Are guidelines enough? An introduction to designing Web sites accessible to older people

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As the Web becomes more integral to day-to-day life, there is a danger that many older people will be excluded if their access needs are not considered by content designers. Although accessibility guidelines for designers are available, experience shows that these guidelines have not been successful enough in producing Web sites accessible to older people. In this paper, the shortcomings of relying solely on accessibility guidelines are reviewed, and several ideas are proposed for encouraging a more holistic approach to accessibility.

INTRODUCTION

As society becomes progressively "digital," there is an increasing risk of excluding users with particular access needs. Among those at risk of digital exclusion are many older people, for whom Web content is difficult to access not only because it is inappropriately designed for those with age-related impairments, but also because content is commonly aimed at a youthful, technologically adept minority who are familiar with the conventions in use. Although the dangers of digital exclusion have been recognized politically,[1] a vital prerequisite for a truly accessible Web is to ensure that designers are equipped with knowledge about nontypical users and the barriers that they can encounter. Although research knowledge about such barriers is available, it is often in impractical forms for communicating with working designers. In this paper some ways of giving designers the knowledge to produce more widely accessible Web content are explored. The current tendency for designers to rely on guidelines and automated tools alone is examined and critiqued, and supplementary strategies are suggested.

The development of online services is an exciting, potentially inclusive process, but it currently runs the risk of excluding a large proportion of the population. Recent figures from the UK Department for Education and Skills show that only around 12 percent of people aged 40–60 without educational qualifications use the Internet, and of those aged over 60 (regardless of education), this figure is only 8 percent.[2] In early 2004 in the United States, only 22 percent of those over 65 used the Internet.[3] Although some of this low level of use is due to

other factors, such as the perception that computer technology is irrelevant and excessively expensive,[4] its main cause lies with the difficulties involved in using the Web for many older people.

■ Under normal aging, people are likely to experience multiple mild-to-moderate impairments with some interactions among them ■

With a global trend toward legislation protecting the rights of disabled people, providing online information and services in a way that makes access difficult or impossible for people with age-related impairments may also be unlawful in some countries. In Australia, for example, the courts ruled that the Disability Discrimination Act of 1992 applied to Web sites when, in 2000, they ruled against the Sydney Organizing Committee for the Olympic Games for providing a Web site with access barriers.[5]

In the United States, following conflicting outcomes of recent court cases, the applicability of the Americans with Disabilities Act to Web content remains uncertain at the time of this writing.[6] However, the rights of disabled people in the United States not to encounter "digital exclusion" when interacting with federal agencies, are preserved by amendments to Section 508 of the Rehabilitation Act.[7] By requiring conformance with a set of technical standards for accessibility,[8] Section 508 sets out clear and specific obligations of federal agencies to ensure the accessibility of both online information provided to the public and information and communication technology provided to agencies' employees.

While no legislation specifically referring to Web accessibility exists in the United Kingdom, under the terms of Part III of the United Kingdom's Disability Discrimination Act (1995), it is illegal for providers of goods, facilities, and services to unjustifiably discriminate against persons because of their disability, through either denial of access to a service or provision of a poorer service. This implies that if a service is available through a Web site and is unavailable in other forms (e.g., discounted airline tickets), discrimination may occur if the Web site presents serious accessibility barriers to a disabled person.[9]

It is unfortunate that the term "accessibility" in this area has become associated almost exclusively with technology that can transform the predominantly visual content of the Web into other modalities (e.g., screen readers for the blind). Obviously, without such technologies many disabled people, including older people with severe visual impairments, would find the Web inaccessible in an absolute sense. However most older people, even those who could benefit from using assistive technologies, are unlikely to perceive themselves as in need of specialized solutions. Even in cases where assistive technologies are preferred by older people, these might not always be available (e.g., in an Internet café on holiday). Thus the assumption that Web pages can simply be designed for "normal" people and "abnormal" people can use assistive technologies if necessary, means that the real needs of many older people are ignored, and as a result, a great deal of Web content is effectively inaccessible to this group.

Gregor et al.[10,11] suggest a more sensitive approach to understanding the needs of users, one that addresses the dynamic diversity of the human species rather than splitting user populations into bipolar categories of ability/disability. Key to this approach is a change in attitude on the part of designers in which their awareness of this diversity is raised and a more user-sensitive design strategy is developed. Clearly, such an approach requires the designer to move beyond guidelines (see Reference 12 for a compendium of research and Web guidelines, see Reference 13 for an overview of computer use, and see Reference 14 for more general factors in designing for older users).

