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Deliverable 12a: Guidelines for developing an AAC-enabled World Wide Web

(including updated Internal Deliverable i6 - Pre Draft Standards for Web-Based Information)

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Executive Summary

This document, a final output of the WWAAC project's Workpackage 7, focuses on guidelines for a World Wide Web that is more accessible by people with complex communication needs who use graphic symbol-based augmentative and alternative communication (AAC). The first stage of this activity was to develop an internal project resource, documenting requirements identified in the early phases of the WWAAC project and current work in the area of Web accessibility. This internal resource, originally prepared as internal deliverable i6, has now been updated and forms the first part of this document.

A framework for design guidelines is described using the Web Content Accessibility Guidelines (WCAG) version 1.0, and then concentrates on the working drafts of WCAG 2.0 in order to facilitate integration of WWAAC recommendations with current drafts and discussions. The particular characteristics of AAC users we are targeting are then described, followed by existing guidelines extracted from sources in the references, as well as from exemplars of good practice found in the Appendices. Existing guidelines cover the development of general-purpose sites, sites specifically for AAC users, and also adapted browsers for AAC users.

Before proposing success criteria, examples and strategies for specific guidelines in the WCAG, a number of issues were discussed with experts within and outside the consortium: whether to have one site for all or two alternative sites, the conflicting needs of users, simplicity of content, summaries of content, top loading, tagging images, navigation mechanisms, and search engines. Discussions on these issues have helped to form a basis for guideline development and have led to the following recommendations, with rationale based on the WWAAC project's user requirements and evaluation work:

Recommendation 1: Provide a clear representational image on the site's home page.

Recommendation 2: Alt tags should provide prime information for the user, and should distinguish between salient (most prominent) and non-salient content.

Recommendation 3: Provide simple page descriptions as metadata.

Recommendation 4: Add clear in-page link such as 'Skip-to-content' near the top of the page (as some Web developers already do).

Recommendation 5: Consider the number, location and focus of links on a page.

Recommendation 6: Provide a progressive complexity for both site and page content, so that people with different abilities may be able to obtain information from the same Web site.

Recommendation 7: Use static, rather than dynamic, content for critical parts of the Web site.

Recommendation 8:
Consider a change of priorities in the Web Content Accessibility Guidelines to reflect the findings of the Disability Rights Commission report (2004).

These recommendations are proposed as success criteria, examples and strategies to be included in the W3C Web Accessibility Initiative's (WAI) draft Web Content Accessibility Guidelines (WCAG 2.0). Whilst these recommendations have been developed to make Web sites more usable and understandable for people with complex communication needs, other user groups who may be struggling due to age, disability or handicapping situations could also benefit.

Guidelines for Developing an AAC-enabled World Wide Web

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APPENDICES

1. Introduction

This document, a final output of the WWAAC project's Workpackage 7, focuses on guidelines for a World Wide Web that is more accessible by people with complex communication needs who use graphic symbol-based augmentative and alternative communication (AAC). The first stage of this activity was to develop an internal project resource, documenting requirements identified in the early phases of the WWAAC project and current work in the area of Web accessibility. This internal resource, originally prepared as an internal deliverable No. 6, has now been updated and forms the first part of this document.

Section 2 provides a framework for design guidelines, using the Web Content Accessibility Guidelines (WCAG) version 1.0, and then concentrating on the working drafts of WCAG 2.0 in order to facilitate integration of WWAAC recommendations with current drafts and discussions. Section 2 also describes the particular characteristics of AAC users we are targeting. The next 3 sections (Sections 3, 4 and 5) extract existing guidelines from sources in the references, as well as from exemplars of good practice found in the Appendices. Although many of the guidelines will overlap to a certain extent, they are grouped according to:

- coding (elements in the HTML, e.g. alt text, scripting, flash, frames, etc.)
- layout (elements of design, e.g., colour, size, page layout, navigation, etc.)

and also according to:

- physical/sensory issues (particularly relevant to access and navigation), and
- cognitive/linguistic issues (particularly relevant to information presentation and transformation).

Section 3 describes existing guidelines for the development of general-purpose sites, Section 4 describes guidelines for those developing sites specifically for AAC users, and Section 5 describes guidelines for those developing adapted browsers for AAC users. Section 6 then discusses issues in developing new guidelines, before proposing recommendations to the W3C Web Accessibility Initiative (WAI) in Section 7.

This document will be used as a basis for providing feedback to the W3C–WAI for its Web Content Accessibility Guidelines V2.0 currently existing in draft form (the version used in this document is dated 1 March 2004). Detailed comments have been provided on earlier drafts to the WAI, which were documented first as part of an additional internal deliverable No. 6a (Co-operation with W3C–WAI). Further co-operation with the W3C–WAI has been documented in Appendix 6, in particular with reference to the WWAAC project's Concept Coding Framework. This activity is conducted in conjunction

with Workpackage 8 as part of project dissemination activities (Task 8.3—Contacting the WAI of the W3C consortium and other manufacturers).

The process of developing guidelines for an AAC-enabled World Wide Web began with the requirements capture phase of the WWAAC project, which included interviews with a variety of users, service providers and manufacturers of AAC equipment. This provided an opportunity to identify some of the requirements for developing AAC enabled WWW pages. An analysis of the WWAAC User Requirements Document (Clarke et al 2001) provides some insights into the likely needs for information on WWW design in this sector. The critical issues related to:

Accessible software applications

Developing good screen reading software and support for speech output, tailored and appropriate for users of AAC, e.g. embedded control elements for speech synthesis software (also issue of different national languages being supported).
Providing simplified WWW browsers (entering URLs in particular).
Making plug-ins such as FLASH or Shockwave accessible (also applies to language extensions such as Javascript).
Providing a good alternative to mouse/pointer input, i.e., keyboard access.
Providing support for switch and other non-mouse users.
Use of large buttons for on-screen controls.

Layout

How to develop simple and uncluttered layouts for WWW pages.
How to simplify and lay out text, grammar, etc., e.g. highlighting of key text.
Supporting the visually impaired, e.g., large text and large, or customised, graphics.
How to use animation appropriately.
Guidance on size and appropriate use of images.
Ensuring a non-reliance on images—also text-only versions of sites.
Strategies for navigation—reminding users where they are and have been.

Coding

Guidance on the use of symbols versus text.
Automatic symbolising of keywords.
Developing symbol vocabulary for WWW use.
Marking keywords on sites clearly.
Ensuring links are meaningful.

General

Providing information on the design implications of different communication problems.
Providing guidance for WWW designers in dealing with cognitive issues.

In summary, a variety of suggestions were given as to the types of services and developments that were needed:

1.1 Integrated Speech Output

The most common need identified was for good text to speech systems that would read email and WWW pages to those with communication problems. There was a perceived need for integrating speech output into such applications. This would also involve being able to control the speech output from within the application, i.e., having embedded control elements tailored and appropriate for users of AAC. For example, image navigation is not particularly important to AAC users, but highlighted boxes and their tailored presentation are.

1.2 Simplified Content

Recommendations were needed to ensure that short and simple text was used on WWW sites and that keywords were clearly identified. One suggestion was to have software that would check the complexity of any language used and automatically simplify it. Another suggestion was that software could be developed that would automatically symbolise keywords on a WWW site. It would need to be decided whether such keywords would be taken from the user's own vocabulary or from a common list.

The issue of layout and use of graphics was seen as being important to address, particularly in relation to the size of images and the use of animation. Recommendations were also needed on the use of graphics on WWW sites, i.e., size of graphics, and also their dynamic aspect, i.e., avoiding excessive moving graphics and animation.

1.3 Accessibility of Language Extension and Plug Ins

Concerns were also raised about ensuring that WWW sites containing plug-ins such as FLASH or Shockwave were accessible to symbol users. Note—this same issue also applies to the accessibility of language extensions such as Javascript.

1.4 Improved Accessibility for Switch Users

Advice on making the Internet accessible to switch users was also seen as being needed, and in addition to the issues of physical and sensory access, cognitive issues were also raised, e.g. simplifying materials and providing navigational cues to users to assist them in using a site. Accessibility issues may arise from either the design of the Web site itself or from the design of the browser, and therefore any guidelines will need to make this distinction. Separate guidelines were needed for the design of WWW browsers and site content.

1.5 Improved Access for Symbol Users

A significant number of comments related to the development of WWW services for symbol users, the need to both develop more symbol-based sites, and to improve access to more general Web sites by symbol users. Speech output was one mechanism for achieving greater accessibility, but in addition there were a variety of other ways in which access could be improved. Simplified WWW browsers for symbol users would be particularly useful, also with an emphasis on limiting the need for entering WWW addresses. Such

software should also be accessible by switch users. Simplified search engines were also seen as being needed.

The work of the ALDICT project (Access for Persons with Learning Disability to Information and Communication Technologies) has made significant impact in this area. Its e-mail software Inter_Comm, enables symbol users to compose, send and receive email messages in his/her own symbol set and language, using Widgit's software 'Writing with Symbols' (Freyhoff, 2001; Pereira, et al., 2003); www.Widgit.co.uk). Following on from ALDICT's work, Widgit Software Ltd. has developed new software called Communicate Webwise. This software can process most Web pages, apart from complicated ones with Java or Flash components, as either symbols, plain text in any font size, or as spoken words. It is necessary to consider, however, whether symbol support for the entire page is needed or desired by end-users, or if a symbol-embellished summary of the Web page or site would be more appropriate. Mencap (www.mencap.org.uk) suggest that some people find too many symbols on a page confusing, and that unless you know your readers prefer symbols above most words, it is better to use symbols just for key words or ideas. Allowing the user to choose is really the answer.

1.6 Developing Core Symbol Vocabularies

A core symbol vocabulary for WWW use was seen as being required, and guidance for WWW designers on how to use symbols versus text was seen as being necessary. It was also seen to be important to develop the resources that would be needed for symbol access, e.g. freely available symbols. A word of caution was expressed, however, as it was suggested that developers would need explicit training in the use of a particular symbol language in order to make effective use of those symbols on their WWW site. This raises an issue of whether it is reasonable to expect a WWW designer to be able to take these issues into account without expert support. Such expert support can, however, be offered to Web developers through the Web authoring tool under development in the WWAAC project.

2. A Framework for Design Guidelines

The W3C Web Content Accessibility Guidelines (WCAG 1.0) provides detailed recommendations for improving accessibility (W3C–WAI, 1999). As a starting point, Web sites should conform to the W3C at least to Priority level 1 in order to be accessible. Priority 1 specifies that a Web content developer **must** satisfy a particular checkpoint; otherwise, one or more groups will find it impossible to access information in the document. In contrast, Priority 2 specifies that the Web content developer **should** satisfy the checkpoint, and Priority 3 specifies that a Web content developer **may** address the checkpoint.

WCAG version 1 is used as the basis for this overview of existing guidelines. Written very much with the HTML coder in mind, unfortunately their on-line documents are not particularly easy to follow, as users are led to a number of documents with overlaps in content. It is easy to get lost in such documents and it can be difficult to find the relevant information needed. The most useful from a developer's perspective is the document HTML Techniques for WCAG 1.0, as this also contains worked examples to show how the general principles are applied.

It is necessary, however, to look beyond version 1 to the Working Drafts of WCAG 2.0 (the version consulted for this document being dated 1 March 2004) and regularly being updated. WCAG 2.0 has been studied to determine where the WWAAC project can add detail that would be particularly relevant for AAC users (W3C–WAI, 2004). It is recognised that guidelines ought to be general enough to be applied to a wide range of emerging technologies; in fact, one of the improvements of WCAG 2.0 over Version 1.0 was to make it more easily applicable to a wide range of Web-based languages. WCAG 2.0 demonstrates how more general (less HTML-specific) WCAG might read, providing guidelines for 4 basic principles, with the goal to create Web content that will be perceivable, operable, understandable, and robust to work with current and future technologies. For each of these principles, non-technology-specific guidelines are provided, as well as success criteria (normative in nature) and also definitions, benefits and examples (all informative in nature). More detail is given in Appendix 1.

