e-Government Website Accessibility: In-Depth Evaluation of Saudi Arabia and Oman

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Abstract: This paper explores three main areas, firstly, website accessibility guidelines; secondly, website accessibility tools and finally the implication of human factors in the process of implementing successful e-Government websites. It investigates the issues that make a website accessible and explores the importance placed on web usability and accessibility with respect to e-Government websites. It briefly examines accessibility guidelines, evaluation methods and analysis tools. It then evaluates the web accessibility of e-Government websites of Saudi Arabia and Oman by adapting the 'W3C Web Content Accessibility Guidelines'. Finally, it presents recommendations for improvement of e-Government website accessibility.

Keywords: Accessibility guidelines, tools, e-Government, web style guide, web testing and evaluation and assistive technology

1. Introduction

Many governments have realised the importance of information and communication technology (ICT) to improve the delivery of information and services to citizens and business. That is, they have started to embrace the World Wide Web for delivering information and services to all citizens and residents. The Web phenomenon has changed the way that people work and communicate. However, while the Web is an exciting technological tool, it does require innovative design to make it accessible to everyone, including people with disabilities.

In addition to the obvious reasons for making e-Government websites conform to accessibility guidelines, the available statistics highlight the importance of such effort. Exploring these statistics, it was found that there are more than 750 million people worldwide with disabilities (Computer Weekly, 2001). In the UK alone, there are 1.7 million blind and partially sighted people (UK RNIB, 2002b). In Saudi Arabia, the total numbers of disabled citizens is 720,000, which represents 4% of Saudi's population. In addition, the rate is expected to increase by 5% annually (Riyadh city reporter, 2004). According to the 1995 census, the number of disabled people in Oman reached 31,510 (Social Development, 1995). however, the W3C estimates that more than 90% of all sites on the WWW are inaccessible to disabled users (Boldyreff, 2002). In particular to e-Government websites, 98% of e-Government websites are inaccessible (Toasaki, 2003). These statistics highlight the extent that of effort needs to be expanded in order to allow the disabled people to gain full benefit of e-Government websites.

This paper investigates the issue that make a website accessible and explores the importance placed on web accessibility with respect to e-Government websites. It briefly examines accessibility guidelines, evaluation methods and analysis tools. Then, an adapted version of the 'W3C Web Content Accessibility Guidelines' will be used to evaluate web accessibility of E-Government websites of Saudi Arabia and Oman as two members of the GCC countries. The evaluation processes include testing each site manually as well as automatically using well-known accessibility evaluation tools. A brief evaluation study was conducted to discover the extent to which developed countries (e.g. UK) and developing countries (e.g. Saudi Arabia and Oman) comply with an internationally accepted accessibility guidelines. Additionally, an email survey of the web designers of government websites in these two GCC countries was conducted exploring some accessibility issues of such websites. Then the paper concludes by presenting recommendations, based on the evaluation findings, for improvements to usability and accessibility of e-Government websites.

2. e-Government

Information and Communication Technology (ICT) has fast become one of the main tools for organisational success. This rapid movement of ICT raises concerns amongst government agencies as to how to deal with technology in order to enhance the agencies' service to the public and to improve the internal progress of the organisation (Atallah, 2001).

e-Government is the application of ICT by government agencies. The aim of using ICT is to enhance the effectiveness and efficiency of the government agencies' processes (Ebrahim, Zahir, and Shawi, 2003; Moon, 2002; Newzeland SSC, 2000). It is also to transform government to be more citizen-oriented. Many governments around the world are moving toward embracing Internet technology. Nevertheless, the introduction of E-Government has encountered many problems, even in developed countries, where a better environment is available for such development (Prins, 2001). The case in developing countries is significantly more problematic.

