Web Accessibility: a review of research and initiatives.

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Abstract

Digital technology provides the potential to widen access to information by allowing more people to access information in a format of their choice and from a location convenient to them. Despite this, technology can still present barriers; research has shown that people with disabilities are at most risk of being excluded from access, and in particular people who are blind or visually impaired and who use assistive technologies such as screen readers. Although assistive technologies can enable people with disabilities to 'read' online materials, unless these materials are designed in a way that can be interpreted by the assistive technologies, barriers to access will still exist.

Accessible web design, 'design for all', or 'universal access' can remove these barriers and help to ensure as many users as possible can read and interact with websites, as well as ensure information can be interpreted by the technology used. A variety of methods are available to check web pages for accessibility and advice and guidelines on the subject of accessible web design are plentiful. However, studies show that despite a growing awareness of web accessibility issues, people are still experiencing barriers to access.

Introduction

The term web accessibility generally refers to the ability of people to access the World Wide Web. The application of technical solutions to the design of a website is good practice which aims to improve accessibility - particularly for people who use

assistive technologies, such as screen readers, screen magnification, or electronic Braille. A well-known example is the application of alternative text using the ALT Tag to describe images (pictures, photos, graphical icons etc) which enables screen reading technology and Braille output to interpret for the user what the image is depicting. Technical solutions refer to the correct application of properly validated coding such as Hypertext Mark-up Language (HTML), or Extensible Hypertext Mark-up Language (XHTML) which apply content to the page, together with the use of cascading style sheets (CSS) which define the way the content on the page is displayed. Advice and guidance on web accessibility are widely available (see for example Waters (1997); Brophy and Craven (2000); Nielsen (2000); Paciello (2000); and Thatcher (2002)), but probably the most well known source of advice comes from the World Wide Web Consortium (W3C) which is an international consortium set up to "lead the World Wide Web to its full potential by developing common protocols that promote its evolution and ensure its interoperability" (quoted in Rosmaita, 2006) - in other words 'universal access'. To achieve this, the W3C established the Web Accessibility Initiative (WAI), which amongst a great deal of good work on accessibility, provides a comprehensive set of guidelines and checkpoints to help ensure websites embrace the concept of 'design for all'. These are available in a number of categories covering guidelines for the accessibility of Authoring Tools (ATAG), User Agents (UAAG), and probably the most well-known: the Web Content Accessibility Guidelines, or WCAG (see http://www.w3.org/WAI/intro/wcag.php)

People with disabilities can be divided into the following main groups which the W3C (2004) have identified as users who could benefit from accessible content:

- Blindness.
- Low vision.
- Colour deficit or distortions.
- Deafness.
- Hearing loss.
- Impairment of intelligence, memory or thinking.
- Inability to interpret and/or formulate language symbols.
- Learning disabilities.
- Speech impairments.
- Paralysis, weakness and other problems with movement and co-ordination of limbs.
- Photo sensitive epilepsy.
- Combinations of the above.

The Disability Rights Commission is an independent body in the UK, established to stop discrimination and promote equality of opportunity for disabled people (see http://www.drc-gb.org/). In an informal investigation into the accessibility of websites (DRC, 2004), the DRC identified similar groups of people who may be most affected by Web accessibility:

- Blind people using screen readers, synthetic speech or Braille output.
- Partially sighted people using magnification.
- People who are profoundly deaf or hard of hearing.
- Specific learning disabilities such as dyslexia.
- Physically impaired people who have a lack of control of arms, hands, or who have tremor or lack of dexterity.

Assessment of accessibility can be undertaken using a variety of methods. The W3C/WAI recommends a combination of automatic, expert and user testing.

Automatic accessibility evaluation tools generally crawl the source codes of web pages and rank accessibility according to a set of guidelines (usually the WCAG). This is a popular way of assessing the accessibility because many of the automated tools available are provided online and are often free of charge (see for example, Cynthia Says: www.cynthiasays.com/ and WAVE: www.wave.webaim.org/wave/index.jsp). A comprehensive list of tools is available at: www.w3.org/WAI/ER/existingtools.html. But this is only part of the process: the results from automated testing can be mis-interpreted, and will not provide the whole picture in terms of accessibility. Expert testing is conducted by accessibility experts who examine the source codes and also view web pages, applying their expert knowledge to assess the accessibility of the page. The further inclusion of user testing is also very important, as the end-user will often pick up on issues overlooked by automated tools and even experts. User testing also reveals usability issues related to the design of the page.

