The Web

Access and Inclusion for Disabled People

A formal investigation conducted by the Disability Rights Commission

Contents

Foreword

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In a short period of time the World Wide Web, with its global reach and versatility, has had a huge impact on the way we live, work and study. Its potential for contributing to the delivery of a genuinely inclusive society must be realised to the full. This Formal Investigation is an important step towards that goal.

This report demonstrates that most websites are inaccessible to many disabled people and fail to satisfy even the most basic standards for accessibility recommended by the World Wide Web Consortium. It is also clear that compliance with the technical guidelines and the use of automated tests are only the first steps towards accessibility: there can be no substitute for involving disabled people themselves in design and testing, and for ensuring that disabled users have the best advice and information available about how to use assistive technology, as well as the access features provided by Web browsers and computer operating systems.

Organisations that offer goods and services on the Web already have a legal duty to make their sites accessible. It is clear from the investigation that these duties are not being fulfilled. The Commission's policy is to seek improvement in the first instance through advice and conciliation, and this report contains a range of recommendations to help website owners and developers tackle the barriers to inclusive design. However, where the response is inadequate, we shall be vigorous in the use of our enforcement powers; these range from "named-party" Formal Investigations which can lead to sanctions against the owners of inaccessible websites, to the provision of support for test cases being brought by individual disabled people.

The situation revealed by this investigation is unacceptable, but not inevitable. There are already enough examples of good practice to suggest that improvements can readily be made. The Disability Rights Commission wants a society where all disabled people can participate fully as equal citizens. It is determined to ensure that this new and powerful technology does not leave disabled people behind.

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Introduction

Background to Web accessibility issues

The World Wide Web is barely ten years old and has been widely used by consumers for less than half that time. It has no central governing authority. This relative immaturity and lack of regulation is both a source of strength and a weakness, giving free rein in equal measure to individual creativity and to irresponsibility. As a result, all who use the Web are likely to experience frustration from time to time, and any site visited can prove to be a "learning experience".

Disabled people must frequently overcome additional obstacles before they can enjoy the full range of information, services, entertainment and social interaction offered by the Web: blind people need sites to provide, for example, text as an alternative to images for translation into audible or legible words by specially designed screenreading devices; partially sighted people may be especially reliant upon large-format text and effective colour contrast; people who are dyslexic or have cognitive impairments may benefit in particular from the use of simpler English or alternative text formats, such as Easy Read, and from the clear and logical layout of an uncluttered website; people whose first language is British Sign Language may also find Plain English indispensable; and people with manual dexterity impairments may need to navigate with a keyboard rather than with a mouse.

Nevertheless, the Web has enormous potential for disabled people. In contrast to other information media, it is, with the benefit of assistive technology[1], potentially tolerant of impairment. Inclusive website design makes it easier to use these alternative means of access, without making a site less attractive to unimpaired users. Irresponsible and inconsiderate

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[1] In the context of this report, the term "assistive technology" refers only to hardware and software designed to facilitate the use of computers by people with impairments.

design, on the other hand, not only puts disabled users at a significant disadvantage but can make life unnecessarily difficult for everyone, whether disabled or not.

The World Wide Web Consortium (W3C), a Web industry co-operative, soon recognised the need for universal accessibility and since 1999 its Web Accessibility Initiative (WAI) has published the Web Content Accessibility Guidelines[2] (the Guidelines) to reduce potential difficulties. As with all W3C recommendations, compliance is voluntary. The recommendations comprise a set of "Checkpoints" or design practices. These Checkpoints are ranked into three categories, defined by the WAI as Priorities 1, 2 or 3, according to its view of their relative decreasing importance in enabling Web access by people with impairments. Conformance with all the Checkpoints in a particular priority category (and those below it) qualifies a site for the designation "Conformance Level A, AA, or AAA" respectively.

A number of commercial products have been developed to detect Checkpoint violations automatically. However, the Guidelines emphasise that such tools "cannot identify all accessibility issues", and recommend the involvement of disabled people in a manual review process. The use of a "declaration of conformance" on a site relies upon self-assessment and does not guarantee that this recommendation has been observed.

Why a Formal Investigation?

On 28 March 2003, the Disability Rights Commission (DRC) announced its first Formal Investigation, into website accessibility for disabled people (see Appendix 1 for the DRC's statutory remit and for the terms of reference of this investigation). The investigation was confined to publicly accessible sites, to which Part 3 of the Disability Discrimination

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[2]   The Web Content Accessibility Guidelines can be found at
      http://www.w3.org/TR/WCAG10

Act 1995 (DDA) applies. Intranets and private sites for which employers may have duties under Part 2 of the DDA are outside the scope of the current investigation.

This is not the first time website accessibility has attracted attention. Internationally, the Australian case of *Maguire v The Sydney Organising Committee for the Olympic Games* found that the Committee had been in breach of the Australian Disability Discrimination Act 1992 by failing to provide a website to which Mr Maguire could have access.[3]

In the USA, the 1998 amendment to Section 508 of the Rehabilitation Act has proved a powerful incentive to compliance with the Guidelines since it requires that all federal agencies must ensure that their electronic and information technology is accessible to disabled people whenever those agencies develop, procure, maintain or use such technology. The public debate about the "digital divide" has also been accompanied by litigation (not always successful) under the Americans with Disabilities Act 1990 (ADA).

Within the European Community, the EuroAccessibility Consortium has, as recently as April 2003, launched an initiative with W3C to foster European co-operation towards a harmonised methodology for evaluating the accessibility of websites.[4]

In Great Britain, Part 3 of the DDA requires providers of goods, facilities and services to avoid the less favourable treatment of disabled people and also to make reasonable adjustments, including the provision of auxiliary aids and services, to any practices, policies or procedures which make it unreasonably difficult for disabled people to make use of the services they provide. Insofar as a website in itself constitutes a service, or is the primary medium for the delivery of a service, it will therefore be covered by Part 3 of the Act.