Two crucial requirements for successful e-Government endeavour are availability and accessibility. Firstly, E-Government transactions have to be available 24 hours a day, 7 days a week. This provides citizens, partners, and government employees with the flexibility to process transactions outside standard government office hours. Therefore, an E-Government website needs to satisfy this "high availability" requirement (The Office of Government Commerce, 2004). Secondly, the E-Government endeavour is critically dependent on the accessibility of its integral websites. If the website is not accessible to the intended target users it will not be successful.

3. Website accessibility

This section will explore the issue of website accessibility, highlighting its importance and relevance to E-Government endeavour.

Web accessibility refers to the degree to which web information is accessible to all human beings and automatic tools. The goal of web accessibility is to allow universal access to information on the web, by all people but especially by people with any impairment, no matter what its severity, (e.g. blindness, low vision, deafness, hard of hearing, physical disabilities or cognitive disabilities). In addition, the information must be accessible by automatic machine tools. This is nicely explained by Chuck Letoumeau (W3C 2002) who defines web accessibility to mean " … anyone using any kind of web browsing technology must be able to visit any site and get a full and complete understanding of the information as well as have the full and complete ability to interact with the site if that is necessary".

Accessible web design entails ensuring that web pages are "user-friendly" in the broadest sense for all those visiting the site. This includes layout, readability, colour choice and browser-independence, as well as considering the requirements of those using adaptive or alternative technology-Assistive or Haptic devices-(Forrester Research 2003). Therefore usability implies accessibility (Brajnik 2000), where accessibility is defined as "the website's ability to be used by someone with disabilities".

3.1 Web accessibility guidelines

The growing community of website accessibility experts has formulated countless guidelines, and a subset of these is currently in common use (Al-Badi, and Mayhew, 2003). In addition to individual efforts, the participants can be divided into four as shown in the table below:

One of these guidelines, W3C WCAG was used in the evaluation process in the course of this study; therefore, it has been introduced briefly in section 3.1.1.

3.1.1 W3C Content accessibility guidelines conformance

The Worldwide Web Consortium (W3C) publishes Web Content Accessibility Guidelines (WCAG), which provide a series of checkpoints for web content development. These checkpoints are broken down into three priorities, depending on their impact on accessibility. The table 2 below shows the priority, the description and the symbol displayed on a website when that website satisfies the description: If none of these guidelines are satisfied, one or more groups will find it impossible to access information in the document.

3.2 Website accessibility tools

Numerous tools exist to determine whether or not a website adheres to various web accessibility guidelines. These tools can provide useful feedback to web designers and maintainers. These tools can also assist in the repair and enhancement of a website. There are websites that provide a selection of these tools with a description of the functionality of each tool (Becker, 2002; Brown, 2002; Graves, 2001; Hower, 2002; NIST, 2004; Thatcher, 2002; W3C, 2003; WEBAIM, 2004). Some of the better-known tools are listed in an internal technical report for the School of Computing Sciences, University of East Anglia (Al-Badi, 2002).

There are various tools that are available that can be used for the web accessibility evaluation. These tools consider a large set of properties depending on attributes and not on the context of websites. The tools supporting repair actions have the potential to dramatically reduce the time and effort needed to perform maintenance activities (Brajnik, 2000).

Table 1: Accessibility guidelines

Participants	Description	Reference
Government	Section 21 of the UK's 1995 Disability and Discrimination Act	(UK, 1995)
	EUROPA - Web Accessibility Policy	(Commission of the European communities, 2001)
	Section 508 of the U.S. Rehabilitation Act Amendments of 1998	(US Section 508, 2002)
Universities	The MIT's Web Accessibility Principles	(MIT, 2002)
	The Oregon State University Web Accessibility Guidelines	(Oregon State University)
	The Santa Rosa Junior College Web Accessibility Checklist	(Santa Rosa Junior College, 2002)
Institutions	IEEE Recommended Practice for Internet Practices	(IEEE, 1999)
	UK Mencap	(UK Mencap, 2002)
	UK RNIB	(UK, 2002; UK RNIB, 2002a; UK RNIB, 2002b; UK RNIB, 2004)
	The WAI initiative by the World Wide Web Consortium (W3C)	(W3C, 1999; W3C, 2002b)
Companies	IBM Guidelines for Writing Accessible Applications	(IBM, 2002)
	Microsoft's Guidelines for Accessible Web Pages	(Microsoft, 2004)
	DAISY Consortium's Digital Talking Book Standard	(DAISY Consortium, 2004)