One aspect of such a holistic approach involves seeking out sources of advice on the Web. However, given the vast amount of information available in this way, the designer should approach such resources with caution. The problems associated with attempting to follow guidelines without a sufficient grasp of the underlying purpose behind them is discussed in this paper. A similar caveat applies to the use of Web-based resources; designers should not approach the resources expecting to find a checklist that removes the need for a more

considered approach to accessibility and usability. Any resources and advice provided must be studied and reflected upon, so that designers can begin to build a clearer picture of the underlying factors that will enhance the accessibility and usability of their work.

With this in mind, the authors view the following resources as constructive elements of the holistic approach to understanding the broader context of accessibility and usability. *A List Apart*[15] offers information on accessibility, usability, and Web standards from a design perspective, and thus the language and motivation behind much of the advice will be familiar to designers. *Accessify*[16,17] provides a range of tutorials and articles on accessible Web design, as well as a discussion forum used by accessibility and usability professionals. Joe Clark,[18] author of the popular book *Building Accessible Websites*,[19] provides a variety of resources including articles, weblogs, and also an online version of the book. *WebAIM*[20] (Web Accessibility in Mind) presents a wide range of advice on accessibility, from an introductory level to advanced techniques, such as captioning of multimedia content. The narrative writing style of *Dive into Accessibility*[21] makes it highly engaging, and the use of personas to describe how different accessibility issues might affect real people fosters a more personal approach to accessibility than most article-based resources. More information about these and other resources can be found on the *Digital Media Access Group* Web site,[22] and, in particular, in Reference 23.

The phrase "standards-compliant" is increasingly used in the context of Web site design. No formal definition exists, but when used by grassroots organizations like the Web Standards Project,[24] it generally refers not to standards from standards-producing organizations such as ISO[25] or IEEE,[26] but primarily to recommendations issued by the World Wide Web Consortium[27] (W3C**). There is some debate as to whether the recommendations issued by the W3C can be referred to as "standards"—they are not officially referred to as such by the W3C themselves—but their intended use as a *de facto* standard for creating interoperable, robust, and optimally accessible Web content may define them as standards in many people's view.

In the context of Web design, "standards-compliant" is generally used to mean a Web site that has been designed using—and where appropriate validated against—W3C Web technology specifications. These are normally HTML (Hypertext Markup Language) or XHTML[28] (Extensible HTML) for the page structure, Cascading Style Sheets[29] (CSS) for the site's appearance, and the Document Object Model[30] (DOM) for dynamic functionality. This is the definition of "standards-compliant" used in this paper. Some interpretations of "standards-compliant" extend the term to include the use of other W3C technology specifications, such as Synchronized Multimedia Integration Language (SMIL) or Scalable Vector Graphics (SVG), or conformance with a particular level of the W3C Web Content Accessibility Guidelines[31] (WCAG).

The term "accessibility" is used to refer to the ability of a range of people to use Web content; in this way it encompasses much of what is also termed "usability," particularly in the sense of "usability problems." Toward the other end of the "usability" dimension are issues related less to "barriers" and "difficulties" and more to "enjoyment," "engagement," and the like. These too are important components of people's ability to satisfactorily use the Web but are beyond the scope of this paper, which will focus more on what are effectively "barriers" to use.

The rest of the paper is organized as follows. The next section describes the accessibility barriers encountered by older people when using the Web. Then, the section "Formative developments in Web accessibility" discusses the role of markup languages in designing for accessibility, accessibility initiatives by professional organizations and government bodies, and add-on tools for accessibility. The section "Automated tools and guidelines are not enough" covers the shortcomings of the current use of accessibility guidelines. Ways to improve the current use of guidelines are presented in "Encouraging a holistic approach to accessibility," in which four major ideas are presented: involving the user in the design process, educating future developers and designers, accessibility workshops for established designers, and the use of storytelling. The ideas presented in this paper are summarized in the last section.

OLDER PEOPLE USING THE WEB

Accessibility options that provide solutions to single serious impairments, such as total blindness or

severe motor-control impairment, cannot be used as a general tool to remove the barriers encountered by older Web users. The impairments associated with normal aging are likely to be less serious than those addressed by accessibility options, and at the same time, there is likely to be a significant level of interaction among them. For example, an older person with visual impairment is also likely to have poorer fine motor control and some minor memory impairment.

■ The Web Content Accessibility Guidelines (WCAG) have formed the basis of Web accessibility policy of many organizations across the world ■

Inappropriate design decisions can therefore create barriers for people on a number of different levels. One effectively removable barrier known to limit the use of the Internet by older people is the legibility of textual content. A fundamental aspect of the legibility of on-screen text is the font size. It has been well-established that older people tend to experience declines in visual acuity, which means that they have difficulty reading text presentations that are based on the requirements of younger readers.[32] Other aspects of text presentation can further impact the ability of older people and others with visual impairments. For example, fonts that are ornate in style can often cause difficulty as they present less familiar word/letter contours; further, the relatively high levels of detail inherent in such fonts are generally more susceptible to degradation due to factors such as low screen resolution, which can make them even less legible.

