Accessibility - Why and how to Include People With Disabilities

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Published in:
Proceedings of the 14th International BOBCATSSS Symposium
Information, Innovation, Responsibility: Information Professional in Network Society,
Tallinn, Estonia, January 30 - February 1, 2006. 19-30.

Abstract

The paper provides an overview of what accessibility means, i.e. the ability to make use of the World Wide Web without restrictions or limitations which might be caused by physical, psychological or mental constraints such as problems with sight or hearing, body defects, dyslexia, etc. An overview of the legal situation in the European Union is followed by an introduction to the Web Accessibility Guidelines of the Web Accessibility Initiative which provide some help and orientation for creating accessible Web sites but are not sufficient as several studies and audits show. Therefore the paper advocates the involvement of disabled people and senior citizens in a user-centred design process using personas for accessibility issues. Personas are fictitious representations (archetypes) of typical users or specific user groups which represent them throughout the design process uniting their most important characteristics, needs and goals in one or more personas. The personas process is described and illustrated by two contrasting personas representing visually impaired users.

Why Accessibility?

"In a fair society, all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin or other such similar factors."
(Association of Computing Machinery – Code of Ethics)

In the European Union (EU) there are 45 million citizens with disabilities who may have problems accessing information and services on the Internet. Moreover, the number of older Europeans who also may have age-related problems in accessing the Internet is steadily increasing (EU: Policies). These facts indicate a serious risk of social exclusion of elder people and disabled people from the information society. To guarantee equal access for everybody, the EU and most of its member states have created specific legislation for accessibility.

Accessibility is an aspect or quality of the individual user's experience of the Web. It implies that every user regardless of specific needs can access information and services without further assistance. This means that the design of a site has to be inclusive i.e. supporting different means of access which are due to special needs and supported by assistive technologies of various user groups such as the following ones:

- People who are blind or visually impaired need alternative texts which describe web images, in order to access the site they use assistive technologies such as screen readers which produce audio output or screen magnifiers which enlarge the content.
- People who are deaf or have hearing impairments have trouble with audio information, they need translations in sign language presented by videos or avatars to understand it.
- People who have limitations of sensory, physical or cognitive functioning – which also may include injury-related conditions – may need specific assistive technologies or keyboard controls instead of using the mouse.
- People of older age may have problems with vision, hearing, memory, or movements, they can also use assistive technologies which help people with disabilities.

For more information on special needs and what barriers may be encountered on the Web see Brewer (2004, ed), Nielsen (2001), and Slatin & Rush (2003).

It is important to keep in mind that accessibility is not an additional burden for an already complex development process but a significant contribution for all users. This can be illustrated by an example from daily life: the curb-cut - a scooped out piece of the sidewalk (Shneiderman 2000: 88). This curb-cut is essential for wheelchair users but its benefits extend to baby carriage pushers, delivery workers, bicyclists, and roller bladers. In the same way, accessible web sites do not only serve disabled people but a broad range of user agents such as various types of web browsers (e.g. *Microsoft Internet Explorer*, *Mozilla Firefox*, *Opera*), all the different kinds of search engines (which identify Web content basically in the same way as blind users with screen readers do), and numerous kinds of mobile devices (e.g. personal digital assistants, mobile phones).

The Legal Situation in the European Union

In order to guarantee equal access for everybody, the EU and its member states have created specific accessibility legislation. In June 2000 at Feira, the European Council (EC) adopted the *eEurope Action Plan 2002* which aimed at improving access to the Internet for all citizens and especially for elder and disabled people. For the future member states the EU had already passed the corresponding action plan *eEurope+* in May 2000 in Warsaw. The next step towards more accessibility was the *EC Communication 2001-529 eEurope 2002: Accessibility of Public Web Sites and their Content* (European Parliament 2001) which the European Commission adopted on September 25th 2001. This regulation stated that by the end of 2001 all public sector Web sites in the member states and the European Institution have to be designed according to the *Web Accessibility Guidelines*. These guidelines are a set of rules created by the *Web Accessibility Initiative* which had been developed with financial support from the *EU Forth Framework Programme Telematics Applications*.

