggested by the DAB that links with descriptive attributes leading to the previous page, the top of the current page, the next page, or even to the beginning of the document or the homepage should be present in all pages in the same location so that it is easier for the user to identify these links.[72]

A number of other issues have recently been addressed regarding the relationship between a web page's effectiveness and the visual appeal from its organizational structure. The placement of the navigational links and the usage of frames and fill-in forms in the web page are only two of the major issues that have surfaced. For example, it has been asserted that links such as those for returning to the top of the page or back to the previous/next page should be both at the same location on every page and at the end of each section or even each page. The reasoning behind this suggestion was efficiency. A screen reader generally reads over the entire page when it is opened. It becomes somewhat tedious and time-consuming for the blind user to have to listen to navigational links before getting a chance to listen to the main part of the text presented in the web page. Pop-up windows appearing during the course of Internet navigation have also been a primary cause of difficulty for visually impaired users. This is because the screen readers are mostly incapable of properly distinguishing between several windows and

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[70] See Glossary for definition.
[71] See Glossary for definition.
[72] Anderson, Charles R., Hamel, Jessica L., and Svendsen, Jason N., "An Accessible Web Site for The Danish Association of the Blind," An Interactive Qualifying Project Report, May 1, 1998, chapVI,p36-37.

handling them effectively. There were an issue in the AOL lawsuit in 1999. Numerous pop-up advertisement windows that required a user to click through the clutter impeded the blind users' ability to logon and navigate the website.

One of the popular uses towards which Internet is advancing towards today is the support of commerce and business online. Suppliers and retailers, as well as service providers, are increasingly selling their products over the Internet. With the rapid growth of *Electronic Commerce* for the general users, it is only reasonable to extend the possibility of these activities to the blind and visually impaired computer/Internet users. However, as discussed previously, some immediate obstacles exist to organize e-commerce websites for blind and visually impaired users. According to the WAI Guidelines for Accessible Web Authoring, there are already several accessibility problems for which a web author must compensate for when designing a general web page. To design an e-commerce web site, there are, in fact, various other accessibility issues that become apparent, such as the design of the pages that display lists of products for sale, the design of the shopping cart and purchase method, the design of the shopping basket and the method of updating the basket, and finally the method of notifying the total cost of goods purchased. There is a considerable difference between a blind or visually impaired individual searching for information on the web, and conducting business or commercial transactions over the Internet. Moreover, apart from the general concerns about privacy, security and payment over the Internet, blind and visually impaired user encounter other subtle but important issues when engaging in e-commerce. For the blind and visually impaired users, the concern about security issues is in fact greater than for the sighted user. Most of these difficulties occur in fill-in forms when

screen readers read them. Particularly, a method is needed for returning feedback to the user regarding whether the data is correct and entered in the correct places of the form. The time has come to look into these and other issues that relate to establishing e-commerce for blind.

The following are design options and ideas to consider when creating an e-commerce web site for the Visually Impaired:

- Providing all-important visual information in audio and/or tactile form.
- Using simple screen layouts, or providing the user with the option to look at one thing at a time.
- Keeping language as simple as possible.
- Accompanying pictures or icons with words.
- Using Arabic rather Roman numerals.
- Providing an attention-getting sound or words before audio presentation.
- Having auto-repeat or a means to repeat auditory messages.
- Presenting information in as many forms as possible/practical or providing as many display options as possible.[73]

Some validation tools are available that are useful when trying to critique a web site for accessibility to the blind and visually impaired. These programs, such as Bobby 3.1.1, search a specified web site for accessibility and browser compatibility errors. The analysis of Bobby is based on the guidelines of the World Wide Web Consortium's Accessibility Guidelines mentioned in the next section. The Bobby web site is found at http://www.cast.org/bobby/. When a URL entered, the program goes to that web site and checks for accessibility. These are some of the types of elements that Bobby checks for:

- Java applets with missing ALT text
- *Server-side imagemaps*[74]
- Client-side-pull
- Smiles (such as ":)" and ":(")
- HTML forms[75]

[73] "Guidelines for the Design of Consumer Products to Increase their Accessibility to Persons with Disabilities or Who are Aging," http://trace.wisc.edu/docs/consumer_product_guidelines/toc.htm.
[74] See Glossary for definition.

2.7 *W3C Guidelines Summary*

The set of guidelines that has been set forth by the W3C describing the recommended standard for designing an accessible web site is based on the study of difficulties created by various web-design items and techniques. These specific elements on which the W3C based their research for the "Web Content Accessibility Guidelines" are summarized as follows:[76]

- Images & animations. Use the ALT *attribute*[77] to describe the function of each visual.
- Image maps. Use client-side MAP and text for hotspots.
- Multimedia. Provide captioning and transcripts of audio, and descriptions of video.
- Hypertext links. Use text that makes sense when read out of context. For example, avoid "click here."
- Page organization. Use headings, lists, and consistent structure. Use CSS for layout and style where possible.
- Graphs & charts. Summarize or use the LONGDESC attribute.
- Scripts, applets, & plug-ins. Provide alternative content in case active features are inaccessible or unsupported.
- Frames. Use NOFRAMES and meaningful titles.
- Tables. Make line-by-line reading sensible. Summarize.
- Check your work. Validate. Use tools, checklist, and guidelines at www.w3.org/TR/WAI-WEBCONTENT.

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[75] Anderson, Charles R., Hamel, Jessica L., and Svendsen, Jason N., "An Accessible Web Site for The Danish Association of the Blind," An Interactive Qualyfying Project Report, May 1, 1998.
[76] "Background for Accessibility Award, Center for Ligebehandling af Handicappede," http://www.clh.dk/gylden/background.htm
[77] See Glossary for definition.

It must be noted that the W3C recommendation, frequently referred to as the WAI Accessibility Criteria, for designing accessible web sites is only a general standard that is geared towards making web sites accessible to blind and low-vision individuals. Moreover, being a standard, the WAI criteria do not necessarily describe or offer any specific methods or technical approaches for achieving the requirements of an accessible web site. The individual web designers may employ their own techniques to adhere to the criteria. This report does describe some of the simple techniques that can be employed to follow some of the guidelines in detail. For others, helpful approaches and even alternative choices are described to implement the guidelines. Interestingly, a web site's accessibility can be increased significantly simply allowing it to be navigated by jumping from link to link on the page using only the TAB key on the keyboard as opposed to preventing access without the particular help of the mouse.

Below is a list of guidelines from the W3C Recommendation:

- Provide text equivalent for every non-text element.
- Provide an auditory description of information of the visual track of a multimedia presentation.
- For time-based multimedia presentation, synchronize equivalent alternatives (auditory description) with the presentation.
- Provide sufficient screen contrast.
- Convey Information with color should also be available without color.
- Identify the predominant natural language of the web site, so screen readers and Braille devices can automatically switch to the appropriate language.
- Specify the expansion of each abbreviation in a document where it first occurs.

- Identify row and column headers in the table.
- Do not use tables for page layout unless table makes sense when linearized.
- Provide summaries for tables.
- Ensure that pages are usable when scripts or other newer technologies are not supported or are turned off.
- Avoid causing the screen to flicker.
- Avoid causing the text to blink.
- Avoid causing movement in pages.
- Do not create periodically auto-refreshing pages.
- Allow users to interact without a pointing device such as mouse.
- Create logical tab order through links and form controls.[78]
- Do not cause pop-up windows to appear.
- Do not change the current window without informing the user.
- *Link text*[79] should be meaningful enough to make sense when read out of context.
- Group related links, identify group.

[78] "Web Content Accessibility Guidelines 1.0, W3C Recommendation 5-May-1999", http://www.w3.org/TR/WAI-WEBCONTENT/

[79] See Glossary for definition.

3 Methodology

The goal of this project was to critique and make recommendations regarding the establishment of an accessible e-commerce web site for blind and visually impaired people in Denmark by working with a company's e-commerce web site. The fundamental objective of the project required this team to conduct in-depth background research on the various aspects of the subject of the project. The topics of research included the various types of visual impairment, statistical information, different products and the technology currently available to aid the blind and visually impaired, the present prominence of e-commerce in the consumer markets, the contrasting American and Danish socio-political views toward accessibility for the blind and visually impaired, and the prevalent guidelines for web site accessibility that are being employed by web designers. The sponsors were interested in whether any pioneering steps have been taken toward the development of e-commerce for the blind and visually impaired in the United States of America. Clearly, any information that we accumulated regarding e-commerce for the blind and visually impaired would be helpful. Upon arrival at the project site, the Danish Association of the Blind, it was observed that the only Screen Reader that has been translated into Danish and could be used for both computer work, as well as Internet usage, was JAWS. Therefore, it was decided that further investigation of products for access to computer/Internet, and specifically e-commerce, would not be useful. The European viewpoint on the issues of accessibility for the blind and the visually impaired is different from that of the United States. Unlike the ADA legislative act that is prevalent

in the USA, there is no Danish law requiring services to ensure the rights of the disabled. In their opinion, legislation causes people to lose sight of the actual goal[80].

Interviews were done with various individuals who were available in Denmark. Interview with certain representatives of organizations, such as the Center for Equal Treatment of Handicaps and Merkantildata, were conducted to help answer specific questions about accessible web sites and help determine what the company expected of us. Any extra information that we needed was obtained through asking the blind members that work at the DAB. Also, using JAWS to navigate the web site also was a way to understand the changes that needed to be made to the Merkantildata web site to make it accessible.

We distributed a survey to those working at the Danish Association of the Blind regarding the use of e-commerce web sites. We did this in order to get an idea of how Danish citizens, who are aware of the issues involving the blind and visually impaired, feel toward security and privacy issues when ordering products through the Internet.

3.1 Background Research

Much of the information for the study was obtained from online Internet resources and medical journals. Gathering and perusing articles on e-commerce, web accessibility, etc., gave us a better understanding on the project we are working with. This background research was done in the United States, as well as in Denmark. Many useful resources became available to us while in Denmark, such as interviews with knowledgeable individuals and contact with the blind members of the DAB.

[80] Mette Røhe, Dansk Blindesamfund (The Danish Association of the Blind), Copenhagen, Denmark.

3.2 Company Background

The purpose of working with a company's e-commerce web site was to test or demonstrate the set of guidelines that was developed by the project team and at the same time provide an in depth critique of their existing web site with specific suggestions for improving its accessibility. The company that we worked with, Merkantildata, is an information technology firm. They specialize in consulting through partnerships with other companies, as well as merchandizing computer hardware and software. Their web site, which we worked on providing suggestions and instructions to make it accessible, is located at http://www.merkantildata.dk/. Merkantildata hopes to be a leading supplier and integrator of information and communication technology (ICT) in the Nordic countries. The company bases its growth on quality and satisfied customers. Merkantildata is a major supplier of ICT-related computer and telecommunications products and services in the Nordic countries. The company's activity is divided into the business segments: System Integration, Application, and Communication. The corporate management is located in Oslo and the company has offices in central areas of Norway, Sweden, Denmark, and Finland.[81]

The reasoning behind choosing Merkantildata as the company to work with was the fact that the DAB and Merkantildata are partners in business and Merkantildata's OnlineShop supplies much of the DAB's hardware.

[81] Merkantildata (english), http://www.merkantildata.no/english/finance/default.htm.

3.3 Obtaining Product Information

It was essential that this team find out what kind of products were available that were geared towards blind people's use of the computer and the Internet in particular. The sponsors had requested information on the latest technological developments in the field of computer and Internet accessibility; therefore, information on recently developed products to enable the blind and visually impaired individuals access the computers and the Internet was important. Most of the research took place online. Research was conducted on topics ranging from the traditional Braille to several popular modern products. The products learned of included Screen Readers, Tactile Tools, and the Voice Recognition Software for computer use in general. Some other products were discovered to be in the market that appeared to combine two or more different tasks (screen reading, speech synthesis, voice recognition, ext.) into one. Further research in the area revealed a handful of computer tools that were specifically aimed at aiding the blind in Internet browsing.

3.3.1 Questions for E-Commerce Companies

A significant amount of correspondence was conducted with the companies, via e-mail, that were marketing the modern products. One concern of this project team was to learn whether these products are manufactured according to set standards or conform to an established model. Some of the responses are included in the appendix. The general impression received from these companies was that the creation of e-commerce websites for the blind is yet to be attempted.

3.3.2 Sample Correspondence

The following is a sample letter, sent via e-mail, to one of the e-commerce companies found while browsing the Internet.

Date: Mon, 31 Jan 2000 17:22:10 -0500 (EST)
From: Matthew Kaichung Chan <mchan@WPI.EDU>
To: techhelp@amazon.com
Subject: Special service

To whom it may concern,

I am a student in Worcester Polytechnic Institute. I am currently doing a project on e-commerce for Blind. Knowing that Amazon.com is one of the biggest e-commerce businesses in the U.S. I would like to know if Amazon.com offers any special Internet service for the blind. If there is any special web site designed for the blind. Your help is greatly appreciated. Thank you!
Matt Chan

3.4 Survey for Blind Organizations

In the United States, a list of eleven blind organizations was obtained from the web and the yellow pages of the phone book. We believed this was a good method for obtaining information about the products being used by the blind members of the organization to access the computer and Internet.

3.4.1 Questions and Expected Results

The questions presented to the blind organizations are listed below, as well as in Appendix C.

- Does your organization know any standard for making Internet and e-commerce web sites accessible to the blind?
- Do you have any statistical information on what technology the members are using to access the computer?
- Do you know any products that help the blind to access the computer? Internet? E-commerce?
- Do you know of any prior surveys that asked related questions?

We hoped that through these surveys we could further investigate the products being used by blind members, the number of blind members that access the computer/Internet, and if any work has been done that would help us with gathering more information about this topic.

3.4.2 Sample Correspondence

The following is a sample letter, sent via e-mail to the blind organizations listed in Appendix C.

Dear Sir or Madam,

We are a group of students from Worcester Polytechnic Institute (WPI). Currently, we are working on a project with the Danish Society of the Blind. The goal of the project is to help the blind people in Denmark to gain access to E-commerce. Right now, we are looking for the technology that the blind people use to access the computer and Internet. It would be greatly appreciated if you can answer the questions listed below. Also, included in this e-mail is an attachment of survey questions. We would like to ask you to distribute these survey questions to the members in your organization. The members' answers are equally important to us. Thank you for your help.

Sincerely,
Liz Amaral
Ali Durlov Khan
Matthew Chan

1. Does your organization know any standard for making Internet, and e-commerce web sites accessible to the blind?

2. Do you have any statistical information on what the members are using to access computer?

3. Do you know any products that help the blind to access computer? Internet? E-commerce?

4. Do you know any prior surveys that asked related questions?

3.5 Survey for Blind Individuals

One matter that quickly became evident was the realization that the best way to learn about how blind people deal with using the computer for general purposes, and perhaps even Internet browsing, was to try to find out from these people personally. A considerable amount of time and effort was invested in researching the availability of blind people who could be approached for questioning. We mainly accomplished this via

e-mail; therefore, we know that the individuals we reached were already accessing the computer/Internet. The first contact was a student at WPI - Mike Gorse. Next were organizations of and/or for the blind in the USA. For the purpose of obtaining the necessary information, a collection of different questionnaires, surveys and interviews were prepared. Both the interview with Mike Gorse and the survey of the various organizations were conducted via email due to convenience. Unfortunately, we received no responses to the survey. Mike Gorse's interview is included in the Results section.

3.5.1 Questions and Expected Results

The following questions were sent to members of the blind organizations with whom we were in contact.

- What product or software do you use to access a computer? (Voice Synthesizers, Screen Readers, etc)
- How do you access the Internet?
- Do you have difficulty accessing the Internet? If so, what is the problem?
- Have you ever used E-commerce? If so, what did you use and what problems did you encounter?
- How frequently do you use computers? Internet? E-commerce?
- Do you feel that you would use computers, Internet, or e-commerce more, or the same amount of times if it were more easily accessible?
- What would you like to see improved on existing software?
- Where did you purchase your existing software?

We hoped that through this survey we would gain information on the existing products being used, the problems with these products, and the problems that these individuals face with accessing the computer/Internet.

3.5.2 Sample Correspondence

The following is a sample letter, sent via e-mail to the blind individuals who are members of the blind organizations.

Dear Sir or Madam,

We are a group of students from Worcester Polytechnic Institute (WPI). Currently, we are working on a project with the Danish Association of the Blind. The goal of the project is to help the blind people in Denmark to gain access to e-commerce. Right now, we are looking for the technology that the blind people use to access the computer and Internet. It would be greatly appreciated if you can answer the questions listed below. Thank you for your help.

Sincerely,
Liz Amaral
Ali Durlov Khan
Matthew Chan

1. What product or software do you use to access a computer? (Voice Synthesizers, Screen Readers, etc)

2. How do you access the Internet?

3. Do you have difficulty accessing the Internet? If so, what is the problem?

4. Have you ever used E-commerce? If so, what did you use and what problems did you encounter?

5. How frequently do you use computers? Internet? E-commerce?

6. Do you feel that you would use computers, Internet, or e-commerce more, or the same amount of times if it were more easily accessible?

7. What would you like to see improved on existing software?

8. Where did you purchase your existing software?

3.6 Available Product Experience

On the second day at the project site, it was decided that a brief instruction in the screen reader program, *JAWS*, would provide valuable insight for the purpose of the project. With the help of Bue Vester-Andersen, the Technical Consultant at the DAB who is also blind himself, we learned the basics of using JAWS to navigate the computer as well as the Internet. By lowering the contrast of the screen to simulate blindness and using keyboard commands, we were able to understand how to navigate web sites and use computer tools with JAWS. We also experienced the difficulties that blind computer/Internet users face when trying to use an application or a web browser to surf any particular website. The information that we learned about JAWS helped us in determining the web-design guidelines that can be used by any company interested in web sites accessible to screen readers.

During one of our meetings with Morten Hadberg of Merkantildata, we used our experience with JAWS to demonstrate how this screen reader navigates through the Merkantildata web site. This gave him a better understanding of why the changes we are proposing are important towards making their web site accessible.

3.7 Interviews

3.7.1 Interview with Michael Gorse, Blind Computer Science Student at WPI

We decided to interview Michael Gorse, a Computer Science student at WPI, because we recognized that he would be a substantial resource considering his major and the fact that he is blind. The following questions were asked via e-mail:

- *How do you access a computer?*
- *What software do you use to do this?*
- *Do you have difficulty accessing the Internet?*
- *How do you access the Internet?*
- *Is the World Wide Web easily accessible?*
- *Have you considered E-Commerce?*
- *Have you ever used E-Commerce? If so, what did you use and what problems did you encounter?*
- *How frequently do you use computers? Internet? E-Commerce?*
- *Do you feel that you would use computers, Internet, or e-commerce the same or more frequently if it were more easily accessible?*
- *What would you like to see improved on existing software?*
- *Where did you purchase your existing software?*

3.7.2 Interview with Representative of the Center for Equal Treatment of Handicaps

We spoke to Frans Storr-Hansen, a contact person at the Center for Equal Treatment of Handicaps, Copenhagen, Denmark. We were notified by Mette Røhe, of the DAB, that Frans has been working with accessibility of web sites for the blind and visually impaired. We designed questions that would help us grasp the underlying Danish attitude toward the Internet technology and web site accessibility as we continued testing the Merkantildata web site. The questions were as follows:

1. How did disability policies develop in Denmark?
2. What has been done in the field of accessible web sites for the blind and visually impaired by the organizations of the disabled?
3. What has been your experience with blind and visually impaired computer users?
4. Is there any web accessibility information that you know of that would be of help to us?
5. Is there any policy dealing with the security and privacy issues in Denmark?
6. How are these policies cooperating with other European countries?
7. Could we have a contact e-mail and/or telephone number to reach you if we have further questions?

3.7.3 Contact with Representative of Merkantildata

A set of questions for Morten Hadberg, a representative at Merkantildata, was e-mailed in order to receive background information on the company and answers to our inquiries about the web site that we prepared after reviewing it and running JAWS to navigate it. A copy of the e-mail is presented below.

From: usa
Sent: 30. marts 2000 13:20
To: 'moha@merkantildata.dk'
Cc: Mette Røhe (mr)
Subject: Good Afternoon

Hello Morten,

We are the WPI students who are working on the Accessible E-Commerce Websites with the Danish Association of the Blind. We wanted to take the opportunity to introduce ourselves. We are Durlov, Liz, and Matt.

There are a few questions that we would like to ask you regarding Merkantildata and its Website.

1) For the purpose of our project report, we were wondering if you might have any information in English about the company background that we could have.

2) We were also interested in studying the website in detail. Since most of the website is written in Java Script, the screen readers used by blind users read the Java codes instead of what is on the screen. We were wondering if we could perhaps get a copy of the specific pieces of the source code for the Online Shopping page so we can understand what the screen reader sees when it loads the web site.

We greatly appreciate your assistance.

Thank you,
Durlov
Liz
Matt

We visited the company to present our findings about their web site relating to the accessible web site guidelines. It is the goal of this project to offer Merkantildata possible suggestions to make their web site more accessible. Also, the guidelines that have been developed will be available to other companies who are interested in making an accessible e-commerce web site in the future.

3.7.4 Contact with Amy Marr, WPI Web Coordinator

An e-mail was sent to Amy Marr in order to receive technical advice on certain problems with the Merkantildata web site. The following correspondence was sent:

Date: Tue, 11 Apr 2000 08:31:28 -0400 (EDT)
From: Lizabeth Pereira Amaral <liz@wpi.edu>
To: Amy L. Marr <trek@wpi.edu>
Subject: Questions

Hi Amy,

My IQP partners and I, are at our project site in Denmark. We are working on an accessible e-commerce web site for the blind and visually impaired. We noticed that WPI's web site follows the W3C guidelines and we have a few questions we hope you could help us with.

When shopping online, we come to a point where if we use the back button, we lose the items in our shopping basket, or lose a secure connection. We were wondering how to design a page where we can go back and forth with out losing this information, like the registrar's page.

Also, if you know how to add a description to a JAVA button or replace a long link address with a link name, so that JAWS (screen reader we are using) doesn't read the whole link name, that would be great too!

If you could help us with this or lead us to a source that will be helpful to us that would be great! Thank you for your time!

