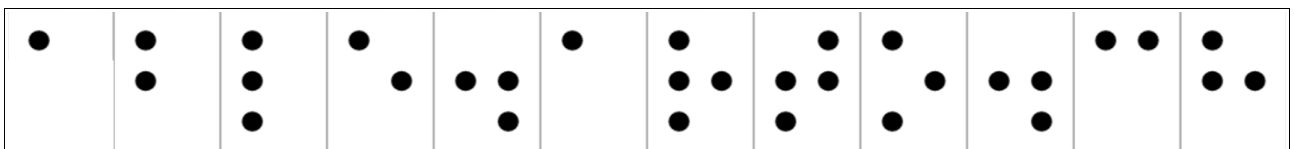


Web Design for the Disabled



ISSM, tia05

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Brugg, 16. April 2006

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What is web accessibility?

The term web accessibility is used to describe the degree to which a web site is usable by as many people as possible without modification.

Web site visitors with physical disabilities are the main subject of this article. Other kinds of disabilities and devices will also be mentioned, because considering one accessibility issue often automatically helps solving an other.

Many users operate computers in a different way than the average web user or designer. And it is not possible to guess the users abilities and environment reliably. Maybe they are not able to see, hear or move their hands normally. Maybe they are temporarily disabled (for example a broken arm) or they are not able to use a keyboard or mouse (for example motor disability, defective or malfunctioning hardware). Some people use a text-only screen, a small screen, or a slow Internet connection. Others do not speak or understand the used language fluently. Web site visitors sometimes are in an unusual situation where their eyes, ears, or hands are busy or interfered with, for example driving a car, on the phone or working in a loud environment. The group of users with early browser versions, entirely different browsers, a voice browser, or different operating systems is growing. Or maybe the visitor just wants to use their system in a different way, for example lean back and read large text or display web sites black and white to prevent the boss from realizing that they are surfing the web.

Why accessibility?

Many web designers may ask themselves why exactly they should consider web accessibility. Here are some briefly described reasons why this subject is worth considering.

The main reason for most designers is probably the moral, ethical motivation: it is good to treat everyone in an equal fashion. There are so many disabled people trying to live their life as "normal" as possible. It has often been estimated that over 80% of the disabilities experienced by people in our communities are invisible to the wider population; therefore it is not surprising most web site developers believe that very few people with disabilities use the Internet. It is extremely difficult if not impossible to guess the rate of disabled people using the web. The governments of countries like the UK, Canada, Australia and the United States report that the rate of disabled people, who are limited in everyday life, is around 20%. So it is probably safe to guess that approximately 10% of web users have a disability that affects their ability to use the web.

In today's community the use of the web is getting increasingly important. Many aspects of modern everyday life are influenced by the web and the many possibilities it contains: Banking transactions, reading the news, ordering books, sending messages by e-mail are just a small number of examples.

Accessible news on the web offers many options for their visitors. Readers can use their preferred user agent together with the implemented accessibility preferences, for example resizing the font size or adjusting contrasts to make the text more readable.

An accessible web can even help people with disabilities more actively participate in society.

They can be contacted by e-mail, they can join online communities and they can get information about any desired subject without any assistance from other people.

Not many web designers know how to create accessible sites. This capability can also be used for advertising the personal skills and making a significant difference to the "regular crowd".

Regarding the economical perspective, new customers can be won, which would not be reached with an inaccessible site.

An often heard argument against considering the guidelines making web sites accessible, is that "most people use the Internet Explorer, why design for a small minority?". But another advantage of accessible design is, that it is compatible with emerging technologies. The use of the web is getting more and more wireless. Accessible sites are ready for the emerging technology, because they support the recommended web standards which future equipment is aiming to support, while others that were just optimized for the most common web browser will have to adapt to the new technologies.

Most techniques used to support accessibility will also help the average visitor, hardly ever harming others. A readable contrast with dark text on a light background is easier to read, even for healthy eyes.

The web offers many new options for people with disabilities. Today it is much easier for a blind person to read the newspaper. Before news were freely available on the world wide web, it was literally impossible for blind people to read the news. No news agency publishes their daily news in braille!

What disabilities will be discussed?

Cognitive and mental disabilities will not be discussed because of their immeasurable complexity. It should be mentioned that many techniques discussed here later on also support the users with cognitive and mental disabilities.

This research focuses mainly on visual, hearing, motor disabilities and combined disabilities.