Web usability generally refers to the experience the user has when reading and interacting with a website, whether using assistive technology or a standard computer set-up. Although the terms accessibility and usability are sometimes blurred, in practice accessibility tends to be technology led and usability tends to be user led. This has revealed some conflicts, where a web page is deemed accessible because it conforms to guidelines such as WCAG, but still presents problems to the user – perhaps because their version of assistive technology does not work as well with the page as the most up-to-date version, or because the technical solution does not match the experience of the user.

Research and initiatives

Web accessibility studies

A number of studies have been conducted on the accessibility of websites to explore whether the increased promotion of accessibility issues and design for all has improved the design and development of websites. In 1999 two studies of library websites in the UK (Ormes and Peacock, 1999; Brophy and Craven, 1999) revealed that accessible design was only in the early stages of development, displaying low levels of accessibility in the websites that were assessed. In 2002, Kelly studied the accessibility of UK university home pages using an automated accessibility checker (Kelly, 2002). The study revealed that despite a move towards the design of accessible web pages, many did not fully comply with the recommendations of the Web Accessibility Initiative Web Content Accessibility Guidelines (WCAG). This trend has been reflected in further studies.

City University tested the accessibility of a sample of museum, library and archive websites in England and internationally (City University, 2004). Automated testing revealed that only a small number of websites (3%) met the WCAG accessibility level AA (level AAA being the highest level , and level A the most basic level of accessibility). Further user testing revealed that a panel of blind people found it impossible to complete 33% of the web-based tasks they undertook and furthermore 22% of the problems they experienced were not actually identified by the automated testing.

In 2004 a formal investigation of web accessibility was commissioned by the Disability Rights Commission (DRC). The study used a sample of 1000 websites which were tested firstly using an automated software tool and evaluated by 50 users with a variety of impairments (DRC, 2004). The study identified 585 accessibility and

usability problems, the most common of which related to the following 8 WCAG checkpoints:

- Checkpoint 1.1: Provide a text equivalent for every non-text element
- Checkpoint 2.2: Ensure foreground and background colour combinations provide sufficient colour contrast etc
- Checkpoint 6.3: Ensure pages are usable when scripts etc are turned off, and if this is not possible provide an alternative.
- Checkpoint 7.3: Until user agents allow users to freeze moving content, avoid movement in pages.
- Checkpoint 10.1: Until user agents allow users to turn off spawned windows, do not cause pop ups without informing the user.
- Checkpoint 12.3: Divide large blocks of information into more manageable groups where natural and appropriate.
- Checkpoint 13.1: Clearly identify the target of each link.
- Checkpoint 14.1: Use the clearest and simplest language appropriate for a site's content.

(DRC, 2004).

As part of the UK Presidency of the EU, in 2005 the UK Cabinet Office was commissioned to evaluate the accessibility of government online services across Europe (Cabinet Office, 2005). These findings revealed that only 3% of the 436 online websites assessed achieved the most basic level of WCAG (A) and none achieved level AA.

This rather depressing picture raises questions as to why accessible design is not improving more rapidly, and suggests further research is needed to discover why this is the case and to make recommendations accordingly.

User studies

Studies of blind and visually impaired people using the web have identified content organisation and navigation paths as the most important factors to aid the information seeking of visually impaired people. A study conducted by the Nielsen Norman group estimated the Web is "about three times easier to use for sighted users than it is for users who are blind or who have low vision" (Coyne and Nielsen, 2001, p.5). Similar findings were also identified in a study by Craven and Brophy (2003) where keystrokes and mouse-clicks performed during web-based task were measured and compared between a sample of 20 sighted and 20 visually impaired users. Observations revealed that the visually impaired sample used a combination of around 16 different keystrokes, whereas the sighted sample used a combination of the same 6 (Craven and Brophy, 2003, p 106).

A survey of blind and visually impaired people using electronic information services in public libraries (Lewis, 2004) found that adherence to accessibility guidelines will not necessarily ensure services are usable for blind and visually impaired people. As a simple example, the WCAG mandate an 'ALT' (alternative) text for all images and other non-textual elements, but while the presence or absence of text can be checked automatically, what cannot be checked in this way is the meaning of the text supplied. Kelly, Phipps and Howell (2005) also raise this point: "technical accessibility does not equate to intellectual accessibility … an ALT tag merely names, not explains an image".