WCAG 2.0 is now starting to make headway in considering the needs of people with communication impairments, and although there is no detailed guidance for AAC users, we now see specific reference to the needs of AAC users. As proposed at a WAI/WWAAC meeting in June 2002, rather than providing totally new principles and guidelines, the WWAAC project aims to provide success criteria, examples, and strategies to make Web sites more accessible to our users. However, it must be remembered that although it is possible to have an accessible, legal and reliable Web site that meets the WAI recommendations, it may not necessarily be a good Web site. Good design will enable good access, but they are not identical. In fact, 'it is almost always possible to find out what is on a Web page if the disabled user has adapted and sophisticated equipment at hand and spends much time using it. But for Web information to become truly *usable* to disabled people, those drafting and

editing Web pages need to follow a number of guidelines' (Engelen, 2001). Therefore, Web developers need to apply best practice in usability into their Web sites, going beyond minimum adherence to best practice and policy, which will help to ensure quality and inclusiveness for all (Office of the E-envoy, 2003).

A recent study, investigating the extent to which the Web discriminates against disabled people, was completed for the Disability Rights Commission (DRC) in the UK by the Centre for Human-Computer Interaction at City University, London (Disability Rights Commission, 2004). The study included a survey of Web site owners and developers, focus groups and interviews with a User Panel of 50 people with disabilities, representing the following impairment groups: blind people using screen readers with synthetic speech or Braille output; partially sighted people who may be using screen magnification; people who are profoundly deaf or hard of hearing; people with learning difficulties such as dyslexia; and people with physical impairments in their arms, hands and fingers. The study included automated accessibility evaluation of 1000 Web site home pages, and both automated and user-based evaluation of 100 complete Web sites.

The study demonstrated that most Web sites are inaccessible to many disabled people and fail to meet the most basic standards set by the W3C. Specifically, it found that violations of just 8 Checkpoints of WCAG 1.0 accounted for 82% of the problems users reported which were covered by the Checkpoints, and 45% of the total number of problems reported by the users. It is interesting to note that 5 of these 8 Checkpoints were not classified by WCAG as Priority 1, and therefore a site could still have Priority 1 conformance. It is also significant that the majority of these most important Checkpoints are qualitative, emphasising that many of the problems can only be found and then resolved by direct involvement of people with disabilities in the design and evaluation of Web sites. Based upon the most common types of Web accessibility problems experienced by a wide range of users, the DRC report makes recommendations to ensure that disabled people can enjoy full access to, and use of, the Web. A selection of the DRC recommendations for better coverage or special emphasis in the WCAG, relevant to the issues discussed in this document, are given below:

- Reduce the number of links and ensure that genuine and necessary links are clearly identified as such
- Improve search design
- Eradicate excessively deep site structures
- Divide blocks of information into more manageable units
- Ensure that foreground and background colours have sufficient contrast

- Use the clearest and simplest language appropriate for the site's content

- Avoid movement in pages until they can be frozen.

These recommendations should be considered by the WCAG Working Group, and may affect future drafts of the accessibility guidelines, including more effective links between the guidelines and the techniques to implement those guidelines. They may also impact upon the 10 most important guidelines found on the 'credit card summary' of WCAG 1.0 guidelines (www.w3.org/WAI/References/QuickTips and Appendix 1, section 4.)

From all of the above, it is clear that there is a need to refine guidelines for the development of general purpose WWW sites to take the needs of those with communication difficulties into account, which should also make Web sites easier to use for other user groups. However, access to more general sites may not always be feasible or desirable for users with severe disabilities, and so there is also a need to develop guidelines targeted at more specific disability groups with more specific needs.

The primary target population of end users defined by the project are people between the ages of 12 and 25 years who use graphic symbol-based AAC in face-to-face interaction, and who are professionally supported in their use of AAC and the Internet within school/college or receiving non-professional support at home. The early phases of the project provided an opportunity to identify some of the characteristics of the different AAC users, who could include:

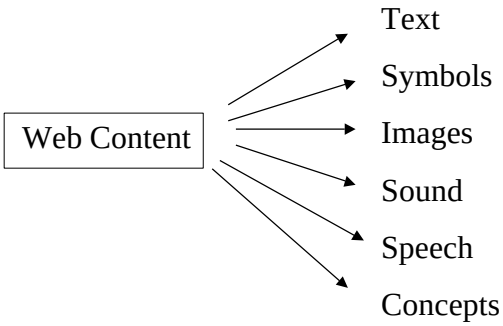
1) Young adults with congenital disorders leading to problems with communication. This group could manifest a range of problems in accessing WWW pages, all of whom could have easier access to the Internet through better design and accessibility features. These users' particular difficulties could include:

   a) Problems with fine movement and co-ordination. Most of these difficulties can be overcome as long as keyboard access, rather than usage of the mouse as input, is available in the browser or the site. Those with less severe problems could then access the sites with keyboard or alternative keyboards. Severe difficulties would require alternative access with scanning style interfaces using a limited number of specialist input switches. Facilitating access by a range of AAC devices would be critical for these users.

   b) Problems with vision. Visual accommodation might be poor for some users requiring large character displays. It was not anticipated that significant numbers would have no usable sight however.

   c) Problems with comprehension of on-screen text. This would mean that simplified text presentation would be needed, or interfaces with a primarily image-based content. Another option would be to support

aural presentation of existing WWW content using screen reading software through the use of Alternative Sound or Speech Tags, similar to ALT Text tags currently in use for describing images. In fact, in order to meet the needs of a wide range of users, the permutations could be wide ranging. Web content in whatever form (text, images, sound, speech, symbols, concepts) could be translated to a more usable form for the user through the use of appropriate Tags, including Alt Text, Alt Symbols, Alt Images, Alt Sound, Alt Speech, or even Alt Concepts:



d) Limited expressive ability, using symbols or other non-text forms of communication. Some of these users may be using limited numbers of symbols, whilst others may have a more extensive symbol vocabulary (1000 words +), and therefore likely to be relatively competent in terms of communication skills. It should be noted that even those who have limited expressive abilities (and cognitive skills within a normal range) can be expected to learn relatively complex operating procedures for using an adapted Web browser and retrieving information from Websites. Expressive use of symbols would be more relevant in interactive Web-based tasks, such as e-shopping, and this should be further developed in the WWAAC software.

e) Limited expressive ability and in addition having learning difficulties. It is for this group that the added value of summaries and language simplification become so important and overlaps with other end user groups, such as pupils or adults with learning difficulties.

2) Adults and elderly people with acquired communication disorders brought on by accident or stroke. Aphasia would be the most common problem, making the reading of on-screen text difficult. Whilst other disabilities might also be present, this group would be characterised by having fairly limited and specific disabilities in relation to text usage, and could therefore benefit considerably from simplified WWW sites and synthetic speech output.

Whilst many of the requirements for these groups of potential users are similar, there are also some potential conflicts in requirements making one optimal design for all potential users impossible. For example, some symbol users clearly have very different needs from the other groups in relation to translation and presentation of information in a visual form. In addition, those with specific acquired disabilities will differ considerably from those with congenital disorders who are probably also more likely to have multiple

disabilities. There will also be a worse case scenario for each category of user where Web accessibility will not be considered relevant; however, the project can still aim for optimal accessibility for a greater number of people.

A significant number of guidelines for general accessibility exist and cover visual impairment and motor impairment in some depth. Ensuring accessibility by specialist AAC devices needs more work, but has been addressed to some extent in existing literature. Likewise, guidance for developing synthetic speech reading of WWW sites could also be extended to support those with communication difficulties rather than assuming screen readers are only being used to support those with visual impairment. Furthermore, support for people with communication difficulties can learn from the needs of people from other user groups, e.g., people with learning disabilities such as dyslexia, who are likely to have reading difficulties and poor short-term memory. Therefore, guidance for designing content to help overcome some of these difficulties is also included in this document as relevant to our users.

Users in the WWAAC project have all or any of physical, sensory, cognitive and linguistic difficulties and it is difficult to separate specific guidelines for specific areas of difficulty. However, the separation can serve to emphasise a particular focus, even though the guidelines will overlap to a certain extent. In terms of physical and sensory issues, it is clear that the needs of those with visual impairments are covered well by the W3C–WAI. It is necessary to consider the needs of switch users as the most extreme case, and these have also been covered to some extent by the WAI. In terms of cognitive issues, WCAG 2.0 is making greater progress, but more work is needed in many areas, for example, with regard to reducing the complexity of the content and providing advice for text summaries. Closely linked to cognitive issues are linguistic issues, and in fact the separation of the two may be a false one. Here it is necessary to consider the needs of non-reading symbol users as the most extreme case. Therefore, text summaries and keyword symbol transformation are particularly important. It must be stressed, however, that symbol support could also be provided to facilitate Web access for a range of other users, including for example, people with aphasia, people with learning difficulties, and elderly, novice users of the Internet.

Therefore, from the perspective of the WWAAC project and its intended user base, the critical dimensions to consider, and refine where appropriate, in the development of WWW design guidelines are (these dimensions have been revised since the first version of Internal Deliverable i6, following discussions within the consortium):

Guidelines for the development of general-purpose sites

a) General issues

- Coding guidelines
- Layout guidelines

b) Physical and sensory issues (access and navigation)

- Coding guidelines
- Layout guidelines

c) Cognitive and linguistic issues (information presentation and transformation)

- Coding guidelines
- Layout guidelines

Guidelines for those developing sites specifically for AAC users

a) Physical and sensory issues (access and navigation)

- Coding guidelines
- Layout guidelines

b) Cognitive and linguistic issues (information presentation and transformation)

- Coding guidelines
- Layout guidelines

Guidelines for those developing adapted browsers for AAC users

a) Physical and sensory issues (access and navigation)

- Coding guidelines
- Layout guidelines

b) Cognitive and linguistic issues (information presentation and transformation)

- Coding guidelines
- Layout guidelines

Recommendations for accessible design can be described as either relevant to coding (elements in the HTML, e.g. alt text, scripting, flash, frames, etc.) or layout (elements of design, e.g. colour, size, page layout, navigation, etc.), and the guidelines have been grouped accordingly. Please note that the guidelines described below and the needs of specific user groups will overlap, either between guidelines for Web pages/Browsers or guidelines relevant to Coding/Layout. If there is such overlap, the guideline has been repeated under each heading. The categories are meant simply to illustrate, with key examples, the focus that such guidelines can take, as well as to help identify gaps in existing guidelines where further research questions may need to be answered now or in the future. In addition, the categories can serve as a conformance checklist for the WWAAC software, as well as for the WAI in

ensuring that the needs of a wider range of users are specifically included in the Web Content Accessibility Guidelines.

It should be appreciated that the Internet is an emerging technology and specific guidelines will therefore change as the technology develops. Since WCAG 2.0 aims to make itself more easily applicable to a wide range of Web-based languages, emphasis will therefore not be placed on making a statement on the preferred technology for developing Web pages. However, the guidelines from WCAG 1.0 listed in this document relate specifically to HTML 4.1, rather than XHTML, as HTML is still the most common mark-up language for WWW sites. In the future, it may be that these guidelines will either need to be refined and revised to take into account the differences between HTML and XHTML, or they will need to be revised to those in WCAG 2.0 as this further develops from its working draft status.

The following guidelines have been extracted from the sources listed in the references section, and also extrapolated from the exemplars of good design described in Appendix 1. Comments have been provided where there is a particular need for further investigation or to refine or extend existing guidelines, some of which will be picked up within this Deliverable in making more specific recommendations to the WAI.