Table 2: Web content accessibility guidelines (WCAG)

Priority	Description	Symbol
Priority 1:	A web content developer ***must*** satisfy this checkpoint. Satisfying this checkpoint is a basic requirement for some groups to be able to use web documents.	W3C WAI-A WCAG 1.0
Priority 2:	A web content developer ***should*** satisfy this checkpoint. Satisfying this checkpoint will remove significant barriers to accessing web documents.	W3C WAI-AA WCAG 1.0
Priority 3:	A web content developer ***may*** address this checkpoint. Satisfying this checkpoint will improve access to web documents	W3C WAI-AAA WCAG 1.0

Examining the effectiveness of tools such as the WatchFire Bobby, W3C HTML Validator, and UsableNet LIFT it was found that, although these tools can help designers to identify a larger number of potential problems, it is not necessary that the designers will be effective in interpreting and applying the guidelines (Ivory, and Chevalier, 2002).

3.3 Assistive technology

For a website to be accesible, it should support 'Assistive technology' and 'Haptic devices', since these tools and technologies are designed to help disabled users.

Assistive technology incorporates software or hardware that has been specifically designed to assist people with disabilities in carrying out their daily activities. Common software-based assistive technologies include screen readers, screen magnifiers, speech synthesizers, and voice input software that operate in conjunction with graphical desktop browsers (among the other user agents). Hardware assistive technologies include alternative keyboards and pointing devices.

According to (Alliance for Technology Access, 1996) assistive access means that the system infrastructure allows add-on assistive software to

transparently provide specialized input and output capabilities. For example, screen readers allow blind users to navigate through applications, determine the state of controls, and read text via text to speech conversion. On-screen keyboards replace physical keyboards, and head-mounted pointers replace mice. These are only a few of the assistive technologies that users may add on to their systems. Interested readers can find a wealth of information online (BrailleSurf4, 2003; Ewers, 2003; IBM, 2003; Intelligent Systems Research Group, 2003).

4. e-Government initiatives and progress in Saudi Arabia and Oman

Saudi Arabia and Oman have realised the importance of moving forward to the information century. Therefore, e-Government initiatives were launched in both Saudi Arabia and Oman as a part of overall country information technology plans in 2001 and 1998 respectively. The national information technology plan for each country focused on ICT as a tool to reform public organizations, therefore, the objectives are similar

in concept but differ in approach based on the structure of the country. In general, the main objectives focused on improving IT infrastructures, supporting the country's economy, E-Learning, E-Government and E-Health, improving productivity at a low cost, setting up standards and guidelines for a national network, developing a security framework and the preserving of the society's characteristics in a digital age.

In a previous study, firstly, one of the main issues investigated was to find out the progress made in online government services in Saudi Arabia and Oman by adapting the United Nation e-Government stages model (Abanumy, Mayhew, and Al-Badi, 2003). The study showed that only 13 Saudi ministries have online presence and 8 Saudi ministries have no presence. In Oman, the situation is similar to Saudi Arabia, 14 ministries out of 22 ministries have online presence and 8 ministries have no presence. The evaluation results are summarized in table 3.