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[3] Maguire v The Sydney Organising Committee of the Olympic Games (decision of the Australian Human Rights and Equal Opportunity Commission (2000))

[4] See www.euroaccessibility.org

At present, there is no reported case law on the application of these provisions to websites. However, the Act explicitly refers to "access to and use of means of communication … and information services" as examples of services covered by these provisions, and the most recent statutory Code of Practice, authorised by the then Secretary of State for Education and Employment, includes commentary and examples that create a very strong anticipation that any future case law will support this interpretation of the Act.[5]

Despite the obligations created by the DDA, domestic research suggests that compliance, let alone the achievement of best practice on accessibility, has been rare. The Royal National Institute of the Blind (RNIB) published a report in August 2000 on 17 websites, in which it concluded that the performance of high street stores and banks was "extremely disappointing".[6] A separate report in September 2002 from the University of Bath described the level of compliance by United Kingdom universities with website industry guidance as "disappointing;[7] and in November 2002, a report into 20 key "flagship" government websites found that 75% were "in need of immediate attention in one area or another".[8] Recent audits of the UK's most popular airline and newspaper websites conducted by AbilityNet reported that none reached Priority 1 level conformance and only one had responded positively to a request to make a public commitment to accessibility[9].

Website access is not, of course, the only area of service provision where the letter and spirit of the DDA may not be adhered to fully. Unusually however, the Web is a part of the social environment that is still relatively new. Whereas access, for example, to the built environment frequently entails tackling barriers

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[5] Code of Practice: Rights of Access Goods, Facilities, Services and Premises (2002)

[6] RNIB, Get the Message Online (2000)

[7] B. Kelly, Web Watch: An Accessibility Analysis of UK University Entry Points (2002)

[8] Interactive Bureau, A Report into Key Government Websites (2002)

[9] www.abilitynet.co.uk/content/news.htm

unthinkingly created many years ago, in the case of the Web, its relative immaturity creates a unique opportunity to encourage the observance of disability rights at a much earlier stage.

If disability discrimination is indeed a function of the relationship between sensory, physical or mental impairment and an unaccommodating environment, the Web presents an aspect of that environment that could, with relatively modest expense and reasonable forethought, be made more accommodating than at present.

In the judgement of the DRC, these distinctive factors make website accessibility a priority area for a general Formal Investigation, conducted in a collaborative and constructive spirit. It is the purpose of this report to describe the process and results of that investigation, and to do so with particular regard to the relationship between formal accessibility guidance (such as that produced by the WAI) and the actual accessibility and usability of a site as experienced by disabled users. From that analysis, the report draws practical conclusions for the future development of website accessibility and usability, and makes recommendations directed at the Government, at disabled people and their organisations, at designers and providers of assistive technology, at the developers of automated accessibility checking tools, at designers of operating systems and browsers, at website developers, and at website commissioners and owners.

In this way, it is the intention of this report to help realise the potential of the Web to play a leading part in the future full participation of all disabled people in society as equal citizens.

Scope of the investigation

Notwithstanding the examples cited above, the evidence of Web inaccessibility has in the past been largely anecdotal or derived from comparatively small-scale studies. To obtain more authoritative data, the DRC commissioned the Centre

for Human Computer Interaction Design at City University, London to survey a large and representative sample of websites used by the British public. Using a commercially available software tool, City University tested the home pages of 1,000 sites for technical compliance with the Guideline Checkpoints. Since some of the Checkpoints are qualitative, their violation cannot be detected automatically; for these the software issues warnings of the need for human inspection.

To establish how far compliance with the Guidelines as revealed by automated testing matches the practical accessibility and usability of the sites tested a representative 10% of these sites was selected for detailed evaluation by a group of 50 users with a variety of impairments which influenced their methods of Web access, as well as for evaluation by accessibility experts.

The impairment groups represented in the user testing were the following:

- blind people who use screen readers with synthetic speech or Braille output

- partially sighted people who may use screen magnification

- people who are profoundly deaf and hard of hearing

- people with specific learning difficulties such as dyslexia

- physically impaired people whose use of the Web may be affected by their lack of control of arms and hands, by tremor and by lack of dexterity in hands and fingers.

These particular groups were chosen to provide representative data on a wide range of different accessibility issues encountered by those most affected by Web inaccessibility. They do not, of course, include every type of impairment that might contribute to an individual encountering difficulty in using the Web.

Furthermore, this Formal Investigation did not address the specific linguistic needs of those whose first or preferred method of communication is not English (for example, the users of British Sign Language (BSL) or Easy Read): it is already established that the provision of some alternative Easy Read text or "video-streaming" of BSL interpretation will frequently be necessary to make websites accessible to such users. This investigation has instead drawn attention to particular technical aspects of the structure of websites (for example, their layout and navigational framework) which will benefit everyone, including those with learning disabilities and those who are deaf. Adopting these would supplement, not substitute for, adjustments such as BSL signing or Easy Read, which are needed to make any written materials, including books, magazines or leaflets, accessible to some people with these particular impairments.

The evaluation itself focused on attempts to perform set tasks, and assessed ease of use and success of outcome. The 50 users also participated in focus groups and interviews which explored practical accessibility and usability issues.

To throw light on the reasons for any shortcomings detected, City University also invited the views of over 700 organisations that might commission websites and of nearly 400 website developers. This survey was backed up by interviews with 25 organisations in each of these categories.

In the early stages of the investigation, public meetings of stakeholders were convened to explain, and invite comments on, its purpose and methodology.

Summary of Findings and Recommendations

GENERAL RECOMMENDATION: Service providers using websites, with the benefit of the complementary work by others identified below, should urgently improve the accessibility and usability of the services they provide through the medium of the Web.

FINDING 1: Most websites (81%) fail to satisfy the most basic Web Accessibility Initiative category. In addition, the results of the evaluations undertaken by disabled users show that they have characteristics that make it very difficult, if not impossible, for people with certain impairments, especially those who are blind, to make use of the services provided. This results both from lack of interest and knowledge on the part of website developers, and from perceived commercial obstacles to accessibility on the part of website commissioners, notwithstanding that anecdotal evidence suggests that this concern is misplaced.[10]

1.1 Few (19%) websites comply even with the lowest priority Checkpoints for accessibility.

1.2 All categories of disabled user consider that site designs take insufficient account of their specific needs.

1.3 Blind users, who employ screen readers to access the web, although not alone in being disadvantaged, are particularly disadvantaged by websites whose design does not take full account of their needs.

1.4 Although many of those commissioning websites state that they are alert to the needs of disabled people, there is very little evidence of such awareness being translated into effective usability for disabled people.

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[10] www.useit.com/alertbox/20030107.html

1.5   Website designers have an inadequate understanding of the needs of disabled users and of how to create accessible websites, and would welcome clearer guidance.

RECOMMENDATION 1: Website commissioners should formulate written policies for meeting the needs of disabled people.