Visual disabilities

About 45 million people worldwide are blind, while 135 million have impaired vision. The category of visual impairments contains full blindness, low vision, color blindness and selective impairments of parts of the visual field.

Color blindness is much more common with men than with women. Approximately one in 12 men has at least some color perception problems.

Actually everybody with limited eye sight, people carrying glasses or using contact lenses, falls into the group of visually impaired.

Hearing disabilities

Hearing disabilities like deafness and hard of hearing are often disregarded when designing for the web. It is true that it is not an issue in many cases. Nevertheless, possible issues should not be ignored. About 0.1% of the world population are deaf.

The amount of web sites based on multimedia or using multimedia for critical content increases daily. This includes audio and video files. Appropriate alternatives reduce the problem.

Motor disabilities

Motor disabilities complicate the handling of input devices, such as a standard PC mouse and keyboard. Many people can use a mouse for most tasks but have trouble with precise movements. Clicking a large button is easier for most users.

20% of the Australians with recorded disabilities indicate that physical disabilities affect their life most of all.

Combined Disabilities

Very often disabled people have more than one disability, either from a single cause or from multiple causes. This can make many everyday life situations much more difficult just like a broken arm together with a broken leg make it impossible to use crutches normally.

Web users who are deaf and blind cannot use the usual screenreader other blind people use or rely on captioning like deaf people without other disabilities. They are limited to technologies that can only be used by people with both disabilities, in this case maybe a refreshable braille keyboard. Assistive technologies will be discussed in the following chapter in more detail.

Deafness and low vision is a much more usual combination of disabilities. The effect is a bit easier because these users can use technologies like screen magnifiers.

The most common causes of multiple disabilities are age-related. Today more and more older people use the web. This number will definitely grow a lot in the next years especially because the older people in future will have more experience with the use of computer systems and the web from their younger years.

Low vision, hard of hearing and motor disabilities are very common age-related disabilities that will have to be considered since these people could find more opportunities to make their life easier due to what the web offers. Ordering groceries on web pages from online shops that deliver the goods to the doorstep can make life much more manageable for someone who does not have the strength to carry heavy bags. But what if this person has under average eyesight and has difficulties controlling the mouse well enough to hit the small shopping basket symbol because its size cannot be increased even when enlarging the font size?

Devices to help disabled users accomplish tasks

Adaptive keyboard

Adaptive keyboards have lowered keys. This makes it easier to place the finger on the right key before pressing it. Users with unreliable muscle control and spastic movements benefit from this type of keyboard.

In addition special software for word completion can be used to reduce the number of keystrokes because typing long texts can get very tiring.

Eye tracking

Eye tracking devices follow the eye movement to allow the user to navigate a whole computer system only with the movement of the eye. Special software is needed to make typing and moving the cursor possible. Because of the high price compared to head wands and mouth sticks such devices are not very common.

Head wand

A head wand is a stick strapped around the head. Like eye tracking, users suffering from quadriplegia can profit from such devices. By moving the head the wand can be used to type and navigate. They are not very expensive and are easy to use, but can be tiring to use when a lot of keystrokes are needed. Another disadvantage is that it is literally impossible to press more than one key at once.

Mouth stick

Mouth sticks are very often used devices, due to the low cost. The usage is similar to the head wand, except that it is a stick placed in the mouth instead of strapped to the head.

One handed keyboard

This type of keyboards can be used with one hand. There are different types, some with many buttons and some with just five buttons (one for each finger), where more than one key is used for one character. Individuals with motor disabilities on one side of their body, for instance hemiplegia, can use these for typing. Advanced users can work at a very high speed.

During research one blind programmer using a one handed keyboard was interviewed. This programmer uses his left hand for reading braille on a refreshable keyboard and simultaneously types with his right hand. Both hands are totally healthy.

Over sized trackball mouse

Trackball mice are used by many people, not only disabled. It is easier to press the mouse button without moving the cursor, so people with motor disabilities can profit from such devices. Using a head wand or mouth stick it is much harder to move a normal mouse pointer than it is to manipulate a trackball. Over sized trackballs can even be used with a foot.

Refreshable braille

Refreshable braille devices can interpret the text that would normally be displayed on a screen and translate it to braille. Little pins pop up and produce braille writing that can be read by blind people who understand braille. It is important to remember that not all blind people know braille!

Screen magnifier

Screen magnifiers do just what the name says: They magnify what is on the screen. Obviously this can be very helpful for people with limited eye sight.