In a further study of disabled people and the internet (Pilling, 2004), users revealed they would like websites to have the following:

- Guides on the home page informing people about the site's contents.
- Less cluttered pages.
- Fewer graphics and advertising.
- Links to be clearer and fewer.
- Print size and colours to be easily changeable.
- Greater standardisation.
- Search to be more clearly marked and more precise.
- Better accessibility for voice recognition system users.

(Pilling, 2004, 34)

Problems with screen readers were described, as well as not being able to afford the more up-to-date technologies such as the latest versions of screen reading technology (Pilling, 2004, 32). Lack of support and training in the use of assistive technologies were identified as another barrier to access. Lack of familiarity with electronic equipment and a lack of support and training in its use were also identified in a previous study by Craven and Brophy (2003) where barriers existed because disabled people could not afford, or were not motivated, to upgrade their assistive software to the latest version.

These user studies show the importance of feedback from real users alongside automated testing of websites, to provide a richer picture of web accessibility and usability in terms of the technical application of accessibility compared with the actual user experience.

Is the message getting across?

To ensure websites are designed with both accessibility and usability in mind it is essential that accessibility awareness exists among people who design websites themselves or who commission the design of websites via an external agency, together with clear guidelines to enable awareness to be put into practice. Current evidence shows that there is still some way to go in order to achieve this.

A number of studies have been conducted over the last few years to establish the extent of awareness and of putting this awareness into practice (see for example ENABLED, 2004; DRC, 2004; Craven and Snaprud, 2005; SupportEAM, www.suppordt-eam.org/)

The results of these studies reveal an inconsistent picture of what is perceived to be accessibility awareness. For example, in the ENABLED project (ENABLED, 2004) a questionnaire to establish an overview of the awareness, knowledge, and training needs of web developers in relation to web accessibility issues for visually impaired people revealed that only 36% indicated that they tried to make their websites or applications accessible. However, a survey conducted in 2005 by the Support EAM project (www.support-eam.org/) revealed that 80% of the stakeholders surveyed (both commercial and non-commercial sectors) said they took accessibility into account when commissioning websites. This high level of awareness is repeated in a survey by the DRC (DRC, 2004) where 95% of website commissioners surveyed said they regarded the Web as an important resource and indicated awareness of accessibility and inclusive design, this was especially high amongst large organisations. The European Internet Accessibility Observatory project (EIAO) also undertook a survey of stakeholders to establish the need for the proposed European

Internet Accessibility Observatory (see Craven and Snaprud, 2005). As well as establishing the need for the Observatory, the findings also showed that stakeholders surveyed had an understanding of the importance of accessibility issues and of methods available to help and guide them towards creating better websites.

However, it cannot be assumed that all stakeholders will have a high level of awareness and further investigations of how awareness is put into practice reveals a less positive picture. For example, in the ENABLED project, only 13% of respondents said they had received any training in accessibility and usability and indeed cited a lack of knowledge relating to accessibility features and authoring tools as the main reason for not doing making their websites accessible. The stakeholders surveyed for the EIAO project indicated high levels of accessibility awareness, but not all were actively involved in the design of accessible websites. Similarly, in the SupportEAM study, despite 80% of respondents indicating that they took accessibility into account when commissioning their websites, only 35% said they checked them for accessibility. Again the main reason cited for not putting accessibility into practice was a lack of some kind of methodology and criteria to adhere to.

The conclusion drawn from the studies above is that although people are aware of accessibility issues they do not necessarily fully understand them or know how to implement them. The studies also show that the main barriers to achieving accessibility by those who design and commission websites are generally related to cost perceptions, training and attitudes. The Disability Rights Commission study (DRC, 2004) lists the main barriers to achieving accessibility as:

- Perceived cost of accessibility in terms of money, time and staff resources
- Low level of knowledge about the issues and how to address them
- A perceived lack of simple guidelines, expertise and skills
- Obstacles presented by the increased demand for graphics and other technical constraints
- Conflict between accessibility and other considerations e.g. creativity
- General lack of awareness about the issues and their potential importance.
(DRC, 2004 p37)

Responses from the website development agencies suggested that 80% attempted to develop accessible sites at least some of the time. However the Website development agencies reported that customers were often uninterested or lacked knowledge about accessibility, although when presented with the business case they could be persuaded of the importance of it for increasing usage.