3. Guidelines for the development of general-purpose sites

Many of the general guidelines that the W3C have documented for improving the accessibility of WWW sites are valid for supporting those with communication problems. However there is a difference in emphasis, as current accessibility guidelines focus primarily in providing access to the visually impaired, for example giving text alternatives to images. Conversely for access to Web sites to be fully facilitated for symbol users, symbol alternatives to all text would need to be provided, which is clearly an onerous task for any Web site developer.

However much can be achieved without having to resort to such an extreme—fortunately many of the general recommendations for improving accessibility are also valid in providing some support for those with communication difficulties, particularly when the broader issues of usability are taken into consideration as well.

3.1 General issues

3.1.1 Coding

- Ensure that any Web page images have ALT tags.
- Avoid using graphics for text, as users will not be able to change the text and background colours when text is presented in this way.
- Ensure pages are clearly structured within the HTML, i.e. use of titles and headings for pages.
- Provide text summaries of complex charts and tables. The LONGDESC attribute can be used to provide this within the HTML page.
- Provide metadata to add semantic information to pages and sites. More detail is needed on how this information can better meet the needs of all users.
- Frames create some problems for access and so when in doubt implement a no-frame version of the site using the NOFRAME option. Having more than two frames on display at any one time should also be avoided.
- Ensure that core functionality does not depend on Javascript, Shockwave, Flash or other extensions or plug-ins. Where such functionality is provided it is important that it can be accessed via the keyboard. It may also be useful to use NOSCRIPT to direct the user to either an alternative version of the site or instructions on how to access the information in another way.

- Where extensions are used, ensure that they are also accessible from keyboard options, e.g. where mouse rollover effects are used make sure they can be accessed via the tab key and enter function.

3.1.2 Layout

- Carefully plan the layout of the home page so that it is immediately obvious what service or information is being provided. Aim to make the subject of the material clear at a glance, even to a non-reader. Place images next to, and not as a background to, the relevant words.

- Use a consistent screen layout. Always put on-screen controls and displays in the same places on different screens. Also ensure that any controls operate in a consistent manner.

- Ensure large text is available and used where possible. Set defaults to include 14 point font text size as a minimum. However, refer to font size within documents in relative rather than absolute terms. Even though some browsers can override styles, the use of cascading style sheets is recommended to allow different styles to be set up for whole Web sites easily.

- Ensure pages can be viewed on a display set to 800 x 600 resolution if necessary. Some users may be using older computers with relatively small displays and other users may require larger fonts. This resolution may therefore be set up as default on many machines being used.

- Use simple to read fonts. Where small fonts are used sans serif are easier to read, but otherwise just use common fonts such as Arial or Times New Roman. Avoid block capitals, italics or underlining as these are harder to read.

- Keep lines left justified with a ragged right edge.

- Avoid background graphics as they can make the text difficult to read and limits the ability to change the font characteristics and background colour.

- Allow presentation aspects to be configured using cascading style sheets. Type, size and colour of fonts and background should be easily configurable, as there is no one ‘best’ combination of text, font size and background colours. In addition image positioning and text highlighting can also be set up using style sheets.

- Use top loading of content, i.e. provide a summary of the Web page at its beginning.

- Provide text summaries of complex charts and tables. The LONGDESC attribute can be used to provide this within the HTML page.

- Ensure that there is a site map, and ideally indicate the user's current location on that map. This will facilitate navigation for all categories of users.

- Use frames with caution, and ensure they are clearly labelled with meaningful headings. This is particularly important to facilitate access by screen reading software as the frame heading will provide context information for the user.

- Ensure that only one active window is open at any one time. Avoid implementing links that open new windows and keep the old one running in the background, as this can make navigation difficult due to users being unable to use all browser functions (i.e. back function) in the new window.

- Ensure all messages and instructions stay on the screen until no longer needed.

- Avoid the use of scrolling windows where possible. It is better to use internal links within a page rather than demanding users operate a scroll bar. Scroll bars add an extra layer of complexity to reading Web pages and horizontal scroll bars should be particularly avoided. Where scrolling is implemented it should be possible to also access this using the arrow keys and page up/page down on the keyboard.

- Optimise pages for fast loading. Avoid having a number of large images on each page. Use thumbnail images to minimise download times, allowing a larger version of the image to be subsequently selected.

- Where possible, design Web pages which can be downloaded and read off-line.

3.2 Physical and sensory issues (access and navigation)

The general advice included in section 3.1 is appropriate for supporting less disabled users with minor to moderate physical or sensory impairments. The following guidelines are targeted at supporting those with more severe difficulties, in particular switch users and also those people using screen reading software. Very few of the target users of WWAAC software are likely to be severely visually impaired (i.e., registered blind), but many of the principles appropriate for supporting screen reading software also have value in supporting AAC users, as well as other disability groups. Furthermore, people with severe hearing impairment are seen as being a relatively low priority for the WWAAC project; however, a selection of guidelines are included for completeness.

3.2.1 Coding

- Provide keyboard support for all functions. Avoid reliance on point and select input devices such as a mouse. This should also include supporting

keyboard shortcuts and the setting up of hot keys. Also consider supporting limited functionality of the application with a maximum of four keys. Note that the space, enter, up arrow and left arrow are common keys used by some accessibility software and hardware, and these require compatibility with serial keys.

- It is understood that the serial port does not have any long-term future as the preferred way of connecting AAC devices. Advice may be needed on other ways of connecting peripherals to computers, e.g. Firewire and USB ports.

- Set up the preferred tabbing order of table elements for Web pages using the TABINDEX function.

- Consider setting up keyboard shortcuts on Web pages using the ACCESSKEY function.

- Make sure that the language used on the page and any changes in language are clearly marked using the LANG attribute.

- Summarise graphs and charts with the LONGDESC attribute

- Ensure that abbreviations and acronyms are explained using the ACRONYM and ABBR attributes. Also use BLOCKQUOTE to provide references to quotations.

- Ensure that the site's core functionality does not rely on plug-ins or add-ons that a screen reader may not be able to handle. These include embedded code such as Javascript and plug-ins like Shockwave and Flash. Where such functionality is provided it is important that it can be accessed via the keyboard. It may also be useful to use NOSCRIPT to direct the user to either an alternative version of the site or instructions on how to access the information in another way.

- Consider having a description attribute in the <embed> and <bgsound> tags so that people with severe hearing impairment can find out about any background sound used on a Web page.

3.2.2 Layout

- Provide content that, when presented to the user, conveys essentially the same function or purpose as auditory or visual content. Aural information should be synchronised with visual information. Added visuals should not be distractive.

- Ensure that on screen buttons are large, i.e. 2 cm or more and well highlighted. Simple background images will also make the highlighted targets easier to identify. Larger targets are also easier to see for those

with some degree of visual impairment, and it is believed that many AAC users may also have undiagnosed visual problems.

- Limit the number of links on any single Web page. Providing large numbers of links will make input by scanning techniques time consuming and difficult, as well as making use with screen readers harder. For spoken menus, five or six options is probably about the limit. Also fewer options are likely to be preferable for those with learning difficulties.

- Make sure all links have meaning when taken out of context, and that they contain enough information about their destination and do not just say 'click here.'

- Ensure any embedded audio used on the page can also be switched off.

- Ensure text being read by screen reading software can be highlighted on screen and the two are synchronised. Characteristics of the synthetic voice, i.e. speed and pitch, should also be adjustable.

- Provide the facility to use different voices within a Web page. This can be used to indicate text versus links or commands.

- Test that the page can be read easily by a screen reader, paying particular attention to tables. Can the page be read a line at a time, and still make sense? Make sure that tables are summarised. Provide headings, captions and summary for any tables used. Avoid complex tables.

- Consider other forms of representation and techniques to convey the same information present in the auditory form.

- All auditory cues (such as ear-cons) and instructions should also be provided in a visual form.

- Any distinction in the level of priority given to a cue or instruction should also be conveyed in visual form.

- All cues and instructions should be clear and concise, and placed in the same location.

- Any message conveyed by a cue or instruction should only be removed when the user is ready.

3.3 Cognitive and linguistic issues (information presentation and transformation)

It is not within the remit of this project to investigate in any great detail specific guidelines for accessibility by people with learning disabilities. However, given the importance and relevance of general language and layout simplification

issues for people with cognitive, linguistic and communication difficulties, guidelines should also be supplemented with recommendations from other user groups. Guidelines aimed at easier access by people with learning disabilities and in particular people with dyslexia have been chosen to supplement this section, specifically from Mencap and the British Dyslexia Association (BDA). In meeting the needs of this specific user group, it is expected that other users will benefit, for example, those who require or prefer a simpler site for whatever reason (e.g. poor vision, foreign language, or other handicapping situations). However, such guidelines sometimes demonstrate the conflicting requirements of different user groups, and question whether there is a need for a more accessible site for some users, rather than one site for all. Such conflicts require further investigation in order to try to answer this question (see Section 6.2).

3.3.1 Coding

- Where possible, allow text fields to be checked for spelling and grammar.

- When displayed text is being read by screen reading software, provide options to 'grey-out' the text or have the text highlighted as each word is spoken.

- Ensure that text descriptive captions for all images, audio files and videos are clear and concise.

3.3.2 Layout

- Ensure that a limited amount of text is displayed on screen (i.e., avoid cluttered screens) and that the language used is simple and the sentences are short. A measure of text complexity needs to be sensitive enough to be used with a range of ability. Currently text complexity measures are crude, based on sentence length and number of syllables making up the words used. (See for example Appendix 2.)

- Use sans serif fonts such as Arial or Comic Sans. Other alternatives include Verdana, Helvetica, Tahoma, Trebuchet and Sassoon.

- Don't use jargon, unnecessary technical detail or abbreviations. Often terms and long words are introduced which if not known by individuals who have learning disabilities can cause uncertainly and anxiety for them. If difficult words need to be used, then include a glossary, dictionary, or list of useful words to explain them. Ensure the Glossary can also be read by screen reading software.

- Use simple punctuation. Avoid semicolons (;), colons (:), hyphens (-), or sentences broken up with too many commas.

- Use active and personal language.

- Use short phrases and sentences using words that are in common usage. (Consider Voice of America Special English at http://www.voanews.com/specialenglish/, or the Plain English Campaign at www.plainenglish.co.uk). Use active verbs and keep your sentence length down to an average of 15 to 20 words).

- Consider presenting simple summaries of pages that can then be accessed in more depth by appropriate links if required. Note—this may also make access by screen reading software easier as well.

- Present text in a single column leaving plenty of space for borders. Text presented in multiple column form is harder to read and will also create some problems for screen reading software as well.

- Avoid the use of embedded links within text. Use bullets or numbered lists instead. Place links at the end of each section and not within the body of the contents.

- Limit the number of links on one page (a maximum number would need to be investigated)

- Limit the number of on-screen controls (it may be better to have a set-up screen rather than keeping rarely used controls active at all times).

- Minimise the use of animated banners and other dynamic images, or at least ensure they can be switched off easily. A person who has difficulty reading screens may be distracted by animation and flashing images.

- Use coloured background colours instead of white. Pale colours such as pale yellow is a good default background colour. However, allow individuals to choose their own background, as some people find certain colours reduce glare more than others. (See http://ddig.lboro.ac.uk to illustrate a simple palette for choosing background colours).

- Consider using different background colours to differentiate between different pages. Note—we should not rely on colour coding as the sole way of imparting information.

- Consider using distinct borders to delineate between text and graphics areas on screen. Use boxes for emphasis or to highlight important text.

- Limit the length of lines to 60 to 70 characters. Short lines containing hyphens should also be avoided. Use wide margins and line spacing between paragraphs to break up text. Line spacing of 1.5 or 2.0 is recommended. Also avoid dense blocks of text by using short paragraphs.