Legibility can also be affected by the choice of colors for text and background. Color blindness notwithstanding, this is mainly due to insufficient contrast between text and background, which can also make word/letter contours less distinct. Similarly, if text is placed over patterned or pictorial backgrounds, elements of that background can interfere with foreground word/letter contours. Scrolling or otherwise moving text is also problematic for older readers as are other presentation techniques often used on the basis of being aesthetically pleasing or engaging. These principles regarding text also apply to the presentation of icons and other visually detailed representations (see Reference 33 for a review).

Although legibility obviously affects the ability to read per se, in the context of Web pages suboptimum legibility markedly hinders the ability to efficiently scan a screen of items in search of a particular target (see, for example, Reference 34). Hence, the more cluttered the screen and the more difficult it is to identify each item within that clutter, the less likely it is for the Web page to be usable by an older viewer. In addition, the cluttering of small, difficult-to-identify items can make the fairly ubiquitous task of "pointing and clicking" excessively demanding for many older people; that is, precise manual dexterity becomes more difficult with advanced age, particularly when motion is indirectly mapped from the mouse onto the screen.

Many of the problems just outlined can be addressed by using customization settings in the browser. For example, if a page is accessibly designed and text sizes are specified relatively rather than absolutely, it is possible to resize text through the browser. Although such a facility is vital to enable skilled users with visual impairments to resize text, older novice users are unlikely to be aware of this possibility and thus experience the page in its "default" form. The older user is thus often presented with a significant visual challenge, even on pages that are theoretically designed to be accessible. This is an important consideration when designing for such older users: pages must be accessible in their default form as well as "potentially" accessible by allowing more knowledgeable users to customize them.

These fundamental difficulties relate to the effects of aging on the user; however, they can be exacerbated by the inexperience of older users who are not familiar with the conventions others take for granted. One example of this would be "hot spots" in image maps, where the user must move the mouse over a particular area of the image before more information can appear. Other similar effects can be generated by using client-side scripting languages, such as JavaScript**. These effects are sometimes used to control the appearance of navigational menus and other significant aspects of

the interface. As a result, users who are unaware of this "hidden" functionality are likely to experience accessibility problems.

Within the UTOPIA Project[35] (Usable Technology for Older People: Inclusive and Appropriate), we have worked with older users in a variety of Web-related projects. During these sessions, anecdotal evidence has emerged that supports the findings of the human factors research discussed earlier. As the human factors research indicates, difficulty seeing information on the screen is a common problem for older users, and one which complicates most aspects of their interaction with the Web. Most text, icons, and symbols are simply too small to be read or identified easily. We observed that older users tend to lean forward towards the screen, struggling to read. Whereas people rarely explicitly complain about the size of text, they may comment obliquely ("I'll need my glasses for this!") and respond positively when larger text is shown as an alternative.

Another problem identified in the literature and confirmed by our own experience is the difficulty that older people have trying to click on those targets they *can* adequately identify. Impaired fine motor control skills coupled with inexperience in using the mouse mean that considerable effort is often expended positioning (and repositioning) the mouse pointer onto the target. Clicking on the target is also difficult: not only do users have to remember which mouse button to click; they also need to hold the mouse stationary while they click. Accompanying the movement required for clicking, there is often an unintended downward movement of the mouse, which drags the pointer off the intended target. This failure to successfully click on the target can be very frustrating and confusing. In a recent evaluation session an elderly evaluator summed up this difficulty: "It's like trying to catch a mouse!"

Lack of familiarity with conventions can make use of Web content difficult. During a series of usability evaluations, users were asked to select appropriate options from a series of check boxes, all of which were selected by default. This apparently straightforward task caused considerable confusion, as the older users were actually "deselecting" the items they wanted. Many experienced Web users (particularly those with good vision) would have noticed that their actions had removed the default ticks and would have recognized the implication of this. However, this was not the case for the older people in these evaluations.

Similarly, objects such as drop-down lists demand a knowledge of conventions that must be learnt before the user can distinguish between such objects and others, such as buttons. Dependence on conventions like these reduces the usability of Web pages for inexperienced users, as well as for those with memory or cognitive impairments.

It has been noted that there is increasing enthusiasm for designers to develop accessible interfaces, and in particular, to take steps to accommodate specific and severe sensory or mobility deficits—steps that can map to specific accessibility guidelines. One challenge facing advocates of accessible design is therefore to encourage development of Web sites accessible to the far larger group of people who experience a combination of mild-to-moderate impairments. This group includes many older people who, as mentioned before, also tend to be inexperienced users of the Web, which raises further potential accessibility problems.