Sincerely,
Liz
Matt
Durlov

3.7.5 Contact with Computer Science Professors at WPI

An e-mail was sent to Professor Isabel Cruz and Professor David Brown, of the WPI Computer Science department, for technical advise on certain problems with the Merkantildata web site. The following is the correspondence sent:

Date: Wed, 12 Apr 2000 08:08:58 -0400 (EDT)
From: Lizabeth Pereira Amaral <liz@wpi.edu>
To: Isabel F Cruz <cruz@wpi.edu>, David C. Brown <dcb@wpi.edu>
Cc: cruz@cs, dcb@cs
Subject: Questions

Good Morning Professors,

My IQP partners and I are at a Denmark project site. We are working on e-commerce for the blind and visually impaired. We have come across some problems with a local e-commerce company's web site, Merkantildata. We are working on a list of suggestions to their accessibility problems. We are using the screen reader JAWS to access their web site.

When shopping on their web site, we come to a point where if we use the back button, we lose the items in our shopping basket, or lose a secure connection. We were wondering how to design a page where we can go back and forth with out losing this information, like the registrar's page.

Also, if you know how to add a description to a JAVA button, that would be helpful. In HTML, we can use ALT text for link description, how is that done in JAVA?

Do you have any ideas of how to make a shopping cart accessible when using a screen reader?

If you could help us with this or lead us to a source that will be helpful to us that would be great! Neither of us are involved in computer science, therefore, the technical components of this project have been difficult for us.

Thank you for your time!
Sincerely,
Liz
Matt
Durlov

3.7.6 Contact with Patrick Burke, Researcher at UCLA

The project team came in contact with Patrick Burke through an online WAI bulletin board that was directed towards discussing different e-commerce web sites that are currently available on the Internet. Following an initial inquiry, an email correspondence was established between the team and Patrick Burke that led to various

new suggestions and several possible information sources for the e-commerce guidelines.

The following is the email that was sent to Patrick:

> -----Original Message-----
> **From:** usa
> **Sent:** 14. april 2000 12:46
> **To:** 'burke@ucla.edu'
> **Cc:** usa
> **Subject:** Re: examples of accessible e-commerce sites
>
> Hi Patrick,
>
> We are students from Worcester Polytechnic Institute, Worcester, MA who are currently working on our junior year project in Copenhagen, Denmark. Our sponsors are the Dansk Blindesamfund (Danish Association of the Blind) and a local e-commerce company.
>
> Our project involves developing a set of guidelines (other than the generic W3C Accessible Web Design Guidelines) that includes specific information/guidelines for making e-commerce websites accessible. We are to address features that are commonly used by e-commerce companies such as the shopping cart system, the checkout system, etc and find solutions that can be applied to make these various features on an e-commerce website accessible.
>
> We would highly appreciate your input as to whether any work has been done to this effect, and, if yes, where we may find pertinent information that would aid us in developing these guidelines.
>
> Thank you for your consideration.
>
> Durlov
> Liz
> Matt

3.7.7 Contact with Wendy Chisholm, Representative from the W3C

The following e-mail was sent to Wendy Chisholm representative from the W3C, asking about a problem we had with one of the solutions mentioned in their guidelines.

-----Original Message-----
From: usa
Sent: 18. april 2000 10:49
To: 'chisholm@trace.wisc.edu'
Cc: usa, wendy@w3.org
Subject: unified web site accessibility guidelines

Hello,

We are writing about the accessibility guidelines that you have written and uploaded at the following Internet address: http://trace.wisc.edu/archive/html_guidelines/central.htm

We had attempted to use the recommendations that you made for using the "headers" and "scope" attributes for Tables (Section 11) the way you described, hoping to make the screen reader read it out correctly.

Unfortunately, the method did not work for us. The screen reader still reads the table purely row-wise and not in the format shown in the example:

> "Caption: Cups of coffee consumed by each senator
> Summary: This table charts the number of cups of coffee consumed by each senator, the type of coffee (decaf or regular), and whether taken with sugar.
> Name: T. Sexton, Cups: 10, Type: Espresso, Sugar: No
> Name: J. Dinnen, Cups: 5, Type: Decaf, Sugar: Yes"

Could you please explain what we have done incorrectly with the solution given? We are attaching a copy of the html file showing the table from the piece of code you used for the example. We would highly appreciate it if you could take a look at the source code. Thank you very much for your time.

Sincerely,
Durlov
Lizabeth
Matthew

3.8 Survey for Danish Attitude regarding E-Commerce

A survey was developed and conducted through the Internet, in order to find out the Danish attitude towards using e-commerce. We were interested in knowing how many people use e-commerce and the reasons why people do not. We separated the surveys into one for those who have used e-commerce and one for those who have not. This survey was distributed among those who work at the Danish Association of the Blind by e-mailing the survey as an attachment and asking them to fill it out and email it back to us. JAWS was run with this survey to make sure that this form is accessible to those who are blind and visually impaired. The questions that were asked are listed below:

These survey questions were asked to those who had used e-commerce in the past.

- Age
- Gender
- Do you have a visual impairment, if so, what type?
- Do you own a credit card?
- What type of product did you purchase through the Internet?
- What were your reasons for using e-commerce (inexpensive, convenience, etc.)?
- Did you use a credit card for this transaction?
- Did you have any problems when using e-commerce?
- Have you ever experienced any incident with security and privacy after using your credit card for an online transaction?
- Do you feel secured when using your method of payment?
- Are you aware of recent developments in online security and privacy issues?
- If you have a visual impairment, do you feel you would use e-commerce more frequently or the same amount of the time if it were more accessible?

These survey questions were asked to those who had never used e-commerce.

- Age
- Gender
- Do you have a visual impairment, if so, what type?
- Do you own a credit card?
- What were your reasons for not using e-commerce (insecure, delivery time, inaccessible, etc.)?
- Would you use e-commerce if there were guaranteed security?
- Are you aware of recent developments in online security and privacy issues?

3.9 Plan for Analyzing/Evaluating Results

For the evaluation of this project, we went through the Merkantildata web site and compiled a list of problems found with the Merkantildata web site and then we developed a list of suggested solutions to the problems found. These problems were found by navigating the web site using JAWS and low screen contrast – to simulate blindness. We also asked Bue Vester-Andersen to navigate the company's web site to find any additional accessibility problems that we may have missed. We used the W3C guidelines to help us make suggestions of an accessible website for Merkantildata. We also used *Bobby*; a program that takes the URL's of different sites and searches the site for inaccessibility problems. For technical solutions to problems found by these tools that we cannot fix, we asked Bue Vester-Anderson, the technical consultant at the DAB, as well as some Computer Science Professors at Worcester Polytechnic Institute, via e-mail, for help. For aspects relating to saving information when using the back or forward tool buttons when navigating on a secure server network (such as when shopping online), we contacted Amy Marr, the Webmaster of the WPI web site, for suggestions. With the help of all of these resources, we hope we determined an accurate list of guidelines for an accessible e-commerce web site.

4 Results of Interviews and Surveys

In this chapter, the information we gained from our interviews and surveys are described. These include the interview with Michael Gorse – a blind Computer Science student at WPI, Frans Storr-Hansen – a representative from Center of Equal Treatment of Handicapped, and Morten Hadberg – a representative from Merkantildata. We also display the results of contacts with Amy Marr, the WPI web coordinator, and other Computer Science professors at WPI. Finally, we present the results of the surveys. The first survey was sent to the blind and visually impaired individuals and organizations in order to find out what type of product they were using to gain access to computer and Internet. The second survey was conducted to find out Danish attitude towards e-commerce. This means of gathering information proved to be very useful to our project. The results of the interviews are presented in the order they were undertaken.

4.1.1 Results of Interviews

4.1.1.1 Interview with Michael Gorse, Blind Computer Science Student at WPI.

This interview was conducted via e-mail. The questions are in Italic, and the answers are verbatim.

1. *How do you access a computer?*
2. *What software do you use to do this?*

   These questions are kind of related, so I'll just answer them both. I generally use a speech synthesizer called a Speak-out, which I hook up to the serial port of the system I'm using. The Speak-out will read out text sent to it, so software is needed to actually send it text to speak. I use yasr (http://www.wpi.edu/~mgorse/yasr/) for this,

but keep in mind that there are many different programs that serve a similar purpose that run on different operating systems. When I'm using Windows I use Jaws for Windows (http://www.hj.com), which include a software synthesizer (i.e., one that converts text to speech and plays it using a normal sound card) so I just use its default synthesizer. You might also want to look at http://www.wpi.edu/~mgorse/article.txt, which is based on an article I wrote for Newspeak a couple years ago.

3. *Do you have difficulty accessing the Internet?*

   Occasionally, web sites that use images with no alt tags are difficult for a blind person to navigate, no matter what screen reading package he is using (even a Windows screen reader can't interpret pictures). Try accessing http://www.marshall.org in lynx, or in Netscape or IE with graphics turned off, to see what I mean. (I should really contact this site's Webmaster about it...)

4. *How do you access the Internet?*

   I don't know exactly what you mean by this; I use lynx for web browsing most of the time; I'll use Internet Explorer in Windows if I run into a page that requires *JavaScript*[82] or otherwise gives lynx an inordinate amount of trouble (last time I remember going into IE was last year when I was trying to get my resume into the resume expert system the CDC uses)

5. *Is the World Wide Web easily accessible?*

   It can be, and should be. Html was designed to be independent of the interface being used (i.e., to support non-visual as well as visual interfaces). Most sites don't cause serious problems, but a few are difficult.

6. *Have you considered E-Commerce?*

7. *Have you ever used E-Commerce? If so, what did you use and what problems did you encounter?*

   As with the www in general, most sites do not cause problems, but there are a few that do. Some people on a mailing list that I'm on were recently complaining about www.linuxmall.com (I have never personally used this site, but from what I can gather, searching/browsing do not work well in lynx and present a lot of useless information. Didn't think to save the messages, though)

8. *How frequently do you use computers? Internet? E-Commerce?*

   I doubt that one could use computers or the Internet infrequently and get by at a tech school... And generally I'll use E-Commerce when I need to order something computer-related.

9. *Do you feel that you would use computers, Internet, or e-commerce the same or more frequently if it were more easily accessible?*

   I am generally able to do what I need to do, but naturally I will be discouraged from using a particular site if it is difficult to access for whatever reason. I would recommend using alt tags for any images designed to convey information on web sites you develop and testing them with a text browser. If you do these things, then you should not run into problems.

10. *What would you like to see improved on existing software?*

    Not sure what software you mean; would be nice if one of the text-mode browsers supported JavaScript, but I don't know anything about JavaScript so I'm not sure if it

---

[82] See Glossary for definition.

is technically feasible to implement it in text mode. But JFW works fairly well with Netscape and IE, so I can use one of those if I need to, for now. And work still needs to be done on the XWindows-based access solutions, but these are in development and not ready for general use from what I've read.

11. Where did you purchase your existing software?

My Speak-out came from GW Micro (http://www.gwmicro.com), although they are not manufacturing them anymore since software synthesizer are becoming popular (one of the high schools I attended actually purchased this for me; don't know if they went through GWMicro directly or not though). The JFW that I use is owned by WPI and was purchased through a reseller in the area; can't remember the name of her company though.

4.1.1.2 Results of Interview with Frans Storr-Hansen

Frans Storr-Hansen also answered many questions and gave us a better understanding of what is currently happening in Denmark, concerning web accessibility. Denmark's disability policies are developed under the cooperation between the Parliament and De Samvirkende Invalideorganisationer (DSI). DSI is the only Danish umbrella organization in the disability domain; it was founded in 1934. Today DSI has 29 member organizations. The members of DSI are organizations *of* the disabled people, such as the DAB. For example, this means that the DAB is operated "*by* the blind and visually impaired" as opposed to those that are operated by sighted persons in a "*for* the blind and the visually impaired" organization. Since 1980, the members of DSI and the Parliament have joined together four times a year to discuss the living conditions of the disabled and the effects of the Danish policy on them. It has been the task of the DSI to

negotiate with the government on issues like pensions, social benefits, medicine, health care, technical aids, and other general concern to all disability group.

Starting in 1998, the W3C (the World Wide Web Consortium) had conducted a survey, through the government information service, to learn about how to make an accessible web site. The result was the W3C guidelines published in 1999. Other efforts have also been undertaken by other organizations. The Center for Equal Treatment of Handicaps initiated a project for accessible web sites at the conference on November 10th, 1999. In order to inspire companies to have an accessible web site, an award competition was set up. Judged by a jury, an award is annually granted to the company with the best accessible web site.

A survey has revealed that currently, JAWS is the first choice screen reader used by the blind and visually impaired in Europe. For Internet access, since 1996 more blind and visually impaired users have started to use Microsoft's Internet Explorer 4.0 or higher with the help of JAWS. However, accessibility problems constantly arise due to advancing technology and changing web design techniques. In order to make JAWS compatible with the advancing technology, updated versions of JAWS need new script files. A user group funded by DAB has been working on making these script files, to maintain JAWS' compatibility with newer software or browsers. People can download the upgrade for free through DAB's website. Another way to reduce the accessibility problem is using the standard format when designing a web site, so JAWS can function effectively. For example, web designers can follow the guidelines established by W3C.

According to Frans Storr-Hansen, a digital signature and key center are to be used to ensure Internet users' security and privacy in Denmark. A digital signature guarantees

who has signed an electronic letter and that unauthorized parties have not made changes to the message. Key center guarantees that the signer is who he or she claims to be. An encryption policy is also to be drawn up securing rights to free encryption for citizens and enterprises without the possibility of illegal interception. This will be set in motion in the second quarter of 2000.

Recently, the European Union (EU) has initiated a project call "E-Europe". The purpose is to enable Europe to be a stronger e-commerce competitor to rest of the world. One of the top priorities is the accessibility for the disabled. Currently, the EU is trying to avoid having different countries make similar, but not identical rules. These rules may serve the same purpose, but too many different specifications make them difficult to be enforced.

4.1.1.3 Results of Visit/Interview with Merkantildata

The visit to Merkantildata, to meet Morten Hadberg, gave us an understanding of what the company would like and expects from us. The general direction taken by the project team was agreeable. We learned that they were interested in a list of possible accessibility hazards and their solutions, as well as general guidelines for making an accessible web site. We further discovered that the company made use of a bureau to set up their web site, and Morten inform us about any elements of the web site that cannot be changed. An overview of the accessibility problems with the Merkantildata web site was discussed, as well as the complexity of the suggested solutions.

4.1.1.4 Results of Contact with Amy Marr, Web Coordinator at WPI

This is the response to the question presented in the methodology chapter (Section 3.7.4). The questions we asked are related to the problems found on the Merkantildata web site.

Date: Wed, 12 Apr 2000 10:13:52 -0400
From: "Marr, Amy L." <trek@WPI.EDU>
To: 'Lizabeth Pereira Amaral' <liz@WPI.EDU>
Subject: RE: Questions

These are really good questions.

The reason that the Registration system works this way is that a login session is created using CGI, not Java. I don't know specifically how to achieve this, since I don't do CGI programming, so that's not going to help you much, I guess.

I don't know anything about Java buttons - we don't use Java because of all the problems people have. Please keep in mind that not everyone has Java anymore - Microsoft isn't allowed to ship their software with Java embedded in it because they violated an agreement with Sun. Only really computer savvy people will make the effort to download Java.

Good luck on your project,
Amy

4.1.1.5 Results of Contact with Computer Science Professors at WPI

The following email correspondence was conducted between the project team and the WPI Professors David Brown and Isabel Cruz. The professors were contacted with regard to enquiries about some of the accessibility difficulties of the Merkantildata web site that were encountered during the critique of the site.

Date: Fri, 14 Apr 2000 19:46:05 -0400 (EDT)
From: David Brown <dcb@sequoia.WPI.EDU>
To: Lizabeth Pereira Amaral <liz@WPI.EDU>
Cc: Isabel F Cruz <cruz@WPI.EDU>, David C Brown <dcb@WPI.EDU>
Subject: Questions

Good Morning Professors,

My IQP partners and I are at a Denmark project site. We are working on e-commerce for the blind and visually impaired. We have come across some problems with a local e-commerce company's web site, Merkantildata. We are working on a list of suggestions to their accessibility problems. We are using the screen reader JAWS to access their web site.

I do not know JAWS but it looks as if it's widely used (http://www.hj.com/).

When shopping on their web site, we come to a point where if we use the back button, we lose the items in our shopping basket, or lose a secure connection. We were wondering how to design a page where we can go back and forth with out losing this information, like the registrar's page.

That clearly needs the server to keep track of the state of the interaction with that user.(i.e. it needs to generate those pages dynamically. Servlets or CGI I expect).

Also, if you know how to add a description to a JAVA button that would be helpful. In HTML, we can use ALT text for link description, how is that done in JAVA?

I don't know Java, sorry.

Do you have any ideas of how to make a shopping cart accessible when using a screen reader?

Without knowing exactly how the screen reader works and how the shopping cart is built/displayed I cannot help.

If you could help us with this or lead us to a source that will be helpful to us that would be great! Neither of us are involved in computer science, therefore, the technical components of this project have been difficult for us.

Prof. Cruz, who's very very busy at present with the Webware course --which teaches the technology to take care of the sort of issues that you raise -- would have a better background than I do to provide more information resources.

Regards,
Dave Brown

4.1.1.6 Results of Contact with Patrick Burke of UCLA

This is the response to the question presented in the methodology chapter (Section 3.7.6).

-----Original Message-----
From: Patrick Burke [mailto:burke@ucla.edu]
Sent: 19. april 2000 00:40
To: usa
Subject: Re: examples of accessible e-commerce sites

Hi Everyone,

Thanks for writing. This is definitely a critical and timely topic, although I don't think there has been much work specifically on E-shopping Web interfaces. So you are in on the ground floor!

I'll give you some of my own thoughts and point you to a couple of possible information sources.

A lot of the accessibility problems faced (for example by blind screen-reader users such as myself) actually are the same as other Web access issues, and they are covered pretty well by the W3C guidelines. No matter what scripting is going on behind the scenes (server-side at least), the end user only knows that the shopping cart button is a shopping cart button. For the screen reader/browser program to know this, good HTML practice & the W3C guidelines need to be followed: that is, the button should be rendered as a properly coded HTML form control (same goes for list boxes, radio buttons, etc.), and if a graphic is used for the button it should have the alternative text ALT="Shopping Cart" or ALT="Buy Now", etc.

A lot of other issues that make E-commerce difficult for people with disabilities also affect other consumers. These fall under the category of Usability (see the work of Jakob Nielsen and others). Very frequently when I tell a colleague that I find a site confusing or cluttered, he/she will respond that it looks visually confusing as well. So principles such

as providing clear and consistent navigation, providing content the user needs without making the screen overly busy, and so on, apply equally to disabled and nondisabled shoppers.

There are a few other points that I think are worth raising: A lot of sites provide a text-only alternative, which helps blind users and anyone with a slower connection. As long as these pages are generated automatically, this can be a useful option. (If pages have to be generated separately, it is almost inevitable for the text version to go out of date while more and more new features are added to the main graphical page.) The text pages should also include all the features available in the graphic-intensive version. You should be able to "turn on" the text option at the beginning (or whenever you like), and be able to continue browsing in text mode to the end of the transaction, & also have the option of switching back to graphics at any point. Still, the best solution is to have one page that transforms gracefully to match the user's requirements. This is a kind of Holy Grail that is hard to implement with today's browsers and authoring tools, but it should be kept in mind. For example, providing a text version does not mean that ALT text labels should be omitted from the graphical imagemap.

JavaScript is another thorny issue at the moment. While screen-reading software (working with IE or Netscape) can read many JavaScript-generated effects and pages, there are other tools that do not support Jscript at all. These include the self-voicing browsers: IBM Homepage Reader, PW WebSpeak, and a few others. For this reason, the NOSCRIPT portion of a page which usually only says "Get a better browser!" should contain all the functional content of the scripted page. Again, this also helps in cross-browser issues where Jscript might not be evenly supported.

Also, requiring users to change their browser settings is generally a bad idea from a usability standpoint (irritation factor), and can also cause problems for disabled users.
For example: Ticketmaster requires image-loading to be turned on for order processing. Ideally the Web site should provide alternatives (or automatic mechanisms) to tailor itself to the user's browser version and settings (The customer is always right).

So, I will close with probably the biggest and best example of an
E-commerce experience: Amazon.com. I have used it numerous times, and there are many features that I find very user-friendly. It is easy to do a search and work through the results. The "other titles by this author", "other customers also bought..." and other links provide a convenient way to expand or fine-tune a search. The checkout process is straightforward (compared to some other sites), with plenty of chances to verify that the order is proceeding properly (correct quantities, etc.). I rarely use the text-only version because most of the features I want are accessible on the main page. However, I usually skip over the unlabeled imagemap links entirely, so new features shown there get ignored by me. Also, other people have reported that some of the graphic-only links for new features are displayed as graphics within the text version of the site (i.e., Amazon's text-conversion scripts are not keeping up as the site expands and adds new elements). The expansion of the site has also meant increased clutter, making pages load more slowly

and making it harder to find the most relevant information (the results of your search, the sound samples to listen to, etc.).

So, I can certainly provide you with more examples if you want them, although you might have to make me a co-author at the rate I'm going...

Feel free to write me for clarification or if you have other questions. For now, here are the resources I promised:

Tim Noonan of Blind Citizens Australia presented a conference paper recently, which contains links to a broader report on a range of E-commerce issues: http://www.csun.edu/cod/conf2000/proceedings/0189Noonan.html

I'm not sure what they have done in the Web commerce field, but a standard reference source for universal design and other access topics is the Trace Center: http://www.trace.wisc.edu

Closer to where you are, you might contact Helle Bjarno. She has been involved in the WAI guidelines development process, and she should have a better idea of what projects are going on in Europe:
Helle Bjarno
Videncenter for Synshandicap / Visual Impairment Information Centre
Rymarksvej 1, DK-2900 Hellerup, Denmark
tlf: +45 39 40 31 00
fax: +45 39 61 94 14
e-mail: hbj@visinfo.dk

Since we're here, my other Danish contact is Claus Thoegerson, who is an advanced user of the JAWS screen reader and might also be able give you some other leads locally: Claus Thoegersen: cltrar@login.dknet.dk

Best of luck,

Patrick

4.1.1.7 Results of Contact with Wendy Chisholm, Representative from the W3C

This is the response to the question presented in the methodology chapter (Section 3.7.7). The questions we asked are related to the technical solution we found in the W3C guidelines

-----Original Message-----
From: Wendy A Chisholm [mailto:wendy@w3.org]
Sent: 19. april 2000 21:17
To: usa
Cc: wai@w3.org
Subject: Re: unified web site accessibility guidelines

Hello,

Using this markup does not ensure that *all* screen readers will linearize the table as we have described. The technique has been prototyped and demonstrated but has not yet been widely incorporated into screen readers. The most recent version of Jaws (from Henter-Joyce) will read a table cell-by-cell.