Table 3: Online presence for Saudi Arabia and Oman ministries

Stage Reached	Saudi's Ministries		Oman's Ministries	
	Number	%	Number	%
No presence	8	38%	8	36%
Emerging presence	0	0	0	0
Enhanced presence	3	14%	7	32%
Interactive presence	10	48%	5	23%
Transactional presence	-	-	2	9%
Seamless	-	-	-	-

Adapted: (Abanumy et al., 2003)

Another important issue investigated was to evaluate the usability of e-Government websites on these two countries. The usability issues that were examined were the adherence to culture of the target audience, information quality, website performance, design consistency and page layout. The findings clearly showed that these issues were not seriously considered in either country.

5. Evaluation of e-Government website

In the current study, the issues such as the culture viewpoints of the target audience, accessibility and design consistency were explored and used in the process of evaluating the two governments' websites. This paper aims to discover to what extent web accessibility is considered by the government's websites of Saudi Arabia and Oman. Therefore, it investigates whether the government websites in these two GCC countries conform to international accessibility guidelines (W3C WCAG) or not and if not, what are the

reasons behind that. As the 'W3C WCAG' guidelines (W3C, 2002b) are comprehensive and cover many elements, the evaluation was restricted to the conformance to an "A" rating. That is, ensuring that all priority 1 checkpoints are met. e-Government website evaluation for Saudi Arabia and Oman has progressed through five stages as follows:

5.1 Stage 1:

The testing procedure started by checking these websites manually for compliance with W3C's WCAG guidelines using a checklist made for this purpose. Initially, the manual checking worked perfectly especially when testing some accessibility elements such as "use the clearest and simplest language appropriate for site content", yet it was a very time consuming process and entailed subjective judgment. Therefore, after the evaluation of a few websites from both countries was completed, the authors decided to use one of the well-known commercial online tools, that is, Bobby (Watchfire, 2002) to

test compliance with the W3C's WCAG guidelines. Bobby does not show what guidelines a website comforms to; rather it shows what guidelines the website does not comform to.

The evaluation process of these government websites, (13 from Saudi Arabia and 14 ministries' sites from Oman), showed that none of these websites conform to all priority1 checkpoints, which means that one or more groups will find it difficult to access information on these websites.

5.2 Stage 2:

At this stage other special purpose tools were used. These tools were selected to perform certain tests including: 1) whether these sites work with input devices and assistive technology such as mouse, keyboard, switch device, touch screen and screen reader; 2) whether these sites support the text-mode browser; and 3) whether these sites have HTML syntax errors such as lack of DOCTYPE declaration (which are supposed to appear at the top of a document, to define the document type and the document's adherence to a Document Type Definition). For such tests it was decided to use the following tools, mainly because they are effective, and freely available.

- Multiweb: A visually impaired use browser (Multiweb, 2004) - downloaded and installed on PCs.
- LYNX: A text browser (Delorie, 2004) - available online.
- W3C validator service (W3C, 2002a) - available online.

The evaluation of the same group of websites in Stage 1 showed that all of these sites failed such tests in the following ways:

- Multiweb: Sites were displayable but not readable (i.e. not linearised)
- W3C validation: The tool display "*Fatal Error: No DOCTYPE Declaration*" and displayed a blank screen for all the tested sites.
- LYNX: Tools gave a message, which was "*unable to locate the remote host…*" and then it displayed a blank screen.

As a result, both the governments' websites failed this testing stage.

The above results led to suspicion regarding the cause of such an outcome, the authors hypothesized that the reasons behind the results from Stage 1 and 2 could be due to:

Hypothesis 1: Guidelines are not implementable or their automated tools are not functioning properly.

Hypothesis 2: Guidelines/tools are language specific.

Hypothesis 3: Other managerial factors related to countries in question.