FORMATIVE DEVELOPMENTS IN WEB ACCESSIBILITY

Before discussing current practice in Web accessibility, we shall look at a number of significant developments in the formation of the field. We will outline the development of HTML and CSS, specifically the work of the W3C in attempting to standardize these technologies. Then the work of the W3C's Web Accessibility Initiative (WAI) will be discussed, including the Web Content Accessibility Guidelines (WCAG), followed by a look at some guidelines produced by other relevant parties. Then we shall consider the attitude of Web designers toward these guidelines, noting the influence of a growing body of Web designers who argue that usability and accessibility are compatible with creative aesthetic design. Despite these positive developments, a great deal of inaccessible Web content continues to be produced. Thus, there is an ongoing need for assistive technologies, such as IBM's Web Adaptation Technology (WAT),[36] and a continuing need to inform and educate the Web design community.

When HTML was developed as a markup language, it was intended to be used to *describe* information

structure meaningfully. For example, a page-level heading can be marked up by using the <h1> tag, whereas subheadings can be marked up with <h2>, <h3>, and so on. From an accessibility and

■ A number of studies reveal that many designers do not adhere to accessibility guidelines ■

usability point of view, the use of descriptive markup is very important. It allows any Web browsing technology to present information to users in the most appropriate way for them. For users of visual browsing environments, headings could be displayed in a large or bold font. For users of non-visual assistive technologies, such as screen readers, a heading could be read out with stronger emphasis than usual, to indicate the importance of a fragment of text over the main body of the page. Headings could be treated as navigational anchors, allowing, for example, a screen reader user to quickly gain an overview of the page content by moving from heading to heading. In other words, the browsing technology itself is responsible for how information is displayed according to the tags used to describe it. Descriptive markup can also be used by "robots," such as Web search engines, to prioritize information found on a page. For example, higher priority may be given to text within a heading than to the same text in the main body of the page.

Although descriptive markup provides information on the various components of a Web page, it is important that content providers are able to augment it with presentational markup to ensure a distinct "look and feel." Cascading Style Sheets (CSS) allow this to be done in a way which keeps the content and the descriptive markup separate from the presentation markup, thus allowing the style descriptions to be reused on multiple pages.

In an effort to encourage greater standardization of Web content, the World Wide Web Consortium (W3C) produces specifications for HTML and CSS and other associated technologies. Unfortunately, before these specifications came to be recognized as de facto standards for Web content, a number of browser makers (most notably those engaged in the so-called "browser wars") had begun to introduce proprietary elements, such as the <font> tag, which allowed style information to be embedded in HTML. The result was that Web designers were effectively encouraged to create Web content that would not work on competing browsers. Not so long ago, many Web sites could be found warning users: "This Web site was designed for browser *x*; if you do not have this browser, click here to download it now." The effect of such an encounter could range from mild frustration for the user to complete inability to access the site. Unfortunately, although the use of this approach has diminished recently, the vast majority of the Web is not standards-compliant.

The W3C's WAI tackles the specific problem of making Web content accessible to as many people as possible. The WAI has produced the WCAG,[31] which offers guidance to developers on how to produce Web content in order to avoid creating accessibility barriers for users with disabilities. The WCAG guidelines focus primarily on technical accessibility; thus, they can only partially address the highly subjective and contextual issues surrounding optimal usability of a specific digital resource. Despite this, they have become widely accepted as the most authoritative set of guidelines relating to Web accessibility. The WCAG guidelines have formed the basis of the Web accessibility policy of many organizations across the world (for example, the government of the United Kingdom), have been mentioned in court cases relating to the legality of Web sites with access barriers in both the United States and Australia[9], and are used as evaluation criteria by most automated Web accessibility evaluation tools currently available.

The U.S. Department of Health and Human Services has also produced a comprehensive set of research-based usability guidelines for Web developers.[37] In his foreword to the guidelines document, however, Ben Shneiderman reminds readers that the guidelines cannot ensure perfect usability of every Web site, and that the effectiveness of the guidelines as a support tool depends on the existence of an effective process for their implementation (this process may include knowing when a resource may be exempt from adhering to a particular guideline). From an accessibility perspective, these guidelines would appear to have had a lower profile in the Web development community, perhaps due to their less technical nature and only partial focus on accessibility and disability. The evidence-based approach

used by these guidelines has, though, been noted, for example by the health-care profession, where commentators have criticized the lack of evidence on which some guidelines are based.[38]