Although this communication set up a deadline for putting the Web Accessibility Guidelines into practice not all the member states did immediately take action to overcome access barriers. Therefore the current states and timelines of accessibility legislation within the EU vary considerably. Nevertheless, it is an important issue for the member states, all of them being obliged to pass corresponding laws incorporating

the guidelines in one way or another as the guidelines by themselves are only recommendations and do not have binding legal consequences.

Web Accessibility Guidelines

The guidelines mentioned above were developed by the *Web Accessibility Initiative* (WAI), a committee of the *World Wide Web Consortium* (W3C). Currently there is a set of three guidelines:

- *Web Content Accessibility Guidelines* (WCAG), first published May 5th 1999 as version 1.0
- *Authoring Tool Accessibility Guidelines* (ATAG), first published February 3rd 2000 as version 1.0
- *User Agent Accessibility Guidelines* (UAAG), first published December 17th 2002 as version 1.0

The guidelines have different scopes and target groups. The WCAG focus on how to make web content accessible. The version 1.0 of the WCAG consists of 14 rules and 65 check points – each equipped with a priority, examples, links to related checkpoints and technical specifications – which describe the technical and text-related requirements for accessible web content (for details see the WAI site). The target groups of the WCAG are designers, developers and authors of web content, basically anybody who contributes to a site. The ATAG refer to authoring tools such as web design software (e.g. *Microsoft FrontPage* or *Macromedia Dreamweaver*) or content management systems. Their aim is to ensure that both the products created by them and the tools themselves are accessible. The UAAG deal with the user agent, i.e. all the different tools users may employ to access web content. Their goal is to deliver content in an accessible way and make the tools themselves more accessible and user-friendly. As both authoring tools and user agents are normally beyond the influence of institutions such as libraries, museums and archives, the focus of the following paragraph is on the WCAG.

The version 1.0 of the WCAG are currently under review and will soon be replaced by the version 2.0. The current working draft for version 2.0 consists of four design principles:

- Content must be perceivable.
- Interface elements in the content must be operable.
- Content and controls must be understandable.
- Content must be robust enough to work with current and future technologies.

Each design principle is provided with a number of check points which should be independent of the technology used for the Web site. There will be two priority levels for compliance instead of three in version 1.0 and each checkpoint will have a priority level and a number of criteria that indicate its success (success levels). A list of benefits and examples indicate why this guideline is important and how it can be put into practice. Another important change in paradigms with version 2.0 is: what counts in regard to accessibility is no longer what is send by the web server but instead what appears in the user agent – this information has to be accessible. This innovation is a very important shift in looking at accessibility as it puts the focus on the user.

Evaluation of Web Accessibility

To achieve accessibility, evaluation is indispensable. Considering the WCAG as a framework for evaluation, one has to distinguish two different sets of rules: some which deal with features to be evaluated by automated tools and others which refer to aspects relying on human judgement. For the first, there is a wide range of software tools available which basically check if the code complies to web standards and/or the WCAG, some popular tools being *WAVE*, a free online service offered by the *University of Utah*'s project *Web Accessibility in Mind* (WebAIM) for accessibility checking, or the *W3C Validator*, a free service run by the *World Wide Web Consortium* (W3C) for code checking. For the latter, a standard evaluation procedure is still missing but the guidelines provide some hints on what to look, e.g. comprehensibility of text, ease of navigation and orientation, etc. Relating to these differences, the WAI recommendations suggest to apply a two-step-process for evaluation. During the first step, automated evaluation tools detect technical accessibility problems, while during the second experts or users work on problems which need human judgements.