Screen reader, audio browser

Audio browsers read web sites to the user and give options to navigate through the web. It is important that users can adjust the speed of the reader. When reading silently the speed of reading is much faster than when reading aloud, especially when reading to someone else. People using screen readers usually do not want to listen to the web at a very slow pace because it is not as efficient as it could be. When blind people get used to the voice of their speed reader they increase the speed so that it is hardly understandable for people without any experience with this software. JAWS is a well known screen reader for Windows.

Text browser

Users with visual impairments, inability to use a mouse and users with slow or expensive Internet connections use text browsers. These do not display images and other multimedia files. It is just plain text in the colors preferred by the user himself. Some mobile devices use text browsers when the connection rates are paid per kilobyte.

Voice recognition

People with motor disabilities can find it impossible or tiring to use a keyboard or mouse. Voice recognition programs enable controlling a complete computer system by speaking voice commands into a microphone.

It takes a lot of time to get used to this method before a computer system can be used efficiently. This requires a clear voice and needs practice, but it can open a whole new world of possibilities for disabled users.

Techniques used by web developers

Easy tests during and after developing a web site

Changing font size

By resizing the font size in a visual browser like Opera, Firefox or the Internet Explorer users can make a site more readable.

There are different approaches for optimizing the font size in a user agent. In the browser settings one can adjust the default font size to a readable value. All well-known browsers have this option. It is also possible to display text in the desired size, font and color, independent of what the author set when designing the page. This option is very useful for people with visual impairments.

Another common way to adjust font sizes is to manually change the size when visiting a web page will illegibly small fonts. In most web browsers this can be done by pressing the control key and simultaneously turning the mouse wheel. Some user agents support font resizing by pressing control and "+" (plus) for increasing or "-" (minus) for decreasing font size.

It is generally a good idea for web authors, designers and front end developers to play around

with the font size in a web browser and see what happens when someone uses individual settings.

Accessibility without images

It is important to make sure how usable and accessible a site is, even when images are disabled. In almost all graphical browsers it is possible to disable images with a few clicks. It is recommended to use this browser function while developing a web site.

Web standards, Techniques, Checklists and Guidelines

The W3C Consortium is a body which has published a set of web standards. These standards consist of guidelines which are the basic principles that are required to be followed in order to make a web site accessible for users with disabilities. Each guideline also lists checkpoints which are divided into three groups of priorities. The checkpoints have technique links which open documents giving more detail to the techniques for that particular checkpoint. There are different levels of standards conformance depending on the satisfied priorities. "Level A" is fulfilled when all priority 1 checkpoints are satisfied. If priority 1 and 2 are satisfied, then "Level B" is reached. For "Level C" all three priorities have to be satisfied.

In the appendices of this document there are "10 Quick tips" to make accessible web sites. Furthermore the URLs of more detailed techniques and guidelines can be found. All are provided by the W3C: "Core Techniques", "HTML Techniques", "CSS Techniques" and "Web Content Accessibility Guidelines". Only the above-mentioned Quick tips will be discussed in this document.

10 Quick Tips to Make Accessible Web Sites (W3C)

1. Images & animations. Use the alt attribute to describe the function of each visual.

This alt attribute is used as an alternative in case the media is not visible. A blind user for example hears the description from the alt attribute instead of seeing the image. It is important not only to use alt attributes but also to make sure they are used sensibly. The alternative text "two well-known business men shaking hands" is much more useful than "image21.jpg".

2. Image maps. Use the client-side map and text for hotspots.

Web developers can make client-side image maps accessible by providing alternative links to the same links associated with the image maps hotspots. Client-side image maps allow the user agent to provide immediate feedback as to whether or not the users pointer is over an active region.

3. Multimedia. Provide captioning and transcripts of audio, and descriptions of video.

Captioning enables deaf users to understand the message of a video file. The attributes "alt" and "longdesc" should be used for all non-textual content elements so that the user has an alternative way to understand the page.

4. Hypertext links. Use text that makes sense when read out of context. For example, avoid "click here."

Hypertext links can be accessed with all equipment designed for the web. It is much more likely that user agents will fail when trying to follow multimedia links.

Some user audio agents for example have a feature enabling the user to jump from link to link. A blind user would hear "click here, click here, click here" which makes it impossible for him to know what he can expect when he "clicks" on a "click here" link.