Historically, usability and accessibility advocates have met with resistance from Web and software developers involved in graphic design.[39] Without doubt though, there has recently been a noticeable culture shift in the Web design community, where usability, accessibility, and standards compliance are increasingly being seen as important technical requirements and core objectives in Web-design development projects. Demonstrations that W3C technologies such as XHTML and CSS need not hinder aesthetic creativity have encouraged a groundswell among developers who are driven equally by issues such as compatibility with previous browser versions, accessibility/usability, and graphic design.[40] In his publication *Building Accessible Web Sites*, Clark specifically reaches out to Web designers from a graphic-design background, at the same time criticizing the W3C's WAI for providing advice and guidelines that are frequently unworkable and unsympathetic to a significant proportion of the community expected to implemented them.[19] From the HCI (human-computer interface) community, there is at the same time an increasing acknowledgement of the important role of aesthetics in the usability of an interface. This is particularly so for engendering a beneficial emotional reaction in the user (see, for example, References 41 and 42). Ultimately though, this positive transition is taking place against ongoing pressure from managers or clients with priorities that may conflict with those of the progressive designer. Thus, despite a full understanding of the issues surrounding the design of usable resources, designers can find themselves tied to producing material that is predominantly intended to make an aesthetic impact on the consumer, without sufficient regard for usability and accessibility.

Partly due to these commercial and corporate pressures and despite the fact such behavior directly conflicts with the message of Clark and others (for example, Reference 43) that accessibility is a requirement, not an option, many designers continue to mix aesthetic values with content in a way that makes the resource very difficult or even impossible to use by people with specific access needs. Some of those who do make the effort to enhance accessibility may express frustration at the apparent constraints that accessibility guidelines or usability heuristics may seemingly impose on them. Perhaps more justifiably, there may be frustration at the failure of many popular browsers to correctly interpret Web content that has been written to adhere to a valid specification. This situation can leave designers having to develop a variety of workarounds to ensure the accessibility of their content. Additionally, the prominence and effectiveness of browsers' accessibility features is crucial in ensuring that Web content can be adapted where necessary; yet this remains out of the control of designers.

Some improvements in accessibility have been developed as "add-ons." For example, IBM has produced Web Adaptation Technology (WAT) to help older users overcome many of the barriers presented by inappropriately designed Web content.[36] WAT works within Internet Explorer to let the user alter characteristics of Web pages to make them more easily accessible. A central advantage of this system is that it places minimal responsibility on the developer of the content but instead takes existing Web content and allows people to alter it so they can read it more easily; it also allows people to use standard computer equipment to enable useful changes to be made easily and immediately.

WAT addresses many of the problems that make the Web so difficult for older people to use and does so in an immediate and reversible way, supplementing browser functionality and thus significantly improving the ability of users with specific access needs to configure the appearance of, and interact with, Web pages. There are several noteworthy advantages to this approach, including as Hanson notes, the fact that such "unified access" (i.e., having numerous settings readily available on a single settings bar) allows users to explore options they would not have found using the standard interface.[44]

However, it is important that the existence of tools such as WAT does not lead designers to conclude that the accessibility of Web pages is no longer their responsibility. Indeed, the more accessible a Web page is, the easier it will be for assistive technologies and adaptation tools to render the page according to users' needs. Conversely, the more *inaccessible* a

page is, the *harder* it will be to adapt, meaning that on those occasions when users need it most, adaptation is least likely to succeed. Therefore, although the continued development of assistive technologies and adaptation tools is necessary and beneficial, designers have a responsibility to ensure that any Web content they produce is optimally accessible in order to maximize the success of these tools.

■ A holistic approach to accessible design relies on a better understanding of users' needs on the part of designers, developers, and managers of digital resources ■

AUTOMATED TOOLS AND GUIDELINES ARE NOT ENOUGH

To develop content that is appropriate for older users and can be easily accessed by them, designers need to know the users and their needs. Although there are various ways of providing such information to designers, there are many misconceptions about Web usability and accessibility that also have to be considered and addressed. The authors have noted an apparent assumption among many designers that the use of automated accessibility checking tools, such as Bobby**,[45] provides a sufficient basis for discovering and rectifying accessibility barriers in a site. Whereas such automated tools can be useful, particularly in processing a large number of Web pages very quickly, they can only check for a limited range of access barriers, and there is often inconsistency between automated tools in reporting accessibility barriers.[46] Once these barriers are discovered, it is still the responsibility of the designer to resolve the problem in the most appropriate way, and a lack of understanding of the issues will likely lead to a suboptimal solution.