Although the current WCAG provide some help and orientation for creating more accessible Web sites, they are not sufficient. An analysis of the existing research literature and various audits indicate that improvements of the WCAG are both possible and necessary. An analysis of literature on studies conducted by various institutions and in various countries reveal that both the application of the current WCAG and automated evaluation tools which apply them result in significant barriers for disabled users (Bornemann-Jeske et al. 2005; Schweibenz 2005). Two noteworthy audits, carried out by the City University, London, indicate that the WCAG version 1.0 are not sufficient to achieve real accessibility (Disability Rights Commission 2004; Petrie, King & Hamilton 2005). In order to do so it is necessary to involve disabled people in the evaluation which is a quite complex issue.

The Complexity of Involving People with Disabilities

Involving people with disabilities in the development process is a comparatively new phenomenon and not yet common practice although it is highly recommended by the WAI (Henry 2005, ed.). The reason for this may be due to the complexity of involving disabled users:

- Usually other people are shy to ask disabled people about their experiences with Web sites because they now little about how people with disabilities use the web and which special needs they have.
- Often there is no or very little understanding of special needs on the side of web designers and commissioners of web sites. They are simply not aware of the fact that there are many people who are excluded by certain features or the lack of compliance to web standards. Therefore creating awareness is important. This can be done by awards for accessible web sites such as the *BIENE Award* in Germany or the *Jody Mattes Accessibility Award* in Great Britain.
- There is a wide range of different disabilities and impairments which require various kinds of assistance. Some of the software features which provide assistance for a certain kind of disability might generate barriers for users with other disabilities. Moreover, disabled people or senior citizens often suffer not only from

one disability but from a combination of several ones which makes it more complex to provide adequate assistance. Especially for these reasons it is important to remember that disabled people are as diverse as other people.

- Assistive technologies for disabled users have only a small market share compared to mass products such as web browsers or mobile phones. Therefore they are often expensive and available only for specific user agents. In addition they are not wide spread outside the user community and often not quite easy to use for people who don't have experience in using them.
- In contrast to traditional user testing, currently there exists only little experience in testing with disabled people. This includes both the question of adequate adjustments of traditional methods and the way of how to organise and conduct tests, especially with regard to the use of assistive technologies. For example, in traditional data collection the focus would be on time-on-task or user satisfaction but these issues are of limited help in understanding errors related to accessibility issues. In a traditional thinking-aloud test there would be only very limited interaction between participants and test operators while in testing accessibility issues more interaction might be necessary to understand the specific needs of the participants and how they use assistive technologies.

For these reasons it might be difficult to directly involve people with disabilities as test users. Nevertheless it should be done as watching disabled users interacting with a site can provide many insights for web designers and developers (Henry 2005). Moreover it is very important to involve disabled people from the start of the project because during the early design and implementation phase it is comparatively easy to make changes according to specific needs while it might not be possible or very expensive to do so later on. But also during the whole process it is important to focus on user needs. A method which supports a user-centred design process is the personas concept which allows an indirect involvement of people with disabilities or senior citizens and their special needs during the design and development process.

Using Personas for Accessibility in the User-Centred Design Process

A persona is a fictitious representation of typical users or a specific user group. It represents them in the design process uniting the most important characteristics, needs and goals of the prospective users in one or more personas. These personas are not real persons but archetypical figures because real persons often have very personal habits, traits, and quirks which are not shared by the average user population. In contrast, archetypical figures combine the typical characteristics of a specific user group. Alan Cooper (1999), who introduced the concept of personas into the software design process, defines them as follows:

"Personas are not real people, but they represent them throughout the design process. They are hypothetical archetypes of actual users. Although they are imaginary, they are defined with significant rigor and precision." (Cooper 1999: 124)

Although each persona is rigorously defined, one persona is often not enough to cover all the characteristics, needs and goals of a heterogeneous user population. Therefore,

usually a set of six to twelve personas is created, the exact number depending on the complexity of the project and the diversity of the prospective users. Typically, some of these personas have very contrasting characteristics representing sometimes extreme needs and demands of a heterogeneous user group and are therefore called contrasting personas. Sometimes, there are even personas which explicitly represent a target group which is definitely not addressed as potential users and can therefore be excluded from the design process.