As a minimum, such policies should:

● explain what standard of accessibility is to be achieved, having regard to the WAI view that if a site falls short of Level AA conformance, one or more impairment groups will find it difficult to gain access to its content

● ensure that disabled people with a range of sensory, cognitive and mobility impairments are involved from early on in the process of website design and development

● ensure that all specifications of requirements and invitations to tender for contract reflect such policies

● ensure that there is a process for maintaining such standards whenever a website is modified.

RECOMMENDATION 2: Organisations which provide and oversee education and training for developers, including the vendors of web-authoring tools, should promote an understanding that good development practice entails attending, and responding, to the needs of disabled people.

As a minimum, such organisations and vendors should:

● create modules on disability awareness and accessibility as part of the basic training in website development

● ensure that such modules form an integral part of any continuing professional development or product support.

RECOMMENDATION 3: Website developers should accept that good practice entails attending and responding to the needs of disabled people.

As a minimum website developers should:

● take steps to familiarise themselves with how disabled people use the Web and with their needs in Web accessibility

● ensure that they are familiar with the principles, practical objectives and limitations of the Web Accessibility Initiative Guidelines, and with the techniques for applying these in their development environment

● in reviewing a specification of requirements, confirm that it makes appropriate provision for meeting the needs of disabled people; where it does not, seek clarification from the project sponsors and website commissioners, drawing their attention to their legal obligations and to best practice in this area.

RECOMMENDATION 4: The Government should raise awareness, in the public and private sector, and in the relevant professional and other occupational groups, of the Web accessibility needs of disabled people and of the actual cost of meeting those needs.

As a minimum, the Government should:

● take steps towards establishing Web accessibility and usability as matters of genuine concern for service providers in the public and private sector, ensuring that its own sites are exemplars of best practice

● sponsor a publicity campaign to make website owners and commissioners better aware of the Web accessibility and usability needs of disabled people, and of their own obligations under the DDA

● take steps towards the systematic collection of data on the following: the extent to which disabled people experience problems with website accessibility in the public and private sectors; the extent to which private sector organisations are aware of their duties in this regard; and the extent to which private sector websites meet acceptable standards for use by disabled people

● promote authoritative research into the costs and benefits of designing and testing websites for ease of use by the public in general and by disabled users in particular, and bring the findings to the attention of those with obligations under the DDA.

FINDING 2: Published Guidelines and automatic testing software are useful diagnostic tools but are only part of what is needed to fulfil the DDA duty on service providers to make "reasonable adjustments" to their website practices, policies and procedures.

2.1 It is very significant that the majority of those Checkpoints that this investigation found to be the most important are qualitative, in the sense that they require the exercise of human judgement. Automatic testing tools alone cannot, therefore, verify effective compliance.

2.2 Compliance with the Guidelines published by the Web Accessibility Initiative is a necessary but not sufficient condition for ensuring that sites are practically accessible and usable by disabled people. As many as 45% of the problems experienced by the user group were not a violation of any Checkpoint, and would not have been detected without user testing.

2.3 Involving disabled people in the design and testing of websites is very likely to improve usability for all, since many of the characteristics which impede disabled users also make the site confusing to users in general.

RECOMMENDATION 5: Website developers should involve disabled users from an early stage in the design process.

As a minimum, website developers should:

- involve disabled people with a range of sensory, cognitive and mobility impairments from early in the process of website design and development

- plan and manage this process so as to expose and remove barriers that people with these impairments might encounter.

RECOMMENDATION 6: In accordance with the Guidelines, website developers should not rely exclusively on automated accessibility testing.

As a minimum, website developers should:

- conduct practical evaluations, or utilise the services of a website accessibility professional for that purpose, involving a range of disabled users and their assistive technology

- plan and manage such practical evaluations so as to expose and remove barriers that people with various impairments might encounter.

RECOMMENDATION 7: Developers of automated accessibility checking tools should enhance their functionality to make them more useful to website commissioners and website developers.

As a minimum, automated tool developers should:

- seek to automate, or partially automate, more of the checks which need to be made

- provide more support to website developers in understanding the issues underlying website accessibility

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problems and how to solve them, in particular by providing more explicit warning messages and by providing information about the detection and correction of potential accessibility barriers

- provide more support to website developers in manually checking issues that require human judgement, in particular by providing better guidance about techniques for improving navigation.

RECOMMENDATION 8: The Government should facilitate the development of best practice guidance for accessible website development and ongoing maintenance and thereafter promote a formal accreditation process.

As a minimum, the Government should:

- ensure that the guidance prescribes a process for the development of accessible websites which involves disabled users throughout the development cycle, from initial design through to final usability testing

- ensure that the guidance provides for the maintenance of websites to include regular internal and external checking for accessibility

- promote a formal accreditation process for website developers, and thereafter a register of accredited website developers who have been appropriately trained and who abide by the guidance

- promote a certification scheme, comprising an accessibility kite mark, for website commissioners who may wish to demonstrate that their website has been developed and maintained in accordance with the guidance.

FINDING 3: The most widely used operating systems and browsers incorporate a range of useful accessibility features, but many disabled users are unaware of them or do not know how to use them.

RECOMMENDATION 9: Organisations of and for disabled people should facilitate the enhancement of the skills required by disabled people to make full use of the Web, since they are uniquely placed to offer impairment-specific advice on these matters to those who need it.

As a minimum, such organisations should:

- provide and publicise guidance on the use of accessibility features in relation to specific impairments

- promote experience-sharing and mutual support through activities such as the establishment and co-ordination of user forums.

RECOMMENDATION 10: Developers of operating systems and browsers should take steps to ensure that accessibility options are easier to discover, understand and select.

As a minimum, the developers of operating systems and browsers should:

- draw special attention to such features in their promotional material and training manuals, and give them greater prominence in the operating systems and browsers themselves so that the relevant features are easier to find, users understand what the various features do and find it easy to set and change the settings.

FINDING 4: Users of assistive technology products, such as screen readers and magnifiers, need easier access to advice on the selection of products to suit their needs. A significant proportion are not investing in the latest versions and do not exploit their full potential because of inadequate training.

4.1 Assistive technology products are usually more expensive than consumer software. High prices discourage users from upgrading to the latest versions, which can cause compatibility problems with newer hardware and software.

4.2 Many users cannot afford sufficient training to become proficient in the use of assistive technology. Although some products come with self-tuition material in a variety of media as well as post-sales telephone support, users do not consider that these meet their training needs.