A tool developed at the W3C called "The Table Linearizer (tablin)" will linearize a table in this way. You can find it at http://jigsaw.w3.org:8000/tablin/ You can view any page at the w3c site by including ",tablin" in the URI. For example, "http://www.w3.org/,tablin".

Be well,
--wendy
World Wide Web Consortium
Web Accessibility Initiative
Madison, WI, U.S.A
tel: +1 608 663 6346

4.1.2 Results of Surveys

4.1.2.1 Survey of Blind Individuals and Organizations

The surveys sent to blind and visually impaired individuals and organizations in the United States proved to be ineffective since no one responded. The purpose of the surveys were to gather information on what products are being used by the blind and visually impaired, when accessing computers/Internet. The lack of response had no effect on the project since it was determined that a list of products would in fact not be useful to the DAB, since they only use the JAWS screen reader.

4.1.2.2 Survey for Danish Attitude Towards E-Commerce

As a result of this survey, we were able to make certain generalizations about the people who are sensitive to the issues of the blind. This is because the survey was only conducted with the individuals at the DAB; therefore, generalizations about the whole country of Denmark would not be qualified. The following information was found as the result of the survey based on the 13 respondents:

Ages- 27-54
Gender- 7 females, 6 males
Visual Impairments- 3 out of 13 are blind
Own a credit card- 13
Percentage of non-users of e-commerce- 8 out of 13
Percentage of users of e-commerce-5 out of 13
Used a credit card for online transaction-5 out of 5 users
Had problems using e-commerce- 0 users
Have experienced security issues after using e-commerce- 0 users
Felt secure using their credit card online- 5 out of 5 users
Aware of recent developments in security of online shopping- 4 out of 5 of users
Aware of recent developments in security of online shopping- 3 out of 8 of non-users
If have visual impairment, feel that if more accessible, it would be used more frequently-3 of 3
Would use e-commerce if there were guaranteed security- 5 out of 8 of non-users

Based on the 5 respondents who have used e-commerce at the DAB, we found that it was used to purchase products such as CD Braille manuals, ecological vegetables, books, and subscriptions to magazines. Their reasons for using e-commerce were convenience, availability, low prices, and it was the only means of ordering a particular product. Based on the 8 respondents who have never used e-commerce at the DAB, the reasons for not using e-commerce were largely security and privacy issues; however, the also indicated other reasons such as not feeling the need for making Internet purchases, and not having a personal computer with Internet connection. The most frequent answer was that they like to see and feel what they are buying.

There are more individuals (8 of 13) that have never used e-commerce, than those who have (5 of 13). Those who have never used e-commerce feel that it is insecure; this suggests that the Danes may not want to use e-commerce because of the insecurity. It also was noticed that 5 out of 8 respondents who have never used e-commerce are not aware of the new developments in security of online shopping and 4 out of 5 respondents who have used e-commerce are familiar with them. One possible suggestion is that those individuals that have never used e-commerce have not done so because they are not educated about online shopping. The individuals who have used e-commerce have not experienced any security or privacy issues; therefore, we can safely assume that e-commerce is not entirely insecure.

From this survey, it can be noted that even though the number of blind individuals was small (3 out of 13 respondents), two of the three have used e-commerce. Therefore, it can be inferred that blind individuals will be more likely to use e-commerce than sighted individuals because of the convenience of not having to go out to purchase the

item and not feeling the need to see and feel every item that they want to purchase. This offers the e-commerce company incentive for making their e-commerce web site accessible to the blind and visually impaired because, according to our survey, the blind individuals would use it more often if it were more accessible. This survey can also be used as a marketing tool for groups trying to promote making web sites accessible.

5 Critique and Guidelines for Accessible E-commerce Website

As described in section 3.9, we used the guidelines determined by the W3C, when making suggestions on how to make Merkantildata's website accessible. We also used *Bobby*; a program that takes the URL's of different sites and searches the web sites for inaccessibility problems. For technical solutions to problems found by using these tools that we could not fix, we sought advice from Bue Vester-Anderson, the technical consultant at the DAB, as well as Computer Science Professors at Worcester Polytechnic Institute, via e-mail. For solutions relating to saving information when using the back or forward tool buttons when navigating on a secure server network (such as when shopping online), we contacted Amy Marr, the Webmaster of the WPI web site, for suggestions. With the assistance of all of these resources, we hope that an accurate list of guidelines for an accessible e-commerce web site was made.

We determined a list of suggested problems to the problems found on the Merkantildata web site from using the screen reader, JAWS, to navigate the web site. Technical information on JAWS was obtained from the Henter-Joyce web site, www.hj.com. We learnt more information on how JAWS responds to a web site by running JAWS while navigating several different sites.

Along with this list of suggested solutions, we wrote a list of guidelines that companies could use in order to make an accessible e-commerce web site. This will be given to Merkantildata, as well as, left at the DAB for future recommendations.

This evaluation chapter includes, in section 5.1, a list of the accessibility problems found with the web site. Section 5.2 states a few accessible elements with the Merkantildata web site that should be kept if and when the web site is changed. Section

5.3 lists suggested solutions to all of the accessibility problems found with the web site. Each problem is described and given a number in 5.1. The suggested solutions to the problems are given a corresponding number in section 5.3. A list of additional suggestions is included in section 4, which would be helpful when a blind user is navigating the web site, but is not completely necessary. Merkantildata could make their own decision on whether or not they would make those changes.

5.1 Problems with the Web Site

When navigating the merkantildata.dk web site with JAWS, we found the following accessibility problems:

1. *Non-descriptive link for categories on Online Shop page.*
   The Online Shop page consists primarily of a list of categories that can be expanded to show the product lists under them by clicking on the triangular icon on the left of each category name. Visually, the icon is basically a link that either causes the list to be expanded or retracted and the state of the corresponding list is represented by the orientation of the icon. When a visually impaired individual navigates the page with a screen reader by tabbing through link-by-link, however, the user only encounters the icon links (without the name of the category, since the categories are not part of the link) and the link is read out as "plus link" or "minus link". Clearly, hearing links with the same name is not accessible for such a user and should be labeled individually.

2. *Description of table layout on main page, not read out correctly by JAWS.*
   It appears that the main page of the Merkantildata web site uses a three-column – five-row table for its layout design. This becomes cumbersome for a visually impaired user since such a user does not realize that the table has no tabular purpose and so gets disoriented when the screen reader moves on to the rest of the page. Whenever a table is used, it should be primarily used for tabulating data and should be headed by a title or description. If a table *is* used for layout or page structure, it is difficult for a blind user to follow unless there is a summary at the beginning describing the layout.

3. *Unreadable text on top of the main page.*
   There are some button links at the top of the main page of the web site just below the Merkantildata heading of the page, specifically the *Kompetencer*, *Jobs*, *Konferencer*, *Boersinfo*, *Presseinfo* and *Profil* links, which are not readable on several browsers and screen resolutions. The problem appears to be the particular choice of foreground and background colors for the fonts used in that section of the web page.

4. *No ALT text for any graphics.*
   The graphics used in the Merkantildata website all need to include alternate text descriptions since a screen reader cannot read a graphic element and therefore the visually impaired user would have to rely on a textual description of the images or applets. Currently, the images are read either as "image" or the exact link verbatim which is even more confusing. An example is the picture on the main page of the Merkantildata web site, which is not labeled and the Merkantildata logo-link on the Online Shop pages of the web site, which reads out the URL of Merkantildata, not the link name.

5. *JAWS reads out long link address instead of the link/button name.*
Merkantildata website is currently run off of a database. Thus, the links on the pages are long database-intensive links. Some of them include the following: the logo links for Merkantildata and the links below the Merkantildata heading (*Kompetencer*, *Jobs*, *Konferencer*, *Boersinfo*, *Presseinfo* and *Profil*) on the main page of the web site, and the navigation links on the Online Shop page – *Navn*, *Fabrikat*, and *Varegruppe*. When the screen reader scans these links, it reads out the entire link address (with the database references) instead of the link text or any other descriptive text, and that is confusing. The problem is in the lack of any textual tag being associated with these hypertext links/buttons.

6. *JAWS reads Java description instead of button description.*
This problem is somewhat similar to the previous one with link descriptions. There are three such buttons that are written in Java for the Online Shop web page, the *Vis vare*, the *Fjern vare*, and the *Bestil* buttons that do not appear to have any textual description associated with the links. As a result, the screen reader reads the exact Java code for these button-links instead of their names or labels when it encounters them.

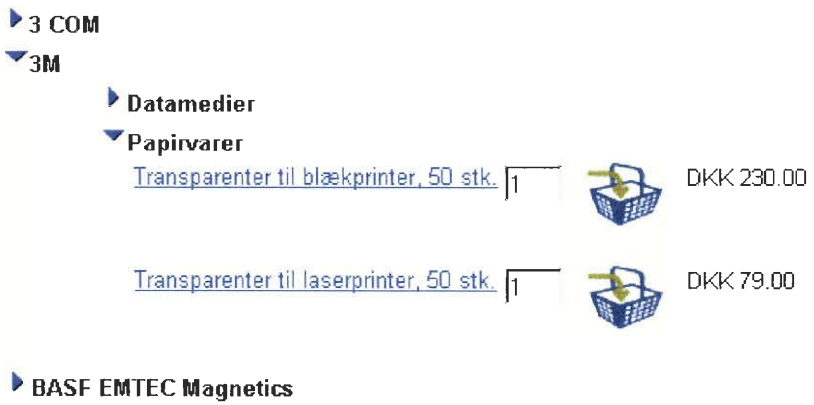
7. *Not all HTML links are tagged with text.*
This problem includes links such as *read more here* and *here* (on the main page of the Merkantildata web site) that need better textual description, as well as the product name links that link to product descriptions in the Online Shop page. The problem with links such as the *read more here* link is that when a visually impaired user navigates the web site using a screen reader and the TAB key, the screen reader only jumps from link to link. Therefore as JAWS arrives at one of these links and reads out only what is underlined as the hypertext link, namely "read more here," the user does not know what idea, comment, or news item that link is referring to. As for the product name links, it is confusing for a visually impaired user to realize what the name of the product could be leading to as a link unless there is some kind of mention such as "click name for product information" on the link. These problems are simply due to lack of appropriate textual description associated with the link.

8. *Links that do not show on the screen but are present on the web site (hidden).*
There are several such links that any user can encounter while using the TAB key to navigate the Merkantildata web site by jumping from link to link. These links are not visible on the web page; thus anyone using the mouse to navigate does not have to worry about running into them. However, *tabbing* through the web site will inevitably lead the user to these links. For the visually impaired user, this can be confusing – for two reasons: first, the links are read by the screen reader as nothing more than, "link," since there is no textual description associated with them; second, the links could either open up some kind of login dialog boxes or are links to certain other pages within the Merkantildata website.

9. *No labels for the edit box in the search engine on main Merkantildata page or in the Online Shop page, or in the quantity edit box in the Online Shop box.*
It appears that none of the edit boxes used for the search engine or for the product quantity have any textual description associated with them. Thus when a screen reader stumbles upon one of these edit boxes, it just reads, "edit box," and waits for the user to type into the box. The problem is that the user does not know what the edit box is for. The problem again is that there is no textual description of the functions associated with the edit boxes.

10. *No label for search button on main page.*
The problem that arises in the case of the search link/button, *Søg*, next to the search edit box on the Merkantildata logo heading on the main page of the web site is that the screen reader only reads "button link," when it encounters the button/link. Thus the user has no idea what this link or button is all about. This problem is again due to the lack of appropriate textual description associated with the link.

11. *The indented directory list of the categories of products to buy, and their subsections, is very confusing.*
This is a structural problem that makes navigation, as well as comprehension of the categories/products list in the Online Shop page, difficult for a visually impaired individual using a screen reader. Apparently, the categories lists are made up in a tree-directory system such that each major category can be expanded to display the list of products that is in a subdirectory within the category directory. The following screen shot of the web page demonstrates this list:



The link that executes the expansion and contraction of the lists are the little triangular links on the left of each of the category names. The problem is that it is easy for a sighted user to notice what the links are doing and the expansion and contraction of the lists. However, for a visually impaired user it is difficult to grasp firsthand since such a structural design is not what anyone is expecting when they click on a link. Moreover, with any list expanded it becomes cumbersome for the user if he/she is *tabbing* through the page to go down to the shopping basket at the bottom frame of the page.

12. *Online shopping link is in the middle of a large column, which is not practical, (too many links).*

This problem arises with the fact that the list of links on the rightmost column of the main page of the Merkantildata web site includes a myriad of links to a variety of places camouflaged among which happen to be important department links, such as those of the Online Shop and M-connect. It is not convenient, but not too difficult either for a sighted user to be able to locate the appropriate link for the Online Shop in this list. On the other hand, the list is anything but convenient for the user who plans on *tabbing* through the multitude of links on the web page to reach the Online Shop link. Chances are the user is apt to give up searching for that link before arriving to it.

13. *Inconvenient checkout process when using shopping cart.*

The checkout process for Merkantildata is unique compared to other e-commerce web sites. It has its advantages in that the customer has the option to pick a product up into the shopping basket as he/she chooses the item by simply clicking on the shopping cart icon next to every product name after filling out the quantity desired. He/she may also keep a constant watch on the current contents of the shopping basket since the basket is always present at the bottom of the page as the customer keeps shopping through the web site. The current structural design of the web site definitely makes it convenient – for sighted users; however, as far as visually impaired users go, the site is not *easily accessible*. First, such a user must *tab* through the entire list of products/categories to go down to the shopping basket anytime he/she wants to check the contents of the basket. It is also difficult to return to the place where the user left off after checking the contents of the basket. Unlike the sighted user, the blind user cannot simply glance at the basket (and perhaps scroll down on the list sometimes, if required) to check on the contents as they go about shopping. Next, for the visually impaired user while he/she is in the shopping basket itself, viewing the product descriptions or removing any particular product is not just a matter of clicking a couple of buttons anymore. It involves *tabbing* back and forth between the *Remove Item* and the *Show Product Description* buttons and the shopping basket. Finally, the total cost of the products thus far selected is a dynamically updated text that allows a screen reader no opportunity to notice as the update is made. In addition, unless the user has been explicitly informed of that feature of the web page and its location, it is useless for the visually impaired customer.

14. *User information read aloud.*

This is a problem that somewhat involves the security and privacy issue related to e-commerce. For a visually impaired customer using a screen reader as he/she fills out the personal and financial information on the purchase form it becomes increasingly difficult to protect the important information such as passwords, credit card details, personal details, etc. A screen reader *reads aloud* keyboard input as it is typed in. Thus, purchasing products at the Merkantildata web site becomes somewhat insecure for the visually impaired. It must be noted that this is

not a problem that is specific to the Merkantildata website but is generic to any e-commerce web site. Therefore, this problem is of grave concern to most visually impaired consumers using e-commerce.

15. *"Back" and "Forward" is not at the very bottom of web page.*
On the online shop pages of the web site, the "Forrige" and "Næste" side buttons are not located at the very bottom of the page. It would be more useful to have it after all other optional links in case the user wants to move to that location. If the back and forward buttons are read before this option, the user may not know that option is there since the user cannot see it for herself/himself.

5.2 List of Accessible Elements on Web Site

When navigating the Merkantildata web site with JAWS, we found accessible elements that the company should consider keeping when changing their web site. They can also be used as reference for the rest of the web site. The following is a list of accessible elements:

1. On the main page, the section titled "Gratis nyhedsbrav" with the edit box is accessible. The presence of "Min email" inside the edit box is quite a useful feature, as are the appropriately labeled radial buttons, "Send" button and the "Peasy Online" link in that section.

2. Also on the main page, news links at the bottom inside the cascaded table in the center column of the page, and the right-column links are accessible because of the appropriate descriptive links.

3. Product links are accessible, since the link phrase includes the entire name of the product. However, description of what the function of the links would be more helpful.

4. The purchase login page that the *Bestil* button on the Online Shop page leads to is accessible. The edit boxes appear to be well associated to the textual descriptions on their left. Except for the distinctive "here" link, the page is quite easily *readable* by a screen reader.

5. The purchase registration page that the "here" link on the login page leads to is entirely accessible. The manner of code used for the edit boxes in the registration form makes the form accessible with the use of a screen reader.

5.3 List of Recommended Solutions to Problems with the Web Site

Each suggested solution corresponds to the number of the problem described in section 5.1. The following are the suggested solutions, as well as additional suggestions for making the web site more accessible:

1. In order to label a link such as the triangular icon in the categories/products list, the following can be done:

    a. On the categories page for Online Shop, the categories are set up as follows:

    ```
    <TR VALIGN=top><TD COLSPAN=5><A
    HREF="/merkantildata/b2b-
    produkter.nsf/product+view1?OpenView&Start=1&Count=30&Ex
    pand=6#6" TARGET="_self"><IMG SRC="/icons/expand.gif"
    BORDER=0 ALT="+ " HEIGHT=16 WIDTH=16></A><font
    face=arial,helvetica,sans-serif size=-1><b>Diverse
    </TD></TR>
    ```

    In order for it to be read correctly by a screen reader, replace the "+" for the link name to the actual category name (in this case replace with **`ALT="Diverse"`**).

    With the ALT text changed, the screen reader will now read, "Diverse Link," which is more understandable than "Plus Link," which was common for all of the category links.

    b. To further convey the information that this link merely expands or contracts the list of products under that specific category, the ALT text could also be phrased more specifically such as, "Diverse, click to expand list link."

2. It is inadvisable to use tables for the purpose of page layout. Tables should be used only for *tabular information*[83]. There are separate HTML attributes for layout of web page contents. These include the following:
    a. Hypertext element attributes such as the ALLIGN attribute, or the TITLE attribute are the best tools when it comes to web page layout designing.
    b. The other great HTML tool for the purpose of layouts is the use of the STYLE SHEET. Although one must be careful when using *style sheets*[84], this tool allows the web page designer flexibility with layout.

[83] See Glossary for definition.
[84] See Glossary for definition.

This report includes a more elaborate description on style sheets in section 5 of this chapter, the Guidelines.

In order for table layout to be readable with JAWS, the following should be considered:

a. For content to always make sense, keep the material as row-oriented as possible. Remember that only the cells that are next to each other *horizontally* will be read in sequence, while *other cells most probably will separate vertical neighbors*. For example, do not place a heading in one cell and the text it belongs to in another cell below that. This is likely to result in the heading being separated from its text and making little sense on its own. Instead, place both the heading and the text in one cell using the `rowspan` attribute, if necessary, to force the cell to stretch down as needed.[85]

b. Explicitly associate table cells with row and column labels.
Future browsers and assistive technologies will be able to automatically translate tables into linear fashions if tables are tagged appropriately. You may tag by using either of the two attributes described below:

"headers" - The following example, shows how to associate header information with the "headers" attribute. The "headers" attribute specifies a list of header cells (row and column labels) associated with the current data cell. This requires each header cell to have an "id."

```
<TABLE border="border" summary="This table charts the
number of cups of coffee consumed by each senator, the
type of coffee (decaf or regular), and whether taken
with sugar.">
<CAPTION>Cups of coffee consumed by each
senator</CAPTION>
<TR>
<TH id="t1">Name</TH>
<TH id="t2">Cups</TH>
<TH id="t3" abbr="Type">Type of Coffee</TH>
<TH id="t4">Sugar?</TH>
<TR>
<TD headers="t1">T. Sexton</TD>
<TD headers="t2">10</TD>
<TD headers="t3">Espresso</TD>
<TD headers="t4">No</TD>
<TR>
<TD headers="t1">J. Dinnen</TD>
<TD headers="t2">5</TD>
<TD headers="t3">Decaf</TD>
```

[85] "HTML Unleashed PRE: Creating Widely Accessible Web Pages," http://www.webreference.com/dlab/books/html-pre/42-4.html#42-4-1

```
<TD headers="t4">Yes</TD>
</TABLE>
```

*A speech synthesizer might read this table audibly as follows:
Caption: Cups of coffee consumed by each senator
Summary: This table charts the number of cups of coffee consumed by each senator, the type of coffee (decaf or regular), and whether taken with sugar.
Name: T. Sexton, Cups: 10, Type: Espresso, Sugar: No
Name: J. Dinnen, Cups: 5, Type: Decaf, Sugar: Yes

"scope" - The following example associates the same header and data information as the previous example, but uses the "scope" attribute rather than "headers." "Scope" must have one of the following values: `row`, `col`, `rowgroup` or `colgroup`. Scope specifies the set of data cells to be associated with the current header cell. This method is particularly useful for simple tables.

```
<TABLE border="border"
summary="This table charts the number of cups of coffee
consumed by each senator, the type of coffee (decaf or
regular), and whether taken with sugar.">
<CAPTION>Cups of coffee consumed by each
senator</CAPTION>
<TR>
<TH scope="col">Name</TH>
<TH scope="col">Cups</TH>
<TH scope="col" abbr="Type">Type of Coffee</TH>
<TH scope="col">Sugar?</TH>
<TR>
<TD>T. Sexton</TD>
<TD>10</TD>
<TD>Espresso</TD>
<TD>No</TD>
<TR>
<TD>J. Dinnen</TD>
<TD>5</TD>
<TD>Decaf</TD>
<TD>Yes</TD>
</TABLE>
```

*Note: Using these markups does not ensure that all screen readers will linearize the table as described. The technique has been prototyped and demonstrated by the W3C but has not yet been widely incorporated into screen readers. According to the W3C, the most recent version of Jaws (from Henter-Joyce) will read a table cell-by-cell.

