MultiWeb: Australian Contribution to Web Accessibility

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Abstract

In a consumer-focused project, accessibility requirements of Internet users with disabilities were investigated. Using a variety of methodologies, input from consumers informed the development of an accessible Internet browser, MultiWeb. In this paper, we describe the innovative browser design features which were developed in response to the Internet accessibility needs of Australian consumers with disabilities.

Keywords

Accessibility, Client Centered design

INTRODUCTION

The Internet has become an important medium for communication. Increasingly, people are required to use the Internet in their home and work environments. Internet access can particularly increase the educational and employment options, and level of participation, of people with disabilities. The Internet provides a wealth of information and opportunities for synchronous and asynchronous communication. The scope and flexibility of Internet communication has obvious benefits for people who may have difficulty using community information facilities such as libraries and standard telephony equipment.

Equitable Internet access is essential for computer users who have sensory, physical or cognitive access needs. The importance of equitable Internet access has been highlighted by consumers with disabilities in Australian telecommunications research. "It (the Internet) is vital to me - it's my best and only opportunity, and easiest way to create an independent lifestyle" (Owens, Lamb & Smith, 1998).

Use of the Internet is compromised if consumers with disabilities do not have appropriate access. This requires a response from the IT community in the design of equipment, software, and web sites. The Human Rights and Equal Opportunity Commission (HREOC) in Australia recognised this in their 1999 report on e-commerce and technology:

> For many people with a disability, and for some older people, the major issue is seen less as one of lack of their own awareness of e-commerce and other services, than a frequent lack of awareness of community access needs in designing and implementing services and technologies. (p. 9)

The research and development project described in this paper demonstrates an Australian initiative in responding to the Internet access requirements of people with disabilities. Collaboration of staff from the Institute of Disability Studies and the School of Management

Information Systems at Deakin University resulted in a user-centered research and development project aimed at investigating the Internet access difficulties of users with a disability. Data from consumers and disability agencies allowed the research team to translate user requirements into an accessible Internet browser called MultiWeb. MultiWeb provides World Wide Web access to the broadest group of users with disabilities by incorporating technology that is oriented to a range of specific disabilities within a single generic software package. It can be configured in flexible ways to give one or more users an interface tailored to his/her specific needs. In this paper we focus on the user interface design solutions that were generated through the process of consumer input and group problem solving.

BACKGROUND

The issue of accessibility is one that every information system technologist should be concerned about. In Victoria alone, an estimated 18 per cent of the population, or almost one in five people, have a disability (Department of Human Services, 1998). It has been observed, that if we live long enough we will all develop some sort of impairment and with an aging Australian population, society's growing reliance on technology and legislation that is sure to be increasing tested, accessibility is an issue that will impact on all technology designers in the future.

Legislation

In Australia the Disability Discrimination Act 1998 (DDA) asserts that individuals with disabilities have the same legal rights to equality of opportunity as other citizens. Direct discrimination, the different treatment of a person because they have a disability, or indirect discrimination, where all people are treated the same and special needs are not accommodated, are violations of the DDA. Consider these discrimination scenarios related to Information Technology access: James, a 20 year old university student who is blind, is denied access to a course because it is assumed he will be unable to use web-based course materials and activities; James' software/screenreading requirements for the course are not assessed and provided. Megan, a 53 year old secretary, has sustained some motor impairment as a result of a car accident and cannot use a keyboard. Her employer provides only standard computer equipment and she is expected to use what is available if she wants to retain her job.

Disability and Access

Historically, disability has been seen from a deficit perspective, where ‘the problem’ lies within the person. This perspective includes a focus on the impairment(s) that an individual may have. An impairment is a limitation or difference which results from a physical, sensory, or cognitive condition.