Furthermore, whereas automated tools can check for simple conditions, such as the absence of text descriptions as an alternative for images, they are incapable of assessing in more depth the impact on accessibility of these features. For example, an image may "pass the test" because it has a text description appended, but there is no meaningful improvement in accessibility if that description is "BoatPic00013" or even "*". Thatcher describes an actual Web site that, while technically meeting accessibility standards, in fact falls far short of providing an acceptable browsing experience to users with severe visual impairments.[47]

The misconception that text-only interfaces, free of graphics and visual quality, solve accessibility problems for people with visual impairments has been repeatedly addressed by accessibility texts, and more recently by design-focused publications.[40] Yet many still believe that aesthetic quality is incompatible with accessibility, and it is widely believed that this stems from the misinterpretation of guidelines such as "Provide equivalent text alternatives to information provided in graphical or audio formats," and "Do not use color alone to present information" (paraphrasing Checkpoints 1.1 & 2.1; WCAG).

Although the WCAG guidelines are a constructive and necessary part of the drive toward a more usable Web, developers should not rely on guidelines alone. Indeed, the WAI itself produces the guidelines as part of a wider commitment to Web accessibility, which includes education and outreach to the Web community in various other ways. Following guidelines to improve accessibility is an important step, but this step must be taken in conjunction with an overall awareness of the usability implications of design decisions, which often cannot be encapsulated neatly into strictly defined guidelines. A more holistic approach is needed, which covers content, functionality, navigation, metaphors, and so on, and, at the same time, addresses the full range of accessibility and usability issues.

There is evidence to suggest that guidelines and standards on their own may have inherent usability problems that can limit their effectiveness in terms of how well a designer following a standard can produce an interface that not only meets the standard but is usable by the intended audience.[48] In a separate study, the WCAG itself was found to have inherent usability problems,[49] and as mentioned, critics such as Clark[18] suggest the content and style of the WCAG often does not engage or encourage developers to implement the advice provided. To that end, Version 2 of the WCAG is currently under development, a key aim of which is to present

recommendations for accessible design in a way that is easier to understand, implement, and test.[50]

The fact that many designers still do not adhere to accessibility guidelines is made painfully clear by many studies (e.g., References 46, 51, and 52). Clearly, the mere availability of guidelines is not enough to ensure suitably accessible and usable resources, nor it seems are legal imperatives to adhere to them. Even well-written guidelines can be inherently difficult to implement, as they attempt to summarize some very complicated issues into manageable and memorable sets of instructions. To be of any value, guidelines must present a generalized rule that can be followed in a variety of scenarios. However, the fine details of each design scenario, which ought to dictate the most appropriate solution in each case, are often lost in this process of summarization. A designer is unlikely to derive the best solution for a particular scenario from a generalized guideline in isolation. At the very least it is necessary to investigate any additional information provided alongside the guideline, including sample scenarios and solutions.

ENCOURAGING A HOLISTIC APPROACH TO ACCESSIBILITY

Enabling designers to produce Web content that is genuinely appropriate for older people is a vital part of making the Web more accessible. There is a body of research information on the problems that older people face using computers (e.g., References 13 and 53) and conventionally designed Web sites (e.g., References 54 and 55); yet there is little evidence that this information is used by Web content designers. It is important for researchers to examine why such information is not being used by those for whom it is directly relevant.

One possible reason for the failure of designers to use relevant academic research is the wider communication failure between researchers and commercial developers, which stems largely from their different priorities and work environments. The pressures on developers to produce commercially viable systems quickly may conflict with researchers' focus on the detail of accessibility and usability. This is analogous to the more general conflict between usability specialists and developers in the software industry where usability experts sometimes fail to communicate successfully with developers. For example, failure to consider technical and time constraints can make their advice seem "naïve and ill informed" (Reference 56, p.22). In addition, designers sometimes judge themselves, or are judged by managers and clients, in terms of the aesthetics of their design rather than its usability.

■ IBM's Web Adaptation Technology (WAT) works within Internet Explorer and allows the user to alter the characteristics of Web pages to make them more easily accessible ■

Attitudinal differences are not the only barriers to communication, however. Pressure on researchers to produce academic publications is arguably detrimental to their ability to communicate with developers: it has been reported that industry-based developers find academic writing "literally unreadable" (Reference 57, p.8). Another factor that may play a role here is the format of the information. Designers are typically visually oriented, and much of design education is done by example. Most accessibility information, however, is presented in textual and numerical form. On a general level, usability experts have failed to get across the message that guidelines are directions for good design that should be complemented by a deeper understanding of the issues, rather than simple rules or instructions that should be followed blindly.

As discussed earlier, guidelines are not sufficient to ensure that the design will result in accessible Web content. The failure of developers to obey guidelines, or to obey them effectively, is arguably matched by the failure of accessibility specialists to produce research results in a form that can be readily used by commercial developers. Yet this is not inevitably so: a variety of successful means of communication have been found and applied in commercial and educational contexts, and these will be discussed in this section. Specifically, these means of communication include involving the user in the design process, educating future developers and designers, offering accessibility workshops for practicing designers, and using storytelling to impart previous experience in designing accessible Web sites.