4.3 Government schemes for funding of assistive technology assessment, training and support, and provision are fragmented, not sufficiently well known and do not cover everyone.

RECOMMENDATION 11: The designers and providers of assistive technology should enable and encourage users to keep their products up to date.

As a minimum, the designers and providers of assistive technology should:

● review their upgrade pricing policies so that the current price disincentives to upgrading are removed.

RECOMMENDATION 12: In line with its commitment to "bridge the digital divide", the Government should provide the funding required to enable access to appropriate assistive technology for all those who need it, and to promote its better use.

As a minimum, the Government should:

● ensure that there is adequate funding to enable schemes for assisting disabled people, such as the Communication Aids Project[11] and Access to Work, to satisfy the demand for assistive technology assessment, provision and training

● provide funding so that schemes such as these can be introduced to cover neglected categories such as adults who are not in work

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[11] See http://cap.becta.org.uk

- ensure that existing and any new schemes are properly co-ordinated so that provision is not interrupted by any change of circumstance, such as starting work or part- or full-time education.

RECOMMENDATION 13: Existing health, social and rehabilitation services with responsibility for assessing their clients' needs for physical aids attend, and respond, to the Web accessibility needs of disabled people.

As a minimum, such services should:

- ensure that they have enough knowledge about information technology and available sources of assistance to provide to their clients a signposting service to appropriate sources of assistive technology assessment, provision and support.

RECOMMENDATION 14: Those professional bodies, colleges and universities involved in training key frontline personnel, such as information and computer technology trainers and librarians, should provide or review awareness and equality training in relation to computer and Web accessibility issues for disabled people.

As a minimum, such professional bodies, colleges and universities should:

- create or review modules on disability awareness and equality, and on computer and Web accessibility as part of the basic training for librarians and information and computer technology trainers

- ensure that such modules form an integral part of any continuing professional development for professionals in these fields.

FINDING 5: Nearly half (45%) of the problems encountered by disabled users when attempting to navigate websites cannot be attributed to explicit violations of the Web Accessibility Initiative

Checkpoints. Although some of these arise from shortcomings in the assistive technology used, most reflect the limitations of the Checkpoints themselves as a comprehensive interpretation of the intent of the Guidelines. City University, as a contributor to the Web Accessibility Initiative, has drawn conclusions from this evidence about potential improvements to the Guidelines, and these are summarised at Appendix 2.

RECOMMENDATION 15: The Web Accessibility Initiative should give serious consideration to the proposals by City University at Appendix 2 of this report for extending the scope of the Guidelines to address limitations identified in the course of this investigation.

Research Phase 1: Identification of Problems

Objective and sources of data

The first objective of the research programme undertaken by City University was to systematically evaluate the extent to which the current design of websites accessed through the Internet facilitates or hinders use by disabled people in England, Scotland and Wales, identifying any recurrent barriers.

To ensure that the conclusions reflect actual rather than perceived needs, a User Panel was established, comprising 50 disabled people including people with a variety of impairments most affected by web accessibility problems, being:

- blindness

- partial sight

- dyslexia

- profound deafness, including people who are Sign Language users, and hearing impairment

- physical impairments that affect access to the Web, such as lack of control of arms and hands, tremor or lack of dexterity in hands and fingers.

The members of the Panel also represented both sexes, a range of ages, levels of experience with computers and the web, and the most widely used types of assistive technology.

Data was collected from five sources:

1. Meetings with stakeholder groups, to identify the underlying barriers to web accessibility.

2.   Focus groups for each of the impairment groups, to identify the specific concerns of particular groups of disabled people according to impairment.

3.   Automated testing of 1,000 home pages, to establish the current state of website accessibility in Great Britain.

4.   In-depth user and expert testing of 100 websites, to establish the actual problems real disabled users have in using websites.

5.   A controlled study of the use of a sample of six websites (three with relatively high accessibility ratings and three with low accessibility ratings) by blind and non-disabled people, to differentiate between the effects of inaccessible design and those of the impairment itself.

1. Stakeholder meetings

A number of well-publicised meetings were held with organisations in both the public and private sectors which commission and own websites; with website developers, who may work for specialist website development agencies or for organisations who own a website; and with organisations of and for disabled people. At the meetings, presentations were made about the Formal Investigation and views were elicited about issues and concerns relating to website accessibility and usability. Follow-up questionnaires were sent to everyone who attended the meetings to elicit more specific information about issues and concerns.

2. Focus groups

Focus groups were held at City University with members of the User Panel. Each focus group, with representatives of one of the impairment groups, lasted between one and two hours. The

discussions concentrated on how people use the Web, what they find useful, the variety of problems they encounter in accessing websites and the problems associated with assistive technologies used by the focus group members.

A key outcome from the blind and partially sighted focus groups was the discovery that assistive technologies were perceived to be very expensive, difficult to learn, and a source of many problems. Focus group members said that, because of the expense of the assistive technologies (eg screenreaders and magnification software), they tend not to upgrade them as often as they would like to, and are therefore forced to use them even if they do not meet all their requirements. Members in the blind focus group stated that it is difficult and expensive to learn how to use assistive technologies effectively, particularly as the guides and tapes supplied were thought to be inadequate. Similarly, none of the members in the partially sighted focus group had received any structured training or advice; all had learned by exploration or from friends. Moreover, assistive technologies have considerable limitations: the focus group members complained that images and words are often distorted when magnified, and overlapping text is a recurrent problem. As one blind focus group member stated, non-disabled people "would not put up with the software we have to use".

Some dyslexic focus group members also use speech-based software to listen to Web pages in preference to reading them. This demonstrates that it is not only blind and partially sighted users who are affected by the purchase costs, learning curve, and limitations of current assistive technologies.

3. Automated testing

The home pages of a sample of 1,000 websites were evaluated using an accessibility testing module which tests websites against the 14 Guidelines. The sites were selected to be representative of five sectors: government and official

information; business; e-commerce; entertainment and leisure; Web services, such as search engines, discussion boards, portals and Internet service providers.

These 14 Guidelines comprise 65 Checkpoints, 16 of which are designated Priority 1, 30 Priority 2 and 19 Priority 3, depending on the Web Accessibility Initiative's view of the Checkpoint's impact on accessibility.

Automated tools cannot check the performance of a website against all 65 Checkpoints, since some require human judgement. For example, while tools can check whether each image in a website has associated ALT text (which provides descriptive text for visually impaired users as an alternative to an image or picture) by inspecting the page's HTML code (which governs the structure and layout of a website), they cannot verify that such text is appropriate or helpful. In such cases, automated tools can only give "warnings" highlighting those aspects that should be checked manually.