To test the above the hypothesis, authors conducted the following stages:

5.3 Stage 3:

To test hypothesis 1, that is, the results could be due to either the guidelines being hard to implement or that the automatic tools were not functioning as prescribed. It was decided to conduct an evaluation study on government websites of one of the developed countries. As the study evaluates ministries' websites for Saudi Arabia and Oman, the UK government websites (i.e. departments) were selected for this purpose. In doing that, the stage 1 and 2 procedures were repeated on a similar number of UK government websites, selecting departments that have similar functionality as those ministries that were tested in Saudi Arabia and Oman. The evaluation result showed that although the UK government websites included more features, the majority of these sites do indeed, comply with the guidelines. Using the other tools these sites were found to be displayable and browseable, although still occasionally throw up error messages. Therefore, the authors concluded that the guidelines were implementable and the tools were functioning properly, thus rejecting hypothesis 1.

5.4 Stage 4:

To test whether the tools used in stage 1 and 2 above are language specific, that is, they do not support the Arabic language, the authors decided to evaluate the English version of these two countries' websites (where they existed). The result was the same i.e. sites were not accessible for disabled users. In addition to that, the authors consulted the detailed documentation and contacted the "Watchfire" company, the current owner of Bobby, where the following answer was obtained: "*The language of the website will not affect the results of the Bobby scan. As the WCAG guidelines are not language specific, our checks are also not language specific. The accessibility guidelines refer to the coding of the page and this is what we use to perform our accessibility checks*" (Rogers, 2004).

Similar messages were sent to the other tools' owners (Multiweb, LYNX and W3C validation service) and their answers were the same i.e. these tools are not language specific, so the language of the website would not affect their results.

The obtained results do indeed show that both governments' websites failed accessibility tests performed above, thus rejecting hypothesis 2.

5.5 Stage 5:

Finally to explore the reasons behind the lack of accessibility/usability of e-Government websites in these two GCC countries an email survey was sent to the webmasters of the government's websites asking them what are the aspects that *hinder* and the aspects that *enable* accessibility/usability of the government websites in question.

The response rate was 37% and the results were as follows:

70% of the respondents believe that the problem of inaccessible websites is due to the "lack of awareness of the importance of accessibility of websites", whereas 65% of them believe that it is due to the fact that there is "no accessibility policy in the country". As a solution to this problem, between 60-80% of the respondents articulated that accessibility could be achieved by implementing at least some of the following strategies: training the IT personnel on web site accessibility; increase management awareness regarding the importance of web accessibility; follow existing guidelines across government websites or provide funds to build new web accessibility guidelines and not the least develop web accessibility policy.

Clearly, having policies that can be enforced was an issue that was endorsed by the majority of surveyed webmasters. Also it was understood that the lack of accessibility of government sites was due to the fact that there was no requirement for accessibility defined by the site owner. Therefore, this results conformed that hypothesis 3 was true.

6. Conclusion

This was in-depth evaluation process yet it showed, with no doubt, that the government websites in these two GCC countries (Saudi Arabia and Oman) still need considerable efforts to become accessible websites at all.

It also revealed that there exists a wealth of accessibility resources and accessibility guidelines that are usable and coherent; yet lack of awareness impedes their use. It seems that the governments in this part of the world have not yet grasped the importance of providing services for that part of the population with special needs.

Governments in GCC countries need to review their accessibility related policies to accelerate the transition to accessible e-Government websites. Also it should work on spreading awareness of equal opportunity for all clients, e.g. disabled as well as non-disabled visitors to websites. Based on the work described in this paper, the authors would like to recommend the following issues as critical initial steps forwards.

Website development requires different IT expertise in terms of accessibility, usability, security, user interface design …etc. therefore the governments need to speed up the process of acquiring such skills by focusing on IT institutions to increase the number of students who have enough education on new technologies. Also, institutions should teach up to date technologies.

Government should either adapt the existing web accessibility guidelines or develop its own guidelines that are appropriate for their context. Also, government should set a policy for web accessibility together with an enforcement procedure e.g. make the accessibility of government websites a compulsory requirement. An incentive or reward for those who accommodate website accessibility may promote good web accessibility.

Considering website accessibility at the beginning of the website development process will reduce the cost associated as opposed to doing that at a later stage.