A tool developed at the W3C called "The Table Linearizer (tablin)" will linearize a table as described. There is an example at

http://jigsaw.w3.org:8000/tablin/ Also, any page at the W3C site can be viewed by including ",tablin" in the URI. For example, "http://www.w3.org/,tablin".[86]

c. For more complex tables, group information into categories.
Future browsers will allow users to select data from a table by asking for categories. For example, a table contains information about several trips a person has recently made. One of these trips is to San Jose. Information on expenses for meals, hotels and transportation are recorded (each in their own column). There are several locations (San Jose, Seattle, Madison). The expenses can be grouped into an "Expenses" category and all of the locations into a "Location" category. The following question could then be asked, "What were all of my expenses in San Jose?" This means "What are all the data cells in the "Expenses=Meals, Hotels, Transport" and "Location=San Jose" categories?[87]
The following example shows how to create categories within a table.

```
<TABLE border="border">
<CAPTION> Travel Expense Report </CAPTION>
<TR>
<TH></TH>
<TH id="a2" axis="expenses">Meals</TH>
<TH id="a3" axis="expenses">Hotels</TH>
<TH id="a4"
axis="expenses">Transport</TH><TD>subtotals</TD>
</TR>
<TR>
<TH id="a6" axis="location">San Jose</TH>
<TH></TH><TH></TH><TH></TH><TD></TD>
</TR>
<TR>
<TD id="a7" axis="date">25-Aug-97</TD>
<TD headers="a6 a7 a2">37.74</TD>
<TD headers="a6 a7 a3">112.00</TD>
<TD headers="a6 a7 a4">45.00</TD><TD></TD>
</TR>
<TR>
<TD id="a8" axis="date">26-Aug-97</TD>
<TD headers="a6 a8 a2">27.28</TD>
<TD headers="a6 a8 a3">112.00</TD>
<TD headers="a6 a8 a4">45.00</TD><TD></TD>
</TR>
<TR>
<TD>subtotals</TD><TD>65.02</TD><TD>224.00</TD><TD>90.00<
/TD><TD>379.02</TD>
</TR>
<TR>
<TH id="a10" axis="location">Seattle</TH>
```

[86] Wendy A. Chisholm, representative from World Wide Web Consortium: Web Accessibility Initiative
[87] Vanderheiden, Chisholm, "Central Reference Document - Version 8, Unified Web Site Accessibility Guidelines," http://trace.wisc.edu/archive/html_guidelines/central.html

```
<TH></TH><TH></TH><TH></TH><TD></TD>
</TR>
<TR>
<TD id="a11" axis="date">27-Aug-97</TD>
<TD headers="a10 a11 a2">96.25</TD>
<TD headers="a10 a11 a3">109.00</TD>
<TD headers="a10 a11 a4">36.00</TD><TD></TD>
</TR>
<TR>
<TD id="a12" axis="date">28-Aug-97</TD>
<TD headers="a10 a12 a2">35.00</TD>
<TD headers="a10 a12 a3">109.00</TD>
<TD headers="a10 a12 a4">36.00</TD><TD></TD>
</TR>
<TR>
<TD>subtotals</TD><TD>131.25</TD><TD>218.00</TD><TD>72.00
</TD><TD>421.25</TD>
</TR>
<TR>
<TH>Totals</TH><TD>196.27</TD><TD>442.00</TD><TD>162.00</
TD><TD>800.27</TD>
</TR>
</TABLE>
```

3. In order for all text, such as that just below the Merkantildata heading on the main page of the web site, to be readable the following must be kept in mind, specifically for visual impaired users:

    a. When setting non-standard colors in the BODY tag, do not forget to explicitly specify *all* the color attributes, including background, text, links, and visited links.

    b. Set proper background color if you're using a background image; otherwise your text may become unreadable for those users who have turned off auto-loading images in their browsers.

    c. The FONT and BASEFONT elements have an attribute, color, which indicates the intended color of text. This attribute, along with the bgcolor, text, link, vlink, and alink attributes of the BODY element, pose another set of accessibility problems and therefore must be handled cautiously and explicitly.[88]

    d. It must also be noted that the actual appearance of any text depends heavily on the screen resolution setting of the user's monitor. It is generally advisable to use a basic 800x600 resolution as a base for any text formatting that is desired for any such web document. This means, the size of the font is just as important a factor as is the coloring of the foreground and background of the font.

[88] "HTML Unleashed PRE: Creating Widely Accessible Web Pages," http://www.webreference.com/dlab/books/html-pre/42-3.html#42-3-2

e. Provide sufficient contrast in color between the background and font in order to be seen by the visually impaired when using enlargement programs.

4. In order to add ALT text for any graphics, the following can be done: (includes images used as image maps, spacers, bullets in lists, graphical buttons, links, to present math equations, etc.)

   a. Use a tag like the following:

   ```
   <IMG src="sailboats.gif" ALT="Our newest model
   sailboats">
   ```

   b. When creating alternative text, aim for a functional label based on the context in which it is used rather than a visual description.
   For example, when making the shopping cart button, it should have the alternative text ALT="Put into shopping cart" or ALT="Buy now", etc.

   c. If descriptive text is already provided above or below the image, an empty description, `ALT=""`, may be used in the IMG tag.

   d. In other situations where alternative text is unnecessary or distracting, such as images used as spacers, bullets in lists, and links, `ALT=""` should still be included so that text based browsers can ignore the image. In such cases of unimportant graphics, the value for the ALT text is known as the NULL value. It is important not to use this technique if the image is a link or is important to understanding the page. For example, the HTML for a divider bar could be:

   ```
   <IMG SRC="./purplebar.gif" ALIGN=MIDDLE ALT="">
   ```

   *Note: Sighted visitors will see the divider bar, while those visiting via a text browser will see/hear nothing. Keep in mind that if the graphic is treated as a link, even though it may be unimportant, it should be labeled so as not to confuse the user.

   e. HTML 4.0 allows you to do exactly the same thing with an `<OBJECT>` tag, as demonstrated in the following example:[89]

   ```
   <OBJECT DATA="me.gif">
   Here's my picture
   </OBJECT>
   ```

[89] "Compatibility & Accessibility--Towards the creation of an accessible, truly World-wide Web, All Things Web," http://www.pantos.org/atw/35621.html

For every object you create, anything that appears between the <OBJECT> tag and the corresponding </OBJECT> tag serves as the "alternative" content to be provided. Thus, in the previous example, an object-aware client that couldn't render a GIF would still obligingly display the text message, "Here's my picture."

In theory, you could even take it a step further and include a standard <IMG> tag (with ALT text, of course) for object-unaware clients:

```
<OBJECT DATA="me.png">
<OBJECT DATA="me.jpg">
<IMG SRC="me.gif" ALT="Here's my picture">
</OBJECT>
```

Here's what the screen reader will read:
Object-aware, PNG-capable clients will display "me.png"
Object-aware, PNG-challenged clients will display "me.jpg"
Object-unaware graphical clients will display the image "me.gif"
Non-graphical clients will display the text "Here's my picture"

f. For an image that presents important information (i.e. a chart, table, or diagram) it is sometimes necessary to provide a detailed description of the image's content. This description can be included in the main web page or placed in a web page all its own and referenced by the LONGDESC attribute of the IMG element. For example,

```
<IMG SRC="chart.gif" ALT="Chart of cash flow for each
month"
LONGDESC="http://www.thismachine.com/cashflowchar.txt">
```

*Note: The current generation of HTML 4.0-based web browsers do not yet support the LONGDESC attribute. In order to provide for both the present and the future, W3C recommends using both the LONGDESC attribute and following the image by a descriptive (or D) link[90]:

```
<IMG SRC="chart.gif" ALT="Chart of cash flow for each
month"
LONGDESC="http://www.thismachine.com/cashflowchar.txt">
<A HREF="cashflowchar.txt">D</A>
```

In this example, the ALT attribute provided a short description of the image. Next to the image, the LONGDESC attribute will provide another link that will lead to the longer description.

[90]Does this image convey important information beyond what is in its alternative text description?, http://www.cast.org/bobby3.0/html/gls/g12.html

5. On the categories page, the links to "Navn, Fabrikat, and Varegruppe" are read as long links rather than link names. The source code presently is as follows:

```
<script>document.write('<table width=100%><td align=Right>' +
prevp + '<img src=/merkantildata/b2b-admin.nsf/images/mshop-
images/$file/previous.gif border=0 alt="Forrige side"></a> ' +
nextp + '<img src=/merkantildata/b2b-admin.nsf/images/mshop-
images/$file/next.gif border=0 alt="Næste
side"></a></td></table>');</script><a href=/merkantildata/B2B-
produkter.nsf/product+view1?openview&count=20><center><b><font
face=arial,helvetica,sans-serif size=-1><img
src=/merkantildata/b2b-admin.nsf/images/mshop-
images/$file/visefter_01.gif border=0></a><a
href=/merkantildata/B2B-
produkter.nsf/product+view2?openview&count=20></a><a
href=/merkantildata/B2B-
produkter.nsf/product+view3?openview&count=20><img
src=/merkantildata/b2b-admin.nsf/images/mshop-
images/$file/visefter_02.gif border=0></a><a
href=/merkantildata/B2B-
produkter.nsf/product+view4?openview&count=20><img
src=/merkantildata/b2b-admin.nsf/images/mshop-
images/$file/visefter_03.gif border=0></font></b></center></a>
```

   Within this source code should be alternate texts for each of the links present. For example, an `ALT="Navn", ALT="Fabrikat", and ALT="Varegruppe"` should be included within the markup text instead of just the link address, in order for JAWS to read it correctly.

6. The problem here is again the absence of alternate textual descriptions of the buttons. This part of the page is written in HTML but uses several embedded scripts written in JavaScript for the purpose of the shopping cart and shopping basket utilities. Thus, in the piece of code that executes the JavaScript, including the ALT text description for the buttons should solve the problem.
   (Please take a look at the solutions for Problem #4 for detailed approaches.)
   For example, the following piece of code was taken from the *Top Bar* Velkommen link that includes some embedded JavaScript also but also displays the use of ALT text (shown in bolded italics) for associated description:

```
<a href="javascript:{top.goshopping('/merkantildata/b2b-
admin.nsf/ links/oversigtside');}"" target=Shopcontent><img
src=/merkantildata/b2b-admin.nsf/images/mshop-
images/$file/mshop_07.gif border=0 name=Image1
alt="Velkommen"></a>
```

7. In order to tag HTML links with text, the following can be done:

   a. Use the `TITLE` attribute to provide the more descriptive string.

   b. Use a more descriptive phrase than just "click here". For example,

```
<A HREF="./about.htm">Click here</A> for information
about our company.
```

Will present "Click here" as the link. However,

```
<A HREF="./about.htm">Information about our company.</A>
```

will display "Information about our company." as the link text.

8. Hidden links can be dealt with in a couple of different ways.

    a. The first option is to remove all links that contain the *HIDDEN* attribute in their description. Such links are usually left behind during code reuse or maintenance and simply create more confusion than provide any usefulness.

    b. In case of situations whereby such a hidden link plays an important role such as allow the system administrator or the webmaster access into the website's database or web page directory, the accessible way to do this would be to move the link to the bottom, give it a name such as "Authorized Access Only" and get rid of the *HIDDEN* attribute. The functionality remains the same, and access to the general public is still denied. However, this time when a visually impaired runs into this link, he/she will not get disoriented because of any lack of appropriate description.

9. For edit boxes with no label, the following can be done:

    a. For those browsers and/or screen readers that cannot identify empty edit boxes, we recommend using place-holding characters such as a space, short description or a textual cue.

    ```
    <b>Keywords</b> <input type=text name="keywords" value="
    " size=40>
    ```

    In this case, the screen reader would read, "Keywords, Edit."

    b. It is often a good idea to also provide a form, which can be downloaded then mailed or e-mailed, or a phone number someone can call for assistance. [91]

[91] "Unified Web Site Accessibility Guidelines, Version 7.2," June 1997, http://trace.wisc.edu/archive/html_guidelines/version7.htm#input.forms

10. In order to label the search button on the main page, the following can be done:

    a. All HTML image buttons (`<<INPUT TYPE="IMAGE" ...>`) in forms should contain a short alternative text description that represents the function of the graphic. This is important for users who have turned off image loading in their web browsers, those using text-based browsers like Lynx, and people who are blind and require the use of a screen reader to read the contents of the screen for them. For example,

    ```
    <FORM ACTION="http://www.foo.com" METHOD="get">
    <INPUT TYPE="image" SRC="bobbylogo.gif" ALT="The Bobby
    logo" WIDTH=200 HEIGHT=200>...</FORM>
    ```

    When creating alternative text, aim for a functional label based on the context in which it is used rather than a visual description.

11. The structural layout of the categories/list of products, when expanded, is not practical. Some suggestions are:

    a. The best option is to get rid of the tree formation and have the category links load separate pages displaying the expanded subcategories/list of products. A back and forth option should be included in order for the user to return to the list of categories.

    If the tree formation would like to be kept, the following can be done:

    b. After every expanded list of products, an option to go to the shopping basket should appear so that if the user is done purchasing products, he/she does not need to tab through the other categories in order to be placed at the bottom of the page where the shopping basket appears.

    c. After each product, a link to the shopping basket should appear so that if the user is done purchasing products, he/she does not need to tab through the other categories in order to be placed at the bottom of the page where the shopping basket appears.

12. The location of the Online Shop link is most effective if it is unique compared to the rest of the ensemble of links that are currently in the rightmost column of the main page table. Some locations could be:

    a. On the left hand column as part of a vertical list of the Merkantildata departmental links.

    b. Below the Merkantildata heading on the main page, again as part of a horizontal list of the company's departmental links.

13. To solve the shopping process when using the shopping cart, the following can be done:

    a. A separate page can display the shopping basket as a table format that changes dynamically when products or quantity is changed. The format should be written horizontally for better screen reader access. Each time a new item is added to the shopping basket, this new page is loaded. The page should have options after each product, such as "save item button", "remove item button", "quantity edit box." The page should also include a "continue shopping button", "proceed to checkout button", and an "update shopping cart button". Also, consider having shortcut keys for these different buttons (see #3 of additional suggestions). The heading for the table layout could be displayed as the following:

Item	Quantity	Price	Remove	Save Item
(item link)	(edit box)	text	(button)	(button)

    *Note: through our e-commerce page experience, one of the best seen shopping cart formats was seen on the amazon.com web site. Although their web site contains many accessibility problems, their shopping cart set up is understandable and easy to use when navigating with a screen reader.

14. For information being read aloud the only suggestions are:

    a. Make sure that no one is in the room when adding information.

    b. Using headphones when not alone.
       *Note: This is not specific to Merkantildata. There are no real suggestions for improvements when considering what the e-commerce company can do, only suggestions to be given to the actual user.

15. Display "Back" and "Forward" buttons on the bottom of web page, after any other relevant information, as the very last link.

5.4 Additional Suggestions

1. Table Layout

   It is most advisable not to use table structure elements solely for the purpose of layout or visual appeal. The utilization of tables to layout the page can lead to difficulties. The separation between the columns is not always obvious for users who do not have an `overview` of the document, which is read by the screen reader when a page is loaded. If possible, it is advised to avoid using tables to increase the margins or for any other presentation effect which can be obtained by the use of a style.

   If no other solution is available (double columns, separation from a menu...) the purpose of the table should be defined in the `summary` attribute. Furthermore, it is very important to ensure that interdependent text portions are not be divided in several cells, in order to enable the reading of a table line after line (the text should be understandable without the HTML table formatting elements like — «`TABLE`», «`TR`», «`TD`» — and the different constituents of the table should not be mixed).[92]

   For your content to always make sense, then, you should keep the material as row-oriented as possible. Remember that JAWS will read the cells that are next to each other horizontally in sequence, while *other cells will probably be separated by vertical neighbors*. For example, do not place a heading in one cell and the text it belongs to in another cell below that, as this is likely to result in the heading being separated from its text and making little sense on its own. Instead, place both the heading and the text in one cell using the `rowspan` attribute, if necessary, to force the cell to stretch down as needed.[93]

2. For good keyboard navigation, it is important that the author allows a user to navigate the web page, link-by-link, using only the TAB key. The following attribute can be used to allow for ordered navigation:

   a. Use the `TABINDEX` attribute to specify proper keyboard navigation order when necessary.
      For example:

```
<INPUT tabindex="1" type="text" name="field1">
<INPUT tabindex="2" type="text" name="field2">
<INPUT tabindex="3" type="submit" name="submit">
```

[92] "Recommendations: Use of HTML elements advisedly," http://www.braillenet.jussieu.fr/livreblanc/english/recom03.html
[93] "HTML Unleashed PRE: Creating Widely Accessible Web Pages," http://www.webreference.com/dlab/books/html-pre/42-0.html

3. To enhance keyboard navigation, the author may also make use of "hot-keys" or "shortcut-keys" for certain control links or buttons. Thus, when the screen reader reads these elements it would read, for example, "Submit button, press ALT+S for shortcut button."

   a. Use the ACCESSKEY attribute to provide access keys for all controls, and for links that act like controls, (underline the access key in the control's label).[94]

   b. Access keys are assigned using the ACCESSKEY attribute. For example:

```
<LABEL
      for="field1"
      accesskey="A">Enter Your <U>A</U>ge:
</LABEL>
         <INPUT type="text" id="field1">
```

4. For tabular information, an option to download into a machine-readable format, which can be examined in more detail off-line, is useful for a user to keep a record of the transaction.

5. For convenience of navigation with keyboard, the Java buttons can include access keys also. Consider the following:

   - Simple methods are used to create AWT and Swing components such as buttons and menus. Different information is available from AWT versus Swing components.

```
a. // creating a button using AWT:
   Button b = new Button("This is an AWT Button");
   // creating a button using Swing:
   JButton a = new JButton("This is a JButton or
   Swing");
   a.setKeyAccelerator('J');
   a.setFont(new Font("SansSerif", Font.PLAIN, 18));
b. // creating a menu using AWT:
   Menu d = new Menu("AWT Menu");
   // creating a menu using Swing:
   JMenuItem item1 = new JMenuItem("Input Dialog
   Example");
```

[94] Web Guidelines, "Microsoft Accessibility: Technology for Everyone," www.asia.microsoft.com/enable/dev/web/default-u.htm.

- How to attach a `JLabel` to a button group. It is simple to work with Swing components like buttons and menus and how to provide keyboard navigation.

C.
```
JPanel holdButtons = new JPanel();
JLabel label = new JLabel ("Possible Radio Button
Label");
label.setLabelFor(holdButtons);
holdButtons.add(label);
// Creating the radio button group first
ButtonGroup group = new ButtonGroup();
jlfButton = new JRadioButton("JLF");
jlfButton.setFont(new Font("SansSerif", Font.PLAIN,
18));
jlfButton.setKeyAccelerator('j');
group.add(jlfButton);
holdButtons.add(jlfButton);
// creating JMenu/JMenuItems, and adding key and
keyboard
// shortcut accelerators.
JMenu menuA = new JMenu("File ");
menuA.setKeyAccelerator('F');
MenuShortcut myShortcut = new
MenuShortcut(KeyEvent.VK_K);
JMenuItem firstItem = new JMenuItem("New ",
myShortcut);
```

*Note: Simple additions to an application can enhance the accessibility. Swing components like `JLabels` and add keyboard navigation to components like `Jmenus/JMenuItems`. To do this, other simple Java applications that are nothing more than a group of radio buttons and some menu items can be used.

5.5 Final Guidelines for Accessible E-Commerce Web Sites

This is a set of guidelines that any e-commerce company should keep in mind. For general web accessibility guidelines please refer to the W3C Web Accessibility guidelines displayed on http://www.w3.org/TR/WAI-WEBCONTENT. The information on this web site is also included in our Appendix G.

1. Make sure shopping basket is accessible and easy to use.

   a) A separate page can display the shopping basket as a table format that changes dynamically when products or quantity is changed. Keep in mind that the format should be written horizontally for better screen reader access.

   b) Each time a new item is added to the shopping basket, this new page is loaded.

   c) The page should have options after each product, such as "save item button", "remove item button", "quantity edit box."

   d) The page should also include a "continue shopping button", "proceed to checkout button", and an "update shopping cart button".

   e) Consider having shortcut keys for these different buttons.

   f) The heading for the table layout could be displayed as the following:

Item	Quantity	Price	Remove	Save Item
(item link)	(edit box)	(text)	(button)	(button)

2. For tabular information, an option to download into a machine-readable format, which can be examined in more detail off-line, is useful for a user to keep a record of the transaction.

3. When designing an e-commerce web site use software or programming language compatible with screen readers, Braille devices, etc. For example, use standard HTML as opposed to a scripting language such as CGI or JavaScript. HTNL 4.0 is quite powerful and recommended when designing web pages.

4. Since the use of frames makes web sites attractive, it is common for e-commerce web sites to make use of frames on their web pages. However, it is important to keep in mind that if the layout of the frames is too complicated then a screen reader will not be able to read the page properly. Therefore, either it is best not to use frames or

alternate pages that do not use frames should be made available. The following can be done:

a. You can use the NOFRAMES tag to show a link to a page that does not use frames.

b. Be sure to label frames with the TITLE attribute.

c. Provide a <NOFRAME> option for each <FRAMESET>.When using the <NOFRAME> option it is easiest to include all essential information on the bottom of the main frame.

d. Title each frame. Notice the use of "TITLE" in the previous example. People accessing the page aurally will more easily keep track of how many frames exist and which is the current one.

e. Describe the layout and purpose of frames and how multiple frames relate to each other. Use the "longdesc" attribute on <FRAME> and <IFRAME> elements to link to a page with descriptions.

5. User-input forms are an important feature of e-commerce web sites. When users register as new customers the e-commerce web site should make sure that the page that provides the user-input forms is accessible. The following points should be kept in mind:

a. Do not use image maps to create graphical "submit" buttons.

b. Make sure that all edit boxes are labeled.

c. Explicitly associate labels with their control.

- The FIELDSET tag allows the *content developer*[95] to define the relationship between a set of input fields. This will enable *user agents*[96] to group the content together for more logical delivery. To specify a FIELDSET, simply wrap the related fields in the FIELDSET container.

- The FIELDSET tag should be coupled with the LABEL tag, which links descriptive text that often precedes or accompanies a field with the field itself.

d. Provide alternative text for images used as "submit" buttons.

e. Specify a logical tab order with "tabindex".

[95] See Glossary for definition.
[96] See Glossary for definition.

f. Group related controls with the <FIELDSET> element.

g. Label a group of controls with the <LEGEND> element.

h. Create keyboard shortcuts for form elements. For example, if "U" is assigned as the access key then typing "U" brings the user to the particular element is represents.

6. Any scripts that are used in the e-commerce web sites are potential hazards for users who access the web sites using screen readers. Hence it is important to provide a <NOSCRIPT> option for all scripts. The NOSCRIPT portion of a page should contain all the functional content of the scripted page.