Priority 1 Compliance (A)

Of the 1,000 home pages tested 808 (81%) had Guideline Priority 1 Checkpoint violations. In other words, just 19% of these home pages are potentially Level A compliant, but to achieve this level they must also pass their Level A manual checks. Since some of these home pages are bound to fail some of the manual checks, the percentage of home pages with Level A compliance is certainly less than 19%.

Of the five sectors investigated, the Government and Information sector achieved much better results than the other sectors, with 32% of home pages achieving automated Level A compliance. For all other sectors, automated compliance levels were approximately 15%.

Priority 1 and 2 Compliance (AA)

Only six (0.6%) of the home pages automatically tested displayed no Priority 1 or 2 Checkpoint violations in automatic tests, and so were potentially AA-Compliant. However, subsequent manual checking of these six pages revealed that only two (0.2%) were in fact AA-Compliant.

With such low numbers, any comparison between the five sectors would not be meaningful.

Priority 1, 2 and 3 Compliance (AAA)

No home pages achieved AAA-Compliance, by having no Priority 1, 2 or 3 Checkpoint violations.

In addition to the proportion of home pages that potentially passed at each level of Guideline compliance, analyses were also conducted to discover the numbers of Checkpoint violations on home pages. Two measures were investigated. The first was the number of different Checkpoints that were violated on a home page. The second was the instances of violations that occurred on a home page. For example, on a particular home page there may be violations of two Checkpoints: failure to provide ALT text for images (Checkpoint 1.1) and failure to identify row and column headers in tables (Checkpoint 5.1). In this case, the number of Checkpoint violations is two. However, if there are 10 images that lack ALT text and three tables with a total of 22 headers, then the instances of violations is 32. This example illustrates how violations of a small number of Checkpoints can easily produce a large number of instances of violations, a factor borne out by the data.

The mean number of Checkpoints violated across the whole sample of 1,000 home pages was approximately eight per home page. This means that there are eight different Checkpoints that the web developer needs to attend to on a typical page.

Analysis of the instances of Checkpoint violations revealed approximately 108 points per page where a disabled user might encounter a barrier to access. These violations range from design features that make further use of the website impossible, to those that only cause minor irritation. It should also be noted that not all the potential barriers will affect every user, as many relate to specific impairment groups, and a particular user may not explore the entire page. Nonetheless, over 100 violations of the Checkpoints per page show the scale of the obstacles impeding disabled people's use of websites.

4. User and expert evaluation

100 websites were selected from the original sample of 1,000 for in-depth evaluation by disabled users and experts. Each User Panel member was asked to evaluate 10 sites and complete two tasks per site. The User Panel members completed 22% of these tasks at City University while being observed by experts, and 78% of these tasks were attempted at home with the members using their own equipment and software. A total of 913 tasks were undertaken in this manner.

The key data from these evaluation sessions included:

- whether the Panel members succeeded or failed in their tasks

- how easy the Panel members found it to perform the tasks, irrespective of whether or not they succeeded

- problems encountered in using websites, as articulated by the Panel members or observed by the experts

- the extent to which the Panel members believed each site took their impairment into account.

For the tasks performed at City University, the experts could observe whether users succeeded or failed. At home, however, users could not always be certain that they had succeeded or failed in their tasks. Users were therefore asked to state how confident they were that they had succeeded (on a scale of 1 to 7) on each task. The analysis of data on success rates considered only tasks where users were sure whether they had succeeded or failed, and so disregarded tasks with confidence rated 3 to 5. This reduced the sample to 769 tasks.

In aggregate, at City University and at home, the Panel members succeeded in 76% of the attempted tasks and failed in 24% of them (based on the sample of 769 tasks). However, this distribution was not equal across all impairment groups. As Table 1 illustrates, blind participants had significantly more difficulty in using the websites, succeeding in only 53% of their tasks, compared with the other impairment groups whose average was 82%. Moreover, the low success rate amongst the blind members was not due to a minority of members failing to complete their tasks, while others mainly succeeded: the trend within the group was uniform.

TABLE 1: TASK SUCCESS RATE BY IMPAIRMENT GROUP

Impairment Group	Tasks succeeded	Tasks failed
Blind	53%	47%
Partially sighted	76%	24%
Dyslexic	83%	17%
Physically impaired	85%	15%
Hearing impaired	85%	15%
All impairments	76%	24%

This result alone demonstrates that blind users constituted the most disenfranchised group studied in this Formal Investigation.

The users' performance was unaffected by the laboratory setting in which the Panel members evaluated the websites at City University. The success rates for those being observed by the experts and for those doing the tasks unobserved at home were statistically undifferentiated between all groups.

Panel members also rated how difficult/easy they found the tasks to complete. These ratings show a similar pattern to the success rates, but more differentiation between different impairment groups. Those with dexterity impairments gave a median rating of 6.8, on a scale of 1 = very difficult to 7 = very easy, finding the tasks easy to complete. The ratings given by deaf and dyslexic people were significantly lower and the ratings by partially sighted and blind people significantly lower again. Thus, although the task ratings only dropped from "very easy" to "neither easy nor difficult", a significant and substantial decline in ease was experienced by dexterity impaired participants, hard of hearing participants, dyslexic participants, partially sighted participants to blind participants.

TABLE 2: MEAN EASE OF TASK RATINGS BY DIFFERENT IMPAIRMENT GROUPS (7 = VERY EASY)

Impairment group	Mean ease of task rating
Dexterity	6.8
Hard of Hearing	5.8
Dyslexic	5.6
Partially sighted	5.1
Blind	4.2

No differences between the five sectors investigated were revealed by any of the three key measures used in the user evaluations: success rates, ease of task ratings, and impairment consideration ratings.

5. Controlled study

To throw further light on quantitative aspects of users' experiences with websites, a controlled study was undertaken with a sample of six websites, three with high accessibility ratings and three with low accessibility ratings. This study concentrated on comparing the experiences of a group of blind Panel members (as the most disenfranchised group in the overall study) and a matched group of non-disabled web users. On the sites with high accessibility, both groups successfully completed nearly all their tasks. However, on sites with low accessibility, non-disabled users still completed all their tasks, whilst blind users completed only 67%.

As well as the difference in completion rates, there was a substantial disparity between the times taken to perform tasks. Table 3 shows the mean time in seconds to complete a task for each type of website.

