On the web, universal content accessibility is not just browser compatibility

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Abstract

The web content accessibility guidelines developed under the auspices of the World Wide Web Consortium (W3C), make clear that web accessibility is a matter of choice for publishers. Following the guidelines it is technically possible to produce exciting, accessible content including content that contains multimedia objects of many kinds. Understanding what is accessible and what is required to make content accessible is another matter. In this paper, a theoretical framework for user equivalence when working on accessibility is proposed and the wide-spread benefits of complying with guidelines are exposed. The disadvantages to many that result from failure to satisfy the guidelines are exemplified. Finally, a practical approach to accessible web development is proposed and resources for ensuring content accessibility are identified.

Introduction

In a report written as primary author by Paul Schroeder, director of the Midwest office, American Foundation for the Blind, the US National Council on Disability[i] reported that "for the United States in the early 1990s, the broad estimates we have identified range from 8.9 million to 10.3 million persons who have a visual disability." NCHS[ii] estimate that 8.6 percent of the US population (3 years and older) have hearing impairment and Georgia Institute of Technology[iii] show that 8 percent of web users have disabilities and of those, 50 percent (3.7 percent of users) have visual disabilities. "In another study, Kirchner and Harkins (1991[iv]) found that among visually impaired people who are employed, those who have no useful vision appear to have higher rates of computer use than those who have a lesser degree of visual impairment." The NCD authors concluded, "It is particularly noteworthy, given their generally lower income and rate of employment, that blind and visually impaired persons use computers and the Internet at rates similar to those of the general population, suggesting the increased importance of this access to them." Similarly, hearing impaired people can be expected to have a higher than average dependency on computer disseminated information. These figures are, by extrapolation, indicative of the situation in Australia. Thus there is a strong case for content accessibility for the benefit of those with disabilities.

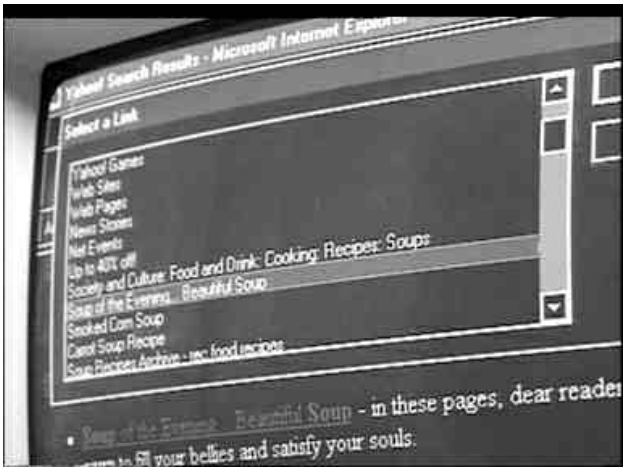
The business case for universal content accessibility of web content is related to the size of the market for web content, and this includes the disabled, but it is also connected to the growth of dependence on the new technologies that challenge current presentation styles. The increasing use of small, hand-held mobile browsing devices have small screens that cannot display the breadth of material which works on a larger screen, and many mobile users do not want to waste precious down-loading time on decorative features of web content as opposed to critical content. The introduction of WebTV and aural browsers, along with kiosk displays, mean that many people have different display needs according to their location or immediate task.

A simple example of the need for universal accessibility is provided by the university lecturer who innocently thinks it would be good to show her students what is available at a particular location on the web. It is not unusual for such a lecturer to have used her desktop or notebook computer to locate some interesting material of relevance to her students. Currently, the chances are high that this lecturer will not be able to simply increase the font size of the content sufficiently to enable the students to read the web page as displayed by the computer projector. Fixed font sizes, fixed table layouts, perhaps choices of fonts made within the web page can prevent the user's browser from over-riding them for replacement with purpose specific layout. This is as frustrating for the lecturer as is the experience of thousands who have slightly failing eye-sight and would like the text a little larger, or a little clearer, or without what appears to them as a gaudy background.

Presentation (layout) and content are not the same and do not need to be inextricably intertwined in the web development process. Content can be ordered by being structured (with HTML code[v]) and layout can be controlled by style sheets (CSS code[vi]), cascaded to allow chosen styles to override offered styles when accessibility is threatened in a particular local situation.

Some special devices to be considered

Jaws is a commonly used solution to the screen-reading problem. Jaws is capable of dissecting web pages into meaningful sections to make it easier for those who cannot see to find what they want. In the illustration shown, Jaws has collected together the links from a single page so the user can choose, without clutter, where to go next. Users might want to know in advance of going through all the content of a page, what headings appear on the page.



The use of Zoom to make small sections of the screen visible has the characteristic that context is lost and the user can easily become disoriented.

A braille reader converts text reading into a tactile activity. Jason White, a student at Melbourne university, is working with W3C to ensure that the guidelines for universal accessibility and the specifications for HTML, CSS, SMIL and all other formats for web content take into account the needs of Braille users.

Accessibility principles

Accessibility turns out to be partly subjective in practice. In different circumstances, the material is more or less accessible depending upon how it is valued by the user.