In general, governments need to understand the obstacles to making e-Government's websites accessible and should adopt the appropriate solution to improve it. They have to spread the awareness of the importance of accessible sites by developing appropriate and enforceable policies.

It is important to understand that all e-Government endeavours are critically dependent on the accessibility of its integral websites. If a website is not accessible to the intended target users, it will not be successful.

Finally, organisations caring for disabled people have a responsibility to spread the awareness amongst government organisations for making e-Government websites accessible. The successful implementation of e-Government website accessibility would enable disabled peoples to get involved directly in the community thus making it better for all.

References

Abanumy, A. N., Mayhew, P., and Al-Badi, A. H. (Year). "An Exploratory Study of e-Government

in two GCC Countries." Paper presented at the The 2003 International Business Information Management Conference, Cairo, Egypt, 16-18/12/2003, 2003.

Al-Badi, A. (2002). *Web Usability/Accessibility Tools*. School of Information Systems, University of East Anglia, Norwich.

Al-Badi, A., and Mayhew, P. (Year). "Towards a Comprehensive Usability Framework for Global Websites." Paper presented at the 2003 International Business Information Management Conference, General Theme: e-business and organizations in the 21st Century, Cairo, Egypt, December 16-18th 03, 2003.

Alliance for Technology Access. *Computer Resources for People with Disabilities: A Guide to Exploring Today's Assistive Technology* (2nd edition ed.). Hunter House(1996).

Atallah, S. (2001). *E-Government: Considerations for Arab States*. United Nations Development Program: USA.

Becker. (2002). *Web Accessibility for Ethnic older adults (WEA3)* http://www.cba.nau.edu/becker-a/Accessibility/main.html

Boldyreff, C. (Year). "Determination and Evaluation of Web Accessibility." Paper presented at the Eleventh IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises (WETICE'02), Pittsburgh, PA, USA, 2002.

BrailleSurf4. (2003). *BrailleSurf 4 homepage* http://www.snv.jussieu.fr/inova/bs4/uk/

Brajnik, G. (Year). "Automatic web usability evaluation: what needs to be done?" Paper presented at the 6th Conference on Huaman Factors & the Web, 2000.

Brown, J. (2002). *Accessibility Monitor* http://www.cpcug.org/user/houser/section508/accessibility_monitor.htm

Commission of the European communities, (2001), *EUROPA - Web Accessibility Policy,* communication from the commission to the council, the European parliament, the economic and social committee, and the committee of regions.

Computer Weekly. (2001). *Why your site should have disabled access*.

DAISY Consortium. (2004). *DAISY Consortium's Digital Talking Book Standard*

Delorie, D. (2004). *Delorie Lynx viewer* http://www.delorie.com/web/lynxview.html

Ebrahim, Z., Zahir, I., and Shawi, S. A. (Year). "e-Government adoption: Analysis of adoption staged models." Paper presented at the 3rd European conference on e-Government, Dublin, 2003.

Ewers, N. (2003). *Introduction to the Screen Reader*

http://wiscinfo.doit.wisc.edu/ltde/access/ewers.htm

Graves, S. Check sites for 508 with audit-edit tools. *Government Computer News, Vol* 20 No 23 (2001).

Hower, R. (2002). *Web Site Test Tools and Site Management Tools* http://www.softwareqatest.com/qatweb1.html

IBM. (2002). *IBM Guidelines for Writing Accessible Applications Using 100% Pure Java* http://www-3.ibm.com/able/snsjavag.html

IBM. (2003). *IBM Home Page Reader: The Voice of the World Wide Web, Version for Windows* http://www-3.ibm.com/able/hpr.html

IEEE. (1999). *IEEE Std. 2001-1999 Recommended Practice for Internet Practices* http://www.computer.org/cspress/CATALOG/st02001.htm

Intelligent Systems Research Group. (2003). *The SPEECH Project* http://www.brookes.ac.uk/schools/cms/research/speech/btalk.htm

Ivory, M. Y., and Chevalier, A. (2002). *A Study of Automated Web Site Evaluation Tools*. Technical Report UW-CSE-02-10-01.