5. Page organization. Use headings, lists, and consistent structure. Use CSS for layout and style where possible.

HTML can be used in the semantic way, which means that each element is used depending on its meaning, not its visual effect in standard browsers. If CSS is used for everything concerning visual effects, then style and semantics can be easily separated which makes sense for users which cannot use the visual part. Other users can modify the CSS stylesheet to fit their needs, for example the contrast between text and background or the preferred font type.

6. Graphs & charts. Summarize or use the longdesc attribute.

The longdesc attribute is meant for descriptions of graphs and charts. A good example can be found on the W3C web site which makes the meaning of this attribute clear:

```
<IMG src="97sales.gif" alt="Sales for 1997" longdesc="sales97.html">
```

In sales97.html:

```
A chart showing how sales in 1997 progressed. The chart  
is a bar-chart showing percentage increases in sales  
by month. Sales in January were up 10% from December 1996,  
sales in February dropped 3%, ...
```

7. Scripts, applets, & plug-ins. Provide alternative content in case active features are inaccessible or unsupported.

The title of this tip is self-explanatory. Usually the easiest and most effective solution is by using plain text as alternative. Almost all software and devices can handle plain text.

8. Frames. Use the noframes element and meaningful titles.

If frames cannot be avoided altogether, then the noframes element can help users without frames support. The titles are important for everyone, even user agent that support frames.

9. Tables. Make line-by-line reading sensible. Summarize.

A good habit when using tables is to test the site with a browser that does not support tables and an audio browser. Like this it is possible to prevent many issues concerning tables. It is also import to use tables solely for tabular data and not misuse them for layout although accessibility software is getting better in interpreting tables.

10. Check your work. Validate. Use tools, checklist, and guidelines at <http://www.w3.org/TR/WCAG>

Sites that do not validate make it nearly impossible to guess what different user agents will interpret when they are served with the buggy code. In some browsers it might look alright while others crash or do not display any of the content in a useful way.

Research

	Personal, telephone or e-mail	Newsgroups	Other (web, newspaper, magazines, books)	Tested by author
Adaptive keyboard	2	5	6	yes
Eye tracking	0	0	1	no
Head wand	0	0	2	no
Mouth stick	0	0	2	yes
One handed keyboard	1	0	0	no
Over sized trackball mouse	0	0	1	no
Refreshable braille	4	8	12	no
Screen magnifier	3	2	4	yes
Screen reader	5	10	7	yes
Text browser	3	12	5	yes
Voice recognition	1	3	4	yes

Interpretation of the results

The questions the contacted people were asked during research:

1. "What are the main obstacles limiting your possibilities?"
2. "What could web designers do to help you?"
3. "In which order do you expect the site navigation, main navigation and content when visiting a web site?"

The first question ("What are the main obstacles limiting your possibilities?") brought a wide variety of answers. Participants with visual impairments, excluding full blindness, mentioned completely inaccessible sites followed by too small font size. Web users with motor disabilities had trouble with links that are so small that it is difficult to hit them with the cursor. Fully blind users mentioned images without alternative text and "click here"-links which annoy when jumping from link to link with an audio browser.

Many did not know why they could not access the web page, due to their technical knowledge in this sector.

The answers to the second question ("What could web designers do to help you?") depended on

the technical background of the participant. Those with knowledge about web techniques nearly all mentioned the Web Content Accessibility Guidelines set up by the World Wide Web Consortium (W3C). According to these disabled users, the guidelines are a real help for making the web more accessible.

The users without HTML and similar knowledge often mentioned techniques that correspond to the official guidelines of the W3C, like alternative texts for images and easily adjustable font size.

"First main navigation, then site navigation followed by the pages content" was the most common answer for question three ("In which order do you expect the site navigation, main navigation and content when visiting a web site?"). Earlier it was said that the content should be the first in the pages source, so that screen readers do not always repeat the navigation. Some blind users said their software has features to skip the navigation. Others explained that they expect a site to be built that way because most people do it like that. So these people got used to what is provided and found a way to live with it.

All techniques that were affordable and possible were tested by the author. Techniques requiring high costs or the knowledge of braille for instance could not be tested.

Sample web site

This document can also be found on the web. The URL is <http://able.arto.ch>. In addition to this text some examples are provided, like audio examples, demonstrating how a web site sounds for visitors using screen readers.



Due to copyright regulations there are no photos of assistive hardware and their use in this document. External web links can be followed to other web sites providing such material.

The web site <http://able.arto.ch> complies with the accessibility guidelines recommended by the Web Consortium (W3C). On the sample site it is explained how one can perform some simple tests to check a sites quality of accessibility. This can be tried on the web site to this text.