If the user knows that content of potential value to them will be obtained from the site, they are far more inclined to be able to work through the content than if they are only speculating that the content will be useful. Accessible descriptions of site content can help in this regard. Such descriptions can cover the content of the site in a 'sitemap' page, which should be readily available from anywhere on the site, thus the visibility of information about the content can be a factor in the site's accessibility. One form of 'metadata' or catalogue information that is being developed especially for automatic generation and presentation to users is sitemap information. This involves the browser gaining access to more than the immediate resource but can be very helpful to users who cannot see at a glance what is available to them. It can also be useful in cases where there is valuable information available but the publisher has not structured the website or the web pages so as to make them easily navigable.

In other cases, users of web resources may not have uncensored access to the web. The merits of censorship are not in issue here. Rather, the recognition that often material suitable for such users would be available if adequately marked as such, and

may be inaccessible simply for the lack of a tag[vii]. In some circumstances, 'white' lists of materials are created and from the list, usually maintained as a set of URLs, users can select resources, often maintained in a local cache. Resources that have not been designated 'suitable' will not be discovered. In other circumstances, lists of resources considered inappropriate are maintained and only these sites are inaccessible. Such 'black' lists may contain materials that are either suitable or desirable for the user but for one reason or another the user's access to them will be blocked. An intermediate technology for filtering of content was developed by W3C some time ago. PICS[viii] depends upon metadata attached to a resource indicating that it matches the criteria for content selection chosen by the user (or an agent such as the user's teacher or parent).

All three censoring and filtering strategies render content undiscoverable and so inaccessible to the user. *Universal* accessibility is denied in these cases although generally this is not the sense in which universal accessibility is understood. Nevertheless, ensuring visibility and discoverability of web resources has become a major endeavour since the broad adoption of standards such as the Dublin Core[ix].

The W3C guidelines[x] address the two general themes of ensuring graceful transformation and making content understandable and navigable:

> "Pages that transform gracefully remain accessible despite any of the constraints … including physical, sensory, and cognitive disabilities, work constraints, and technological barriers."

W3C recommends that content developers ensure that their content is understandable and navigable. This means not only providing understandable mechanisms for navigating within and between pages but also making the 'reading' of the page clear and simple. Not all users can make use of visual clues such as image maps, proportional scroll bars, side-by-side frames or graphics that guide sighted users of graphical desktop browsers. Users lose access to contextual information when they view only a portion of a page, either because they are accessing the page one word at a time (speech synthesis or Braille display) or one section at a time (small display, or a magnified display). Without orientation information, users may even not be able to understand very large tables, lists, menus, etc.

One site for all – the theory of 'equivalence'

When embarking on the initiative that supports the work of those who want to make sites accessible to all, the World Wide Web Consortium (W3C) chose the slogan *universal accessibility*. There was concern to ensure that it was broadly understood that, as with 'curb cuts', many communities benefit from wide accessibility, including the communities for whom it may be specifically sought (such as those with vision impairments).

In theory, a well defined website can have a single form and yet be accessible in an equivalent way to all users. The alternative, which achieves a measure of accessibility, is multiple forms of the same website. This approach has some associated practical disadvantages such as the difficulty of maintaining such material. More significant from the equal opportunity perspective is the general lack of

satisfaction for those who find that in practice this usually means a text only, summary version of the content for the visually impaired, or screen reader dependent, for example. Such an approach usually does not guarantee accessibility to the *same* material unless it is adapted beyond the removal of images, as text format layout may also make the text inaccessible.

Many have argued that the best way to cater for the different needs of users is to 'browser sniff' and give them what their access device seeks. This approach allows for variation of presentation on screens according to the software being used but does not usually include variation for devices such as paper printers or palmtop readers. Style sheets are used by HTML versions 4.0 and beyond to do this. Apart from the difficulties associated with browser sniffing approach, which assumes that users have made a conscious choice and do not want to change it depending upon the circumstances, the accessibility of the content is not guaranteed by this process: the browser may be able to access the content but this does not guarantee the user can.

W3C staff member Charles McCathieNevile[xi] has drawn attention to the equivalence of different sensory media for web content and argued that accessibility for the visually impaired, for instance, is not so much a matter of avoiding images as providing an equivalent medium, perhaps text or maybe voice, which in some way equates the experience of the non-visual user with that of other users. Additionally, many visually able people have limited literacy or other problems that render text an inaccessible medium. Fortunately such people may not depend upon provision of content in other media so much as the facility within their web access device to have text read to them by the computer. Their devices can read text if it is properly presented.

The theory of equivalence supports equity of content as equity of access and has led W3C to adopt the slogan 'media independent equivalence' to describe content that satisfies the accessibility principles. The composition or structure of an integrated web resource is as much a part of the resource as the individual items: in isolation the individual items may not have the same meaning as they do in the composed version. Descriptions of resources are never the same as the resources but structured representations of structured resources with contextual descriptions of elements of a resource are more 'equivalent' to the original resources than ad hoc representations of unstructured resources. In other words, the potential for equivalence is increased as a function of the degree of structured of the original resource.