Involving the user in the design process

The most effective strategy for ensuring that developers appreciate the barriers placed in the way of a specific user group is to ensure that they meet and observe members of that group using relevant technologies. In a recent academia-industry collaboration project at the University of Dundee, developers were invited to facilitate a "structured walkthrough" of the prototype e-mail system with a group of older, novice computer users. Although the issues that they encountered had been previously related to them by the researchers, the effect of seeing these problems for themselves was profound. After the session, one of the developers wrote in his report:

> The first overwhelming observation is that some of our users start right back at the very basics. That is, [with] absolutely NO prior knowledge whatsoever!... We take for granted all kinds of metaphors and conventions in user interface design. The lesson for me was that absolutely NOTHING can be assumed.

The effect of observing users firsthand was very powerful, and the qualitative discussion between user and developer allowed the developers to develop an empathy with the user group that would have been unlikely to develop in a less personal context. As Wixon notes, "It is no accident that most usability testing involves encouraging entire design teams to watch the test, and it is well-known that much of the effectiveness of the test comes from this active participation."[58] Within the context of knowledge of the user group and an understanding of the problems they are likely to face, guidelines are a useful tool that can be intelligently and sensitively applied. However, guidelines alone are an impoverished source of information when compared to the rich, in-depth knowledge that firsthand interaction with the user group can provide.

Although such personal interaction is the best and most effective means of gaining the necessary knowledge about the user group, such interaction is not always realistic within the tight time constraints of commercial software development (although the "business case" to the contrary is currently being developed by advocates of inclusive design). It is certainly the case that in these contexts it can be difficult to persuade the developers (and their budget holders) of the necessity of such in-depth contact. Given that the role of usability and accessibility specialists is to communicate the needs of the user as effectively as possible, this means that other strategies must be found to enable designers and developers to make decisions that are informed both by reliable quantitative and rich qualitative data.

Educating future developers and designers

At the University of Dundee, emphasis is placed on ensuring that students are aware of good practice and the issues involved in working with a variety of users.[59] The undergraduate major lasts for four years with specialization in the final two years. User-centered design issues are emphasized throughout and are focused on and reinforced in the final years. In the third year, for example, students are encouraged to critique existing systems from the perspective of older people and to prototype their own appropriate and usable systems. These systems are then evaluated by older volunteers in a face-to-face evaluation period intended to illustrate for students the insufficiency of theoretical knowledge when designing systems for use in the "real world." These sessions also encourage students to reflect on their own preconceptions about computer systems and to realize that it is impossible to extrapolate confidently from their own experience to that of the users of the systems which they will design when they graduate. These evaluation sessions have received very positive responses from students. Similarly, fourth-year students are encouraged to challenge accepted thinking on accessible design by considering accessibility needs in situations where common guidelines and thinking may not apply. This helps them to develop their critical abilities, to challenge without fear what is perceived to be accepted thinking, and to justify alternatives that are accessible and acceptable. The result of these sessions is that graduates are aware of the need to interact with users and are capable of using guidelines intelligently rather than being tempted to blindly follow every detail.

Although these techniques are successful for encouraging future developers and designers to consider the importance of interacting with users, it is an entirely different matter to attempt to replicate this process with specialist developers already working in the field. Moreover, as many other undergraduate computing courses have yet to include similar issues in their courses, people will

continue to qualify as potential Web developers without obtaining these valuable insights. Thus, there remains the question of how to communicate with such developers in acceptable and useful ways.

Accessibility workshops for established designers

The UTOPIA project runs regular industry workshops that are intended to communicate the issues concerning technology development for older people to industry representatives. Various subject areas are covered, including an overview of demographic change, technology for older people, the legal necessity for accessible design, and the financial benefits of usable Web site design. Perhaps most importantly, older computer users give presentations and contribute to panel sessions, allowing industry representatives to interact with the user group directly. It is not, however, easy to persuade industry of the need to attend such events. A considerable proportion of the businesses contacted declared that they had "no interest" in design for older people, others doubted there was anything new to learn about IT, and others questioned the need to design for older people who, they believe, do not use technology anyway. Although a few businesses were eager to send representatives, these were a small minority of those contacted. Those who attended these events completed an evaluation questionnaire. The evaluations indicated that the seminar had been effective in persuading those who had attended of the need to take action: 80 percent stated that they had been "prompted to further action." The organizations that attended were, of course, atypical.