7. A useful tool for the purpose of layout is the style sheet. For pages that must contain several layers of backgrounds such as the company logo, major product categories, and other elements (search engines for particular products or the actual contents of the page, such as a specifically chosen product), the use of style sheets is very handy. However, web designers must use these features carefully in order to maintain accessibility.

a. Use style sheets to position text and objects within pages, rather than physically marking up text and graphics.
For example, you can use <B> or the "align" attribute of <IMG>.

b. Use style sheets rather than:

- converting text to images or alternative text file formats
- using tables or PRE elements to layout pages
- using proprietary extensions
- using "invisible" images to layout pages
- writing a program to accomplish something that is possible with style sheets or plain HTML

c. Use style sheets to:

- position text and graphics
- create drop caps, subscripts and superscripts
- avoid uncommon typographic characters or constructions (such as ASCII art, etc.)
- highlight sections of a document with font size, formatting or color'

d. Ensure that your pages are readable and usable without style sheets. (e.g. when the browser does not support or the user prefers not to load). Since style sheets are a new phenomenon, older browsers will not support them, and new browsers to support them in a standard way.

8. The structural layout of the categories/list of products should be easily read and easily searchable. Some suggestions are:

    a. The best option is to get rid of any tree formation that has the category lists expand into subcategories/lists of products. It is better to have separate pages load, displaying the expanded subcategories/list of products. A back and forth option should be included in order for the user to return to the list of categories.

    If the tree formation would like to be kept, one of the following can be done:

    b. After every expanded list of products, a button with the option to go to the shopping basket should appear so that if the user is done purchasing products he/she does not have to navigate the page to start the checkout process.

    or

    c. After each product, a button with the option to go to the shopping basket should appear so that if the user is done purchasing products he/she does not have to navigate the page to start the checkout process.

9. Make sure that the e-commerce web site uses something like Secure Sockets Layer (SSL) or Secure Electronic Transaction (SET), for the user's personal information security.

10. Provide text description of all products rather than just graphics.

11. Avoid automatic pop-up windows for options such as using plug-ins (Shockwaves, Applets, Flash, Macromedia, etc.), because they become confusing when opening a web page. This multimedia option frequently requires the user to download the software, which is also confusing and inconvenient for users.

12. Provide an option for user to navigate the e-commerce site without using any plug-in or changing any browser setting.

13. When considering text-only alternative pages, these pages have to be generated and updated automatically. If these pages are generated separately, chances are they will be less updated than the graphical version. The text-only version should also include all the features available in he graphical version, so that the user will be able to continue browsing in text mode to the end of the transaction.

14. Providing an accessible search. This will allow the visually impaired users to find the product they want efficiently.

6 Conclusion

The main goal of this project was to critique Merkantildata's web site and make suggestions of how to make it accessible to the blind and visually impaired. These inaccessibility problems are listed in section 5.1 of the report and the suggested solutions are listed in section 5.3. Section 5.2 mentions the portions of the web site that is already accessible and should be kept if Merkantildata changes their web site in the future. Also, additional suggestions that Merkantildata can consider to make their web site easier to navigate are included in section 5.4.

Finally a set of guidelines, specific to designing accessible e-commerce web sites, concludes the critique of the web site. A separate booklet, including all of the sections just mentioned as well as appendices containing the W3C guidelines for web accessibility and JAWS keyboard commands, was given to Merkantildata in order for them to easily review our suggestions for improving the accessibility of their web site.

The survey performed for this project suggested that blind individuals would be more likely to use e-commerce than sighted individuals. This is because of the convenience of not having to go out to purchase the item and not feeling the need to see and feel every item that they want to purchase. This gives an e-commerce company more reasons for making their e-commerce web site accessible to the blind and visually impaired because, according to our survey, the blind individuals would use it more often if it were more accessible. This also can be used as a marketing tool for groups trying to promote making web sites accessible.

We hope that this project serves as a starting point for e-commerce companies to "follow in the footsteps" of Merkantildata's interest in making their web site accessible.

Accessibility to e-commerce websites may prove to be a vital part in the current trend for growth in Internet businesses.

Appendices

Appendix A: *SEC. 508 - ELECTRONIC AND INFORMATION TECHNOLOGY*

Following is the Section 508 of the Americans with Disabilities Act (ADA) that was referred to in section 2.4 of this report. This Section requires that Federal agencies' electronic and information technology be accessible to people with disabilities, including employees and members of the general public. It establishes requirements for any electronic and information technology developed, maintained, procured, or used by the Federal government. This covers everything including computers (hardware, software, and accessibility to web sites), fax machines, information/transaction machines (ATM's and fare card machines), copiers, telephones, and other equipment used for transmitting, receiving, using, or storing information. The only exemptions from these requirements are national security systems.

(a) REQUIREMENTS FOR FEDERAL DEPARTMENTS AND AGENCIES.--

(1) ACCESSIBILITY.--

(A) DEVELOPMENT, PROCUREMENT, MAINTENANCE, OR USE OF ELECTRONIC AND INFORMATION TECHNOLOGY.--When developing, procuring, maintaining, or using electronic and information technology, each Federal department or agency, including the United States Postal Service, shall ensure, unless an undue burden would be imposed on the department or agency, that the electronic and information technology allows, regardless of the type of medium of the technology--

(i) individuals with disabilities who are Federal employees to have access to and use of information and data that is comparable to the access to and use of the information and data by Federal employees who are not individuals with disabilities; and

(ii) individuals with disabilities who are members of the public seeking information or services from a Federal department or agency to have access to and use of information and data that is comparable to the access to and use of the information and data by such members of the public who are not individuals with disabilities.

(B) ALTERNATIVE MEANS EFFORTS.--When development, procurement, maintenance, or use of electronic and information technology that meets the standards published by the Access Board under paragraph (2) would impose an undue burden, the Federal department or agency shall provide individuals with disabilities covered by paragraph (1) with the information and data involved by an alternative means of access that allows the individual to use the information and data.

(2) ELECTRONIC AND INFORMATION TECHNOLOGY STANDARDS.--

(A) IN GENERAL.--Not later than 18 months after the date of enactment of the Rehabilitation Act Amendments of 1998, the Architectural and Transportation Barriers Compliance Board (referred to in this section as the 'Access Board'), after consultation with the Secretary of Education, the Administrator of General Services, the Secretary of Commerce, the Chairman of the Federal Communications Commission, the Secretary of Defense, and the head of any other Federal department or agency that the Access Board determines to be appropriate, including consultation on relevant research findings, and after consultation with the electronic and information technology industry and appropriate public or nonprofit agencies or organizations, including organizations representing individuals with disabilities, shall issue and publish standards setting forth--

(i) for purposes of this section, a definition of electronic and information technology that is consistent with the definition of information technology specified in section 5002(3) of the Clinger-Cohen Act of 1996 (40 U.S.C. 1401(3)); and

(ii) the technical and functional performance criteria necessary to implement the requirements set forth in paragraph (1).

(B) REVIEW AND AMENDMENT.--The Access Board shall periodically review and, as appropriate, amend the standards required under subparagraph (A) to reflect technological advances or changes in electronic and information technology.

(3) INCORPORATION OF STANDARDS.--Not later than 6 months after the Access Board publishes the standards required under paragraph (2), the Federal Acquisition Regulatory Council shall revise the Federal Acquisition Regulation and each Federal department or agency shall revise the Federal procurement policies and directives under the control of the department or agency to incorporate those standards. Not later than 6 months after the Access Board revises any standards required under paragraph (2), the Council shall revise the Federal Acquisition Regulation and each appropriate Federal department or agency shall revise the procurement policies and directives, as necessary, to incorporate the revisions.

(4) ACQUISITION PLANNING.--In the event that a Federal department or agency determines that compliance with the standards issued by the Access Board under paragraph (2) relating to procurement imposes an undue burden, the documentation by the department or agency supporting the procurement shall explain why compliance creates an undue burden.

(5) EXEMPTION FOR NATIONAL SECURITY SYSTEMS.--This section shall not apply to national security systems, as that term is defined in section 5142 of the Clinger-Cohen Act of 1996 (40 U.S.C. 1452).

(6) CONSTRUCTION.--

(A) EQUIPMENT.--In a case in which the Federal Government provides access to the public to information or data through electronic and information technology, nothing in this section shall be construed to require a Federal department or agency--

(i) to make equipment owned by the Federal Government available for access and use by individuals with disabilities covered by paragraph (1) at a location other than that where the electronic and information technology is provided to the public; or

(ii) to purchase equipment for access and use by individuals with disabilities covered by paragraph (1) at a location other than that where the electronic and information technology is provided to the public.

(B) SOFTWARE AND PERIPHERAL DEVICES.--Except as required to comply with standards issued by the Access Board under paragraph (2), nothing in paragraph (1) requires the installation of specific accessibility-related software or the attachment of a specific accessibility-related peripheral device at a workstation of a Federal employee who is not an individual with a disability.

(b) TECHNICAL ASSISTANCE.--The Administrator of General Services and the Access Board shall provide technical assistance to individuals and Federal departments and agencies concerning the requirements of this section.

(c) AGENCY EVALUATIONS.--Not later than 6 months after the date of enactment of the Rehabilitation Act Amendments of 1998, the head of each Federal department or

agency shall evaluate the extent to which the electronic and information technology of the department or agency is accessible to and usable by individuals with disabilities described in subsection (a)(1), compared to the access to and use of the technology by individuals described in such subsection who are not individuals with disabilities, and submit a report containing the evaluation to the Attorney General.

(d) REPORTS.--

(1) INTERIM REPORT.--Not later than 18 months after the date of enactment of the Rehabilitation Act Amendments of 1998, the Attorney General shall prepare and submit to the President a report containing information on and recommendations regarding the extent to which the electronic and information technology of the Federal Government is accessible to and usable by individuals with disabilities described in subsection (a)(1).

(2) BIENNIAL REPORTS.--Not later than 3 years after the date of enactment of the Rehabilitation Act Amendments of 1998, and every 2 years thereafter, the Attorney General shall prepare and submit to the President and Congress a report containing information on and recommendations regarding the state of Federal department and agency compliance with the requirements of this section, including actions regarding individual complaints under subsection (f).

(e) COOPERATION.--Each head of a Federal department or agency (including the Access Board, the Equal Employment Opportunity Commission, and the General Services Administration) shall provide to the Attorney General such information as the Attorney General determines is necessary to conduct the evaluations under subsection (c) and prepare the reports under subsection (d).

(f) ENFORCEMENT.--

(1) GENERAL.--

(A) COMPLAINTS.--Effective 2 years after the date of enactment of the Rehabilitation Act Amendments of 1998, any individual with a disability may file a complaint alleging that a Federal department or agency fails to comply with subsection (a)(1) in providing electronic and information technology.

(B) APPLICATION.--This subsection shall apply only to electronic and information technology that is procured by a Federal department or agency not less than 2 years after the date of enactment of the Rehabilitation Act Amendments of 1998.

(2) ADMINISTRATIVE COMPLAINTS.--Complaints filed under paragraph (1) shall be filed with the Federal department or agency alleged to be in noncompliance. The Federal department or agency receiving the complaint shall apply the complaint procedures established to implement section 504 for resolving allegations of discrimination in a federally conducted program or activity.

(3) CIVIL ACTIONS.--The remedies, procedures, and rights set forth in sections 505(a)(2) and 505(b) shall be the remedies, procedures, and rights available to any individual with a disability filing a complaint under paragraph (1).

(g) APPLICATION TO OTHER FEDERAL LAWS.--This section shall not be construed to limit any right, remedy, or procedure otherwise available under any provision of Federal law (including sections 501 through 505) that provides greater or equal protection for the rights of individuals with disabilities than this section. [97]

[97] Americans with Disabilities Act, http://www.usdoj.gov/crt/508/508law.html

Appendix B: *Correspondence with Companies*

This appendix includes all the correspondence that had been conducted via emails between this project team and different companies in the USA as was mentioned in section 3.3 of the report. Some of these companies are involved in making web accessibility products for the blind, while others are e-commerce companies who were of interest to us since we wanted to find out if they had considered web site accessibility as an issue for their businesses.

Date: Mon, 31 Jan 2000 17:22:10 -0500 (EST)
From: Matthew Kaichung Chan <mchan@WPI.EDU>
To: Lizabeth Pereira Amaral <liz@WPI.EDU>
Subject: Your Amazon.com Inquiry (fwd)

To: techhelp@amazon.com
Subject: Special service

To whom it may concern,

I am a student in Worcester Polytechnic Institute. I am currently doing a project on E-commerce for Blind. Knowing that Amazon.com is one of the biggest E-commerce businesses in the U.S., I would like to know if Amazon.com offer any special Internet service for the blind. If there is any special web site designed for the blind. Your help is greatly appreciated. Thank you!
Matt Chan

Date: Sun, 23 Jan 2000 15:22:58 -0800 (PST)
From: info@amazon.com
To: Matthew Kaichung Chan <mchan@WPI.EDU>
Subject: Your Amazon.com Inquiry

Dear Mr.Chan,
Greetings from Amazon.com.

We currently don't have a way to search or view our site for people who are visually impaired. I do believe, however, that there exists software and hardware specifically designed for visually impaired that enables them to explore the Internet.

Feel free to contact us any time--we will always be glad to hear your questions or comments. We hope to see you again at Amazon.com!
Best regards,
Marko Vujicic
Amazon.com
Earth's Biggest Selection
http://www.amazon.com

Date: Sat, 29 Jan 2000 10:52:32 -0800 (PST)
From: Fran Weisse <franweisse@yahoo.com>
To: mchan@WPI.EDU
Subject: Web access for blind persons

Dear Mr. Chan:

Using special software, individuals who are blind or visually impaired access the Internet by using large print or speech. Commercial companies supply this software. To learn more about how blind people surf the net, I would suggest that you contact the National Braille Press, 88 St. Stephen Street, Boston, MA 02115 (617) 266-6160 www.nbp.org. They have recently published several books on the subject.

Sincerely, Fran Weisse
Acting Director of Information and Support Services

Date: Fri, 21 Jan 2000 15:32:40 -0500 (EST)
From: Lizabeth Pereira Amaral <liz@wpi.edu>
To: info@prodworks.com
Subject: question

To whom it may concern,

Hello, My name is Lizabeth and I am looking for information on e-commerce for the blind. I saw on your home pages that you "provide software to audio-enable both applications and web devices...such as e-commerce." Could you please send me information about this can be done or where I can look for this information. Thank you for your time.

Sincerely,
Lizabeth

Date: Fri, 21 Jan 2000 16:04:53 -0500
From: Susan Jennings <susanj@prodworks.com>
To: Lizabeth Pereira Amaral <liz@WPI.EDU>
Subject: Re: question

Dear Lizabeth,
We have a product called WebSpeak. It is an Internet browser for people who are visually impaired. It reads web pages out loud with synthetic speech called Softvoice. It comes on a CD and costs $150.

The next release of the browser will support e-commerce. In other words, it will be able to get into web sites that have security layers that are needed for online shopping such as at Amazon.com. This is something our clients want to be able to do.

We have a free thirty-day evaluation of WebSpeak if you are interested. It has to be downloaded from our web site.
Hope this information has helped. Regards, Susan

Date: Sun, 23 Jan 2000 13:40:21 -0500 (EST)
From: Lizabeth Pereira Amaral <liz@wpi.edu>
To: denise@obs.org, blindpi@gte.net, info@acb.org, webmaster@humanware.com
Subject: e-Commerce for the blind and visually impaired

To whom it may concern,

Hello, My name is Lizabeth and I am looking for information on e-commerce for the blind. I saw on your home pages that you "provide software to audio-enable both applications and web devices...such as e-commerce." Could you please send me information about this can be done or where I can look for this information. Thank you for your time.
Sincerely,
Lizabeth

Date: Mon, 24 Jan 2000 08:36:51 -0800
From: Judy Seiler <Seiler@humanware.com>
To: Lizabeth Pereira Amaral <liz@WPI.EDU>
Subject: RE: e-Commerce for the blind and visually impaired

Hello Lizabeth,

Thank you for your message and including HumanWare in your question. As of this date, however, we have not implemented e-commerce on our web site. Three or four years ago we looked at the feasibility of e-commerce on our site, but for various reasons decided not to implement it at that time. We'll be taking another look in the near future.
Sorry I don't have more information to offer you at the time.

Kind regards,
Judy Seiler, Marketing Manager
HumanWare, Inc.
Phone: (800) 722-3393
Direct: (916) 652-1418
Fax: (916) 652-7296
Email: seiler@humanware.com

Date: Tue, 25 Jan 2000 01:13:14 -0500
From: James Vanover <blindpi@gte.net>
To: Lizabeth Pereira Amaral <liz@WPI.EDU>
Subject: Re: e-Commerce for the blind and visually impaired

This is from blindinfo.

My name is Mr. James Vanover, and I am the editor of the Blindinfo web page for the blind and visually impaired.

First of all I would like to apologize for not returning your email before now. I hope that you will forgive me for taking such a long time in returning your requests for information.

It is my sincere hope that if you have any questions that you will please feel free to email me, and I promise that I will reply as soon as possible.

I know of many computers and many Internet browsers that will work for the visually impaired. I know that Internet explore has the ability to enlarge the text size so that it is easier to read I also think that Netscape V 4.7 also has many features that a person who is visually impaired may find beneficial.

I do not know of any Internet browser software that is specifically available for the blind, and or for the visually impaired. But I am not able to keep up with all of the software on the market today. It is just not possible with so many manufacturers of software in the world.

I say this because I do not want anyone to get discouraged for I know one thing if any thing that there are always knew innovations being developed every single day.

I thank you for your interest, and hope that this will be some assistance to you. Please let me know if you receive this information and if you have any other questions at all do not hesitate to write me back by email.

Sincerely,
Mr. James Vanover, editor Blindinfo
My Web Page is:
http://members.tripod.com/blindinfo/index.html
My E- Mail is:
blindpi@gte.net

Date: Thu, 27 Jan 2000 12:57:32 -0500
From: Charles Crawford <CCrawford@ACB.org>
To: Liz@WPI.EDU
Subject: Your inquiry about e-commerce

Hello Lizabeth,

Thank you for contacting the American council of the Blind about your interest in software relative to e-commerce. Are you asking about what software is used to provide the web interface and content, or the software that is used to access the information? Let me know.

Charlie Crawford: Executive Director - ACB.

Appendix C: *Organizations for/of the Blind*

The following is the list of the different organizations related to the blind and visually impaired as was mentioned in section 3.4 of the report. Some of these organizations describe themselves at organizations *for* the blind while others describes themselves at organizations *of* the blind – and they are strict about the distinction between the two categories.

Massachusetts Association for the Blind (MAB)
51 Harvard Street
Worcester, MA 01609
(508) 791-8237
Telephone Tape: (508) 791-6911

Bell Atlantic Program/MAB Store
33 Lancaster Street
Worcester, MA 01609
Voice (508) 791-1021
FAX (508) 791-1973
Email: mablind@tiac.net
http://www.mablind.org

Massachusetts Commission for the Blind
David Govostes, Acting Commissioner
88 Kingston Street
Boston, MA 02111
MCB Home Page
Tel: (617) 727-5555
Fax: (617) 727-5960

Central Mass - Region II
340 Main St., Rm. 650
Worcester, MA 01608
(508) 754-1148
1-800-392-6450 x0522
Email: barbara.dahm@state.ma.us

The Carroll Center for the Blind
Telephone/Fax:
617-969-6200; 1-800-852-3131
Fax: 617-969-6204
E-mail: intake@carroll.org

National Federation Of The Blind (N.F.B.)
Of Massachusetts
Massachusetts
Mrs. Priscilla Ferris, President
55 Delaware Avenue
Somerset, Massachusetts 02726
(508) 679-8543

Helen Keller International
2cd Floor
90 West Street
New York, New York 10006
U.S.A.
(212)766-5266 Voice
(212)791-7590 FAX
E-Mail: info@hki.org

New England Region
Suite #1135
89 Broad Street
Boston, Massachusetts 02110-8702
(617)924-3434

Lowell Association For The Blind, Inc.
174 Central Street
Lowell, Massachusets 01852
USA
(978)454-5704 Voice
(978)458-5563 FAX
E-Mail: Arthur R. Kelts arklab@cwix.com.
Jennifer Britton Nangle arklab@cwix.com

Perkins School For The Blind
175 North Beacon Street
Watertown, Massachusetts 02172-9982
U.S.A.
(617)924-3434 Voice
(617)926-2027 FAX
E-Mail: Richard Moffat
moffatr@perkins.pvt.k12.ma.us

Vision Foundation
818 Mount Auburn Street
Watertown, Massachusetts 02172
U.S.A.
(617)926-4232 Voice
(800)852-3029 Toll Free
e-mail: mablind@tiac.net

Appendix D: *Correspondence to Organizations of the Blind and Blind Individuals*

Following are the actual emails that were sent out to the blind organizations and individuals as mentioned in section 3.4 and 3.5 of the report. These emails were the primary tools for the surveys that were conducted in the USA.

(For Blind Individuals)
Dear Sir or Madam,

We are a group of students from Worcester Polytechnic Institute (WPI). Currently, we are working on a project with the Danish Society of the Blind. The goal of the project is to help the blind people in Denmark to gain access to e-commerce. Right now, we are look for the technology that the blind people used to access the computer and Internet. It is greatly appreciated if you can answer the questions listed below. Thank you for your help.

Sincerely,
Liz Amaral
Ali Durlov Khan
Matthew Chan

1. What product or software do you use to access a computer? (Voice Synthesizers, Screen Readers, etc)

2. How do you access the Internet?

3. Do you have difficulty accessing the Internet? If so, what is the problem?

4. Have you ever used E-commerce? If so, what did you use and what problems did you encounter?

5. How frequently do you use computers? Internet? E-commerce?

6. Do you feel that you would use computers, Internet, or e-commerce more, or the same amount of times if it were more easily accessible?

7. What would you like to see improved on existing software?

8. Where did you purchase your existing software?

(For organizations)
Dear Sir or Madam,

We are a group of students from Worcester Polytechnic Institute (WPI). Currently, we are working on a project with the Danish Association of the Blind. The goal of the project is to help the blind people in Denmark to gain access to e-commerce. Right now, we are look for the technology that the blind people used to access the computer and Internet. It is greatly appreciated if you can answer the questions listed below. Also, included in this e-mail is an attachment of survey questions. We would like to ask you to distribute these survey questions to the members in your organization. The members' answers are equally important to us. Thank you for your help.

Sincerely,
Liz Amaral
Ali Durlov Khan
Matthew Chan

1. Does your organization know any standard for making Internet, and e-commerce web sites accessible to the blind?

2. Do you have any statistical information on what the members are using to access computer?

3. Do you know any products that help the blind to access computer? Internet? E-commerce?

4. Do you know any prior surveys that asked related questions?

Appendix E: *Keyboard Commands*

The following includes the various keyboard commands for a JAWS user. These commands are alternatives for using the mouse to navigate the computer and offer quick and realistic navigation for blind and visually impaired computer users. The keyboard commands have been taken verbatim from the technical notes in the JAWS Help Files Directory (Hotkeys.hlp).