Impairments that can impact on an individual’s ability to interact with an information system include vision, hearing, cognitive, language and motor impairments. Vision impairment ranges from difficulty seeing text displayed in small size fonts to complete blindness. Colour blindness can also be an issue where colour is used to convey meaning in an interface. People who have a hearing impairment will not be able to access systems which deliver information or instructions using audio as the only medium of communication. Literacy is also problematic for many deaf people, particularly those whose first language is sign language. Computer users with cognitive and language impairments may have difficulty understanding the user interface and text-based information. Difficulties understanding the tasks involved in using the Internet and the sequence of activities required to complete the task are also difficult for some people. People who have a physical impairment may have difficulty using standard computer input devices such as mouse or keyboard. This is especially so for individuals who

are unable to use voice input. Many individuals have multiple impairments and have numerous access needs.

In contrast to a deficit perspective, the more recent social model of disability views disabilities as social barriers that impact on people's participation. Many people with disabilities are disadvantaged in the degree of participation that is possible in a range of life activities, including activities that involve the use of technology. This is because the technology has not been designed to accommodate individuals who have particular computer access needs. Technology that has not been developed for 'all' creates inequity in participation. Limitations to participation and activity involvement are critical dimensions of the definition of disability. In response to the social model of disability, the World Health Organisation (WHO) (1998, 1999), has reclassified its definitions of disability to reflect the interaction between the person, their body/impairment(s), and environmental factors which may assist or impede their participation in activities. This newer model recognises 'the universal nature of disablement;' that the environment and other people may be additional important disabling factors (WHO, 1998, p.2). Technology, as an environmental factor, can enable or disable. The use of technology and assistive devices can be an important means of 'removing limitations on activities' (p. 16).

Web Access Issues

The move away from text based Internet content to the increasing use of multimedia and interactive information on the web has created barriers for users with disabilities. Poor web site design can exacerbate the problem. Web assess is also a function of the accessibility of the Internet browser (and other software designed to render source documents) as well as the transmission protocols that could allow additional accessibility information to be delivered to the user. Because of this, guidelines for designing accessible web pages, user agents and transmission protocols that support accessibility features have or are being developed by the World Wide Web Consortium's Web Accessibility Initiative (Vanderheiden, 1998). The combined efforts of web authors, infrastructure architects and software and hardware designers is essential if accessibility of the web is to become a reality (Vanderheiden, 1998).

DESIGN FOR ACCESS

Universal Design and Assistive Technology

Universal design is a design concept where the creation of products (devices, environments, systems, processes) can be used by the greatest number of people with varying abilities (Vanderheiden, 1996). The customary example of universal design is layback kerbs (gutter crossings) that facilitate access to footpaths for people in wheelchairs. However they also facilitate access for people pushing prams or trolleys and for those riding pushbikes etc. Universal design products should be designed so that they can be used without requiring modification or add-on technology for the broadest group of consumers. Universal design products, including computers, should also accommodate consumers who require assistive technology for successful access. Assistive technology is additional hardware or software products that provide specialist input and output capabilities such as adapted keyboards, screen readers and voice input systems. Ideally, universal design (with or without assistive technology) should eliminate disablement, as all users would be successful in using the technology for their required activities (Newell, 1995).

Cross Disability Access

Cross disability access is a term used by Vanderheiden & Law (1998) to describe technology that has seamless extensions of a standard or default interface, allows use by the broadest possible group of individuals, and incorporates low-cost strategies and little or no added complexity (p. 4). This type of access requires increased design flexibility that allows people with different disabilities to use electronic equipment such as computers, automated banking machines, business phones, office automation, and a range of appliances (Vanderheiden & Law (1998). Cross disability access enables people who have different types of impairments (e.g. low vision, hearing loss, reduced motor control, language and literacy difficulties) to access the same device or piece of equipment. Interfaces are enhanced and the individual makes a choice as to how they will make selections and access information.

The MultiWeb project was designed to clarify and address web access issues for people with disabilities with an aim toward cross-disability access.