TABLE 3: TASK COMPLETION TIMES FOR HIGH AND LOW ACCESSIBILITY SITES (IN SECONDS)

	Time taken by control group	Time taken by blind users
High accessibility site	36	114
Low accessibility site	52	173

TABLE 4: TASK COMPLETION TIMES FOR HIGH AND LOW ACCESSIBILITY SITES (FROM A BASELINE OF 100)

	Time taken by control group	Time taken by blind users
High accessibility site	100	321
Low accessibility site	146	486

If a non-disabled user on a high accessibility site is treated as a baseline of 100, there is clearly an inherent disadvantage for blind users: even on high accessibility sites, blind users with screenreaders took over three times as long as unimpaired users to complete their tasks. However, poor accessibility design substantially aggravates this disadvantage: on low accessibility sites a blind user takes nearly five times as long to complete a task as a non-disabled user on a high accessibility site, with only two-thirds the likelihood of a successful outcome.

Moreover, on high accessibility sites, 18% of tasks were rated as taking an unacceptably long time by blind users, compared to only 3% of tasks by unimpaired users. On low accessibility sites, 35% of tasks were rated as taking an unacceptably long time by blind users, compared to only 15% of tasks by unimpaired users.

It is also notable that both blind users and non-impaired users took far longer on low accessibility sites than on high accessibility sites, and that this effect was not much more pronounced for disabled users: 51% longer for blind users, and 46% for non-disabled users. It follows that all users, not just disabled people, would benefit greatly from the measures required to make sites accessible and usable by blind people.

Recurrent barriers identified

A total of 585 accessibility and usability problems were identified in the user evaluations, either by the User Panel members themselves or the experts working with them. These difficulties were collated and categorised. The most frequently recurring problems, not all of which are obviously impairment related (eg text size for hearing impaired users), are tabulated below and explain the failure rates summarised earlier.

TABLE 5: KEY PROBLEMS EXPERIENCED BY IMPAIRMENT GROUP (instances in brackets)

Key problems experienced by blind users

- Incompatibility between screen reading software and web pages, eg the assistive technology not detecting some links, or it proving impossible to highlight text using text-to-speech software (26)

- Incorrect or non-existent labelling of links, form elements and frames (24)

- Cluttered and complex page structures (23)

- ALT tags on images non-existent or unhelpful (16)

- Confusing and disorienting navigation mechanisms (16)

Key problems experienced by partially sighted users

- Inappropriate use of colours and poor contrast between content and background (20)

- Incompatibility between accessibility software (eg for magnification) and web pages (19)

- Unclear and confusing layout of pages (18)

- Confusing and disorienting navigation mechanisms (16)

- Graphics and text size too small (10)

Key problems experienced by physically impaired users

- Confusing and disorienting navigation mechanisms (20)

- Unclear and confusing layout of pages (19)

Key problems experienced by physically impaired users *(cont)*

● Graphics and text size too small (11)

● Inappropriate use of colours and poor contrast between content and background (10)

Key problems experienced by hearing impaired users

● Unclear and confusing layout of pages (23)

● Confusing and disorienting navigation mechanisms (12)

● Lack of alternative media for audio-based information and complex terms/language (10)

● Inappropriate use of colours and poor contrast between content and background (9)

● Graphics and text too small (9)

Key problems experienced by dyslexic users

● Unclear and confusing layout of pages (41)

● Confusing and disorienting navigation mechanisms (32)

● Inappropriate use of colours and poor contrast between content and background (20)

● Graphics and text too small (14)

● Complicated language or terminology (7)

Automated testing versus user evaluation

Given that website developers frequently rely on automated testing tools in creating and maintaining accessible websites, it is important to establish the extent to which such tools can accurately detect all accessibility and usability problems which cause disabled users difficulties.

To investigate this topic, a comparison was made between the results of the automated testing and of the user evaluations. In the first instance automated testing was conducted on the 100 websites evaluated by the User Panel. Either the whole site was tested, or the first 500 pages encountered if the site was larger than this, making a total of nearly 39,000 web pages tested. The number of Checkpoint violations and the instances of violations were compared with the results of the user evaluations. The number of Checkpoint warnings or instances of warnings do not relate statistically to any of the user evaluation measures. Regrettably then, automated tests alone do not predict the experience of disabled people when using websites.

In fact, this is not a surprising result because the majority of actual problems the Panel members encountered when evaluating the 100 websites (eg navigation problems, contrast issues) were in categories that cannot be automatically checked.

The user evaluations revealed 585 accessibility and usability problems. 55% of these problems related to Checkpoints, but 45% were not a violation of any Checkpoint and could therefore have been present on any WAI-conformant site regardless of rating.

On the other hand, violations of just eight Checkpoints accounted for as many as 82% of the reported problems that were in fact covered by the Checkpoints, and 45% of the total number of problems. These eight Checkpoints are shown in Table 6.

TABLE 6: CHECKPOINTS ACCOUNTING FOR MOST REPORTED PROBLEMS

Checkpoint	Priority
1.1 Provide a text equivalent for every non-text element	1
2.2 Ensure that foreground and background colour combinations provide sufficient contrast when viewed by someone having colour deficits or when viewed on a black and white screen	2/3
6.3 Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported. If this is not possible, provide equivalent information on an alternative accessible page	1
7.3 Until user agents allow users to freeze moving content, avoid movement in pages	2
10.1 Until user agents allow users to turn off spawned windows, do not cause pop-ups or other windows to appear and do not change the current window without informing the user	2
12.3 Divide large blocks of information into more manageable groups where natural and appropriate	2
13.1 Clearly identify the target of each link	2
14.1 Use the clearest and simplest language appropriate for a site's content	1

Only three of these eight Checkpoints were Priority 1. The remaining five Checkpoints, representing 63% of problems accounted for by Checkpoint violations (or 34% of all problems), were not classified by the Guidelines as Priority 1, and so could have been encountered on any Priority 1-conformant site.

Further expert inspection of 20 sites within the sample confirmed the limitations of automatic testing tools. 69% of the Checkpoint related problems (38% of all problems) would not have been detected without manual checking of warnings, yet 95% of warning reports checked revealed no actual Checkpoint violation.

Since automatic checks alone do not predict users' actual performance and experience, and since the great majority of problems that the users had when performing their tasks could not be detected automatically, it is evident that automated tests alone are insufficient to ensure that websites are accessible and usable for disabled people.