The advantage of the personas concept is that they represent the concrete characteristics, needs and goals of users and force the Web designers and developers to deal with them instead of referring to abstract issues or relying on general assumptions or personal experience. This is important to identify design problems and making educated guesses on users' preferences and skills as Cooper states:

"Personas allow us to see the scope and nature of the design problem. They make it clear exactly what the user's goals are, so we can see what the product must do [...]. The precisely defined persona tells us exactly what the user's level of computer skill will be, so we don't get lost in wondering whether to design for amateurs or experts." (Cooper 1999: 130f)

The question for whom to design can also refer to disabled people or senior citizens who can be represented by personas which illustrate their skills and special needs and make them obvious for web designers and developers.

A central prerequisite for the personas concept is reliable data about the user community. The data can be drawn from different sources, e.g. marketing and customer care or directly from the user population by interviews, focus groups or direct observation in usability labs or field tests. The next step is to identify specific user needs from the data and apply the personas concept to assign these specific characteristics, needs and goals to a certain range of personas. The results are typical user needs which can influence a user-oriented design which will finally lead to a user-oriented product. The personas process as described in figure 1.

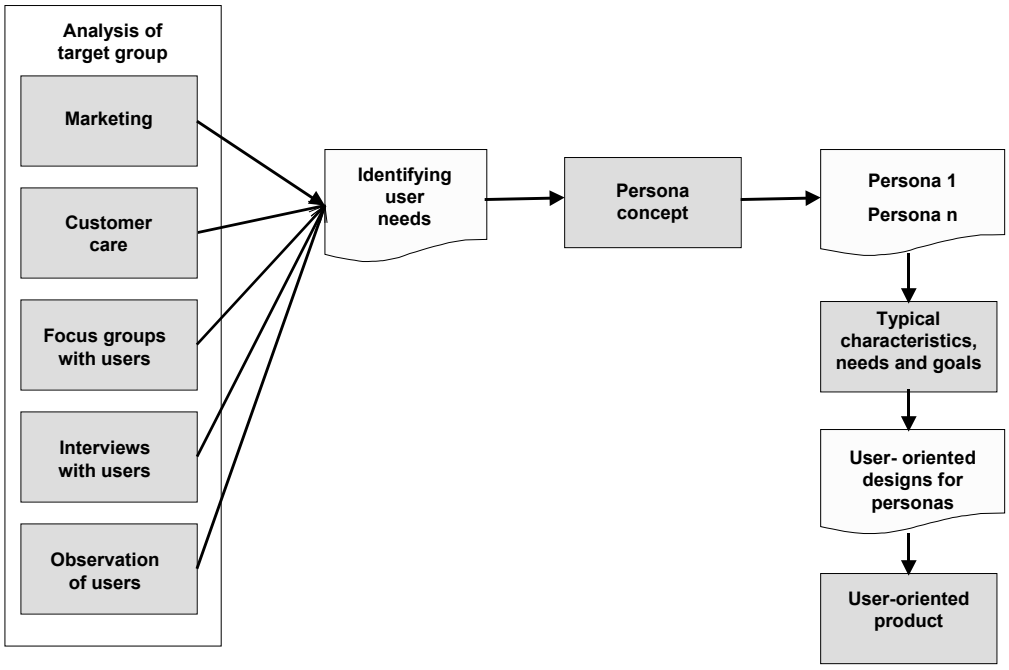

Figure 1: Overview of the personas process

Creating Personas for Users with Disabilities

Creating a set of personas, also called a cast of characters, is a two-step-process. First, the characteristics, needs and goals of the personas are designed. Second, a scenario for each persona is developed which represents the specific context of use. In addition, personas can be designed more lively and convincing by depicting their individual characters in little narratives woven into the persona description (cf. the personas in Pilgrim 2002). This might be helpful when playing the persona's role in the scenario. Nevertheless one has to be quite careful not to exaggerate because in this case the persona would loose their credibility and usefulness.