METHODOLOGY

The MultiWeb browser was developed with the participation of users with a disability. For the project, a user-oriented, participative research approach (Patton, 1986) was used within a multi-method qualitative research design. The project was user-oriented in that user-knowledge, skills, requirements and information was a major focus. Qualitative methods, using group interviewing and brain-storming techniques, were particularly well-suited to research geared to technology development as it fostered a problem-solving approach in which difficulties were raised and resolved in the context of information shared by disabled and non-disabled participants. Use of a consumer focus is also in accord with the principle of greater accountability and better outcomes for people with disabilities from funded services, government departments, and departmental initiatives such as the AccessAbility Program from the Department of Communication, Information Technology and the Arts.

Participants

A purposive sample of consumers from national disability groups and organisations (representing the full range of disabilities) located in Melbourne, Canberra and Sydney was selected. Recruitment was through letters of invitation. Thirty eight organisations and groups were invited to participate. Focus groups consisted of six participants in Melbourne and in Canberra and three participants in Sydney. All participants were computer users and the majority were users with a disability.

Procedure

While focus groups were being organised, agency case studies were completed. Agency case studies involve a range of different methods of collecting data (Robson, 1993), including: observation of consumer online usage, telephone, fax or on-line interviews and face-to face interviews with consumers and coordinators. In this project, two agency case studies were completed and involved members of the project team as well as disability agency staff who were familiar with access issues and computer equipment and software. The on-line communication requirements of consumers with disabilities were discussed and software/equipment was demonstrated.

Focus groups incorporated demonstrations of software and depth interviewing techniques. The focus groups were oriented to ascertaining user software requirements and were held in participating disability agencies. During each focus group, a demonstration of a browser prototype was used to stimulate discussion. Participants completed a questionnaire which was designed to elicit information about what participants felt were the most important requirements and features.

The discussion which occurred during the focus group was particularly useful as individuals in the groups had different perspectives on functional access. Most had expertise in particular disability areas (e.g. vision impairment, physical impairment etc) and asked questions or gave comments which prompted the research team to consider specific access requirements. To put this in context, this initial research took place at the time when most people with disabilities were still using Windows 3.1 (which has no built-in accessibility functions) and when mainstream browsers were inoperable without a mouse. In this context participants were very keen to see the development of a browser that could enable them (and the disability group they represented) to access the Internet. However, after participants felt their particular requirements were understood, group brain-storming occurred and participants worked together to solve design problems. For example, one highly visual design solution was suggested by a blind participant who was able visualize a solution even though this was not a feature he would need to use.

Analysis

Audio-taped focus group discussions were transcribed and included for analysis with hard-copy questionnaire responses and notes from agency case studies. Analysis of qualitative data was conducted using standard inductive techniques and thematic analysis by two recorders. While the thematic analysis of the focus group recommendations was pertinent to the overall perspective of the system, the individual perspectives of users with diverse needs and expectations of the system provided much more valuable information in informing specific interface requirements. Quantitative data was analysed using descriptive statistics. The thematic analysis, some individual comments, and quantitative information were forwarded to the team members responsible for technology development. The data was considered and decisions were made about software design, relative to the projected budget and time constraints of the project.

RESULTS AND DISCUSSION

Three major themes emerged from the data: (Baxter et al, 1997):

1. Need for customisation

Navigation, default settings and other features needed to be customisable for the diverse group of users with disabilities. This relates to visual and motor elements such as contrast, polarity, type and size of font, and size and arrangement of program controls.

2. Accessible Information

Information needs to be accessible by all disability groups. As information on the web can be contained in many different types of source documents this implies a need for access to these different formats. Participants did not necessarily understand that content accessibility is not only a function of browser operations but also web site authorship.

3. Use with assistive technologies.

The browser should be compatible with peripheral devices and specialised accessibility software, e.g. Zoomtext, switches, expanded keyboards, speech synthesisers, and braille terminals.