- Use bold to highlight, as italics or underlining can make words run together. (Note that this guideline from BDA indicates that underlining links could cause difficulty. See also dashed line beneath links on AbilityNet Web site at www.abilitynet.org.uk to help overcome this problem).

4. Guidelines for those developing sites specifically for AAC users

Currently there is little information on this topic, and more specific guidance in this area needs to be developed by the WWAAC consortium. Some of the issues we need to address include:

4.1 Physical and sensory issues (access and navigation)

4.1.1 Coding

No further coding guidelines, in addition to those listed above, are considered necessary here.

4.1.2 Layout

- Make it easy for the user to identify what the site is about.
- Ensure that key information and images are highlighted, but how and for which categories needs to be investigated.
- Access to both content and to links needs to be more efficient and less tiring for switch users, and mechanisms other than scanning through unwanted text and links needs to be provided.

4.2 Cognitive and linguistic issues (information presentation and transformation)

4.2.1 Coding

- Ensure that documents are clear and simple enough for this user group.
- A symbol vocabulary is needed that could be used on Web pages for a given symbol set user, especially to be used in the automatic conversion of text summaries of Web pages, rather than translation of the entire Web page.
- A symbol set for browser and within page navigation may also be needed. This may need the development of new symbols.
- Ideally the symbol set used by a particular user should be stored on the user's own machine and reused when needed rather than images having to be downloaded from a Web site. This makes symbol concept coding an important aspect of the project.

- Allowing concept coding to be tagged within the HTML is likely to be essential in any automatic symbol conversion process for symbol users. (This would be in the user' browser settings, so that the browser will embellish the page if setting is 'on' but if the setting is 'off' for the non-AAC user, then text only will appear.)

- We may need a new 'SYMBOL' tag that informs the reader that the site they are accessing is a symbol-enabled WWW page and therefore should be presented as it is to a symbol user without any intelligent filtering of content by an adapted Web browser.

4.2.2 Layout

- More work is needed on general language guidance, in particular, looking at measures of text complexity, and how this guidance can be usefully provided to Web developers.

- Consider the needs of non-reading symbol users and how a text précis can best be provided so that it can effectively be transformed into the user's own symbol set.

- The most appropriate level of text summary needs to be investigated, i.e., for a whole site and/or for each page.

5. Guidelines for those developing adapted browsers for AAC users

In addition to careful design of Web pages, accessibility could also be improved by enhancing the accessibility of browser software. The majority of these recommendations come from Kasday, 2001:

5.1 Physical and sensory issues (access and navigation)

5.1.1 Coding

- Provide an option to increase the size of small images used in links.
- Allow users to tab through selection items (supported in Internet Explorer but not Netscape 4.73). Note tab support is also needed for radio buttons.
- Provide an option to increase the size of checkboxes and radio buttons
- Provide mouse utilities such as “SnapTo” and “SmartSpeed” that work on browsers.
- Provide an option to stop or slow moving images.
- Allow users to tab to elements containing mouseovers, and provide a keyboard equivalent for its activation.
- Allow keyboard shortcuts to be set up for on-screen objects (commands). This can be used to reduce the need for large numbers of tab operations.
- Provide an option to highlight selected links. Currently this is only supported in Opera. Note—Internet Explorer allows a style sheet to be set up allowing this function for keyboard users, but the visibility is very poor. Being able to set up accessibility style sheets for a given user may also be a useful browser function.
- Make it easier for frames to be resized by giving them thick borders or a “handle” to make them easier to grab.
- Provide keyboard support for all functions. Avoid reliance on point and select input devices such as a mouse. This should also include supporting keyboard shortcuts and the setting up of hot keys. Also consider supporting limited functionality of the application with a maximum of four keys. Note that space, enter, up arrow and left arrow are common default keys used by some accessibility software and hardware.
- Set up the preferred tabbing order of table elements for Web pages using the TABINDEX function.

- Ensure that the voice output can be easily interrupted to move onto the next chunk of information or to go back to the beginning of the existing chunk of information. Simple commands are also needed to repeat messages where necessary.

5.1.2 Layout

- Ensure large text is available and used where possible. Set defaults to include 14 point font text size as a minimum. However, to refer to font size within documents in relative rather than absolute terms. The use of cascading style sheets is also recommended to allow different styles to be set up for whole Web sites easily. However, it must be remembered that Browsers can overwrite styles.

- Use a consistent screen layout. Always put on-screen controls and displays in the same places on different screens. Also ensure that any controls operate in a consistent manner.

- Where icons are used for navigation and control purposes, it is recommended that mixed text and images be used rather than text or images alone.

- Ensure that only one active browser window is open at any one time. Avoid implementing links that open new windows and keep the old one running in the background, as this can make navigation difficult due to users being unable to use all browser functions (i.e. back function) in the new window.

- Provide an easy facility to close pop-up windows, in particular for non-mouse users.

- Ensure that on screen buttons are large, i.e. 2 cm or more. Larger targets are generally easier to hit with a mouse or joystick input device and also easier to see for those with some degree of visual impairment.

- Limit the number of links on any single Web page. Providing large numbers of links will make input by scanning techniques time consuming and difficult, as well as making use with screen readers harder. For spoken menus, five or six options is probably about the limit. Also fewer options are likely to be preferable for those with learning difficulties.

- Test that the page can be read easily by a screen reader, paying particular attention to tables.

5.2 Cognitive and linguistic issues (information presentation and transformation)

5.2.1 Coding

- Provide an option to stop or slow moving images

- Ensure that the voice output can be easily interrupted to move onto the next chunk of information or to go back to the beginning of the existing chunk of information. Simple commands are also needed to repeat messages where necessary.

5.2.2 Layout

- Use a consistent screen layout. Always put on-screen controls and displays in the same places on different screens. Also ensure that any controls operate in a consistent manner.

- Where icons are used for navigation and control purposes, it is recommended that mixed text and images be used rather than text or images alone.

- A limited number of links, fewer than that for other users, is preferable for people with learning difficulties.

6. Issues in developing new guidelines

Before proposing success criteria, examples and strategies for specific guidelines in the Web Content Accessibility Guidelines (WCAG 2.0), a number of issues were discussed with experts within and outside the consortium. In addition to the WWAAC project's user requirements and evaluation work, discussions on these issues have helped to form a basis for guideline development.

The participants in the discussions included representatives from industry and user organisations attending the WWAAC project's Concept Coding Workshop held in Oxford, February 2004. In addition, a 'quick and dirty' survey was held at a workshop at the 2nd Cambridge Workshop on Universal Access and Assistive Technology (CWUAAT), Fitzwilliam College, University of Cambridge, 22nd-24th March, 2004. Following a presentation on guidelines for an AAC-enabled Internet (Nicolle et al, 2004), a discussion ensued, followed by a questionnaire completed by 15 participants. Not all the respondents included their name or organisation, but their skills and expertise ranged from computer scientists, designers, engineers, industrial representatives, ergonomists and sociologists. With varying levels of expertise with AAC and Web accessibility, their opinions or comments have been included below where appropriate (full details in Appendix 5). It is interesting to note that in most cases replies on various issues were mixed and did not relate to the level of expertise in AAC or Web accessibility of the respondents. Not all of the issues below have resulted in specific recommendations but are included here to contribute to the debate.

6.1 Alternative Sites

There is difference of opinion as to whether there should be one site for all users, or two sites including an alternative, e.g. text-only, flashless, etc., site. Arguments in favour of having one, accessible site claim that one site eliminates the need to synchronise and maintain multiple versions of the content, thus reducing costs and effort. Inevitably the 'secondary', accessible site may become out of date, with the main site being updated on a regular basis. Thus, those whose only access to the information via the more accessible site would end up suffering separate and unequal treatment (Sherman and Protas, 2003).

The Royal National Institute for the Blind emphasises that a text-only site can be a real problem for people with reading or cognitive problems, and even partially sighted users can benefit from a visually appealing site with both text and graphics. They also point out that a text-only site which hasn't been updated for 6 months might be accessible for some users, but not be much use to anyone (Accessible information, Frequently asked questions, www.rnib.co.uk). On the other hand, Mencap's Web site for people with learning disabilities (www.mencap.org.uk) uses a lot of graphics and tables to help its target audience, and so they justify developing a separate site with the

same content using text only for people with sight problems. Experts have also suggested that the crucial parts of a site could be marked to make it easier to create and update a simplified version.

According to WCAG 1.0, Guideline 11, an alternative text-version of the content is allowed only "when other solutions fail because alternative pages are generally updated less often than 'primary' pages" (WCAG 1.0). However, according to an editorial note in WCAG 2.0 Guideline 3.1 (1 March 2004), this advice seems to no longer exist in WCAG 2.0.

Text-only versions of Web sites, especially if produced automatically, may not comply with the WCAG and therefore they may not meet all users' needs, for example those of people with visual impairments. It is important that the aims of an alternative version of the site are made clear, and the sites must be tested to make sure that they are achieving those aims (Office of the E-envoy, 2003).

The identification and consideration of contradictory accessibility guidelines have as far as we can determine not been adequately addressed. From a Web designer's perspective this is particularly important when deciding whether to design a single inclusive Web site or one which contains material specifically designed for a particular type of user. In fact, if we follow the path of having alternative sites, this could potentially mean having several sites, and not just 2, to accommodate the needs of specific user groups! It is felt that none of the existing standards identify or consider such important factors.

Specific contexts of use and application areas also need to be considered. Simplified versions of Web sites already have to be developed for use with, e.g., wireless application protocol, or WAP. The WAP example emphasises why alternatives are accessible, even desirable, for some end-users and some contexts. However, further research is still needed in order to best cater for different user groups, but still providing flexibility for individual choice and preferences.

According to the mini-survey conducted at CWUAAT (Appendix 5), opinion was varied as to whether there should be one or two sites. When participants at the CWUAAT workshop were asked if there should be both an original site plus a text only/flashless, etc., site, or if there should be a single site more accessible to all, the replies were as follows:

9/15 respondents said there should be only 1 site.
6/15 respondents said there should be 2 sites.
1/15 respondent preferred 2 sites, but suggested 1 if possible.

It was noted that a 'design for all' solution is not really possible, even if a 'design for many' is. Considering the context of use and specific application areas, it was pointed out that 2 sites are also useful for people on dial-up. It was also suggested that 2 sites may be needed initially, moving to one site in the future. This, for example, is the case with the UK's Tesco grocery chain. At the moment, there is an alternative on-line 'Access site' at

www.tesco.com/access/, but it is understood that they are moving towards one site for all in the future (Howell, 2004).

It would appear that, ideally, there should be one accessible site. However, if there is a second site, it must be updated as often as the original site. It is also suggested that a standard mechanism be employed to tell the user that there is a more accessible version of the Web site. Techniques suggested in WCAG 1.0 are (see 4.3 in Appendix 1):

- Provide links at the top of both the main and alternative pages to allow a user to move back and forth between them, and
- Use meta information to designate alternative documents, so that the alternative page can be automatically loaded based on the user's browser type and preferences.

Our survey identified other suggestions for standardising the link to alternative pages, for example, providing a meaningful image or having a single opening page with the two options (combined with automatic browser capability detection). All the various options (Appendix 5) still need to be discussed further, but would provide some possibilities for WAI to consider.

6.2 Conflicting Needs

It is clear from the research of the WWAAC project that whilst there is limited and fragmented advice currently available, there is no comprehensive source of information about the design of Web pages for people with learning or communication difficulties, and even less information on designing sites to facilitate access by symbol users. Current guidelines in this area are primarily focused towards the simplification of text content, supplementing text with images and providing the opportunity for speech synthesis of text content.