Screen Navigation

BottomOfFile use CTRL+END. If the active item is an edit box, the caret or focus moves to the end of the open document. Otherwise, moves to the bottom of the current control. This is the Windows command for moving the cursor to the bottom of the file, if supported by the application.
CloseListBox use ALT+UP ARROW. Closes a list box. However, when in an edit control, moves to and says the prior sentence.
ControlDownArrow use CTRL+DOWN ARROW. This script depends on the application and the current item. In some edit windows it moves to the next paragraph. In some list boxes or list views, it moves the focus down without removing the selection in order to select non-contiguous items.

ControlUpArrow use CTRL+UP ARROW. Depends on the application and the current item. In some edit windows it moves to the prior paragraph. In some list boxes or list views, it moves the focus up without removing the selection in order to select non-contiguous items.
JAWSCursor use NUM PAD MINUS. The JAWS cursor is similar to the mouse pointer. If pressed twice quickly, the Invisible cursor is activated.
JAWSEnd use END. Depends on which cursor is active. For example, this keystroke moves the active JAWS cursor or Invisible cursor to the right edge of the active window. The PC cursor tracks the application cursor and is active by default in most applications. Pressing END moves the insertion point to the end of a line when an edit field and often places the selection on the last item when in a list view, tree view, or edit combo box.

JAWSFind use CTRL+INSERT+F. Opens a Find dialog box that allows you to enter text or graphics in order to search the current screen area. Search for graphics by entering the text label of the graphic. Use the Find or Search feature in an application for more extensive searches.
JAWSFindNext use INSERT+F3. Searches the current screen for the next instance of the text or graphic last entered in the JAWS Find dialog. Use the application's Find or Search feature for more extensive searches.

JAWSHome use HOME. Depends on which cursor is active. For example, this keystroke moves the active JAWS cursor or Invisible cursor to the left edge of the active window. The PC cursor tracks the application cursor and is active by default in most applications. Pressing HOME moves the insertion point to the beginning of a line when in an edit field and often places the selection on the first item when in a list view, tree view, or edit combo box.
JAWSPageDown use PAGE DOWN. Moves the JAWS cursor, if active, to the bottom of the active window, but does not move left or right. The result is controlled by the application.

JAWSPageUp use PAGE UP. Moves the JAWS cursor, if active, to the top of the active window, but does not move left or right. The result is controlled by the application.

JAWSWindow use INSERT+J. Moves focus to the JAWS user application window and activates a context menu allowing the user to select JAWS menu items.

Note: This keystroke does not operate if you have elected to run JAWS from the System Tray. In this case, use INSERT+F11 to open the Select A System Tray Icon dialog and choose JAWS from the list.

ListTaskTrayIcons use INSERT+F11. Opens the Select a System Tray Icon dialog box. After selecting the desired icon from the system tray, you can act on the icon by tabbing through and choosing a button representing the left, right, or left double-clicking of a mouse button.
MinimizeAllApps use INSERT+F6. Minimizes all application windows. The desktop gains the focus and is not obscured by any open windows. An alternative keystroke is WINDOWS LOGO KEY+M.

NextDocumentWindow use CTRL+TAB. Use to switch between document windows or group windows. Also switches between the different page tabs in multi-page dialog boxes.
OpenListBox use ALT+DOWN ARROW. Usually opens a list. When in an edit control, moves to and says the next sentence.
PassKeyThrough use INSERT+3. JAWS does not use or process the key following this keystroke. It is sent directly to the application, as if JAWS were not loaded. This is very useful if you have a key conflict.

PreviousDocumentWindow use CTRL+SHIFT+TAB. Use to switch between document windows or group windows. Also switches between the different page tabs in multi-page dialog boxes.
RestrictJAWSCursor use INSERT+R. Restricts JAWS cursor movement to a particular window. Turn restrictions on when you want to read only within a particular window or control, and turn restriction off when you need to read all around the screen.
RouteJAWSCursorToPc use INSERT+NUM PAD MINUS. Routes the JAWS cursor or the Invisible cursor, if it is active, to the location of the PC cursor.

RoutePCCursorToJAWS use INSERT+NUM PAD PLUS. Routes the PC cursor to the location of the JAWS cursor. The PC cursor is controlled by the application and it usually cannot go everywhere in the window, as the JAWS cursor can.
TopOfFile use CTRL+HOME. If the active item is an edit box, the caret or focus moves to the beginning of the open document. Otherwise, moves to the top of the current control. This is the Windows command for moving the cursor to the top of the file, if supported by the application.

TypingEcho use INSERT+2. Sets the level of typing echo, moving through three choices: Characters, Words, or None. Characters speaks each character as you type. Word speaks the complete word when you press the SPACEBAR. None indicates no typing echo.
UpALevel use ESC. In menus, this script closes the menu and places the focus on the Menu bar. In combo list boxes, this script exits the combo list box and returns focus to the combo box without making a selection. This script also closes a Context menu. Windows command.

WindowClassReassign use INSERT+7. Gets the class of the current window and lets you equate it to a known class so JAWS can speak it properly. May also be adjusted using the JAWS Configuration Manager.

THERE ARE NEW NAVIGATION KEYS TO BE USED WHEN INSIDE OF AN HTML TABLE

ALT+CTRL+NUM PAD5 reads the cell containing the virtual cursor along with associated row and column headings.
ALT+CTRL+RIGHT ARROW moves to and reads the same cell in the next column along with the column heading.
ALT+CTRL+LEFT ARROW moves to and reads the same cell in the prior column along with the column heading.
ALT+CTRL+DOWN ARROW moves to and reads the same cell in the next row along with the row heading.
ALT+CTRL+UP ARROW moves to and reads the same cell in the prior row along with the row heading.

CTRL+NUMPAD5 is now used to read the current paragraph.

Screen Reading

ReadWordInContext use INSERT+C. Sometimes a word must be reviewed in its context to see if it is spelled or used correctly. Use this script in the Spell Check or Find dialog, or when performing a search-and-replace for specific text or items.
SayActiveCursor use ALT+DELETE. Says the name of the active cursor and its position by pixel.

SayAll use INSERT+DOWN ARROW. If the PC cursor is active, JAWS scrolls the screen by moving the PC cursor down. If the JAWS cursor is active, the rest of the window is read by moving the JAWS cursor down a line at a time, if reading manually.

SayAppVersion use CTRL+INSERT+V. Useful if you are running multiple versions of an application.
SayBottomLineOfWindow use INSERT+PAGE DOWN. The bottom line is usually the status line of the active window.
SayCharacter use NUM PAD 5. Reads the character or graphic symbol at the active cursor. If the PC cursor is active, JAWS looks for the visible caret or the light bar. If the JAWS cursor is active, it speaks the character or graphic at the mouse pointer. Press twice for phonetic spelling.

SayColor use INSERT+5. Says the color of the text at the active cursor position. This script uses the values indicated in COLORS.INI to define the colors from the RGB values. If you hear numbers instead of colors, add a corresponding entry to the COLORS.INI file and define its color.
SayCurrentHotKey use CTRL+SHIFT+H. Says the underlined letter in the name or prompt for the current item in a dialog box or window. Use this letter with the ALT key to choose that item, even when it does not have the focus.

SayCursorType use CTRL+INSERT+SHIFT+C. Speaks the type of mouse pointer, which indicates what the mouse is capable of doing at the current location. For example, if the JAWS cursor is active and the mouse pointer shape is a hand pointing to a link, clicking the left mouse button opens the item at the mouse pointer.
SayDefaultButton use INSERT+E. Dialog boxes usually have a button, such as Okay or No, which is set as the default. This button represents the function that will be performed when you press the ENTER key, unless focus has moved to another button. Use this script to determine which function will be performed.

SayDriveLetter - Keystroke not assigned. Says the name of the disk drive or network drive that has the focus in Windows Explorer in order to provide the correct drive letter.
SayFont use INSERT+F. Says the font style name and character size. Also speaks the attributes such as bold, underline, and italics.
SayFrame no keystroke assigned. A frame is not valid unless certain things about it are true, such as the name of its real window, the class of its real window, and the search string, if any.

SayFrameAtCursor use INSERT+X. All text within the boundaries of the frame that contains the active cursor is spoken.
SayFromCursor use INSERT+PAGE UP. Says the text from the cursor to the end of the line, including the current character.
SayLine use INSERT+UP ARROW. If the PC cursor is active, reading is restricted to the current item or window. Otherwise, reading includes all the text on approximately the same line, even if it is outside the current control or window, unless JAWS cursor restriction is on.

SayNextCharacter use RIGHT ARROW. Moves to and reads the next character.
SayNextLine use DOWN ARROW. Moves to and says the next line.
SayNextParagraph is called by CTRL+DOWN ARROW. Moves to and reads the next paragraph.
SayNextSentence is called by ALT+DOWN ARROW. Moves to and reads the next sentence only if edit type controls. Otherwise, the keystroke is controlled by the specific applications.
SayNextWord use CTRL+RIGHT ARROW or INSERT+RIGHT ARROW. Uses the active cursor, JAWS or PC. PC cursor movement is controlled by the application.

SayParagraph use CTRL+NUM PAD 5. Reads the current paragraph with the active cursor.
SayPriorCharacter use LEFT ARROW. Moves to and reads the prior character.
SayPriorLine use UP ARROW. Moves to and says the prior line.
SayPriorParagraph use CTRL+UP ARROW. Moves to and says the prior paragraph.
SayPriorSentence use ALT+UP ARROW. Moves to and reads the prior sentence only if edit type controls. Otherwise, the keystroke is controlled by the specific applications.

SayPriorWord use CTRL+LEFT ARROW or INSERT+LEFT ARROW. Uses the active cursor, JAWS or PC. PC cursor movement is controlled by the application.
SayProgramComments use CTRL+SHIFT+C. Useful if you are running multiple versions of an application.
SaySelectedText use INSERT+SHIFT+DOWN ARROW. This provides an easy way to check if you have selected the correct text in preparation for other actions, such as deleting, copying, bolding, underlining, etc.

SaySentence use ALT+NUM PAD 5. Say the current sentence with the active cursor.
SaySpecialWindowClasses use CTRL+INSERT+F2. Cycles through four window groups: Parent, Child, Previous, and Next. Just keep pressing the CTRL+INSERT+F2 to hear the window classes.
SaySystemTime use INSERT+F12. Says the time on the taskbar. If pressed twice quickly, says the date.
SayTextAndAttributes use ALT+INSERT+DOWN ARROW. Reads the visible text in the active window without moving the cursor. As it passes over changes in attributes, they are announced.

SayToCursor use INSERT+HOME. Says the text from the start of the line up to the cursor, not including the current character.
SayTopLineOfWindow use INSERT+END. The top line is usually the title of the active window.

SayWindowPromptAndText use INSERT+TAB. Says the prompt for the window or control that has focus, and the type of the window, and the text in the window.

SayWindowTitle use INSERT+T. Says the application title, dialog box title, and item with focus.
SayWord use INSERT+NUM PAD 5. Reads the word or graphic symbol at the active cursor. If the PC cursor is active, JAWS looks for the visible caret or the light bar. If the JAWS cursor is active, it speaks the word or graphic at the mouse pointer. If pressed twice quickly, the word at the active cursor is spelled.
ScreenEcho use INSERT+S. Sets the level of screen echo, moving through three choices: Highlighted, All, or None. Highlighted is the default, speaking only highlighted text when it appears on the screen. All speaks all of the text that written to the screen.

Appendix F: *Realigning to a Network Society*

This appendix includes the "Realigning to a Network Society" as mentioned in section 2.5 of the report, which is the statement from the Government to the Danish Parliament on how the Danish society is changing and thus is creating the need for a new agenda for the welfare of the society. According to the statement, the economical and political ground rules have changed, as have the relations between people, businesses and authorities. Below is the statement verbatim.

Conversion to the Network Society

The network society is a reality. With computers in 1.4 million homes, with 226,000 home workplaces paid for by employers and with 1.7 million Danes using the Internet on a regular basis, Denmark has commenced its conversion to the society which is going to take over from the industrial society: the network society. In all aspects of life - work, training and education, leisure time, culture and trade and commerce - this will offer a large number of new technologies and possibilities which, if used correctly, will make the life of the individual citizen much easier and improve the services provided by society for the individual citizen.

The network society has its own economy with very great potential for wealth. The EU Commission estimates that 80 million Europeans will generate a turnover of DKK 3,700 billion on the digital market by 2002. The Internet is a network on which enterprises offer their goods to consumers worldwide in sharp competition with each other. This sets a new agenda for Danish trade and industry. New enterprises and industries are emerging, while others are disappearing. We are seeing the creation of new

media and forms of communication. The economic and political rules are changing. The interaction between people, enterprises and public authorities is changing.

The challenge will be to exploit the future possibilities by realignment in all areas of our economy and society. In short, the challenge is to make Denmark a leading IT nation, while still preserving the best values of our welfare society.

A Historical Challenge

We are not the only country facing this challenge. Virtually all Governments in the western world are working to meet similar objectives. Denmark has a number of advantages, which we can utilise in our conversion to the network society:

– In a number of surveys, Denmark has been assessed as the country in the world that is best prepared to meet the challenges of the future.

– We have a well-developed telecommunications infrastructure and widespread use of the Internet.

– Danes have a high level of training and education and we have a flexible educational system.

– We have an industrial structure with relatively small enterprises with great conversion potential.

– We have a well-functioning public sector.

There are also a number of conditions which make conversion difficult:

– Denmark has a poor high-tech entrepreneurial culture, and we do not yet fully utilize the potential, which our high level of training and education suggests that we have.

– We lack large enterprises that can push the digital market forward, including the many relatively small enterprises, which are ready for realignment.

– We have a sector-divided public sector, which makes it difficult to co-ordinate the process of conversion.

Denmark has the opportunity to be among the pioneering countries in the network society. We can use this to promote the use of technology to the benefit of all, at the same time as ensuring a share in the growth potential of the digital economy.

Telecommunications Policy

The foundation of the network society is the telecommunications, which are offered in Denmark. Just as the industrial society was held together by an infrastructure consisting of traffic by rail, sea and road, the network society connects us to each other via cables, radio waves and computers. Telecommunications are our ticket of admission to the global network.

Therefore, all citizens and enterprises are to have quick, easy access to the Internet, and all citizens must feel so comfortable with the technologies that they do not opt out of using them in advance. Being on the Internet must be just as natural, easy and inexpensive as turning on the water tap or flicking on a switch to turn on the light. Competition, including the implementation of an invitation to tender for new frequencies, is the way to ensure that everyone feels at home in the network society. It is therefore important to stimulate a competition-based supply of several different types of connections between the individual consumers in the network society. These connections may either be wireless or wire-based.

On this basis, a number of possibilities will open up for individual consumers. The supply of new frequencies, for example third-generation mobile networks, is of importance for this development. It will bring the Internet out to citizens and enterprises

in an even more finely meshed form and free Internet development from its bondage to complicated computers in favor of mobile phones and other types of small devices which are just as easy to use as the remote control for the TV.

But also the development in consumers' wire-based access to the network society will open up new possibilities. One example is the so-called XDSL technology, which, when it really gains a foothold, may revolutionize the possibilities for consumers' to have easy access to the Internet.

Seen overall, this development will make it easier for citizens to link up with the Internet and will result in new applications and, consequently, new business areas for the enterprises which are ready to seize this opportunity.

The political challenge consists in promoting the establishment of a telecommunications market, which can meet the demands, and requirements of the ordinary consumer, not just today, but also in the long term.

Based on the desire for healthy competition and genuine freedom of choice, a large number of parties in the Folketing, the Danish Parliament, entered into an agreement on telecommunications policy in September 1999. This agreement will be followed up by new legislation in the present session of the Parliament. The object is to promote real telecommunications competition - also within areas in which it is still difficult to make out the contours of the many possibilities for application in everyday life.

We Must Establish Priorities

Denmark cannot be at the forefront in all areas. We must establish priorities and concentrate our initiatives on the areas of priority chosen. This requires experience of life

in the network society, and we will gain this experience through concrete projects. Two IT lighthouses are to put Denmark on the world map of IT. One is to be located in Northern Jutland. The other in Ørestaden in Copenhagen. The objective is to create a regional network society to which all citizens can be given a ticket of admission at the same time as the economic and financial potential is utilized optimally.

The development has its own momentum in many areas; in others, political initiatives are necessary to ensure quick development to the benefit of all. It is therefore an important political task to establish priorities as to what should be a Government task and what can be left to the market and other players.

The Government presents here 37 concrete initiatives as a first quick follow-up on the report from the Committee on Digital Denmark, November 1999, and on the cross-party telecommunications policy agreement in principle from September 1999. The report will be revised and supplemented annually.

The Government's objective is that Denmark:

– should have the most modern, future-proof infrastructure in which as many citizens as possible have broadband access

– gives its citizens fundamental IT rights so that they feel comfortable and secure when they are on the Internet

– ensures its citizens of life-long learning and quality in the network society

– is committed to e-commerce and maintains Denmark's position of strength as a competent trading nation

– makes it easy for its citizens to contact the public authorities 24 hours a day

– enhances IT policy efficiency through, for example, annual network reports.

Initiatives Which Will Be Implemented in the Year 2000

Telecommunications Infrastructure

All Danes are to have the most modern, future-proof infrastructure to which as many citizens as possible have inexpensive broadband access.

1. Wireless Subscription Networks

As long as there is only one subscription network in Denmark, there will not be genuine competition throughout the telecommunications market. This is to the detriment of consumers and Denmark's competitiveness. With the latest wireless technology (FWA technology), an alternative to the existing subscription network can be established. An alternative network will really create competition as to price and capacity. It must be cheaper and easier to make calls and to send large quantities of data. Therefore, an invitation for tenders for frequencies will be implemented with a view to the establishment of a number of new wireless subscription networks in Denmark.

This will be set in motion in the first quarter of 2000.

2. Mobile Access to the Internet

Access to the Internet is to be expanded from complicated computers to mobile phones and other small portable devices which are easy to operate. The technology is there (UMTS). Consumers will receive even better mobile communication more cheaply. The task is to make use of the technology widespread. Therefore, an invitation to tender for frequencies will be implemented, which is to form the basis for the build-up of these third-generation mobile networks.

This will be set in motion in the fourth quarter of 2000.

3. Cheaper to Make Calls on Mobile Phones

Even though there is competition on the mobile phone market, further initiatives are required to maintain this competition. One way of doing so is by giving the mobile phone market access to use additional frequencies. With this initiative, we shall ensure even lower prices for making calls on a mobile phone - and better coverage and quality on the networks so that mobile phone customers in outlying districts will also benefit fully from the competition.

This will be set in motion in the second quarter of 2000.

4. Increased Competition

As part of the revision of telecommunications legislation, the rules will be tightened in a number of areas to ensure real competition for all telecommunications companies on the market. This will include new and more effective regulations for fixing the prices and terms, which the other companies are to pay and comply with for leasing capacity on the network of Tele Denmark (joint traffic prices).

This will be set in motion in the first quarter of 2000.

5. Better Communication for Emergency and Stand-by Purposes

In critical accident situations, it is important that as much information as possible about the accident should be quickly available to those who are to turn out to the task. Typically several authorities will have to work together smoothly, and a shared information basis is essential. By means of digital technologies, we now have the possibility of improving communication in the field of emergency and stand-by arrangements. The technology is there (TETRA - Terrestrial Trunked Radio), and this is a good basis for a professional and reliable data network. The network can also be used by

a large number of enterprises in Denmark, including the contracting trades, the transport sector and other sectors. An invitation to tender for frequencies will be implemented with a view to issuing licenses for the introduction of TETRA.

This will be set in motion in the third quarter of 2000.

A Network Society for All

All citizens are to be given fundamental IT rights so that they feel comfortable and secure when they are on the Internet.

6. Security on the Internet

The citizens are to feel secure when they are on the Internet. In order to create transparency, IT rights for the citizens are to be drawn up making it clear which rules apply when, for example, the individual citizen communicates with the public sector or shops on the Internet. An encryption policy is to be drawn up securing right to free encryption for citizens and enterprises without the possibility of illegal interception.

This will be set in motion in the second quarter of 2000.

7. Telephone Line to the Public Authorities

Out of consideration for citizens without Internet access who need to contact the public authorities also outside normal opening hours, one collective telephone number to the public authorities will be established. The objective for this new service will be to be able to offer the citizens one collective telephone access to the public authorities from which they can obtain general information and, in the long term, have their inquiries directed to the proper authority. The possibilities will be mapped and turned into concrete proposals after review work.

This will be set in motion in the second quarter of 2000.

8. IT in Danish

Language barriers may constitute a major obstacle to citizens and trade and industry utilizing the potential possibilities of the network society. In order to give Danes equal possibilities, language technological tools are to be developed which can automatically translate texts from Danish into other languages and vice versa. At the same time, these tools are to help make Danish information on the Internet more easily accessible to citizens and enterprises worldwide. A plan of action is to be prepared which has a Danish language technological dictionary as one of its main points.

This will be set in motion in the first quarter of 2000.

9. IT and Public Service

The public service channels are to help popularize IT. The first element in this popularization process will be for this objective to be formulated as part of the core activities of DR and TV-2 and for the channels to strengthen their online activities as part of their public service obligation.

This will be set in motion in the first quarter of 2000.

10. Accessibility for the Disabled

The Ministry of Research and Information Technology will draw up a situation report on the IT initiatives aimed at the disabled, which have been taken so far. The objective is to assemble these and, if required, propose new initiatives in connection with the Minister for Research and Information Technology's next report to the Parliament. At the same time, it must be ensured that the Government's new IT policy initiatives contain reflections on accessibility for all, including the disabled.

Finally, the Government has decided to set up an inter-disciplinary ministerial committee to deal with issues concerning the disabled. Until May 2000, the committee will consider barriers to the involvement of disabled persons in social life and follow up on the initiatives, which have been implemented so far.

This will be set in motion in the first quarter of 2000.

11. The Public Libraries in the Network Society

The public libraries are an important resource in the Government's efforts to develop a network society for all. A new Act on library activities will give the population better possibilities of having access to information. In accordance with the Bill, the public libraries will, in addition to books, etcetera, be under an obligation to provide access to the Internet and digital information resources and to lend music media and CD-ROMs. Finally, in accordance with the Bill, it will be possible to search and order materials at the libraries via the Internet.

This will be set in motion after the passing of the Bill in the first quarter of 2000.