The project addressed the themes by providing maximum customisation for users and by providing a range of user options that would assist in accessing documents on the web. In order to reduce cost for consumers and to reduce the need for add-on technology, MultiWeb incorporates accessibility features that would otherwise be provided by additional software or hardware eg. scanning facility, text enlargement and speech synthesis. For this reason and

because of project constraints, testing to ensure MutliWeb was compatible with the increasing range of add-on technology was not carried out.

Design Rationale for MultiWeb

One of the most challenging aspects of designing a browser to facilitate disability access to the Internet is that users have an enormous range of abilities. The issues for a user with low vision are entirely different from a user who can not use a keyboard or mouse. Following the lively debate in focus groups it became apparent that a single design solution that would meet the needs of all was not going to be possible. The browser's basic functions would need to be accessible in multiple ways – hence the name MultiWeb. This feature was achieved by allowing the user to configure MultiWeb (using a separate configuration program) so it could run with one of a number of interfaces and one or more access options.

The interfaces are designed around the input device consumers use to access the computer. Most of the six interfaces feature a button interface rather than the standard Windows menu design. Buttons provide a larger target area for mouse operation, facilitate scanning for switch devices, and provide clearer visual feedback on the available functions.

User Interface Implementations

The **Default Interface** (shown in Figure 1 with right button alignment) allows for mouse or keyboard control. For mouse users, the buttons provide a large target area. As well as clicking on a link, activating a link can also be achieved via buttons: the Go button to activate a link, Jump to move through the links. For keyboard users, buttons only require one keystroke to activate. This was identified as an important requirement as many users are unable to hold down two keys simultaneously.

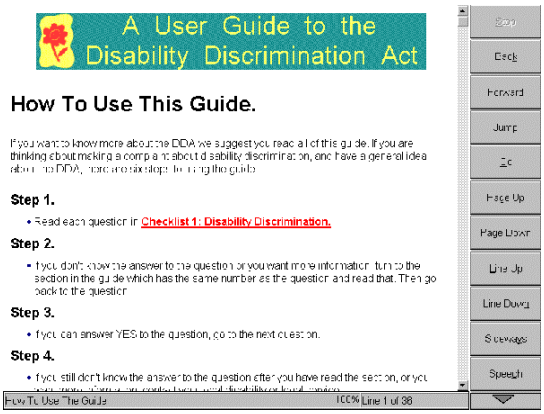

Figure 1: Default Interface

The **Switch Device interface** (shown in Figure 2 with left button alignment) allows access via a switch device plugged into a modified mouse. The switch device can be attached to the individual's wheelchair next to a body part which has reliable movement; this may be an elbow, head, mouth, foot, or finger. Users are required to initiate, maintain, and release movement with the switch in order to control a target system, such as an on-screen keyboard, via the switch interface (Jensen & Bergman, 1992). All available button options are scrolled through one at a time. Selection is by operating the switch when the desired button is highlighted (shown in black in Figure 2). Activating the Jump button will initiate scrolling between all visible hyperlinks. The scrolling rate can be adjusted.