Microsoft. (2004). *Microsoft's Guidelines for accessible Web pages* http://msdn.microsoft.com/library/default.asp?url=/nhp/Default.asp?contentid=28000544]

Ministry of Social Development,1995,Oman 1995 Census

MIT. (2002). *MIT's Web Accessibility Principles* http://web.mit.edu/atic/www/slides/dontindex/index.html

Moon, M. J. The evolution of E-Government among municipalities: Rhetoric or Reality. *Public Administration Review, Vol* 62 No 4 (2002).

Multiweb. (2004). *MultiWeb Internet Browser home page*. http://www.deakin.edu.au/infosys/multiweb/mwIndex.htm

Newzealand SSC, N. Z. S. S. C. (2000). *e-Government - a vision for new Zealanders* http://www.e-Government.govt.nz/programme/vision.asp

NIST. (2004). *WebMetric Tools* http://zing.ncsl.nist.gov/webmet

Oregon State University. *Web Accessibility Guidelines* http://oregonstate.edu/dept/tap/Policy/web.html

Prins, J. E. J. *Designing e-Government on the crossroads of Technology Innovation and Institutional Change*, Kluwer Law International (2001).

Riyadh city reporter. (2004). *The problem of 720, 000 disabled in KSA*. LahaOnline magazine (Arabic version)http://lahaonline.com/People/a4-10-03-2004.doc_cvt.htm

Rogers, M. (2004). *Technical Account Manager-Watchfire*.

Santa Rosa Junior College. (2002). *Web Accessibility Checklist* http://www.santarosa.edu/access/checklist/

Thatcher, J. W. (2002). *JimThatcher.com: Evaluation and Repair* http://jimthatcher.com/erx.htm

The Office of Government Commerce. (2004). *Measuring the expected benefits of E-Government* www.ogc.gov.uk/sdtoolkit/workbooks/businesscase/HMT%20Guidelines%20Version%201.4.pdf

Toasaki, Y. (2003). *e-Government from A User's Perspective*. APEC telecommunication and information working group, Chinese Taipei.

UK. (1995). *Disability Discrimination Act 1995* http://www.hmso.gov.uk/acts/acts1995/1995050.htm

UK. (2002). *Royal National Institute of the Blind* http://rnib.org.uk/

UK Mencap. (2002). *Making your website accessible for people with a learning disability* http://www.mencap.org.uk/html/services/accessibility_services.htm

UK RNIB. (2002a). *Accessible Web Design: hints for designing accessible websites* http://www.rnib.org.uk/digital/hints.htm

UK RNIB. (2002b). *Campaign for Good Web Design* http://www.rnib.org.uk/digital/

UK RNIB. (2004). *See it Right Accessible Website logo scheme* http://www.rnib.org.uk/digital/siraccess/

US Section 508. (2002). *Section 508 of the rehabilitation Act Amendments of the 1998* http://www.section508.gov/, http://508as.usablenet.com/508AS/1.0/help/Help.html

W3C. (1999). *Web Content Accessibility Guidelines* http://www.w3.org/TR/WAI-WEBCONTENT/

W3C. (2002a). *W3C HTML validation tools* http://validator.w3.org/

W3C. (2002b). *Web Content Accessibility Guidelines 2.0, draft* http://www.w3.org/WAI/GL/WCAG20/

W3C. (2003). *Evaluation, Repair, and Transformation Tools for Web Content Accessibility* http://www.w3.org/WAI/ER/existingtools.html

Watchfire. (2002). *Bobby: A Verifier of Web Site Accessibility* http://www.watchfire.com/products/bobby.asp, http://www.cast.org/bobby/

WEBAIM. (2004). *Products and Tools* http://www.webaim.org/products/evalandrepair/commercial