Life-long Learning

Denmark is to ensure its citizens of life-long learning in the network society.

12. Virtual University

Denmark has further education degree courses of a high quality. This is the basis for building up a virtual university, which can offer remote teaching for students in Denmark and abroad via the Internet. The virtual university is to be established as a virtual network organization with members from universities and other higher educational establishments.

The virtual university is to be launched via a central educational platform on the Internet, where it must be possible to find, pay for and take courses. It must also be possible to take exams on the Internet.

This will be set in motion in the second quarter of 2000.

13. Better IT at Universities

Within the framework of the universities' development contracts, the focus in the future is to be on the universities' use, integration and supply of IT and IT-based studies.

This will be set in motion in the first quarter of 2000.

14. Home Pages for Students

All students at universities and other higher educational establishments are to be offered a special home page which they can use in a number of fields via the Internet, for example for communication with academic staff, presentation of essays, registration for examinations, enrolment on courses and applications for student grants.

In line with the experience gained, the scheme will be extended to cover all students.

This will be set in motion in the second quarter of 2000.

15. Learning Lab Denmark

In the network society there is a constant need to develop new ways of co-operating and learning. A new research and development unit will be set up to promote the possibilities for Danish enterprises and educational establishments to use new methods of learning. Through experiments with the participation of enterprises, educational establishments, researchers and teachers, partnerships will be established to develop new methods for learning and competence development.

The Learning Lab is expected to be established with an independent Executive Committee as a faculty under the proposed Danmarks Pædagogiske Universitet.
This will be set in motion in the first quarter of 2000.

16. IT Integration in All Subjects

Denmark is to be the first country in which IT is included as an integral element in all subjects. The IT integration will have a significant influence on the contents, methods, pedagogy, didactics and forms of evaluation of all subjects. New learning methods and working methods and a changed organization of teaching may be expedient. There must be a systematic collection of experience from the large number of implemented and ongoing trials, and further trials should also be started. This work is to form the basis for an extensive review of Acts and Executive Orders for all training and education, with a view to a revision of the regulations to ensure that IT is really integrated in teaching and at examinations.
This will be implemented on a continuous basis.

17. Life-long Learning

Training and education are only of limited durability in the network society. Therefore, all citizens, irrespective of their age, educational background and residence, are to be offered the possibility of keeping up and developing the new competence and skills, which are in demand in the network society. Life-long learning must be based on the situation of the individual citizen, and the training and education offered are to be adjusted accordingly. Virtual training and educational offers and courses are to be developed in which physical presence is not a requirement and which can be realized, for example, at the workplace, at home or in an educational establishment. The initiative is to

be given more concrete form in the Ministry of Education's current work on life-long learning.

This will be implemented on a continuous basis.

E-commerce

Denmark is to be committed to e-commerce and to maintaining Denmark's position of strength as a competent trading nation.

18. Electronic Signature

In order to strengthen e-commerce and the exchange of information via the Internet for use, among other things, for communication with public authorities, the Minister for Research and Information Technology will table a Bill on electronic signatures. An electronic signature guarantees who has signed an electronic letter and that unauthorized parties have not made changes to the message. A so-called key center guarantees that the signer is who he or she purports to be. As this is a new market in which technological development is very rapid, the legislation must, in so far as this is possible, be technology neutral and able to be taken forward in to the future. In addition, the Ministry of Justice has set up a committee which is to prepare proposals on how to ensure that the legislation does not contain requirements as to form, etcetera which will present inconvenient obstacles to the use of electronic communication.

This will be set in motion by the passing of the Bill in the second quarter of 2000.

19. Objectives for Public E-commerce

The public sector is to act as an engine for Danish trade and industry's use of e-commerce through consistent use of digital communication in connection with public procurement. A plan of action is to be prepared for when public institutions are to switch

to electronic procurement of various product groups such as travel, office supplies and IT equipment. In the long term the public's trading partners are to be charged fees for employing paper documents.

This will be set in motion in the second quarter of 2000.

20. A Public Auction Hall on the Internet

To ensure as cheap public procurement as possible, a public Internet auction hall is to be established at which enterprises can make bids for supplying of goods and services to the public sector and where public institutions can make joint procurements. The electronic auction hall is to be co-ordinated with initiatives which have been started under the auspices of Statens og Kommunernes Indkøb A/S and Statens Information (the Danish State Information Service) and it is, moreover, to be based on commercial incentives and commercial business models.

This will be set in motion in the second quarter of 2000.

21. E-hus Danmark - A Danish E-commerce House

The spread of e-commerce and increased globalization will be of great competitive importance to trade and industry. At the same time, it will revolutionize and redefine business models and procedures in both the private sector and the public sector. Denmark is to build on its traditional role as a trading nation and develop into a center for e-commerce. In concrete terms, Ørestaden is to be made into a center for an innovative e-commerce environment, which will be built up in connection with the large-scale initiatives, which have already been planned in the area (the IT College, the IT Science Park, etcetera). To this are added a number of new elements:

– In connection with the IT College and the IT Science Park, an E-commerce House will be established - a building in which know-how, methods, tools and international contacts can be built up and where e-commerce enterprises can locate their business.
– An annual international e-commerce competition is to be held with prizes being awarded to the enterprises and countries which have done best.
– An overall home page (Copenhagen Cyberport) is to contribute to establishing an international environment in which knowledge about e-commerce can be exchanged.
This will be set in motion in the second quarter of 2000.

22. E-commerce Thermometer

In order to keep a finger on the pulse of the network economy of the future, an e-commerce thermometer is to be established which shall closely monitor the development in Danish e-commerce. The focus will be on enterprises, public institutions and consumers and on the e-commerce between these.
This will be set in motion in the second quarter of 2000.

23. Better Management of the Enterprises of the Network Society

Increased e-commerce will, together with the new network economy, revolutionize and redefine business models and procedures in both the private sector and the public sector. This will make great demands on the training of Danish managers. A partnership is to be established on e-management development with participation of trade organizations, educational establishments and other relevant science centers. The task of which will be to establish nation-wide initiatives within the e-management of the conversion of the enterprises to the network society.
This will be set in motion in the third quarter of 2000.

24. Prize Awards for Digital Businessmen

In order to promote the awareness and widespread use of e-commerce, a quarterly prize will be awarded to the digital businessman or businessmen - public or private - who has or have made a particularly noteworthy effort to convert the enterprise to the digital world.

This will be set in motion in the third quarter of 2000.

Digital Administration

The digital administration is to make it easy for citizens to contact the public authorities 24 hours a day.

25. Electronic Bridge across Øresund

On the initiative of the Government and in co-operation with the relevant Swedish authorities, an information function is to be established in the Øresund region on, among other things, the labor market, tax regulations and social services regulations on both sides of Øresund. The initiative is to facilitate the integration of citizens and trade and industry in the Øresund region and consequently create a basis for Ørestaden as an e-commerce center. The Øresund information will be based on the Internet, call center, etcetera.

This will be set in motion in the first quarter of 2000.

26. Citizens' Access to Their Own Electronic Data

It must be ensured that citizens can use the existing access to acquire information about themselves and that public data about citizens are not monopolized by various public authorities and enterprises.

This will be set in motion in the first quarter of 2000.

27. Personal Internet Access to the Public Authorities

All Danish citizens are to be offered personal Internet access which can give them access to publicly registered information about themselves, to a customized information system and to easy, rapid, secure self-service in relation to public authorities and institutions. The objective is better service, enhanced efficiency and more openness.

This will be set in motion in the first quarter of 2000.

28. Public Information Server

On the basis of already existing public registers, a public information server is to be established. This information server is to give citizens and enterprises easy, secure access to the large quantity of information registered by the public authorities on Denmark and Danish citizens. This is the first step on the way to citizens only needing to give data to the public authorities once.

This will be set in motion in the first quarter of 2000.

29. Electronic Forms

Before the end of 2000, citizens are to be able, via the Internet, to retrieve, complete and submit the most common forms used by citizens, such as notices of change of address, notices of change of doctors, etcetera An increasing number of forms are to be offered on the Internet so that all important forms can be found on the Internet before the end of 2002.

This will be set in motion in the first quarter of 2000.

30. Effective Electronic Filing

The Danish Public Records Act stipulates, as does the Danish Freedom of Information Act and the Danish Public Administration Act that records must be kept of

public documents. The Ministry of Research and Information Technology is implementing a review as an introduction to a plan of action, which is to speed up the switch of the public administration to electronic administration, including effective electronic filing.

This will be set in motion in the first quarter of 2000.

31. Mark Book for Public Home Pages

In order to improve the quality of the public home pages, a quality check will be made four times a year. The evaluation of the public home pages with the grades awarded will be published. The objective is to ensure that the public sector is at the forefront regarding the utilization of the possibilities offered by the Internet for better service and greater user-friendliness, including general accessibility for the disabled.

This will be set in motion in the first quarter of 2000.

32. Open Mail Lists on the Internet

The Ministry of Research and Information Technology is starting a trial with open mail lists. In the light of, among other things, the experience gained from this trial, a plan may be prepared for how public authorities can offer citizens easy access to monitor the public sector, for example by public authorities making their mail lists available to the public on the Internet.

This will be set in motion in the third quarter of 2000.

IT Lighthouses, IT Maps and IT Reviews

Denmark is to enhance the efficiency of its IT policy through, among other things, annual network reports.

33. Denmark's First Network Society (Northern Jutland)

In several places in the world, strong IT environments have been established in demarcated areas via massive, focused investments. These IT environments are today acting as magnets which attract high-tech enterprises, financial investors, entrepreneurs, researchers and students, who are absorbed into a dynamic, strongly competitive interaction. Denmark needs to establish similar environments, which are to develop and support the special niches of the network society in which we have a special tradition and culture to build on. The Danish network societies are to focus on both "soft" network areas such as democracy, trade and commerce, teaching and service and "hard" areas such as research, innovation, development and production.

The Danish investments and initiatives are to be made with the establishment of a regional IT environment, which, in full scale, will demonstrate the potential of the network society for enterprises and citizens.

On the basis of the very positive co-operation which has already been established between enterprises, Aalborg University, Forskerparken Novi A/S and central political decision-makers in the region, an IT lighthouse will be established in Northern Jutland. This will be set in motion in the first quarter of 2000.

34. Strategy for Ørestaden as a Network Society

A strategy is to be prepared for Ørestaden as a network society based on the large-scale initiatives which have already been planned in the area, but with greater speed, more focus and a clearer strategic cohesion.

This will be set in motion in the third quarter of 2000.

35. IT Maps

With a view to achieving synergy effects from the many IT projects around Denmark, an initiative will be taken to gather and communicate experience of projects at political, administrative and technical levels which are otherwise kept separate. The experience from Northern Jutland, Ørestaden and other interesting IT areas is to be used as a springboard for new initiatives to create growth.

This will be set in motion in the fourth quarter of 2000.

36. Report on Convergence in the Network Society

In the network society, known technologies are merging and forming new ones (convergence). For example, TV, computer and mobile phone can become one united technology. A report is to be prepared on convergence in the network society which is based on the breakdown of the borders between the telecommunications, IT and media sectors. The report is, among other things, to look at the need for new regulation in the network society of the future.

This will be set in motion in the second quarter of 2000.

37. Annual IT Policy Review

The Government is to prepare an annual IT policy network report to the Parliament, in which:

– the IT policy initiatives are compared with the many objectives, strategies and plans of action within various sectors

– a review of legislation pertaining to IT policy assesses which Bills in the last session of Parliament have had the greatest significance for the development of IT and the conversion to the network society

– a comprehensive IT statistical model quantifies the development of IT in Danish society and Denmark's position in relation to other leading IT nations.

This will be set in motion in the fourth quarter of 2000.

Further Proposal

In addition, a number of initiatives are being considered:

1. Share Options

In the global network society, there is increased pressure from competition on Danish enterprises. To give the enterprises more versatile and flexible possibilities for attracting and holding on to key employees, the rules on the taxation of share options are to be changed so that they can be used to a greater degree as a tool for recruiting and holding on to employees.

2. Access to the Internet for Every 10th Pupil

In order to ensure the best possible basis for the integration by primary and lower secondary schools' of the Internet in their teaching, an analysis is to be made of the status of and plans for high-speed Internet access for the pupils in primary and lower secondary schools and out-of-school educational establishments. On the basis of the result of the analysis, it will be considered whether to include the subject in the negotiations on the coming municipal agreement to ensure at least one high-speed link-up to the Internet for every 10th pupil. It should also be considered whether to establish local networks with wireless technologies to ensure that the possibilities for IT use in schools can be carried forward into the future at the same time as portable computers and other mobile technologies are gaining ground.

3. More Computer Science Graduates

The number of students admitted to the computer science degree courses is to be doubled over three years.

4. PC Scheme for All Publicly Employed Teachers

For a 2-year period, all publicly employed teachers and instructors are to be offered a home PC with Internet access. The PC shall be acquired for an educational and/or vocational purpose. The PC scheme is to be financed by a combination of user payment via subtractions from the gross salary and employer's contribution.

5. Development of Digital Teaching Aids and Materials

Digital teaching aids and materials are a prerequisite for being able to implement actual IT integration in Danish teaching.

A specialist and financial partnership is to be established between the Ministry of Education, producers of teaching aids and materials and multimedia on the development of digital teaching aids and materials of a high quality for different levels in the educational system. The Ministry of Education will highlight the levels in question on the basis of an evaluation of requirements. The participants in the partnership are to contribute equally to the development of the teaching aids and materials, both financially and in terms of specialist input.

6. More IT Research and Teaching on Further Education Degree Courses Are to Attract More IT Students

The number of IT researchers is to be increased in order to attract more students with an interest in IT. This will ensure better qualified teaching on further education IT

degree courses, which will make it more attractive to apply for admission to an IT degree course.

7. Danish IT Research

In some areas, there is a special need for promoting Danish research initiatives in the network society, including within:

– security and encryption of telephony, data transmission and over-the-air communication

– the consequences of the expected fusion of different media, the so-called media convergence.

An IT and telecommunications consortium is to be established, involving existing public and private centers in this field.

8. Research Programme on a Network Society for All

Increased, focused research initiatives are to increase our knowledge of the social perspectives in the network society - with special focus on IT and democracy, the cohesion of Danish society and the risk of an IT knowledge gap between different population groups.

9. Five IT "Incubators" as a Food Chain for the Innovation Environments

Up to five IT incubators are to be established in the immediate vicinity of training, education and research environments in the field of IT. These incubators are to give researchers and students the possibility to test, at an early stage, ideas with a long-term or highly risky commercial aim.

10. Efficiency in the State Sector

Digitization of the State sector's internal administrative routines, which offer possibilities of economizing by large-scale operations, is to be commenced. For example, payroll and personnel functions, IT operations and support, electronic case-handling systems and government procurement.

11. www.foreninger.dk

A main portal, www.foreninger.dk, is to be established. In addition to providing information about associations, this portal is also to support the associations' interactive communication with their members, public authorities and other interested parties.

12. Green IT Policy

As part of the Danish environmental protection policy, calculations are to be made which highlight the environmental consequences of increased communication and e-commerce in the network society. At the same time, the communication of knowledge about environmentally friendly electronics for buyers and consumers is to be given higher priority so that consumers' possibilities for green shopping are strengthened. One of the ways to achieve this is through increased use of existing marking schemes.

Continuous Strategy

As the report shows, a number of initiatives will be implemented right away. However, it is essential for the Government that all interested environments and citizens in Danish society participate in shaping the continuous development of the network strategy. Therefore, three regional IT policy conferences will be held in the course of the spring of 2000. In order to further secure the continuous development of IT policy, a

network report is to be submitted to Parliament in the autumn, supplemented with further proposals for IT policy follow-up.[98]

[98] "Realigning to a Network Society," http://www.fsk.dk/cgi-bin/doc-show.cgi?doc_id=20746

Appendix G: *Web Content Accessibility Guidelines from W3C*

The Web Content Accessibility Guidelines, mentioned in section 2.7 of the report, were developed by the Web Accessibility Initiative group of the World Wide Web Consortium for the purpose of offering web designers a guide to creating more accessible web pages. The initiative was begun in 1997 and the following is a verbatim copy of the latest version of the guidelines that have been developed thus far.

Guideline 1. Provide equivalent alternatives to auditory and visual content.

Provide content that, when presented to the user, conveys essentially the same function or purpose as auditory or visual content.

Although some people cannot use images, movies, sounds, applets, etc. directly, they may still use pages that include equivalent information to the visual or auditory content. The equivalent information must serve the same purpose as the visual or auditory content. Thus, a text equivalent for an image of an upward arrow that links to a table of contents could be "Go to table of contents". In some cases, an equivalent should also describe the appearance of visual content (e.g., for complex charts, billboards, or diagrams) or the sound of auditory content (e.g., for audio samples used in education).

This guideline emphasizes the importance of providing text equivalent of non-text content (images, pre-recorded audio, video). The power of text equivalents lies in their capacity to be rendered in ways that are accessible to people from various disability groups using a variety of technologies. Text can be readily output to speech synthesizers and braille display, and can be presented visually (in a variety of sizes) on computer displays and paper. Synthesized speech is critical for individuals who are blind and for many people with the reading difficulties that often accompany cognitive disabilities, learning disabilities, and deafness. Braille is essential for individuals who are both deaf and blind, as well as many individuals whose only sensory disability is blindness. Text displayed visually benefits users who are deaf as well as the majority of Web users.

Providing non-text equivalents (e.g., pictures, videos, and pre-recorded audio) of text is also beneficial to some users, especially nonreaders or people who have difficulty reading. In movies or visual presentations, visual action such as body language or other visual cues may not be accompanied by enough audio information to convey the same information. Unless verbal descriptions of this visual information are provided, people who cannot see (or look at) the visual content will not be able to perceive it.

Checkpoints:

1.1 Provide a text equivalent for every non-text element (e.g., via "alt", "longdesc", or in element content). *This includes*: images, graphical representations of text (including symbols), image map regions, animations (e.g., animated GIFs), applets and programmatic objects, ascii art, frames, scripts, images used as list bullets, spacers, graphical buttons, sounds (played with or without user interaction), stand-alone audio files, audio tracks of video, and video. [Priority 1] For example, in HTML:
Use "alt" for the IMG, INPUT, and *APPLET*[99] elements, or provide a text equivalent in the content of the OBJECT and APPLET elements.

For complex content (e.g., a chart) where the "alt" text does not provide a complete text equivalent, provide an additional description using, for example, "longdesc" with IMG or FRAME, a link inside an OBJECT element, or a description link.

For image maps, either use the "alt" attribute with AREA, or use the MAP element with A elements (and other text) as content.
Refer also to checkpoint 9.1 and checkpoint 13.10.

1.2 Provide redundant text links for each active region of a server-side image map. [Priority 1] Refer also to checkpoint 5.1 and checkpoint 9.1.

1.3 Until user agents can automatically read aloud the text equivalent of a visual track, provide an auditory description of the important information of the visual track of a multimedia presentation. [Priority 1] Synchronize the auditory description with the audio track as percheckpoint 1.4. Refer to checkpoint 1.1 for information about textual equivalents for visual information.

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[99] See Glossary for definition.

1.4 For any time-based multimedia presentation (e.g., a movie or animation), synchronize equivalent alternatives (e.g., captions or auditory descriptions of the visual track) with the presentation. [Priority 1]

1.5 Until user agents render text equivalents for client-side image map links, provide redundant text links for each active region of a client-side image map. [Priority 3] Refer also to checkpoint 1.2 and checkpoint 9.1.

Guideline 2. Don't rely on color alone.

Ensure that text and graphics are understandable when viewed without color. If color alone is used to convey information, people who cannot differentiate between certain colors and users with devices that have non-color or non-visual displays will not receive the information. When foreground and background colors are too close to the same hue, they may not provide sufficient contrast when viewed using monochrome displays or by people with different types of color deficits.

Checkpoints:

2.1 Ensure that all information conveyed with color is also available without color, for example from context or markup. [Priority 1]

2.2 Ensure that foreground and background color combinations provide sufficient contrast when viewed by someone having color deficits or when viewed on a black and white screen. [Priority 2 for images, Priority 3 for text].

Guideline 3. Use markup and style sheets and do so properly.

Mark up documents with the proper structural elements. Control presentation with style sheets rather than with presentation elements and attributes.

Using markup improperly -- not according to specification -- hinders accessibility. Misusing markup for a presentation effect (e.g., using a table for layout or a header to change the font size) makes it difficult for users with specialized software to understand the organization of the page or to navigate through it. Furthermore, using presentation markup rather than structural markup to convey structure (e.g., constructing what looks like a table of data with an HTML PRE element) makes it difficult to render a page

intelligibly to other devices (refer to the description of difference between content, structure, and presentation.).

Content developers may be tempted to use (or misuse) constructs that achieve a desired formatting effect on older browsers. They must be aware that these practices cause accessibility problems and must consider whether the formatting effect is so critical as to warrant making the document inaccessible to some users.

At the other extreme, content developers must not sacrifice appropriate markup because a certain browser or assistive technology does not process it correctly. For example, it is appropriate to use the TABLE element in HTML to mark up tabular information even though some older screen readers may not handle side-by-side text correctly (refer to checkpoint 10.3). Using TABLE correctly and creating tables that transform gracefully (refer to guideline 5) makes it possible for software to render tables other than as two-dimensional grids.

Checkpoints:

3.1 When an appropriate *markup language*[100] exists, use markup rather than images to convey information. [Priority 2] For example, use MathML to mark up mathematical equations, and style sheets to format text and control layout. Also, avoid using images to represent text -- use text and style sheets instead. Refer also to guifdeline 6 and guideline 11.

3.2 Create documents that validate to published formal grammars. [Priority 2] For example, include a document type declaration at the beginning of a document that refers to a published DTD (e.g., the strict HTML 4.0 DTD).

3.3 Use style sheets to control layout and presentation. [Priority 2] For example, use the CSS 'font' property instead of the HTML FONT element to control font styles.

3.4 Use relative rather than absolute units in markup language attribute values and style sheet property values. [Priority 2] For example, in CSS, use 'em' or percentage lengths rather than 'pt' or 'cm', which are absolute units. If absolute units are used, validate that the rendered content is usable .

[100] See Glossary for definition.

3.5 Use header elements to convey document structure and use them according to specification. [Priority 2] For example, in HTML, use H2 to indicate a subsection of H1. Do not use headers for font effects.