When first checking the site with an accessibility validator (<http://www.contentquality.com>) two warnings were shown. One for the missing tabindex attribute and one for missing access keys.

The tabindex can be ignored because it can easily be jumped from one link to the other by using the tab key. This attribute is very important for sites with many links and where tabbing doesn't work the way the user would expect it.

Accesskeys are added to the site. Depending on the browser, they can be activated by first pressing the alt key (Internet Explorer, Mozilla Firefox) and after the appropriate key Internet Explorer expects the user to press "Enter".

Conclusions

Different disabled users use very individual combinations of techniques and technologies to

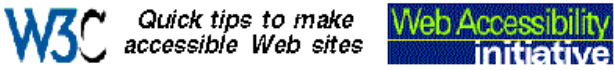
improve their situation and to extend their range of options while using the web. It is not possible to consider every possible workstation installation including the software used and the individual health state of the individual person. Following some simple guidelines helps most visitors without harming others. Following the Web Content Accessibility Guidelines published by the W3C and testing the site extensively with different hard- and software while developing the design is making a reasonable effort in making the web more usable and accessible for a large number of visitors and potential customers.

Appendices

Appendix A: Quick Tips to Make Accessible Web Sites

1. Images & animations: Use the alt attribute to describe the function of each visual.
2. Image maps. Use the client-side map and text for hotspots.
3. Multimedia. Provide captioning and transcripts of audio, and descriptions of video.
4. Hypertext links. Use text that makes sense when read out of context. For example, avoid "click here."
5. Page organization. Use headings, lists, and consistent structure. Use CSS for layout and style where possible.
6. Graphs & charts. Summarize or use the longdesc attribute.
7. Scripts, applets, & plug-ins. Provide alternative content in case active features are inaccessible or unsupported.
8. Frames. Use the noframes element and meaningful titles.
9. Tables. Make line-by-line reading sensible. Summarize.
10. Check your work. Validate. Use tools, checklist, and guidelines at <http://www.w3.org/TR/WCAG>

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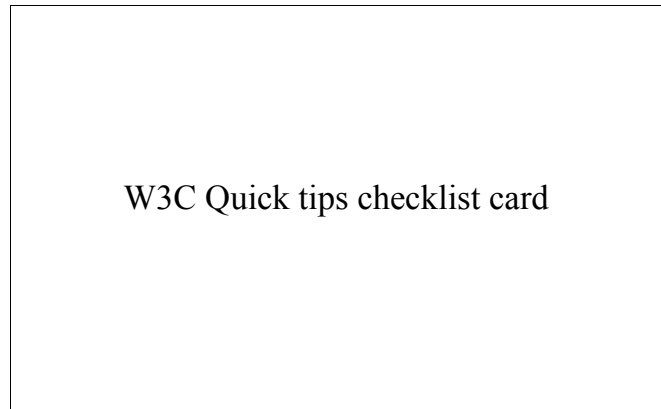


FOR COMPLETE GUIDELINES&CHECKLIST: WWW.W3.ORG/WAI

- **Images & animations.** Use the **alt** attribute to describe the function of all visuals.
- **Image maps.** Use client-side **MAP** and text for hotspots.
- **Multimedia.** Provide captioning and transcripts of audio, descriptions of video, and accessible versions in case inaccessible formats are used.
- **Hypertext links.** Use text that makes sense when read out of context. For instance, do not use "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.** Label with the **title** or **name** attribute.
- **Tables.** Make line by line reading sensible. Summarize. Avoid using tables for column layout.
- **Check your work.** Validate the **HTML**. Use evaluation tools and text-only browsers to verify accessibility.

199902



W3C Quick tips checklist card

Appendix B: Web Content Accessibility Guidelines and Techniques

Core Techniques for Web Content Accessibility Guidelines 1.0

<http://www.w3.org/TR/WCAG10-CORE-TECHS/>

HTML Techniques for WCAG 1.0

<http://www.w3.org/TR/WCAG10-HTML-TECHS/>

CSS Techniques for WCAG 1.0

<http://www.w3.org/TR/WCAG10-CSS-TECHS/>

Web Content Accessibility Guidelines 1.0

<http://www.w3.org/TR/WAI-WEBCONTENT/>

Appendix C: Validation Tool

HiSoftware® Cynthia Says™ Portal

<http://www.contentquality.com>

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