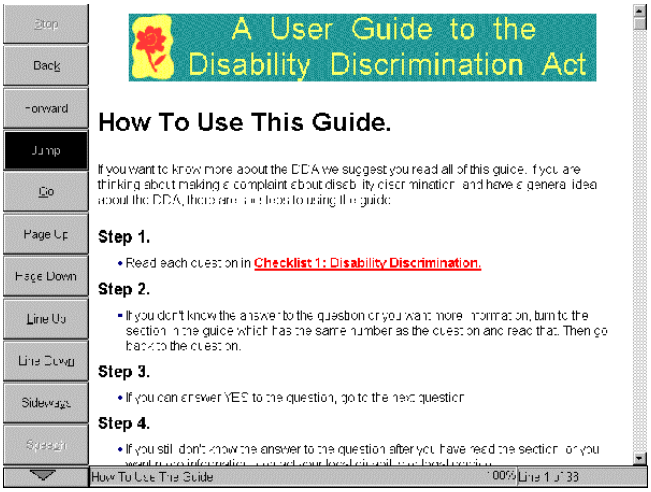

Figure 2: The Switch Device Interface

The **Touch Screen interface** (shown with the large print option in Figure 3) has been designed with extra large buttons to facilitate use with a touch screen. A main button panel is always visible and touching one of the buttons on the main panel produces a submenu of applicable buttons. Icons are used to indicate which sub-menu relates to the selected button. The buttons are positioned around the perimeter of the screen so the screen edge can be used as a rest.

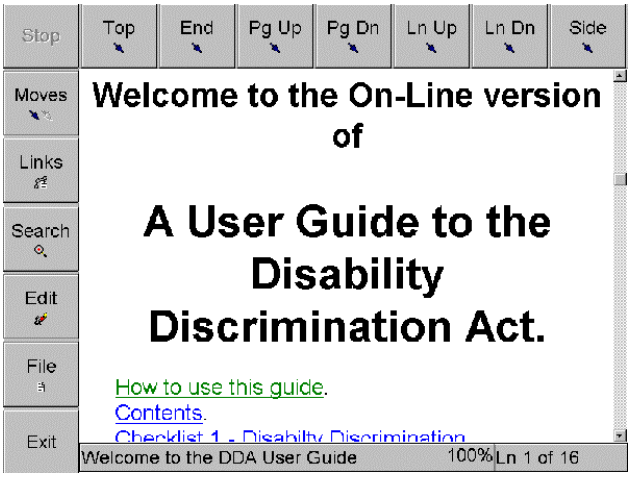

Figure 3: Touch Screen Interface

Mouse-Keyboard Interface (not shown) was designed for use with both mouse and keyboard. The keyboard is used for moving through the document using the keyboard's navigation keys such as page up and down, arrow keys etc. This means that on-screen buttons for these navigational functions are not required so buttons offering other functionality can be positioned on the main button panel. The buttons can be activated with mouse or keyboard.

The Keyboard Interface was designed to maximise the viewing area. There are no buttons and movement is via single keystroke commands which must be remembered by the user. A large viewing area means the user needs does not need to activate navigational keys as often; this is important for some users with physical disabilities.

The **Menu Interface** is similar to the Keyboard interface. It was designed to maximise the viewing area and was requested by users familiar with Windows menu systems.

MultiWeb has built-in multimedia facilities, designed to allow assess to various video and audio file formats. The interface to these features, as well as all dialogue forms (i.e. open file, save file, find and site), are designed to emulate the chosen interface. For example, all the elements in the open file dialog are scanned if the Switch Device interface has been chosen.

MultiWeb also includes an on-screen keyboard that can be used with the touch screen interface and the switch interface (see Figure 4). This provides an alternative method of producing text for filling out internet forms and entering internet address details.