3.6 Mark up lists and list items properly. [Priority 2] For example, in HTML, nest OL, UL, and DL lists properly.

3.7 Mark up quotations. Do not use quotation markup for formatting effects such as indentation. [Priority 2] For example, in HTML, use the Q and BLOCKQUOTE elements to markup short and longer quotations, respectively.

Guideline 4. Clarify natural language usage.

Use markup that facilitates pronunciation or interpretation of abbreviated or foreign text.

When content developers mark up natural language changes in a document, speech synthesizers and braille devices can automatically switch to the new language, making the document more accessible to multilingual users. Content developers should identify the predominant natural language of a document's content (through markup or HTTP headers). Content developers should also provide expansions of abbreviations and acronyms.

In addition to helping assistive technologies, natural language markup allows search engines to find key words and identify documents in a desired language. Natural language markup also improves readability of the Web for all people, including those with learning disabilities, cognitive disabilities, or people who are deaf.

When abbreviations and natural language changes are not identified, they may be indecipherable when machine-spoken or brailled.

Checkpoints:

4.1 Clearly identify changes in the natural language of a document's text and any text equivalents (e.g., captions). [Priority 1] For example, in HTML use the "lang" attribute. In XML, use "xml:lang".

4.2 Specify the expansion of each abbreviation or acronym in a document where it first occurs. [Priority 3] For example, in HTML, use the "title" attribute of the ABBR

and ACRONYM elements. Providing the expansion in the main body of the document also helps document usability.

4.3 Identify the primary natural language of a document. [Priority 3] For example, in HTML set the "lang" attribute on the HTML element. In XML, use "xml:lang". Server operators should configure servers to take advantage of HTTP content negotiation mechanisms (RFC 2068 section 14.13) so that clients can automatically retrieve documents of the preferred language.

Guideline 5. Create tables that transform gracefully.

Ensure that tables have necessary markup to be transformed by accessible browsers and other user agents.

Tables should be used to mark up truly tabular information("data tables"). Content developers should avoid using them to lay out pages ("layout tables"). Tables for any use also present special problems to users of screen reader. (refer tocheckpoint 10.3). Some user agent allow users to navigate among table cells and access header and other table cell information. Unless marked-up properly, these tables will not provide user agents with the appropriate information. (Refer also to guideline 3.)

The following checkpoints will directly benefit people who access a table through auditory means (e.g., a screen reader or an automobile-based personal computer) or who view only a portion of the page at a time (e.g., users with blindness or low vision using speech output or a braille display, or other users of devices with small displays, etc.).

Checkpoints:

5.1 For data tables, identify row and column headers. [Priority 1] For example, in HTML, use TD to identify data cells and TH to identify headers.

5.2 For data tables that have two or more logical levels of row or column headers, use markup to associate data cells and header cells. [Priority 1] For example, in HTML, use THEAD, TFOOT, and TBODY to group rows, COL and COLGROUP to group columns, and the "axis", "scope", and "headers" attributes, to describe more complex relationships among data.

5.3 Do not use tables for layout unless the table makes sense when linearized. Otherwise, if the table does not make sense, provide an alternative equivalent (which may be a linearized version). [Priority 2]

Note. Once user agents support style sheet positioning, tables should not be used for layout. Refer also to checkpoint 3.3

5.4 If a table is used for layout, do not use any structural markup for the purpose of visual formatting. [Priority 2] For example, in HTML do not use the TH element to cause the content of a (non-table header) cell to be displayed centered and in bold.

5.5 Provide summaries for tables. [Priority 3] For example, in HTML, use the "summary" attribute of the TABLE element.

5.6 Provide abbreviations for header labels. [Priority 3] For example, in HTML, use the "abbr" attribute on the TH element.

Refer also to checkpoint 10.3

Guideline 6. Ensure that pages featuring new technologies transform gracefully.

Ensure that pages are accessible even when newer technologies are not supported or are turned off.

Although content developers are encouraged to use new technologies that solve problems raised by existing technologies, they should know how to make their pages still work with older browsers and people who choose to turn off features.

Checkpoints:

6.1 Organize documents so they may be read without style sheets. For example, when an HTML document is rendered without associated style sheets, it must still be possible to read the document. [Priority 1] When content is organized logically, it will be rendered in a meaningful order when style sheets are turned off or not supported.

6.2 Ensure that equivalents for dynamic content are updated when the dynamic content changes. [Priority 1]

6.3 Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported. If this is not possible, provide equivalent information on an alternative accessible page. [Priority 1] For example, ensure that links that trigger scripts work when scripts are turned off or not supported (e.g., do not use

"javascript:" as the link target). If it is not possible to make the page usable without scripts, provide a text equivalent with the NOSCRIPT element, or use a server-side script instead of a client-side script, or provide an alternative accessible page as percheckpoint 11.4. Refer also to guideline 1.

6.4 For scripts and applets, ensure that event handlers are input device-independent. [Priority 2] Refer to the definition of device independence.

6.5 Ensure that dynamic content is accessible or provide an alternative presentation or page. [Priority 2] For example, in HTML, use NOFRAMES at the end of each frameset. For some applications, server-side scripts may be more accessible than client-side scripts. Refer also to checkpoint 11.4

Guideline 7. Ensure user control of time-sensitive content changes.

Ensure that moving, blinking, scrolling, or auto-updating objects or pages may be paused or stopped.

Some people with cognitive or visual disabilities are unable to read moving text quickly enough or at all. Movement can also cause such a distraction that the rest of the page becomes unreadable for people with cognitive disabilities. Screen readers are unable to read moving text. People with physical disabilities might not be able to move quickly or accurately enough to interact with moving objects.

Note. All of the following checkpoints involve some content developer responsibility Until user agents provide adequate feature control mechanisms.

Checkpoints:

7.1 Until user agents allow users to control flickering, avoid causing the screen to flicker. [Priority 1]

Note. People with photosensitive epilepsy can have seizures triggered by flickering or flashing in the 4 to 59 flashes per second (Hertz) range with a peak sensitivity at 20 flashes per second as well as quick changes from dark to light (like strobe lights).

7.2 Until user agents allow users to control blinking, avoid causing content to blink (i.e., change presentation at a regular rate, such as turning on and off). [Priority 2]

7.3 Until user agents allow users to freeze moving content, avoid movement in pages. [Priority 2] When a page includes moving content, provide a mechanism within a

script or applet to allow users to freeze motion or updates. Using style sheets with scripting to create movement allows users to turn off or override the effect more easily. Refer also to guideline 8.

7.4 Until user agents provide the ability to stop the refresh, do not create periodically auto-refreshing pages. [Priority 2] For example, in HTML, don't cause pages to auto-refresh with "HTTP-EQUIV=refresh" until user agents allow users to turn off the feature.

7.5 Until user agents provide the ability to stop auto-redirect, do not use markup to redirect pages automatically. Instead, configure the server to perform redirects. [Priority 2]

Note. The BLINK and MARQUEE elements are not defined in any W3C HTML specification and should not be used. Refer also to guideline 11.

Guideline 8. Ensure direct accessibility of embedded user interfaces.

Ensure that the user interface follows principles of accessible design: device-independent access to functionality, keyboard operability, self-voicing, etc.

When an embedded object has its "own interface", the interface -- like the interface to the browser itself -- must be accessible. If the interface of the embedded object cannot be made accessible, an alternative accessible solution must be provided.

Note. For information about accessible interfaces, please consult the User Agent Accessibility Guidelines (WAI-USERAGENT) and the Authoring Tool Accessibility Guidelines (WAI-AUTOOL)

Checkpoint:

8.1 Make programmatic elements such as scripts and applets directly accessible or compatible with assistive technologies Priority 1 if functionality is important and not presented elsewhere, otherwise Priority 2.] Refer also to guideline 6.

Guideline 9. Design for device-independence.

Use features that enable activation of page elements via a variety of input devices. Device-independent access means that the user may interact with the user agent or document with a preferred input (or output) device -- mouse, keyboard, voice, head

wand, or other. If, for example, a form control can only be activated with a mouse or other pointing device, someone who is using the page without sight, with voice input, or with a keyboard or who is using some other non-pointing input device will not be able to use the form.

Note. Providing text equivalents for image maps or images used as links makes it possible for users to interact with them without a pointing device. Refer also to guideline 1. Generally, pages that allow keyboard interaction are also accessible through speech input or a command line interface.

Checkpoints:

9.1 Provide *client-side image maps*[101] instead of server-side image maps except where the regions cannot be defined with an available geometric shape. [Priority 1] Refer also to checkpoint 1.1, checkpoint 1.2, and checkpoint 1.5.

9.2 Ensure that any element that has its own interface can be operated in a device-independent manner. [Priority 2] Refer to the definition of device independence. Refer also to guideline 8.

9.3 For scripts, specify logical event handlers rather than device-dependent event handlers. [Priority 2]

9.4 Create a logical tab order through links, form controls, and objects. [Priority 3] For example, in HTML, specify tab order via the "tabindex" attribute or ensure a logical page design.

9.5 Provide keyboard shortcuts to important links (including those in client-side image maps), form controls, and groups of form controls. [Priority 3] For example, in HTML, specify shortcuts via the "accesskey" attribute.

Guideline 10. Use interim solutions.

Use interim accessibility solutions so that assistive technologies and older browsers will operate correctly.

For example, older browsers do not allow users to navigate to empty edit boxes. Older screen readers read lists of consecutive links as one link. These active elements are

[101] See Glossary for definition.

therefore difficult or impossible to access. Also, changing the current window or popping up new windows can be very disorienting to users who cannot see that this has happened.

Note. The following checkpoints apply Until user agents (including assistive technologies) address these issues. These checkpoints are classified as "interim", meaning that the Web Content Guidelines Working Group considers them to be valid and necessary to Web accessibility *as of the publication of this document*. However, the Working Group does not expect these checkpoints to be necessary in the future, once Web technologies have incorporated anticipated features or capabilities.

Checkpoints:

10.1 Until user agents allow users to turn off spawned windows, do not cause pop-ups or other windows to appear and do not change the current window without informing the user. [Priority 2] For example, in HTML, avoid using a frame whose target is a new window.

10.2 Until user agents support explicit associations between labels and form controls, for all form controls with implicitly associated labels, ensure that the label is properly positioned. [Priority 2] The label must immediately precede its control on the same line (allowing more than one control/label per line) or be in the line preceding the control (with only one label and one control per line). Refer to checkpoint 12.4.

10.3 Until user agents (including assistive technologies) render side-by-side text correctly, provide a linear text alternative (on the current page or some other) for *all* tables that lay out text in parallel, word-wrapped columns. [Priority 3]

Note. Please consult the definition of linearized table. This checkpoint benefits people with Until user agents (such as some screen readers) that are unable to handle blocks of text presented side-by-side; the checkpoint should not discourage content developers from using tables to represent tabular information.

10.4 Until user agents handle empty controls correctly, include default, place-holding characters in edit boxes and text areas. [Priority 3] For example, in HTML, do this for TEXTAREA and INPUT.

10.5 Until user agents (including assistive technologies) render adjacent links distinctly, include non-link, printable characters (surrounded by spaces) between adjacent links. [Priority 3]

Guideline 11. Use W3C technologies and guidelines.

Use W3C technologies (according to specification) and follow accessibility guidelines. Where it is not possible to use a W3C technology, or doing so results in material that does not transform gracefully, provide an alternative version of the content that is accessible. The current guidelines recommend W3C technologies (e.g., HTML, CSS, etc.) for several reasons:

W3C technologies include "built-in" accessibility features. W3C specifications undergo early review to ensure that accessibility issues are considered during the design phase. W3C specifications are developed in an open, industry consensus process. Many non-W3C formats (e.g., PDF, Shockwave, etc.) require viewing with either plug-ins or stand-alone applications. Often, these formats cannot be viewed or navigated with standard user agents (including assistive technologies). Avoiding non-W3C and non-standard features (proprietary elements, attributes, properties, and extensions) will tend to make pages more accessible to more people using a wider variety of hardware and software. When inaccessible technologies (proprietary or not) must be used, equivalent accessible pages must be provided. Even when W3C technologies are used, they must be used in accordance with accessibility guidelines. When using new technologies, ensure that they transform gracefully (Refer to guideline 6.).

Note. Converting documents (from PDF, PostScript, RTF, etc.) to W3C markup languages (HTML, XML) does not always create an accessible document. Therefore, validate each page for accessibility and usability after the conversion process (refer to thesection on validation). If a page does not readily convert, either revise the page until its original representation converts appropriately or provide an HTML or plain text version.

Checkpoints:

11.1 Use W3C technologies when they are available and appropriate for a task and use the latest versions when supported. [Priority 2] Refer to the list of reference for information about where to find the latest W3C specifications and WAI-UA-SUPPORTfor information about user agent support for W3C technologies.

11.2 Avoid deprecated features of W3C technologies. [Priority 2] For example, in HTML, don't use the deprecated FONT element; use style sheets instead (e.g., the 'font' property in CSS).

11.3 Provide information so that users may receive documents according to their preferences (e.g., language, content type, etc.) [Priority 3]

Note. Use content negotiation where possible.

11.4 If, after best effort, you cannot create an accessible page, provide a link to an alternative page that uses W3C technologies, is accessible, has equivalent information (or functionality), and is updated as often as the inaccessible (original) page. [Priority 1]

Note. Content developers should only resort to alternative pages when other solutions fail because alternative pages are generally updated less often than "primary" pages. An out-of-date page may be as frustrating as one that is inaccessible since, in both cases, the information presented on the original page is unavailable. Automatically generating alternative pages may lead to more frequent updates, but content developers must still be careful to ensure that generated pages always make sense, and that users are able to navigate a site by following links on primary pages, alternative pages, or both. Before resorting to an alternative page, reconsider the design of the original page; making it accessible is likely to improve it for all users.

Guideline 12. Provide context and orientation information.

Provide context and orientation information to help users understand complex pages or elements.

Grouping elements and providing contextual information about the relationships between elements can be useful for all users. Complex relationships between parts of a page may be difficult for people with cognitive disabilities and people with visual disabilities to interpret.

Checkpoints:

12.1 Title each frame to facilitate frame identification and navigation. [Priority 1] For example, in HTML use the "title" attribute on FRAME elements.

12.2 Describe the purpose of frames and how frames relate to each other if it is not obvious by frame titles alone. [Priority 2] For example, in HTML, use "longdesc," or a description link.

12.3 Divide large blocks of information into more manageable groups where natural and appropriate. [Priority 2] For example, in HTML, use OPTGROUP to group OPTION elements inside a SELECT; group form controls with FIELDSET and LEGEND; use nested lists where appropriate; use headings to structure documents, etc. Refer also to guideline 3.

12.4 Associate labels explicitly with their controls. [Priority 2] For example, in HTML use LABEL and its "for" attribute.

Guideline 13. Provide clear navigation mechanisms.

Provide clear and consistent navigation mechanisms -- orientation information, *navigation bars*[102], a site map, etc. -- to increase the likelihood that a person will find what they are looking for at a site.

Clear and consistent navigation mechanisms are important to people with cognitive disabilities or blindness, and benefit all users.

Checkpoints:

13.1 Clearly identify the target of each link. [Priority 2]
Link text should be meaningful enough to make sense when read out of context -- either on its own or as part of a sequence of links. Link text should also be terse. For example, in HTML, write "Information about version 4.3" instead of "click here". In addition to clear link text, content developers may further clarify the target of a link with an informative link title (e.g., in HTML, the "title" attribute).

13.2 Provide metadata to add semantic information to pages and sites. [Priority 2] For example, use RDF (RDF)to indicate the document's author, the type of content, etc.
Note. Some HTML user agents can build navigation tools from document relations described by the HTML LINK element and "rel" or "rev" attributes (e.g., rel="next", rel="previous", rel="index", etc.). Refer to also Checkpoint 13.5

[102] See Glossary for definition.

13.3 Provide information about the general layout of a site (e.g., a site map or table of contents). [Priority 2] In describing site layout, highlight and explain available accessibility features.

13.4 Use navigation mechanisms in a consistent manner. [Priority 2]

13.5 Provide navigation bars to highlight and give access to the navigation mechanism. [Priority 3]

13.6 Group related links, identify the group (for user agents), and, until user agents do so, provide a way to bypass the group. [Priority 3]

13.7 If search functions are provided, enable different types of searches for different skill levels and preferences. [Priority 3]

13.8 Place distinguishing information at the beginning of headings, paragraphs, lists, etc. [Priority 3]

Note. This is commonly referred to as "front-loading" and is especially helpful for people accessing information with serial devices such as speech synthesizers.

13.9 Provide information about document collections (i.e., documents comprising multiple pages.). [Priority 3] For example, in HTML specify document collections with the LINK element and the "rel" and "rev" attributes. Another way to create a collection is by building an archive (e.g., with zip, tar and gzip, stuffit, etc.) of the multiple pages.

Note. The performance improvement gained by offline processing can make browsing much less expensive for people with disabilities who may be browsing slowly.

13.10 Provide a means to skip over multi-line ASCII art. [Priority 3]

Guideline 14. Ensure that documents are clear and simple.

Ensure that documents are clear and simple so they may be more easily understood.

Consistent page layout, recognizable graphics, and easy to understand language benefit all users. In particular, they help people with cognitive disabilities or who have difficulty reading. (However, ensure that images have text equivalents for people who are blind, have low vision, or for any user who cannot or has chosen not to view graphics. Refer to Guideline 1.) Using clear and simple language promotes effective communication. Access to written information can be difficult for people who have cognitive or learning

disabilities. Using clear and simple language also benefits people whose first language differs from your own, including those people who communicate primarily in sign language.

Checkpoints:

14.1 Use the clearest and simplest language appropriate for a site's content. [Priority 1]

14.2 Supplement text with graphic or auditory presentations where they will facilitate comprehension of the page. [Priority 3]

14.3 Create a style of presentation that is consistent across pages. [Priority 3][103]

[103] Web Content Accessibility Guidelines 1.0 W3C Recommendation 5-May-1999, http://www.w3.org/TR/WAI-WEBCONTENT/

Glossary

accessible
Content is accessible when it may be used by someone with a disability.

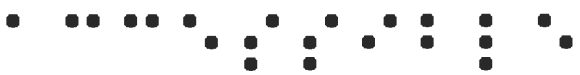
ALT attribute
An HTML attribute is to provide an alternative text description for graphics, sounds, movies, and scripts in a web page.

applet
A program inserted into a web page.

ASCII art
ASCII art refers to text characters and symbols that are combined to create an image. For example ";-)" is the smiley emoticon.

attribute
A parameter that is placed inside an HTML tag that specifies additional information to change how the markup is interpreted.

Braille
Braille uses six raised dots in different patterns to represent letters and numbers to be read by people who are blind with their fingertips. The word "Accessible" in braille follows:



A ***braille display***, commonly referred to as a "dynamic braille display," raises or lowers dot patterns on command from an electronic device, usually a computer. The result is a line of braille that can change from moment to moment. Current dynamic braille displays range in size from one cell (six or eight dots) to an eighty-cell line, most having between twelve and twenty cells per line.

client-side image maps
Client-side image maps allow the user agent to provide immediate feedback as to whether or not the user's pointer is over an active region. (See imagemaps).

Content Developer
Someone who authors web pages or designs web sites.

element
This document uses the term "element" both in the strict SGML sense (an element is a syntactic construct) and more generally to mean a type of content (such as video or

sound) or a logical construct (such as a header or list). The second sense emphasizes that a guideline inspired by HTML could easily apply to another markup language.

form

An HTML construct that creates input elements, such as text entry boxes, buttons, and checkboxes on a web page for the user to submit information to a web server.

frames

An HTML construct that splits the web browser window into multiple sections, usually separated by borders and separately scrollable.

HyperText Markup Language (HTML)

A standard language made for typesetting, currently up to Version 3.2. It is mainly used for creating documents on the World Wide Web. Included in the language are provisions for including pictures and links to other pages.

hyperlink

Hyperlink, or simply link, is part of the HTML language. When you view an HTML document using a browser, it is common practice to display the hyperlink in blue with an underlined font. When you click on a hyperlink, you will jump or link to another area in that document, or a different document.

image

A graphical presentation.

imagemap

An image that has been divided into regions with associated actions. Clicking on an active region causes an action to occur. When a user clicks on an active region of a client-side image map, the user agent calculates in which region the click occurred and follows the link associated with that region. Clicking on an active region of a server-side image map causes the coordinates of the click to be sent to a server, which then performs some action. Content developers can make client-side image maps accessible by providing device-independent access to the same links associated with the image map's regions.

Information Technology (IT)

This term refers to the field of work dealing with computers and technology.

Java

This is a platform-independent programming language designed by JavaSoft. Java is much like C++, but includes some restrictions. Java mainly runs on Web browsers at the moment, but it can also run natively on operating systems or in a Java virtual machine.

JavaScript

A simple scripting language designed by Netscape to be embedded into HTML documents. It is unrelated to Java.

JAWS

Job Access With Speech. A common screen reader program for Microsoft Windows and DOS.

link text

The rendered text content of a link.

Markup Language

A language that defines the syntax and meaning of specific markup for a certain use. Markup languages are often described by an SGML DTD.

navigation bars

A navigation bar is a collection of links to the most important parts of a document or site.

server-side imagemap

A type of imagemap that is defined on the web server using a CGI script which determines a page to send to the browser by the x,y-coordinates sent to it by the browser when an area of the image is clicked. (See imagemaps).

screen reader

A software program that reads the contents of the screen aloud to a user. Screen readers are used primarily by individuals who are blind. Screen readers can usually only read text that is printed, not painted, to the screen.

style sheets

A style sheet is a set of statements that specify presentation of a document. Style sheets may have three different origins: they may be written by content providers, created by users, or built into user agents. In CSS, the interaction of content provider, user, and user agent style sheets is called the *cascade*.

tables

An HTML construction that allows content on a web page to be separated into multiple rows, columns, and cells. Often used incorrectly for layout and alignment of text.

tabular information

When tables are used to represent logical relationships among data -- text, numbers, images, etc., that information is called "tabular information" and the tables are called "data tables". The relationships expressed by a table may be rendered visually (usually on a two-dimensional grid), aurally (often preceding cells with header information), or in other formats.

tag

A single element of markup in a markup language that causes the enclosed text to be formatted in a particular way, such as bold or italics, or specifies the certain function of the enclosed text, such as a header, paragraph, hypertext link, etc. In HTML, tags are separated from the text of the document by < and >.

user agent
Software to access web content, including desktop graphical browsers, text browsers, voice browsers, mobile phones, multimedia players, plug-ins, and some software assistive technologies used in conjunction with browsers such as screen readers, screen magnifiers, and voice recognition software.

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