During the first step in which the persona is designed, she is also supplied with a name and a face (using a picture) in order to give her more personality and presence. When creating personas for accessibility design important factors according to Beck (2005: 47) are:

- The location of access
- The time of access
- The mobility of the persona
- Restrictions of abilities (body and mind)
- The kind of user agent is used

The following paragraphs present two personas representing visually impaired user groups which have contrasting backgrounds and skills as well as characteristics, needs and goals (so called contrasting personas). In this way, they represent a wide range of aspects which have to be considered during the design and implementation of a product or a web site. As the narratives describing the personas can be quite lengthy and

sometimes even complex, our experience indicates that for practical application it can be helpful to sum up the most important aspects of a persona in a table (cf. table 1 and 2). Such tables allow easy and structured access to the characteristics, needs and goals as well as fast comparisons between different or contrasting personas. Therefore such tables support web designers and developers in their daily work and can contribute to more and easier acceptance of the personas concept.

In the following paragraphs, two contrasting personas are presented. The corresponding usage scenarios for the personas had to be omitted. This is partly due to limitations of space and partly to the lack of a specific context in which the personas would use an application to fulfil specific needs and achieve certain goals. Examples for scenarios can be found in Brewer (2004, ed.), Grossnickle & Henry (2004) and Pilgrim (2002).

Persona 1: Gerald Oldman

Gerald Oldman is 68 years old, married and has three grown up children who live in the neighbourhood. Before he retired three years ago, he worked as an investment banker for an international bank. Although retired, he is still interested in business, economics, and banking. So he spends several hours a week on the Internet to do research and manage his personal investments and pension funds. In addition he frequents the public library to read a variety of business newspapers and to consult online databases for business and stock information. For all his lifetime he has keen on all kinds of sports, especially football and hockey which he had practiced in younger years.

As Gerald used to work with office software and online databases on the job for several decades, he is a very computer literate user but has never been interested in becoming a power user or even an administrator. He is definitely not interested in how software works, he just wants to use it. Regarding the Internet, he has only little experience which he acquired mostly by learning by doing. He is not surfing around much but usually restricts himself to Internet sources recommended by business newspapers. In addition, he is very careful to install new software and Internet plug-ins as he depends on the functioning of his computer for managing his financial assets and does not want to take a risk by changing a running system.

Gerald has some impairments which are quite common with senior citizens. He has reduced vision due to age-related degeneration. After reading some time, the letters of the text start to blur, so he needs a 100 watt overhead light and a magnifying glass. Moreover his hands tend to be shaky so that he has difficulties at times to do very exact movements. In daily life this tremor does not bother him except for when he is using a computer mouse. Therefore he prefers keyboard controls and is quite good in remembering them as in the old times they were quite common. Apart from these restrictions, Gerald is in good health and enjoys walking several miles with his wife two or three times a week and hiking at weekends with friends and former colleagues.

On his personal computer at home, Gerald uses *Firefox 1.0* as browser. His son Peter provided him with the screen magnifying software *MagicView 5.2* which enlarges the screen by factor 12. This software requires no special training as it is operated by mouse movements and clicks. Although it is helpful, Gerald can not use it always because of his tremor which cause him difficulties in handling the mouse. In this case he relies on

the browser's built-in enlargement function which he operates by pressing Crtl and +. This is one of the reasons he likes *Firefox*. At the computers of the public library he has to cope with the *Internet Explorer 6.0* which has no keyboard control for the enlargement function but needs to be mouse-operated. In general, Gerald appreciates high contrast on web sites as this makes it easier for him to read text.