Whereas awareness of accessibility issues and the importance of accessible web design undoubtedly exist, there is still a lack of understanding relating to the specific reasons for applying accessibility features to a website, as well as a lack of knowledge of how to implement them systematically and effectively.

Increasing accessibility awareness and good practice

EU programmes and actions

To increase use of the Internet to all areas of European society, Member States of the EU are required to adhere to the eEurope Action Plan (European Commission, 2002). The Action Plan recommends the adoption of the Web Accessibility Initiative (WAI) guidelines and the development of a European Design for All curriculum, strengthening assistive technology and Design for All standardisation.

Recommendations are also made relating to the procurement of accessible public information and communication technologies, along the same lines as the Section 508 legislation in the United States which requires the procurement of electronic and information technologies that are accessible to people with disabilities.

Since 2002, the European Commission has disseminated a Communication on eAccessibility which aims to move forward the recommendations of the Action Plan and to achieve "an 'Information Society for All', promoting an inclusive digital society that provides opportunities for all and minimises the risk of exclusion" (European Commission, 2005a). The measures recommended by the Commission include Design For All methods in the design of products and services, including the design and evaluation of websites and drawing on recommendations made by the W3C/WAI. At present e-Accessibility is still required on a voluntary basis, but if sufficient progress has not been made by the planned review of progress, then legislative action may have to be considered.

As part of the European Commission Information Society Technologies (IST) programme of research activities to support e-inclusion (http://www.cordis.lu/ist/home.html) ; accessible web design, development and assessment has been the focus of a Web Accessibility Benchmarking (WAB) cluster of three EU funded projects working to develop a harmonised European methodology for evaluation and benchmarking of websites: the 'Unified Web Accessibility Methodology' or UWEM (see www.wabcluster.org/). The Cluster Projects are looking at three specific areas:

- The European Internet Accessibility Observatory (EIAO) - Preparation of a platform for a possible observatory (measurement machine with modular tests, site inventory for jurisdictions, results management and aggregation).
- SupportEAM - Investigation of a possible Web accessibility quality mark (proposal of a certification mechanism and authority, national helpdesks, training material etc.).
- BenToWeb - Production of test suites for evaluation tools, and evaluation modules for checkpoints difficult to automatise. Research into integration of testing modules in CMS and issues related to dynamic multi-version web pages.

By co-ordinating aspects of the work described above, the three projects will work together to develop an EU-harmonised assessment methodology for Web accessibility, based on W3C/WAI and to be synchronised with the move from WCAG1.0 to WCAG2.0.

To further the aim to create an information society for all, the European Commission has issued a mandate to three European standardisation organizations (CEN, CENELEC and ETSI) to establish standards in support of European accessibility requirements for public procurement of ICT products and services. The objectives of the mandate are to harmonise and facilitate the public procurement of accessible ICT products by identifying a set of accessibility requirements, these will be used to provide an electronic toolkit which will enable public procurers to implement the accessibility requirements in a harmonised way. The requirements will take into account issues relating to assistive technologies and design for all. The mandate will be carried out in two phases:

- Phase 1: an inventory of European and international accessibility requirements and assessment of suitable testing and conformity schemes.

- Phase 2: Standardisation activities to support work undertaken in phase 1. Included in this will be an online toolkit providing access to a European Standard of technical specifications for public procurement which corresponds with requirements identified for accessibility; guidelines of accessibility criteria; and guidance and support material for public procurements.

(European Commission, 2005b).

Web Content Accessibility Guidelines version 2

Most organisations concentrate on the WCAG and many have also produced their own accessibility guidelines based on the WCAG recommendations, but often written in less technical terms or focussing on issues specific to the organisation. For example, a paper by Jenkins describes how the Web Accessibility Guidelines were implemented at IBM (Jenkins, 1997) and includes some of the issues raised relating to specific disabilities. In the UK, the Cabinet Office e-Government Unit's Guidelines for government websites (www.cabinetoffice.gov.uk/e-government/resources/handbook/introduction.asp) state that all UK government websites should, as a minimum, adhere to both Priority One and Two levels of the WCAG (version 1.0), in other words be A-A compliant.

Currently WCAG Version 1.0 is still the working document which should be referred to. However, WCAG version 0.2 is likely to be released in the near future. Although the aim of this revised version is not to change the thinking about web accessibility drastically, it will have an impact on the way the Priority Levels are viewed and will present advice as testable statements that are not technology-specific, rather than a prescriptive list of Checkpoints.