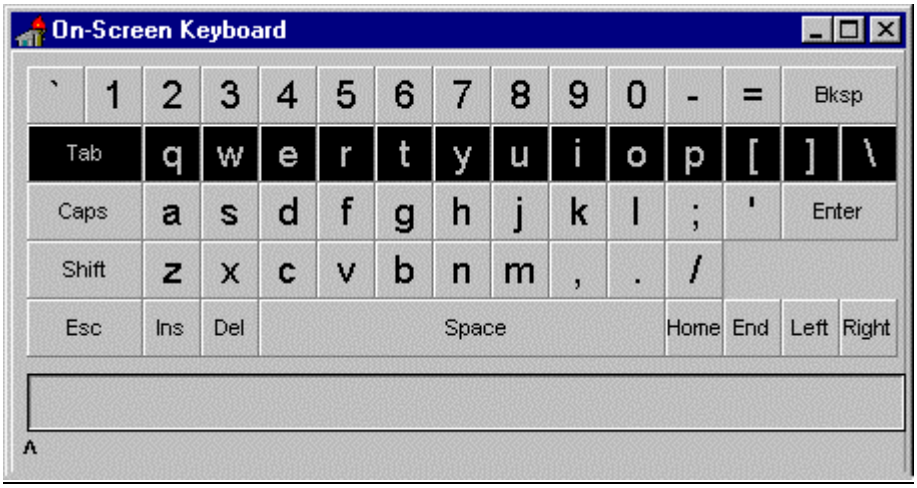

Figure 4: On-Screen Keyboard - shown with scanning

User Options Available

MultiWeb includes additional accessibility options that can be included with each interface (where this is possible). These options are:

- Large print
  The large print option provides large fonts for text (including button text) as well as large cursors.
- Highlight text
  This option allows the current line of text to be highlighted in inverse video to assist with reading. It is particularly useful when combined with large print or speech for people who have difficulty maintaining their place in a document as they read.
- Small buttons
  The small buttons option provides buttons which are smaller than normal thus increasing the available viewing area.
- Speech
  MultiWeb includes its own built-in speech synthesis software which operates in conjunction with any standard PC sound card, providing a low cost alternative to commercial screen readers.
- Talking buttons
  This option provides audio feedback as to which button is currently ready for activation. If using a switch device the button caption is read automatically as the button is scanned.
- Colours and fonts
  MultiWeb allows customisation of colours and fonts to suit individual needs. The background of the browser, the text, the colour of hotlinks, the button background and text are all customisable. Several default colour schemes were also devised after consultation

with users with vision impairments. The default colour schemes are available to streamline choice and assist in configuration.

- Button placement
  Buttons can be placed at the top, left, right or bottom of the screen to ensure easy access.

MultiWeb can be installed so that several users have their own configuration set up on one PC. Each individual has their own icon set up on the Windows desktop. This flexibility is useful in work, education, and community environments where computers may be shared.

CONCLUSIONS

When needs are met and full access to the Internet is supported, people with disabilities are able to participate in home, work, and community online activities. The MultiWeb project was developed in response to a need for creative and flexible interface design options for Internet users with disabilities, particularly those with multiple impairments, who require accommodations in two or more areas, e.g. vision and switch access, and for those with older computer equipment. The software product outcome of this project has addressed many of the Internet needs of this user group.

Consumer involvement in the earliest stages of development resulted in a consumer-focused innovative design. This was accomplished through identification of consumer needs, elimination of barriers, and provision of accessible software to the broadest possible group of consumers with disabilities with the least possible cost. The lack of additional expense for consumers is a significant factor. Although hardware and software development have progressed far beyond a Windows 3.1 platform, accessible browsers and software which are available for users with disabilities all come with a price. Because many consumers with disabilities are on a pension or have reduced employment opportunities, they are not able to upgrade to more recent computer equipment or software due to cost. MultiWeb provides a solution to Internet access in this situation as it has many access features built-in and is Windows 3.1 compatible.

The MultiWeb project has led to another Deakin University, government funded project, MultiMail. The MultiMail project has aimed to investigate the online communication requirements of people with disabilities and to develop an email software package to address those needs (Keller and Owens 2000). The email software outcome of the project is downloadable free of cost from the Internet. Like MultiWeb it includes various interface options. It also features four onscreen keyboards with or without scanning, word prediction, and a range of other user options for users with disabilities to choose from. With built-in word prediction, the interactive nature of email communication will be maximised for consumers with literacy difficulties as well as for those with other functional limitations. MultiMail is initially available as Windows 3.1 compatible software.

In a related project we will investigate the online training needs of people with disabilities and of those who work with them.

Some modifications are also being made to MultiWeb as a result of consumer feedback; these involve improving switch access and the preparsing of web documents to convert framed web pages to a suite of inter-related pages to improve access. A 32-bit software upgrade of both MultiWeb and MultiMail is envisaged for the near future.