Table 1: Persona Gerald Oldman representing a visually impaired senior citizen

Name	Gerald Oldman
Gender and age	male, 68
Disabilities and restrictions	reduced vision due to age-related degeneration, his hands tend to be shaky which causes him difficulties in using the mouse
Education	College degree in economics (BA)
Profession	retired for 3 years now, used to work as an investment banker
Hobbies	economics and business, all kinds of sports, especially football and hockey, walking and hiking
Location of use	at home and in the public library
Computer literacy	high, several years of professional practice as a user, but never as a power user
Special needs when using a computer	enlarged text, high contrast
Computer equipment and user agents	at home: browser *Firefox 1.0* and screen magnifier *MagicView 5.2* which enlarges the screen by factor 12 in the public library: browser *Internet Explorer 6.0*
Internet literacy	low, mostly self-taught and learning by doing, careful to install new software and Internet plug-ins
User agent literacy	none required as *MagixView* is easy to operate by mouse movements and clicks

Persona 2: Tracy Young

Tracy Young is a 28-year-old and was born blind. In school and at college she did well as she could rely on audio tapes and books and the support of tutors. So she never bothered really to learn Braille. She holds a college degree in English literature and is very fond of writing poems and short stories. Her dream is to become a audio book

author. As she is still working on her break-through, she makes a living on writing software documentation for a high-tech company which provided her with a home office equipment consisting of a personal computer with high-speed Internet access and the software *JAWS* which reads out aloud the content of the computer screen (or code respectively) in an artificial voice (screen reader). *JAWS* runs only on the browser *Internet Explorer* which is used as standard browser in the company Tracy works for.

As Tracy has much experience in listening to audio tapes and the screen reader, she is able to follow audio output at high speed which would not be comprehensible for other people. Moreover, she has developed great skills at remembering audio output and recognising foreign words or abbreviations which cause problems for the screen reader. Due to her job experience as technical writer, she is quite familiar with software applications, especially with features which are difficult to handle or do not work as intended. So she has developed some patience with applications that are not easy to use. She also has a lot of Internet experience, as she uses it on a daily basis for downloading music, audio books and do online shopping which is much more convenient then using her guide dog and public transportation to go to a shopping mall where she needs assistance by the employees to locate the things she is looking for. In addition she uses the Internet to communicate with people in chat rooms. This is a very convenient way to be in touch with friends without leaving her home and meet people who are not aware of her disability.

Table 2: Persona Tracy Young representing a blind company employee

Name	Tracy Young
Gender and age	female, 28
Disabilities and restrictions	blind
Education	college degree in English literature (MA)
Profession	works as a technical writer and author for software documentation
Hobbies	listening to audio books and music, creating audio novels, communicate with people in chat rooms, online shopping
Location of use	at home, home office and personal use
Computer literacy	high, several years of professional use
Special needs when using a computer	screen reader
Computer equipment and user agents	browser Microsoft Internet Explorer 6.0 combined with screen reader JAWS 6.20
Internet literacy	a heavy user on daily basis
User agent literacy	high, she is familiar with almost all the features

Conclusion

Accessibility is not only an issue which is relevant due to legal requirements. Although being applied to meet special needs of disabled people, accessible design has two clear advantages for all users: accessible web sites reach a broader audience because they conform to standards which can be displayed by a wide range of user agents relying on such standards and they improve the ease of use for all users by providing, for example, clear structure and layout, good orientation, and short download times. These advantages will finally lead to aesthetically richer, more productive, and more satisfying web experiences for everyone, not just for disabled people (Slatin & Rush 2003: 161).

A means to achieve this goal can be user-centred design supported by personas. Personas are fictitious representations of typical users or specific user groups representing their characteristics, needs and goals throughout the design and development process. In this way they help to ensure that the whole process is centred around the users' needs. As many web designers and commissioners are not yet aware of the needs of people with disabilities and senior citizens it is necessary to increase the awareness. Personas can be a means to promote this awareness in a lively, illustrative and expressive way.

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