WCAG 2.0 covers issues relating to web accessibility and, where they have an impact on accessibility, usability issues will be addressed. Four principles of web accessibility are proposed in the current draft document (W3C, 2006):

- Content must be perceivable to each user.
- User interface components in the content must be operable by each user.
- Content and controls must be understandable to each user.
- Content must be robust enough to work with current and future technologies.

At the time of writing, a working draft of WCAG 2.0 has been released following an extensive review process in which the WCAG Working Group (WCAG WG) received hundreds of comments. The Working Group have been processing issues that were raised in these comments ready for the release of the next version of WCAG 2.0.

Web Standards Project

The Web Standards Project (WaSP) was formed in 1998 to promote the use of web standards and to encourage browser developers to adhere to standards, and thus help to ensure access to the Web by as many people as possible. The project was formed due to a perceived lack of support for the W3C standards which had resulted in barriers to access due to the incompatibility of many web browsers. Barriers were particularly experienced by people using assistive technologies.

Since 1998 the WaSP has gained support and commitment from many browser companies. One of the main aims of WaSP is to "provide educational resources that can help our peers learn standard-compliant methods that are in their interest and that of their clients and site users" (www.webstandards.org). The WaSP sees

developer education as an important aspect of increasing awareness of the importance of using and supporting standards in order to increase access for all.

Publicly Available Specification (PAS 78)

Although awareness of web accessibility issues is increasing, results of various studies identified in this paper have shown that a lack of knowledge still exists in how to implement web accessibility and that there is a need for more effective guidance. This conclusion is confirmed by the continued widespread failure of websites to be fully accessible. After the DRC study (DRC, 2004) was undertaken, the Disability Rights Commission in the UK commissioned the British Standards Institute (BSI) to produce new guidance to help increase knowledge and ability of web developers and commissioners to implement web accessibility effectively. The guidelines have not been published as a full British Standard as this can take years to be approved. Instead, guidance is produced as a Publicly Available Specification (PAS), which can be updated on a regular basis, and therefore more in keeping with the rapid development of web technologies. The PAS 78 covers areas such as:

- How disabled people use websites
- Developing an accessibility policy for websites
- Web technologies
- Testing for accessibility
- Web design and accessibility auditing services.

(British Standards Institute, 2006).

Teaching accessible design

The UK Cabinet Office report on the accessibility of government online services across the EU makes a recommendation to the software industry that all web designers must be training in accessibility requirements and techniques. The Cabinet Office recommendations should be taken further to ensure all courses and modules relating to web design have accessibility built into them, rather than as an add-on.

This issue was explored in a survey of textbooks on web design, which revealed that accessibility is generally treated as an add-on rather than a fundamental part of the design process, and thus students learning web design view accessibility features as "something you go back and throw in at the end, after you've done the important stuff" (Rosmaita, 2006). Using these findings as a basis, an approach has been developed to address the issue. The 'Accessibility First' approach makes accessibility the focus of the course so that "all aspects of web design should be taught from the standpoint of how they contribute to accessibility" (Rosmaita, 2006). Furthermore, if this approach is adopted from the start of the course, students will consider this the natural way to approach web design.

Conclusions

A great deal of emphasis has been placed on the importance of web accessibility and the need to adhere to standards and guidelines. The W3C WCAG in particular have been adopted by many public and private institutions as an indication of what level of accessibility their websites should reach. How the new version of WCAG (WCAG 2.0) will translate onto the many guidelines and policies developed by institutions and companies remains to be seen and, as Carey argues, the challenge for web

designers and developers "will not be the actual standard so much as finding tools to measure compliance" (Carey 2002).

The development of more reliable tools to measure compliance is ongoing, together with the need to include users in any accessibility assessments. However, the real challenge is persuading people to take accessibility seriously, not just measuring compliance. A major barrier to improving the situation appears to lie in the perception that accessibility is an add-on to the design of a site, may result in further costs being incurred, and may also stifle creativity in the pursuit of 'design for all'.

Recommendations to provide appropriate training not only for web designers, but for web commissioners, information managers, policy makers etc are therefore vital if a culture of accessible design and universal access is to be shifted from the perception of an add-on, to be just another fundamental part process of commissioning, designing, and developing websites that will be accessible for everyone.

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