Clearly, it is essential that designers also perform the manual checks suggested by the tools. However, the evidence shows that, even if this undertaken diligently, many serious usability problems are likely to go undetected.

This leads to the inescapable conclusion that many of the problems encountered by users are of a nature that designers alone cannot be expected to recognise and remedy. These problems can only be resolved by including disabled users directly in the design and evaluation of websites.

Research Phase 2: Survey of Website Commissioners and Website Developers

Objective and sources of data

The second objective of the research programme undertaken by City University was to make a provisional assessment of any technical and commercial considerations that are presently discouraging the adoption of inclusive design.

The assessment was based on the response to questionnaires sent to 712 website commissioners drawn from the public and private sectors, and to 388 web development agencies, and on interviews conducted with 21 website commissioners and with 25 website developers.

The response rate to the questionnaire both from commissioners and from developers was low: 9% in the case of the former, and 6% in the case of the latter. Such a low response rate invites caution in the interpretation of any results obtained. On the other hand, it suggests in itself a relatively low level of interest in accessibility issues, even amongst website developers, who might be thought to benefit commercially from concerning themselves with such matters. A similar request for information on other "compliance" matters, for example health and safety or data protection, might be expected to find its way, at least within larger organisations, to a designated officer with responsibility and expertise in the relevant field. Disturbingly, it appears that this formal approach to compliance is not yet applied to the DDA, at least in relation to website accessibility issues. Moreover, as indicated by the analysis of questionnaire responses below, there is reason to believe that those commissioners and website developers who did respond may well be those relatively few who are genuinely aware of accessibility issues and therefore unrepresentative of the website development population as a whole.

Website commissioners

The responses from website commissioners revealed that 95% regarded the Web as an important resource and potential means of communication with customers, thereby confirming the view that the Web is already a significant vehicle for the distribution of goods and services. The rest of the responses to the questionnaire, and indeed to the interviews, indicate a striking dichotomy between those larger organisations with more than 250 employees, and those with less than 250 employees.

On the face of the results, large organisations' levels of awareness appear quite good: 97% claimed to be aware of accessibility as an important issue; 88% claimed to be aware of their responsibilities under the DDA; 76% stated they had policies on accessibility; 68% asserted that they took accessibility into account when developing a site; 71% claimed to have conducted some form of testing, and 88% said they had plans to make improvements.

The responses from small and medium-sized organisations with less than 250 employees were less encouraging: only 69% appeared to be aware of accessibility as an issue; 48% claimed to be aware of their responsibilities under the DDA; 34% said they had policies on accessibility; 29% said they took accessibility into account when developing a website; 17% claimed to have conducted some form of testing; and 58% said they had plans to make improvements. The interview responses reinforced this impression of a division between large and smaller organisations: 9 of the 21 website commissioners interviewed of which seven were small organisations were completely unaware of accessibility as an issue.

Although these figures would suggest a reasonable level of awareness amongst larger organisations, it should be recalled that the testing of 1,000 websites does not support the conclusion that organisations give informed attention to accessibility when commissioning or designing web sites:

81% of websites failed to satisfy even the most basic Web Accessibility Initiative category. It is also noteworthy, as reported below, that although 58% of website design agencies claimed to discuss accessibility with their clients, only 31% of clients showed a positive attitude towards it. These figures suggest that, if 68% of website commissioners from large organisations do indeed take accessibility into account, their concern to meet the needs of disabled people is, sadly, not being turned into good enough practice on the ground.

When asked about the barriers to achieving accessibility, most respondents, whether from large or smaller organisations, pointed to one or more of five main considerations: the perceived cost of accessibility, in terms of money, time and staff resources; the low level of knowledge about the issues and how to address them, reinforced by a perceived lack of simple guidelines, expertise and skill; the obstacles presented by the increased demand for graphics and other technical constraints; the conflict between accessibility and other considerations, especially aesthetic and creative considerations; and general lack of awareness about the issues and their potential importance.

In short, the recurrent barriers to achieving accessibility disclosed by this phase of investigation appear to be a combination of unsupported assumptions about what it takes to achieve an accessible website and of ignorance about how to tackle access issues even where the will to do so is already present. The recommendations in this report, especially those directed to the Government, and to website developers and commissioners, are designed to mitigate those deficiencies.

Website development agencies

The responses to the questionnaire revealed that 80% of website development agencies attempted to develop accessible sites at least some of the time. The most commonly successful argument in persuading customers to take accessibility

seriously was the business case that accessibility entailed an increase in potential audience. Respondents reported that generally, however, customers were neither interested in, nor knowledgeable about, accessibility issues. This assertion reinforces the view that the responses from website commissioners reported above do not accurately reflect the true level of awareness amongst commissioners as a whole.

The level of accessibility expertise amongst website developers themselves was also low: only 9% claimed any sort of expertise, and although 70% had conducted user testing, only 9% had ever included disabled users in such tests. Instead, they tended to rely upon automated testing tools: 21% had made use of these, but were non-committal about their benefits, with the majority classifying them as neither "useful" nor "not useful". By contrast, 65% had referred to the WAI Guidelines, 25% to the RNIB guidelines, and 5% to Government guidelines, and generally found them "useful".

When asked what they considered to be the main problems in developing accessible websites, respondents suggested similar factors to those identified by website commissioners, especially the cost in time and resources, lack of knowledge, the lack of authoritative guidance, and conflict with aesthetic and other design considerations.

The responses obtained in the interviews largely complemented these findings: 81% were aware of accessibility issues 58% would always mention accessibility to a customer, yet in just 31% of cases was the response from customers positive. Only 48% of those interviewed had ever used the WAI Guidelines or conducted automated testing; and only one developer had ever involved disabled people in user testing.

The low rate of expertise identified, the lack of involvement of disabled people in the design and testing processes, and the relatively low use even of automatic testing tools contribute to an environment which makes the currently poor state of Web accessibility inevitable.

Conclusions and Recommendations for Achieving Usability

Action to be taken by providers of support services to disabled people

Disabled people need better advice about the assistive technology available so that they can make informed decisions about what best meets their individual needs, and better training in how to use the most suitable technology so they can get the best out of it.

There is a need to increase the availability of affordable individual expert assessments, but this must be complemented by appropriate signposting to such qualified specialist organisations. That implies a requirement for the education of those who have prime responsibility for assessing the more general assistive technology needs of disabled people (such as occupational therapists, rehabilitation staff, special educational needs coordinators, and Job Centre Plus staff), and of those who are likely to provide advice and training to disabled people (for example, librarians, advisers in information bureaux, as well as professional information and computer technology trainers and assistants).