In addition, research on the design and functionality of browser software is also important to recognise. Whilst it will not be possible to provide general guidelines that encompass all disability groups in the most optimal way, it is a desirable objective to try and maximise the numbers and range of users that can access Web sites developed for use by the general public. The developers of the AVANTI Web Browser (at present a lab-tested system only, with no open field trials) are exploring ways of providing more adaptable and usable interaction for people who are able-bodied, blind and motor-impaired. AVANTI's Unified User Interfaces enables *adaptability* at the start of each interaction session, according to the user's abilities, expertise and usage characteristics, things which are assumed to remain unchanged during that session. It also employs *adaptivity* techniques which will dynamically select and modify aspects of the user interface according to interaction events detected at run-time, e.g. if the user has a high error rate (Stephanidis *et al.,* 2001). The EU IST IPCA project (www.ipca.info/desc) is also working on a smart Web browser to facilitate interaction with Internet services by people with severe motor and speech disabilities. The project will not be developing a new browser, but will extend functionalities of Open Source browsers in order

to allow the user a faster, customisable and smart interaction with Web-based applications.

The diverse needs of different disability groups make it difficult to produce general recommendations for Web site design, as the needs of one disability group may conflict with the needs of another. For example, a site that uses a high degree of visual imagery in its content is less appropriate for a person with a severe visual impairment, whilst for those with communication problems, sites with a high degree of text content will also be less than optimal. The cognitive and linguistic abilities of users will also be a limiting factor in how much variation can be accommodated in a Web site designed for general access, as the level of content needed for a person with a severe cognitive impairment to understand a Web site could be considered trivial by more able groups. Some of the techniques used to make a site more interesting to those with learning difficulties, such as dynamic images and active mouse rollover effects, could also make a WWW site less accessible to some user groups, particularly if extensions to HTML such as Flash or Shockwave are used. Some access software may also have problems dealing with Javascript, and so this needs to be used with care (that is, it must be possible to access essential functionality without the use of a Javascript-enabled browser).

Providing general guidelines that cover all disability groups is unlikely to be successful, as there will always be some potential for conflict. Currently, accessibility guidelines primarily assume that text is the preferred medium of communication and that the transformation of images and spatially presented information such as frames and tables into a text-readable form is, therefore, of a high priority. The conversion of written text into a spoken form is also seen as a high priority for accessibility, supporting a wide range of disability groups. People with visual impairments benefit considerably from screen reading software, and, in addition, those with communication difficulties are also likely to prefer aural to written forms of communication. However, some users with learning or communication difficulties will also require images or symbols to augment or replace written text. However, many Web pages are currently image intensive, making it difficult for some users to filter relevant from irrelevant information. For a person with communication difficulties this may be as difficult to understand as a text-based site, and assistance is therefore needed to filter salient images from those added purely for visual appeal. Whilst some guidance within existing mark-up languages can be provided, language extensions may also be necessary to fully achieve this objective.

The requirements of people with dyslexia (See Appendix 1, section 6.3) are considered separately from other people with learning disabilities to further demonstrate the difficulties in identifying appropriate guidelines when the needs of certain disability groups conflict. For example, visually impaired people require a high contrast between text and background. This may be different to other user groups such as people with dyslexia, who may experience pattern glare effects as a result of high contrast. Dyslexic people in particular also find text which is underlined difficult to read (although human

factors advice suggests that underlining makes text more difficult to read for everyone). This is in contrast to the convention to use underlined words as a way to show a hypertext link. The convention used by the AbilityNet Web site attempts to overcome this difficulty by using spaced dashes as an underline for links (See www.abilitynet.org.uk and Appendix 1, section 6.3).

In the Disability Rights Commission study (2004), some dyslexic focus group members used speech-based software to listen to Web pages in preference to reading them. During the evaluation of the simulated Web browser (ISAAC Workshop, Odense, 13 August 2002), comments from a user with dyslexia also suggested that the WWAAC browser could be very useful to support people with reading difficulties. Although this particular user could read, he suggested that the speech support could help him improve his reading comprehension and confidence, and also the summary was a useful feature to extract important information like a description of the page and key words. However, some people with dyslexia may find this method of access unhelpful, even though it could be considered to help improve their reading skills.

According to Beacham et al (2003), dyslexic students should be allowed to use active reading and learning strategies while performing particular tasks. The reader needs to be able to concentrate on the meaning of what he or she hears, rather than the word that he or she is seeing. What is seen and what is heard are 2 different tasks to a person with dyslexia, and therefore, the combination of the media (movement of the outline around the text and the spoken word) is unhelpful and could distract the reader from the task at hand, i.e., understanding the content. Ideally, however, the rest of the page could be greyed out when reading a particular paragraph. In contrast, if the task were proofreading, and the task were to read word by word, then the line around the word would be acceptable in order to help focus on the individual word rather than the meaning of the full text. Possibly these issues slightly overemphasise the benefits of adaptive technologies for users with dyslexia, as opposed to simple, well displayed pages. However, they should at least be considered by the User Agent Accessibility Guidelines (http://www.w3.org/TR/UAAG10/).

6.3 Simplicity of Content

Complexity of many Web sites, and the language contained within them, can be a serious barrier to people with language and communication disabilities. However, simplified sites would also help many other people, even for those who have to read, or are not used to reading pages of information from computer screens. As can be seen in Appendix 2, Microsoft Word can display information about the reading level of a document, basing its readability scores on the average number of syllables per word and words per sentence.

Flesch Reading Ease score
Rates text on a 100-point scale; the higher the score, the easier it is to understand the document. For most standard documents, aim for a score of approximately 60 to 70. However, a score of approximately 70

to 80 is recommended for people with dyslexia, and this could probably also be applied to other user groups with communication or learning disabilities (British Dyslexia Association).

Flesch-Kincaid Grade Level score

Rates text on a U.S. grade-school level. For example, a score of 8.0 means that an eighth grader (13 year old) can understand the document. For most standard documents, aim for a score of approximately 7.0 to 8.0. However, a score of approximately 5.0 is recommended for people with dyslexia (British Dyslexia Association) This means that by using short sentences, and not by dumbing down vocabulary, a fifth grader, i.e., a Year 6, average 10 year old, can understand the document.

These scores emphasise the particular needs of certain individuals, and can provide guidance to the Web and content developer to make the text more readable for more people. In addition to the recommendations above, the British Dyslexia Association also provides other advice for calculating the readability of text. They suggest a simple method called the Five Finger Test which we could equally apply to the content of Web sites. Text in italics below has been added by WWAAC to the original wording from the British Dyslexia Association in order to focus on Web-based content:

- Choose a book *(or Web site)* you like
- Open it in the middle (*or go deeper into the Web site, away from the home page)*
- Try to find a page without pictures.
- Start reading at the top. Go on until you reach a word you do not know.
- Put your little finger on it.
- Continue reading. Put a finger on each word you do not know.
- If you run out of fingers before you get to the bottom of the page, the book (*Web page)* is probably too difficult for independent reading.

If Web pages were able to offer this strategy as a feature, it may help dyslexics, and other user groups, decide whether the Web site is suitable for them. Web developers could insert a tag indicating that the page is 'plain language' (www.plainenglish.co.uk) or 'special English' (http://www.voanews.com/specialenglish/), or possibly indicating a language level, so that Web browsers could act upon this information based upon the user's needs and preferences. In any case, plain language should be used for any summaries of content, which would make it more accessible not only to those using symbol and screen readers, but also to everyone else. Ideally, a Web authoring tool, as that developed in the WWAAC project, could prompt the Web developer to change words that are not in simple language, possibly by offering alternative words like a thesaurus (following whatever lexicon is decided upon). Ideally, it could also prompt the Web developer to change the structure (such as recommending active voice, maximum length of noun phrases, maximum number of sentences in paragraphs, etc.).

6.4 Summaries of Content

Research has shown that reading from a computer screen is about 25% slower than reading from paper-based copy. However, Nielsen (2000) recommends that 50% less, not just 25%, should be written when writing for the Web, since it is not just how fast the text can be read, but 'a matter of feeling good.' This requirement to write less for the Web also enforces good discipline on the writer to convey information in a concise, readable form.

Nielsen (2000) also suggests that some form of a page abstract is necessary because the page titles on their own do not provide enough information about the content. He recommends, however, that page abstracts be kept short, since search engines will display only the first 150-200 characters of the descriptive text, and in any event, users are likely to only the scan the text rather than reading it in full. In fact, one of his studies found that 79% of users always scanned any new page, rather than reading every word. Two to three levels of meaningful headings, as well as bulleted lists, and ways of highlighting key points for emphasis will facilitate such scanning of text. He points out that 'modern life is hectic and people simply don't have time to work too hard for their information.' This makes the summaries and/or abstracts of content an appealing option for many people when confronted with long pages of text. The Office of the E-envoy (2003), quoting from Nielsen, state that content should ideally be displayed in 3 levels: a short, scannable headline, an intermediate précis, and the full document. This, along with clear, well structured headings, enables users to orientate themselves to what is on the site quickly and efficiently.

BrookesTalk, a Web browser for blind and visually impaired users (www.brookes.ac.uk/speech/) provides an interesting example in the use of both summaries and abstracts. A page summary is provided consisting of the number of words, headings, links, images and keywords found on a page. This allows people with visual impairments to understand the structure of the page they are visiting. In addition, BrookesTalk provides an abstract, which is a collection of significant sentences drawn from the page. This is done by extracting the key phrases consisting of 3 words (tri-grams) from the contents of the page. These are then put back into the sentences in which they were found and these sentences are then presented as the abstract of the page, amounting to about 25% of the total number of words on the page. Such an abstract enables the user to 'scan' the page with the screen reader, and the full detail can be read out later if required (Zajicek and Venetsanopoulis, 2000). The 2 facilities aimed to meet different needs: users found the summary more useful for Web surfing, and the abstract more appropriate for accessing specific information (Zajicek, personal communication).

Zajicek and Morrissey (2001) report that their design for BrookesTalk was informed by experiments with sighted users which showed that in assessing the usefulness of a Web page, they looked first at images, then links, and then headings. This suggests that summaries should also include at least the most representative image.

Foulds and Comacho (2003) emphasise the benefits of text summaries for people who are blind, deaf or dyslexic as an alternative method of skimming large sections of text. They suggest that the use of computer-generated text summaries is recognised as an efficient method of extracting the main themes in a document, especially where there are no abstracts, indexes, table of contents, or tagged headings within the text. Of course, consideration must be given to the type of Web page that needs summarising. Some pages will be easier to summarise than others, for example a news page could be summarised, but a shopping page with items for sale may be harder to summarise.

Nielsen (2000) prefers to see the abstract written by the authors themselves, as humans are still better than computers at writing what the page is really about. The page abstract would be contained in a meta tag with the name 'description' in the page header. If this guidance were made more explicit in the guidelines, the description would be more useful and *used* to meet the need of more users.

6.4.1 Summary of Page or Site

Finally, it needs to be decided whether the summary should be of the whole site, the page, or parts of a page. In our quick survey, participants were asked at what level they thought the summary should be: 6 experts said that the summary should be at the page level, and 3 said at the site level. 5 experts said the summary should be at the site *and* page level, with one of those saying 'as appropriate.'

From this diverse opinion, the WWAAC project would recommend that the Home Page of the Web site gives a summary of the whole site, and the other pages give a summary of each individual page.

6.4.2 What the user sees

Various methods for navigating to a summary, or other Alternative Representation of the content, need to be further investigated, but the illustration in Appendix 4 provides an example as to what the user could actually see. The Alt-Representation in this example is a simple summary of the content on the Web page, which can be embellished with symbols (in this case either Rebus or PCS) to meet the needs of specific AAC users. In preparing the summary of the content in this example, certain strategies for reducing the complexity of the text were followed, e.g.