Storytelling

Although workshops are a useful means of communicating necessary information, they necessitate travel and take time to attend. Because they are also unlikely to be available just when a new project is started, their relevance may not be perceived until it is too late. An alternative strategy is the use of video to replace direct interaction with the users. This technique has been used with considerable success within the UTOPIA project. A video of an older lady, who had suffered a stroke, talking about her use of mobile phones and computers, was seen by a representative of a major mobile phone manufacturer at a UTOPIA event. The video was subsequently requested by the mobile phone manufacturer and has been shown throughout the management structure. Such individual stories shown in a short, entertaining, and transportable presentation like a video are effective in presenting information and are likely to be seen by more specialists than other forms would be.[35,60] The success of the video, of course, raises the question of how to communicate more specific and detailed information by video and whether this can be done effectively.

■ Although the WCAG are a constructive and necessary part of the drive towards a more usable Web, developers should not rely on guidelines alone ■

Similarly, the use of a wider range of formats to convey user information can promote a deeper understanding of the users and the associated issues. Anecdotes and multimedia can be used to tell stories about real or fictional users with whom the designer can empathize. Personas, essentially models of users that serve as design targets, are a way of transferring such information and insights in a manner that is more accessible to designers. Designers can then create scenarios based around the personas to derive needs and feature requirements. By designing for an archetype whose goals and behavior patterns are well understood, the aim is to satisfy the requirements of a broader group of people represented by that archetype.[61]

Illustrations of successful design solutions, like design patterns, are closer to the way designers exchange information than are textual guidelines. Design patterns originated in architecture but have increasingly wider applications. "Each pattern describes a problem which occurs over and over again, and then describes the core of the solution to that problem, in such a way that this solution can be used a million times over, without ever doing it the same way twice."[62]

CONCLUSION

It is increasingly apparent that the World Wide Web and other portals to electronic information are becoming unavoidable aspects of everyone's day-to-

day life. At present though, much of the "information super-highway" is either effectively or absolutely inaccessible to a large proportion of society. Adherence to technical accessibility standards and carefully considered design can help limit current levels of exclusion, although somewhat more radical steps will be required to remove them altogether. A variety of factors have been identified in this paper and discussed in terms of their role in helping or hindering the design of accessible Web sites, including the following:

- Technical standards and accessibility guidelines are often presented in a format that is difficult to digest or implement by designers.
- Guidelines are often used strictly as rules or instructions rather than as intended, that is, as directions supported by a wider understanding of the issues.
- Conflicting priorities, such as aesthetic demands or time pressure, hinder the implementation of guidelines.
- Accessibility guidelines and tools focus on the basic level of accessibility and do not cover higher-level problems such as navigational structure, functionality, and inexperience with user interface conventions.
- Assistive technologies (e.g., IBM's WAT) can overcome some low-level accessibility problems but their effectiveness is limited when Web content has been marked up inappropriately. Furthermore, such solutions cannot address the types of higher-level problems noted above.
- Guidelines tend to emphasize extreme disabilities, causing designers to neglect larger groups of users with (often multiple) minor impairments.

A central element in ensuring more accessible design is to encourage a more sensitive approach to understanding users' needs on the part of designers, developers, and managers of digital resources.[10,11] Embracing the dynamic diversity of the human species as exemplified by the older population, rather than designing for homogeneity, will facilitate more inclusive design for all. In this paper a number of approaches have been discussed that have been used successfully at the University of Dundee, Scotland, UK, to achieve this, including the following:

- Exposure of students to nontypical user groups raises awareness of the issues and challenges their preconceptions.
- Meeting and observing users provides designers with the deeper understanding needed to interpret and apply guidelines.
- Representations of users through videos, anecdotes or personas can complement guidelines in a more accessible format than direct observation.
- Examples of successful designs and design patterns could play an important educational role.
- More research is needed into methods that make academic usability information available to designers working in an industrial context.
- More research is needed into approaches that promote a more holistic view of development, that is, one that takes into account the usefulness, the usability, and the accessibility of the final product.

The Digital Media Access Group is an accessibility consultancy based at the University of Dundee with which the authors have been associated. The members of this group have been advising on accessible and usable interface design since 1999. Over the last five years, they have found a change in attitude among designers toward inclusive design. Designers and developers seeking advice and support in accessible design are asking "Why?" less and asking "Show me!" and "What do I need to do first?" more. This suggests that supporting accessible design should focus on prioritized and pragmatic advice, including legislative implications, aligned with real examples of the impact of accessibility barriers and the benefit of removing these barriers. Translating generic advice provided by guidelines into instance-specific advice helps designers to understand that inclusive design is not an exercise in following a recipe, but involves taking a holistic approach to provision of information and functionality.

With better education of prospective designers, better information resources for current designers, and better communication among users, usability researchers, and designers, the Web can fulfill its potential as an inclusive social resource. The techniques described here go some way toward contributing to this, but it is necessary to recognize that only through genuinely struggling to communicate with designers and developers in their own language and using their own terms can researchers truly influence the process.

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Accepted for publication January 18, 2005.
Published online August 9, 2005.

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