MultiWeb and MultiMail are freely available for downloading from the MultiWeb web site (http://mis.deakin.edu.au/multiweb/). A link to MultiWeb can also be found on the World Wide Web Consortium's Web Accessibility Initiative website (http://www.w3.org/WAI/References/Browsing)

REFERENCES

Baxter, C., Braithwaite, R., Lamb,G., Owens, J. and Smith, K. (1997) *Computer Software For Users with Disabilities: An evaluation of the LEAD Program. Second Report to the Commonwealth Department of Health and Family Services.* Deakin University, Burwood.

Baxter, C., Braithwaite, R., Keller, S. and Verlinden, D. (1997) *Computer Assisted Access to Documentation: An Evaluation and Further Development of the Technology. Final Report to the Commonwealth Department of Health and Family Services.* Deakin University, Burwood.

Department of Human Services (2000) *Some Disability Statistics for Victoria*. URL http://hnb.dhs.vic.gov.au/ds/disabilitysite.nsf/pages/statistics

Human Rights and Equal Opportunity Commission (1999) *Progress Update on Reference: Access to Electronic Commerce and New Information and Service Technologies for Older Australians and People With a Disability*. HREOC, Canberra.

Jensen, A. and Bergman, J. (1992) Positioning the Child for Viable Switch Access. In Goossens, C. and S. Sapp Crain (Eds) *Utilizing Switch Interfaces With Children Who Are Severely Physically Challenged.* Pro-Ed, Austin, TX.

Keller, S. & Owens, J. (2000) *Keller S, Owens J, Parker C 2000. Improving Online Access for People with Disabilities.* Proceedings of the 8th European Conference on Information Systems, July 2000 Vienna, Austria.

Newell, C. (1995) Competition in the Local Loop: Some Critical Reflections. 'Crossed Lines: Economic Myths and Social Realities in Telecommunication. *Proceedings of the Conference of the Consumers' Telecommunication Network*. Sydney.

Owens, J., Lamb, G., and Smith, K. (1998*) Telecommunication Needs of People With Speech/Communication Difficulties. Report to the Communication Aid User Society And Telstra.* Deakin University, Burwood.

Patton, M. (1986) *Utilization-focused Evaluations* (2nd ed.). Sage, Beverley Hills.

Robson, C. (1993) *Real World Research: A Resource for Social Scientists and Practioner-researchers.* Blackwell, Oxford.

Roulstone, A. (1998) *Enabling Technology: Disabled People, Work and New Technology*. Open University, Buckingham.

Vanderheiden, G. (1996) *Universal Design: What It Is and What It Isn't.* Trace Research and Development Center, University of Wisconsin-Madison. URL http://www.trace.wisc.edu/text/univdesn/whats_ud.ht

Vanderheiden, G. & Law, C. (1998) *EZ Access Strategies for Cross-Disability Access to Kiosks, Telephones, and VCRs.* Trace Research and Development Center, University of Wisconsin, Madison. URL http://www.trace.wisc.edu/docs/tide98_keynote_ez/keynote.html

Vanderheiden, G. (1998). Cross-modal access to current and next-generation Internet – fundamental and advanced topics in Internet accessibility. Technology and Disability 8 (1998) p115-126

World Health Organisation (1998*) Towards a Common Language for Functioning and Disablement: ECIDH-2. The International Classification of Impairments, Activities, and Participation*. World Health Organisation, Geneva.

World Health Organisation (1999*) International Classification of Functioning and Disability: Beta-2 Draft Full Version.* World Health Organisation, Geneva.

ACKNOWLEDGEMENTS

The MultiWeb research and development project was funded by the Commonwealth Department of Health and Family Services. The MultiMail/MultiWeb research and development project is funded by the Commonwealth Department of Communication, Information Technology and the Arts' AccessAbility Program.

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