- Using the Voice of America word list to the greatest extent possible (http://www.voanews.com/specialenglish/) — Voice of America was meant to be just an example of simple English, and the intention was not to recommend it as the best example for the European cultural and

contextual setting. Note, however, that flexibility is needed in using such a word list, as proper nouns and terminology specific to the application area, e.g. BBC and workshop, could not easily be avoided. These could be made more accessible by providing a glossary or defining terms within the text. Alternatively, users have suggested the possibility of selecting and right-clicking on an acronym or technical term to see or hear a definition.

- Using short, simple sentences, and active rather than passive verbs.

A Web authoring tool could encourage and enable this process. As noted in Section 6.3, a Web authoring tool could prompt the Web developer to change words that are not in simple language, as well as provide a prompt to create a simple summary of the whole site, the page's content, or part of a page, by means of 'in-page annotation'. This would also be supplemented by symbol support, if the Web page is concept coding aware, as already implemented by the WWAAC project's Web Authoring Tool. The summary could be displayed as either a pop-up window, preferably with the background page greyed out to minimise distraction, or could take the user to a new page, similar to the summary produced by the WWAAC Browser.

6.5 Top Loading

Since Web users do not read everything they see and tend to scan, Nielsen recommends that a Web page should start with the conclusion. This can be described as an 'inverted pyramid style', ensuring that the 'Who', 'What', 'Where', 'When', and 'Why' of the text appears at the beginning, followed by the other main points. This means that text from the bottom of the page can be cut out, or in effect not read by a screen reader, without the user missing any of the most important points (Office of the E-envoy, 2003).

One idea to consider is to develop Web pages with progressive complexity of content. In order to facilitate access to Web site content, one existing strategy (WCAG 2.0, Guideline 3.1) is that vocabulary should be used that is likely to be familiar to intended readers. Whilst this principle is sound, it does limit the inclusiveness of Web pages to a wider audience, as site complexity relevant for one user group may not be appropriate to another. It is therefore proposed that as a general accessibility principle it may be better to provide a progressive complexity for both site and page content, so that people with different cognitive abilities may be able to obtain information from the same Web site.

This is similar to the established principle of top loading Web page content to ensure that a page's content is summarised at the beginning of a page. However, we believe that this principle could be extended to also cover complexity of Web content, ensuring that the language used within such a summary is as simple as possible, and that complex information such as technical terms, acronyms and abbreviations are only introduced later in a page.

We believe that this would facilitate page navigation with screen readers and also make it easier for a person browsing to get a simple overview of page content. This would also facilitate the use of automatic translation systems to give overviews of content in other languages (including symbol systems). The same principle could of course be applied to the complexity of the entire site's content—The higher-level pages of a site providing a simple overview of the subject matter being addressed, with added complexity and detail being obtained by selecting pages further into the site.

This is supported by Nielsen's suggestion (Nielsen, 2000) that higher level pages should minimise the number of graphics, especially large ones that require long download times. Only when the user has indicated a particular interest in a topic area should more and larger graphics be introduced. This accommodates the need for interesting images on a site, but also gets over the difficulty of long download times until the user makes a definite decision to follow links to more specific pages and thus more and larger images, as well as more detailed and technical content.

6.6 Tagging Images

Dealing with different types of image content in Web sites is particularly critical for users who are not able to deal with large amounts of information. In order to get readers to focus on the essential elements of a Web page, Nielsen (2000) recommends stripping away 'as much of the fluff as possible' (i.e., the ornately embellished graphics that are taking up space but communicating a minimum of information). Tagging the most representative image conforms to Nielsen's comment (2000) that the home page should answer the following questions for the first-time visitor: 'Where am I and what does this site do?'

Currently, there is no convenient way of flagging the importance of a site's images in understanding the content of a site, and all images are treated as being identical. On the other hand, background images, which are embedded differently in HTML, can be differentiated by browsers. With regard to meaningless images, Nielsen (2000) recommends that these should have an empty ALT string, rather than no ALT text at all—using an empty string ("") is a convention to indicate that the image is purely decorative or is not trying to convey any meaningful information. For people with visual impairments, only then will a screen reader know that this image has no meaning and will move on to the next meaningful content. If no such string is present, the screen reader will feel obliged to tell the user that an unknown image is present, because it is impossible to tell if it is important or not, or if the Web developer just forgot to include any description.

This contrasts significantly with the way that text is handled within mark-up languages, allowing titles, headings, and other aspects of text emphasis to be highlighted. Some way of marking those images that are essential to understand the content of a Web site is needed, so that attention can be given to these images in any automatic processing of Web-based information. One

application of this could be to identify the most salient, or useful/informative image on a site's home page, which could in fact be just a stylised brand name or logo. This could then be used in the automatic creation of a thumbnail image representing the site's content for non-text-based browsers. This suggestion in fact came directly from one of the users of the WWAAC prototype browser, who asked that when adding a Web site to his list of favourites, a symbol, logo or thumbnail image be assigned automatically as an alternative presentation to text. Resolution size of the graphic needs to take into account the fact that if it is going to be reduced in size for use on the Favourites page, the higher the screen resolution the smaller any given graphic will be displayed (Nielsen, 2000). Therefore, such a representative image needs to be kept clear and simple.

In our mini-survey, experts were asked what the categories should be in developing a markup language for images, and in an ideal world, what would be the most useful for end users, and especially those with communication needs. More detail can be found in Appendix 5, but some of these responses are listed below:

Background (although these images are embedded differently in HTML, so browsers can differentiate these anyway)
Key content
Illustration / technical
Decorations (also things like bullets in lists)
Advertisements (consider pop-ups)
Transactional, informational, and entertainment.

However, since non-content images (e.g. spacers) are already marked up with the ALT tag, it was suggested that only those images with useful content should be tagged. It was also suggested that a ranking similar to Nielsen's ranking of usability problems in heuristic evaluation could be used:
1 = vital for understanding the content of this page.
2 = important for understanding the content of this page
3 = relatively unimportant for understanding the content of this page.
4 = cosmetic only
5 = third part material, including advertising.

Advertising is an interesting issue. If a commercial company has produced an accessible site, they will, reasonably, want the user to receive their advertisements. However, if future guidelines mean that advertisements will have low prominence, this may discourage industry from producing accessible sites. Experts were asked whether they thought that advertisers would want priority when tagging their images, and if so, should we bother even suggesting this. Opinions vary (See Appendix 5), and comments and suggestions still need to be considered further, but could provide some useful options for WAI to consider.

6.7 Navigation mechanisms

In his section on people with cognitive impairments, Nielsen (2000) recommends the use of site maps to enable people to visualise the structure of the information. He also suggests that these users could be aided further if the browser updated the display of the site map with the navigation path and the location of the current page. In their studies of people with disabilities, including people with learning disabilities, the IRIS Project (Abascal et al., 2003) also emphasises the importance of a site map and suggest 'breadcrumb navigation is a feature frequently utilised that improves usability of the Web site.' Such advice is surely useful for anyone who gets lost in a maze of complicated Web pages. Simple structures such as a 2 or 3 level hierarchy are also easier to understand and navigate. This raises the interesting issue of how best to present a site map or structure to users who are blind and use screen readers.

Another issue to be considered is the order in which content is displayed and the order in which it appears in the source code of the document. Screen readers will follow the order in which the content appears in the source of the (HTML) document, not the order in which it appears on the Web page. And so, for a blind person using a screen reader, the earlier the content appears in the source, the sooner a screen reader will read it to the user, even if that same content is displayed at the bottom of the page. For switch users or others using screen readers, if the source code is not optimal, more could be done to enable them to navigate more easily to or through the content and links on a Web page, for example, by implementing 'skip-to-content' or 'skip to links.'

Appendix 4 provides an illustration of 'skip to content' and summary of the content (also see Section 6.4.2.)

Skip-to-Content

In our mini-survey, experts were asked if they thought it is a good general design principle to have a 'skip to content' link at the top of the page when there are already a number of links there (an example of a site that has implemented the 'skip to content' link is http://accessibility.kde.org). Out of 13 replies, 10 gave a positive response, with some reservations and comments (See Appendix 5).

Experts were also asked if the 'skip to content' link should be transparent. Out of 7 replies: 5 gave a fairly positive response, with some reservations and comments. One respondent said that it was not vital to be transparent, but certainly acceptable, while another respondent said that it should probably be transparent because otherwise there would have to be another link on the page, which increases confusion and difficulty.

A number of suggestions were offered as to how best to navigate to Alternative Content or Representation of the content (e.g., a summary of the content, with symbols if required). Suggestions included that control rest with the user, that style sheets should be used, and also that existing HTML 4 features be used to provide alternative content (ALT, LONGDESC, TITLE). It was also noted that in-page 'transparent,' rather then hidden, content, could

be rendered by any given browser, if well designed and consistent, and also that hidden tags could point to separate pages, on the assumption that alternative pages will be smaller and hence faster to download. It was emphasised, however, that all representations of content should be treated equally, and that the AAC version should not be considered a 'secondary' version.

Skip-to-Links
When experts were asked if they thought it was a good general design principle to have a 'skip to links' link, out of 11 replies, 7 gave a positive response, with some reservations and comments as given in Appendix 5.

Experts were also asked if limiting the number of links on a page, what would be a reasonable number of links to recommend. The replies ranged from 5, 5 +/- 2, 7 +/- 2, ~10, and their comments ranged from 'impossible to determine' to 'it depends, as very many Web pages are far too cluttered.'

It would seem sensible to suggest no more than 10-12 links on a page. If this number were chosen, then they could easily be associated with the numerical or function keys on the keyboard to provide another method of navigating through them.

6.8 Search engines

A search engine is the most common way people arrive at a Web site, followed by arriving at a new site via links within emails (Nielsen, as reported in Office of the E-envoy, 2003). It is therefore important that search engines are not only easy to use in conducting a search, but that the search results are easy to interpret and follow.

Firstly, search engines should ideally provide a spell checker (as many already do and as already suggested by WCAG 1.0 Techniques), whereby any search terms for which no hits were found would offer a list of alternative spellings to repeat the search (e.g., Nielsen, 2000). This would benefit everyone, but especially people with low literacy, people with dyslexia, and of course poor spellers or typists. Nielsen also recommends that a list of keywords be included in a Meta tag in the page header, to be used to determine the relative ranking of the retrieved pages in the search results. He suggests that the keywords should include both simple terms (e.g., 'bus'), as well as compound terms (e.g. 'double-decker bus') in order to accommodate the greatest number of users' search queries.

The IRIS project also make complementary recommendations for accessibility based as a result of their studies with people with disabilities, including people with learning disabilities. They suggest that the search engine must (Abascal et al., 2003):

- Be available and visible on all pages
- Carefully reflect the content and functionality of the site

- Accommodate weak writing skills, be able to overcome any typing or spelling mistakes, and recognise synonyms and different verb or noun forms
- Display the results of the search before any other information such as advertisements or related links), and
- Be able to suggest alternative keywords according to the users' history of search queries.

The IRIS Project also found that the most mentioned issue by all disabled participants in their study was the need for support in navigating a Web site and understanding the information presented. Therefore, it is recommended that the search function should be able to interpret and manage the output for the user by pulling together the information and providing assistance to the user in understanding the structure of the Web site (Abascal, et al., 2003).

Some progress has been made to provide an alternative to text-based Web searching for people who have difficulty with reading and writing. Both the WWAAC Web Browser and AbleLink Technologies' Web Trek Visual Search (www.ablelinktech.com/) provide an easy, picture-based facility to enter a search term in a search engine. The search results, however, even though accessible, often prove daunting to users. More work is needed in designing the output from search engines to be more usable.