The development of on-line user communities and the consequent development by users of their own mutual support arrangements will usefully supplement individual assessments of this sort.

It is therefore recommended that:

- organisations of and for disabled people should assist their constituencies in acquiring the skills required by disabled people to make full use of the Web [recommendation 9].

● in line with its commitment to "bridge the digital divide", the Government should provide the funding required to enable access to appropriate assistive technology for all those who need it, and to promote its better use [recommendation 12]

● existing health, social and rehabilitation services with responsibility for assessing their clients' needs for physical aids attend, and respond, to the Web accessibility needs of disabled people [recommendation 13]

● those professional bodies, colleges and universities involved in the training of key frontline personnel, such as information and computer technology trainers and librarians, should provide or review awareness and equality training in relation to computer and Web accessibility issues for disabled people [recommendation 14].

Action to be taken by designers and providers of assistive technology

The comparatively small market for assistive technology products inevitably has an impact on quality and cost but, given the unsatisfied demand, there is likely to be a business case for reducing cost barriers to initial acquisition and, especially, upgrading such products.

It is therefore recommended that:

● the designers and providers of assistive technology should enable and encourage users to keep their products up to date [recommendation 11].

Action to be taken by designers of operating systems and browsers

It is not just assistive technology that could serve disabled people better. The vendors of operating systems and browsers have a part to play in ensuring that disabled users are able to identify, select and employ the accessibility features in those products.

It is therefore recommended that:

● developers of operating systems and browsers should take steps to ensure that accessibility options are easier to discover, understand and select [recommendation 10].

Action to be taken by website developers

Website developers are relatively well informed about the existence of the Guidelines. What they lack is training in, and the resulting confidence in the use of, accessibility features. It is important that those who train website developers include standard training modules on disability awareness and the techniques required to translate that awareness into practice. Corresponding modules should be incorporated into any continuing professional development prescribed. There is also a need for better guidance to website developers: the Guidelines do not provide adequate coverage of information architecture and navigation design issues. Above all, website developers must engage disabled users in the process of evaluating websites from the early stages of the design process, and should supplement automated testing with manual checks.

It is therefore recommended that:

● organisations which provide and oversee training for developers, including the vendors of web authoring tools, should promote an understanding that good development practice entails attending, and responding, to the needs of disabled people [recommendation 2]

- website developers should accept that good practice entails attending and responding to the needs of disabled people [recommendation 3]

- website developers should involve disabled users from an early stage in the design process [recommendation 5]

- in accordance with the Guidelines, website developers should not rely exclusively on automated accessibility testing [recommendation 6]

- the Web Accessibility Initiative should give serious consideration to the proposals at Appendix 2 of this report for extending the scope of the Guidelines to address limitations identified in the course of this investigation [recommendation 15].

Action to be taken by website commissioners and owners

Website owners and commissioners must obtain a better understanding of the accessibility needs of disabled people, and recognise that such improved understanding is in their commercial interest. They also have a legal duty to anticipate these needs and should address the issue urgently, rather than waiting for the next redevelopment cycle.

It is therefore recommended that:

- website commissioners should formulate written policies for meeting the needs of disabled people [recommendation 1]

- the Government should raise awareness, in the public and private sectors, and in the relevant professional and other occupational groups, of the Web accessibility needs of disabled people and of the actual cost of meeting those needs [recommendation 4]

- the Government should facilitate the development of best practice guidance for accessible website development and thereafter promote a formal accreditation process [recommendation 8].

Action to be taken by developers of automated accessibility checking tools

Automated testing of websites is an important resource for website developers and owners. Although there is a need to supplement automated testing with user evaluation, there is much that can be done to make automated testing itself more effective, especially through the provision of additional support to website developers and through the refinement of the automated checking tools themselves.

It is therefore recommended that:

- developers of automated accessibility checking tools should enhance their functionality to make them more useful to website commissioners and website developers [recommendation 7]

APPENDIX 1
DRC Powers and Terms of Reference for the Investigation

The Disability Rights Commission (DRC) is empowered by the Disability Rights Commission Act 1999 to conduct a Formal Investigation for any purpose connected with the performance of its duties under section 2 (1) of the Act.

Those duties are:

- to work towards the elimination of discrimination against disabled persons

- to promote the equalisation of opportunities for disabled persons

- to take such steps as it considers appropriate with a view to encouraging good practice in the treatment of disabled persons

- to keep under review the working of the Disability Discrimination Act 1995 and of the Disability Rights Commission Act 1999.

On 28 March 2003, the DRC gave notice of its intention to conduct an investigation into website accessibility for disabled people in Great Britain.[12]

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[12] The Financial Times, and The Guardian, 28 March 2003

The investigation had three main purposes:

- To evaluate systematically the extent to which the current design of websites accessed through the Internet facilitates or hinders use by disabled people in England, Scotland and Wales

- To analyse the reasons for any recurrent barriers identified by the evaluation, including a provisional assessment of any technical and commercial considerations that are presently discouraging inclusive design

- To recommend further work which will contribute towards enabling disabled people to enjoy full access to, and use of, the Web.

This report presents the DRC's findings and is published in accordance with paragraph 7 (4) of Schedule 3 of the Disability Rights Commission Act 1999.

APPENDIX 2
Recommendations from City University on the WAI Guidelines

The Guidelines should provide better coverage of information architecture and navigation design issues in relation to accessibility by making recommendations that will:

- reduce the number of links and ensure that genuine and necessary links are clearly identified as such

- avoid site fragmentation: navigation mechanisms should be consistent (eg in appearance and behaviour), the relative importance of different sections (across the site and within pages) should be apparent, mark-up languages should be used to indicate the structure of pages

- preserve links to the Home page

- improve search design

- eradicate excessively deep site structures; and ensure that page titles are informative.

In addition, the Guidelines should place special emphasis, in the form of elevated prioritisation, on the following matters already covered:

- the need to divide blocks of information into more manageable units

- the need to ensure that foreground and background colours have sufficient contrast

- the need to provide a text equivalent for every non-text element

- the need to avoid creating pop-ups and new windows without informing the user

- the need clearly to identify the target of each link

- the need to use the clearest and simplest language appropriate for the site's content

- the need to ensure that pages work when scripts and applets are not supported

- the need to avoid movement in pages until they can be frozen.