7. WWAAC Project Recommendations for WCAG 2.0

Even though some AAC users would benefit from Web sites being developed in symbol form, it is clearly not an efficient use of resources for Web developers creating more general purpose Web sites to invest a considerable amount of effort in translating Web content into symbols. However, it is reasonable to expect that developers follow simple guidelines, restricted to the essential principles, that can make such WWW sites more accessible to a wide range of disability groups, including those using AAC products to communicate. If standards-compliant content is produced by Web developers, then intelligent browsers will be able to render it accessible to users with disabilities. In addition, intelligent Web authoring tools need to be developed to assist the Web developer in reducing the complexity of content so that it will be more understandable by not only users with cognitive and communication difficulties, but also by those who speak a different language.

The user requirements activities and the evaluation of the WWAAC project's adapted Web browser have provided valuable and unique insight into the guidance that is needed by developers to make the Internet simpler to access by people with complex communication and physical needs. Whilst the primary objective of the evaluation activities in the WWAAC project was to further develop the alpha and beta versions of the prototype software, the project has also identified some areas where further general guidelines are needed to ensure that Internet sites can be more accessible for those who use vocabularies of symbols as their primary means of communication, without conflicting with the needs of other disability groups (some of this section first published in Poulson and Nicolle, 2002; 2003 and 2004).

The evaluation results that particularly highlighted the need for new guidelines, or success criteria for existing guidelines, were the following:

- AAC users (and others) need an easy way to add a clear image for a new favourite site.
- AAC users (and other users) need to be spared extraneous information and should be able to filter most important text and images
- Web developers need guidance in providing a simple summary, which would also support symbol translation for AAC users
- Many users could benefit from easier navigation to Content or Links

The recommendations below, with rationale based on the WWAAC project's user requirements and evaluation work, provide suggestions for success criteria, examples, and strategies related to draft guidelines in WCAG 2.0, working draft dated 1 March 2004. In some cases, the suggestion points towards a browser solution that would render content for specific groups of users, rather than relying on changes to the Web page itself. WCAG 2.0 has

been chosen as a framework, rather than WCAG 1.0 in order to facilitate integration with current drafts and discussions.

The rationale for the proposals are based on the WWAAC project's user requirements (User Requirements Document, WWAAC Deliverable 2) and evaluation work (Final User Evaluation Report, WWAAC Deliverable 11), as well as additional comments from experts, including the Concept Coding Workshop and the Workshop held at CWUAAT.

Recommendation 1:

Provide a clear representational image on the site's home page.

WGAG 2.0 Principle 3: Content and controls must be understandable.
Level 3 Success Criteria for Guideline 3.1:
Ensure that the meaning of content can be determined.

It is recommended that the home page contains at least one image (which could be a photo, graphic, diagram, etc.) which clearly represents the content of the site. Web authors should ask themselves the following question: "If I just looked at this image without reading supporting text, would I be able to guess correctly what the site is about?"

Rationale

Based on feedback from users about their Favourites Page, identification of the most representative image would enable people with complex communication needs (and others) to more readily guess what the site is about. Tagging the most representative image in the content could be used in the automatic creation of a thumbnail image representing the site's content for non-text-based browsers. This suggestion in fact came directly from one of the users of the WWAAC prototype, who asked that when adding a Web site to his list of favourites, a clear symbol, logo or thumbnail image be assigned automatically as an alternative presentation to text.

This thumbnail should be large enough to facilitate recognition (e.g. minimum 64 x 64 pixels), and because it is likely to have to be reduced to a thumbnail, it should therefore be simple enough so that it will be clear and intelligible when reduced. This tag could also be used to provide the most representational image on the page's summary, with the Alt tag saying that this is the image of the site's content, with longdesc to describe the image in detail.

Another way of providing a suitable image for the favourites page would be to provide a clear thumbnail image of the page itself. Some sites already provide a favourite icon used by modern browsers to add a small graphic to the favourites page. But, for people who use AAC and the envisaged usage of the WWAAC browser, a small graphic of the entire home page of the site may not be large enough, or may be too detailed. A graphic of the entire page, in a much larger size, may facilitate recognition of the Web site on the favourites page by end users. The pixel size of the graphic will depend on the screen resolution, but it is suggested that the minimum size be 64 x 64 pixels.

However, this needs to be considered in a similar way to computer displays in general (for example, with reference to appropriate character height at a particular viewing angle and distance). More work is therefore needed to refine this recommendation to guide the designer in calculating the size of the thumbnail based on the resolution of the screen. Ideally, alternative recommendations could be provided, e.g. for 800 x 600 resolution, then the thumbnail image would be 'X' (the higher the screen resolution, the larger the thumbnail would need to be). Alternatively, the image size could also be specified as a percentage of the screen size so that a single-sized image can be used across different screen resolutions.

Recommendation 2:

Alt tags should provide prime information for the user, and should distinguish between salient (most prominent) and non-salient content.

WGAG 2.0 Principle 3: Content and controls must be understandable.
Level 3 Success Criteria for Guideline 3.1
Ensure that the meaning of content can be determined.

Specifically under Strategies for Reducing the Complexity of Content.

Rationale

Based on discussions and evaluation work in WWAAC, it was found that end users, especially those with complex communication needs, would benefit from less extraneous information. Users were also at best amused and at worst annoyed when the screen reader read out text dividers like vertical brackets and 'less than greater than' (< >) in full. One of the Strategies for Reducing the Complexity of Content recommends "Including non-text content to supplement text for key pages or sections of the site." Some non-text content, however, relates only to decorative images and for some users, this just provides unnecessary clutter. Furthermore, screen readers should also be able to recognise characters and images used simply for layout.

Non-content images (e.g., line, spacers and background) should already be marked up with Alt* and therefore Web browsers and screen readers should be abler to render these images properly. However, this advice needs to be made explicit in the guidelines and techniques documents. In addition, key images and those that are not essential for the content of the site should be identified as such. It would then be possible for a filtering mechanism in the Browser to keep only the most salient images to meet the needs and preferences of users, and not just AAC users. Meta tags can be used to denote the image type, e.g., background, decorative, advertising, etc. (See Section 6.6 for a discussion of possible categories.) It is difficult to resolve how advertisers will deal with this recommendation, as they naturally consider their images essential and part of the funding source for the site.

Recommendation 3:
Provide simple page descriptions as metadata.

WGAG 2.0 Principle 3: Content and controls must be understandable.
Level 3 Success Criteria for Guideline 3.1
Ensure that the meaning of content can be determined.

Specifically under Strategies for Reducing the Complexity of Content:
Providing summaries to aid understanding.
Adding non-text content to the site for key pages or sections specifically to make the site more understandable by users who cannot understand the text-only version of the site.
Making it possible to convert text into symbolic languages such as those used by Augmentative and Alternative Communication (AAC) devices.

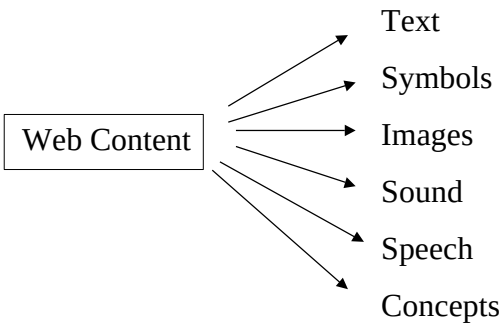
It is proposed that all pages include a simple summary of the page's content in the form of an abstract in the meta tag description. In addition to assisting search engines, this also has considerable potential for providing support to the assistive technology user, as it is anticipated that adapted browsers could be set up to read and translate headings, titles and description meta tags rather than the main body of text. This could be of particular value in supporting symbol translation of site content, as it is considered unrealistic to try and translate whole sites. It is recommended that the Home Page of the Web site gives a summary of the whole site, and the other pages give a summary of each individual page.

The Web page author would be encouraged to provide Alt-Representation of content to the page or parts of the page by means of 'in-page annotation', using existing or emerging document formats, to support access to the content. This Alt-Rep would be stored within the page itself, rather than through an annotation server. See Appendix 4 and Section 6.4.2 for an example of how this could look to the user. The Alt-Representation in this example is a simple summary of the content on the Web page, which can be embellished with symbols (either Rebus or PCS) to meet the needs of specific AAC users.

Rationale
The evaluation of the WWAAC Browser raised the issue of whether the content of the summary should be for the whole site, the page or part of a page. Different options for the summary and Alt-Representation still need to be investigated further, but a discussion of these issues can be found in Section 6.4. Text used in the summary would need to take into account strategies for reducing the complexity of the content, e.g. using clear, simple language, and sentences using active voice and free of professional jargon.

Related to this work are developments taking place in Web annotation, which would allow individuals or groups of users to annotate Web site content with text and images and then share them with others through an annotation server. For example, the Amaya browser developed by W3C–WAI supports the use of collaborative annotation (http://www.w3.org/Amaya/). Such

annotation could support AAC users by allowing pages to be annotated through semantic markup with images for symbol users. Attached remotely to any Web document or to a selected part of it, they could be classified according to type, e.g., summary, definition, comment, plain language, alternative language, symbols, etc., in order to provide the content in an alternative or summarised way to best meet the needs of individual users. This strategy, however, was abandoned in favour of suggesting in-page hidden, or transparent, content, whereby the Web developer would be encouraged to add Alternative Representation of the content, for example a page summary written in plain language, or concept-coding enabled to provide text embellished with the user's own symbols. The Browser, as in the case of the WWAAC browser, would need to be capable of handling such formats, and would recognise the user's preferences for Alternative Representation to the content:



Alternative methods for navigating to Alt-Rep need to be further investigated, but the demonstration in Appendix 4, described in Section 6.4.2, provides an example as to what the user could actually see. The link to the Alt Representation could be either visible or transparent, depending on user preferences, and detectable by a screen reader. If visible, a standard graphic needs to be agreed to show that there is a summary of a page or of the site, and both type and the summary itself would need to be noted in the meta tag.

Recommendation 4:

Add clear in-page link such as 'Skip-to-content' near the top of the page (as some Web developers already do).

WGAG 2.0 Principle 2: Interface elements in the content must be operable.
Level 2 Success Criteria for Guideline 2.4:
Facilitate the ability of users to orient themselves and move within the content.

Already included in the success criteria is the following:
'Large blocks of material that are repeated on multiple pages, such as navigation menus with more than 8 or more links, can be bypassed by people who use a screen reader or who navigate via keyboard or keyboard interface'.

The WWAAC project would suggest that the recommendation be more specific and suggest that a clear in-page link such as 'Skip-to-Content' should be used, which would look for substantial content (headings, long sentences,

no or few links). This would facilitate quick access to Alternative Representations of the content when required by some users. See Appendix 4, described in Section 6.4.2, for an illustration and note that the direct link to content, as shown in the example, could be either visible or transparent.

Rationale
Skip-to-Content
Evaluations in the WWAAC project with AAC users demonstrated that switch users using a scanning interface and speech support were frustrated at having to work their way through a long list of links before arriving at the content on the page. Providing a direct link to content will facilitate quick access to the main text of the page, especially important for switch users and those using screen readers. It will also facilitate quick access to Alt-Rep. Some Web sites of course already provide a transparent direct link to content. This link should be standard practice, and should appear as high as possible in the source code of the page. It needs to be decided if the link should be transparent and only detected by the screen reader, or be provided visually as a practice of 'Access for All.' For AAC users, the latter is probably preferred. Using the screen reader on the WWAAC browser, the auditory feedback that it was possible to 'skip to content' may have been missed and only followed if it was highly visible.

Skip-to-Links
In addition to 'Skip-to-Content', a 'Skip-to-Links' link should also be considered, but the benefits of having this extra link still have to be assessed. In an earlier working draft of WCAG 2.0 (24 June 2003), the editorial note to Guideline 2.1 is particularly relevant to switch users' need to move through a long list of links. The Editorial suggests to 'Add a definition of operable as meaning not using mouse keys or an infinite tabbing on a long doc or other unreasonably inefficient keyboard access' and to 'Add another definition that says something to the effect that access is efficient.' For example, '. . .if a document has a very large number of links, some mechanism other than tabbing though them one at a time needs to be provided.' 'Skip-to-Links' would start this process, followed by a browser's facility to skip (for example) 5 links in order to bypass unwanted links more quickly. A 'Skip-to-Next-Group-of-Links' may also be useful. For example, in the example in Appendix 4, the groups of links are 'Updates,' 'Character Info,' and 'Fun and Games.' This may accommodate user preferences better than skipping 5 links at a time.

Recommendation 5:
Consider the number, location and focus of links on a page.

WGAG 2.0 Principle 2: Interface elements in the content must be operable.
Level 3 Success Criteria for Guideline 2.4:
Facilitate the ability of users to orient themselves and move within the content.

It is suggested that the number of links on one page be limited—a maximum number of links on a page should be agreed, but 10-12 is recommended. Avoid the use of embedded links within text. Instead, encourage the use of

links at the end of sentences, or preferably use bullets or numbered lists instead. In addition, distinguish between in-page links and links to other pages. This will help to orientate the user and will make browsing a list of links more effective and understandable.

(Please note that this recommendation differs from classic hypertext, where words within sentences represent links in order to maintain a smooth flow of text.)

Rationale
Coding for links may mean that they are 'accessible' but if there are 100 on a page, going through the links may not be very 'usable'. Therefore, more consideration needs to be given to the number of links on a page and the way in which they are displayed. One of the facilitators during the Alpha Browser evaluation suggested that a finite number of links could be given as a guideline for Web design. Providing large numbers of links makes input by scanning techniques time consuming and difficult, as well as making use with screen readers harder. It would seem sensible to suggest no more than 10-12 links on a page. If this number were chosen, then they could easily be associated with the numerical or function keys on the keyboard to provide another method of navigating through them. Fewer options than 10-12 may be even better—for spoken menus five or six options is probably about the limit. Also fewer options are likely to be preferable for those with learning difficulties.

Recommendation 6:

Provide a progressive complexity for both site and page content, so that people with different abilities may be able to obtain information from the same Web site.

WGAG 2.0 Principle 2: Interface elements in the content must be operable.
Level 3 Success Criteria for Guideline 2.4:
Facilitate the ability of users to orient themselves and move within the content.

In order to facilitate access to Web site content, one existing recommendation is to use vocabulary that is likely to be familiar to intended readers (WCAG 2.0, Guideline 3.1, Level 3 Success Criteria). In fact, all the strategies for reducing the complexity of content under that guideline will do much to make the content more understandable to more people. Whilst these principles are sound, they do not necessarily enable inclusiveness of Web pages to a wider audience, as site complexity relevant for one user group may not be appropriate to another. It is therefore proposed that as a general accessibility principle it may be better to provide a progressive complexity for both site and page content, so that people with different cognitive abilities may be able to obtain information from the same Web site.

This is similar to the established principle of top loading Web page content to ensure that a page's content is summarised at the beginning of a page. However, this principle could be extended to also cover complexity of Web

content, ensuring that the language used within such a summary is as simple as possible, and that complex information such as technical terms, acronyms and abbreviations are only introduced later in a page. This would also facilitate page navigation with screen readers and make it easier for a person skimming or browsing to get a simple overview of page content. This would also facilitate the use of automatic translation systems to give overviews of content in other languages (including symbol systems). The same principle could of course be applied to the complexity of the entire site's content—The higher-level pages of a site providing a simple overview of the subject matter being addressed, with added complexity and detail being obtained by selecting pages further into the site (See Appendix 2 for Text Complexity Measures).

Recommendation 7:

Use static, rather than dynamic, content for critical parts of the Web site.

WGAG 2.0 Principle 4: Content must be robust enough to work with current and future technologies.
Level 1 Success Criteria for Guideline 4.2: Ensure that user interfaces are accessible or provide an accessible alternative(s).

In an ideal world, if a required plug-in, e.g. Flash, is not fully accessible, then an alternative solution will be provided that conforms to WCAG 2.0. However, this is not an ideal world, and many Web pages are still not accessible to all users. Web pages should, therefore, be designed so that dynamic elements can, if necessary be ignored, and critical parts of the Web site are not missed. Related to this recommendation is that images with embedded content and/or navigation should also be avoided. Therefore, it is essential that, for example, a site map is represented as a text page—that is, an image should never be used as a navigation aid. However, more work may be needed on textual site maps which may be lengthy to access with a screen reader.

This guidance needs to be made more explicit in Guideline 4.2, as well as in the following technology-supports-access issues (with the final words in italics added by the WWAAC project):
"Individuals can identify (either through site documentation or automatically through metadata) whether or not they are likely to be able to use a site. In conjunction with a search engine or a proxy server, this could be used to automatically filter out sites a user cannot access or to automatically filter to the top sites that would be most usable *or at least whose critical elements use static, accessible content."*

Rationale

Browsers (such as that developed by the WWAAC project) can identify a Web site as having some inaccessible elements, e.g. Flash or JavaScript. However, the WWAAC browser evaluations have noted some conflicting requirements in that dynamic images are often more interesting but less accessible for some users. In an ideal world, of course, all browsers should support Flash, and technologies are improving so that this may not be an

issue for much longer (See that Macromedia Flashplayer is now considered 'totally accessible' at www.macromedia.com/macromedia/accessibility). However, dynamic content still creates many problems for people with communication and cognitive impairments. Fast changing objects (e.g. news tickers) may be distracting and confusing for people with low reading skills, and impossible to be accessed by screen reading tools. Floating objects on top of other text may hide screen-reader cursors beyond it. Invisible text (text in the same colour as its background) and hidden texts (collapsible menus) may still be found by a screen reader or difficult to access by switch users.

Other guidance drawn from WCAG does emphasise these points. For example, in their 'See it Right' Guidelines for Accessible Web Design, the Royal National Institute for the Blind, state: "Do not rely on JavaScript for essential page functions." This advice to use static, rather than dynamic content for critical parts of the Web makes the guidance more explicit to Web developers, so that if they choose to use such technologies, at least the critical elements of the Web site will be accessible to all users, who may still be free to enjoy other interactive and dynamic, but inessential, elements of the page.

It is also suggested that a standard mechanism be employed to tell the user that there is a more accessible version of the Web site, but what that mechanism should be still needs to be decided. (See Section 6.1 for comments and suggestions).

Recommendation 8:

Consider a change of priorities in the Web Content Accessibility Guidelines to reflect the findings of the Disability Rights Commission report (2004).

The WWAAC project would advise that the Recommendations from the Disability Rights Commission be considered in establishing priority levels in the WCAG 2.0, based upon the most common types of Web accessibility problems experienced by a wide range of users.

These revised priorities may also impact upon the 10 most important guidelines found on the 'credit card summary' of WCAG 1.0 guidelines (www.w3.org/WAI/References/QuickTips and See Appendix 4 and see Appendix 1, section 4).

Rationale

The study conducted by the Centre for Human-Computer Interaction at City University, London (Disability Rights Commission, 2004) demonstrated that most Web sites are inaccessible to many disabled people and fail to meet the most basic standards set by the W3C. Specifically, it found that violations of just 8 Checkpoints of WCAG 1.0 accounted for 82% of the problems users reported which were covered by the Checkpoints, and 45% of the total number of problems reported by the users. It is interesting to note that 5 of these 8 Checkpoints were not classified by WCAG as Priority 1, and therefore

a site could still have Priority 1 conformance even though it failed to meet these checkpoints (See Section 2). It is also significant that the majority of these most important Checkpoints are qualitative, emphasising that many of the problems can only be found and then resolved by direct involvement of people with disabilities in the design and evaluation of Web sites.

The 8 Checkpoints which accounted for the most reported problems in the Disability Rights Commission report (2004) were:

Checkpoints:
1.1 Provide a text equivalent for every non-text element (priority 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 (priority 2/3).
6.3 Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported (priority 1).
7.3 Until user agents allow users to freeze moving content, avoid movement in pages (priority 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 (priority 2).
12.3 Divide large blocks of information into more manageable groups where natural and appropriate (priority 2).
13.1 Clearly identify the target of each link (priority 2).
14.1 Use the clearest and simplest language appropriate for a site's content (priority 1).

The priority of individual guidelines now needs addressing in WCAG 2.0. For example, the need to use the clearest and simplest language appropriate for the site's content is certainly a difficult guideline to test. However, this Guideline 14 from WCAG 1.0 has lost its Priority 1 status in WCAG 2.0 and has been relegated to a Level 3 Success Criteria for Guideline 3.1 (Ensure that the meaning of content can be determined). This only serves to downgrade the importance of reducing the complexity of content, which is a common problem for many users, and not just those who use AAC. The IRIS Project (Abascal, et al., 2003) also point out that the cognitive accessibility recommendations of the WAI are classified at the low priority level, specifically listing those checkpoints of WCAG 1.0 that benefit people with cognitive impairments, including the recommendation to use simple language. However, the IRIS project, as well as the WWAAC project, recognise the fact that efforts are underway to improve and refine the WAI guidelines in this area, but that some of these elements are not easily testable.

It is also recognised that many of the high-frequency problems experienced by users are covered by checkpoints of the User Agent Accessibility Guidelines 1.0, and also that authoring tools conforming to Authoring Tool Accessibility Guidelines 1.0 play a role in achieving accessibility (http://www.w3.org/2004/04/wai-drc-statement.html). Unfortunately the on-line documents are sometimes not particularly easy to follow, as users are led to a number of documents with overlaps in content. It is easy to get lost in such

documents and it can be difficult to find the relevant information needed. Therefore, it may be necessary to establish more effective links between the different sets of guidelines and the techniques to implement those guidelines. There is also a need to take steps to ensure that developers of Web sites, browsers, media players and assistive technologies receive training in accessibility and usability features (Engelen et al., 2003; DRC, 2004). Steps need to be taken that will make this training and implementation of the WCAG more effective.

8. Conclusions

The user requirements activities and the evaluation of the WWAAC project's adapted Web browser have provided insight into the guidance that is needed by developers to make the Internet simpler to access by people with complex communication and physical needs. It is not the intention of this document to produce startling new guidelines for Web accessibility, as WCAG 2.0 have covered the main general principles. Instead, the WWAAC project is making more specific guidance for an AAC-enabled World Wide Web in the form of success criteria, examples, and strategies related to draft guidelines in WCAG 2.0, working draft dated 1 March 2004.

A significant contribution of the WWAAC project is also to provide more direct support for symbol users on Web pages through its open-sourced concept coding infrastructure and protocol. The vision of concept coding is that instead of images and symbols having to be transferred from one computer to another, it should be possible to transmit a unique code designating the meaning of the symbol needing to be transferred. Using this infrastructure, the WWAAC project is also developing a Web authoring tool which will enable Web developers to embellish their Web pages with symbols using the on-line concept coding database. This optional symbol support (for example for keywords, headings and summaries of content) can then be displayed by 'concept coding aware browsers,' like that developed by the WWAAC project. These important issues are also being discussed with and within the WCAG working group. It is expected that the concept coding work of the WWAAC project will lead to more advances in this area, and should feed into the development of techniques for a more accessible Web for AAC users. (See Appendix 6).

Whilst recommendations in this document have been developed with Web accessibility in mind, it is also anticipated that they could have broader application for the design of multimedia applications. Likewise, Web sites made more usable and understandable for users with complex communication needs could also benefit others who may be struggling due to age, disability or handicapping situations.

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