Multimedia for all

The often assumed idea that multimedia must be sacrificed for universal accessibility signals a serious misunderstanding of the accessibility principles. The standards for HTML and other formats provide for the use of multimedia and can be seen to celebrate multi-media use, in as much as they recommend the use of multiple media objects in a single context.

W3C has worked particularly on its multimedia integration standard to encourage the use of multimedia, which W3C recognises as valued by both users and publishers/ presenters of web material. Synchronised Multimedia Integration Language (SMIL)

gives normalised access to multimedia objects in the same way as proprietary software environments have been achieving this in other computer-based circumstances. The need for specialised software or plug-ins to gain access to the material once it is on the web is obviated when multimedia producers use editing software that renders their products in SMIL. The added advantage of using SMIL is that it allows for graceful transitions to forms of accessible content.

Web examples

Some examples of web pages will be useful to illustrate graceful transformation and content understandability and navigability.

Note that these pages were taken from the web some time ago (August, 1998) and were offered as illustrative of a problem to which attention needed to be drawn and about which almost nobody had been concerned to that date.

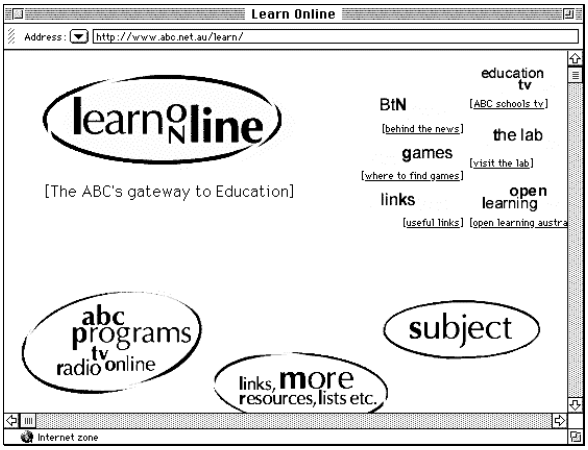


Figure 1: the page as seen through an Explorer web browser

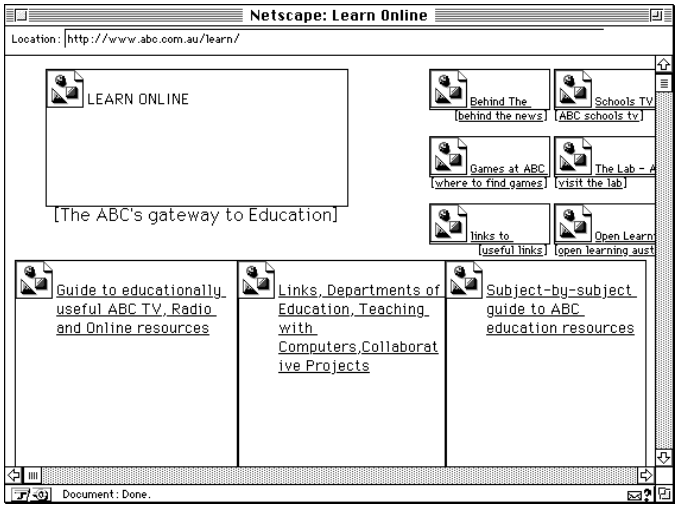


Figure 2: the same page seen through a Netscape browser with the images turned off (often done for faster loading).

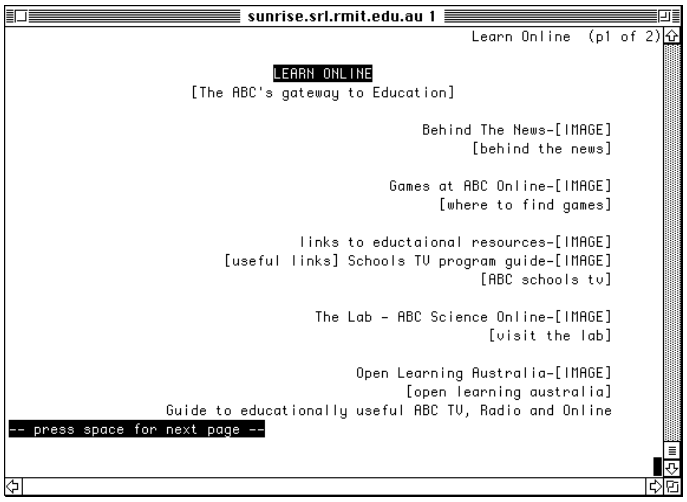


Figure3: the same page viewed using a text-only browser called Lynx. It should be noted that some large communities, such as many students in tertiary institutions, have free access to web resources in this form but must pay privately to gain more complete access.

The three versions of the page, taken from the ABC Learning Site[xii] in August 1998, show the transition of a fairly well structured page from its full graphical representation to a text only version.

Figure 2 shows how the images are 'tagged' with information that can be read by those looking for material of interest and also can be 'read' by devices such as screen readers that render the text as speech. The problem is that the page maintains its layout and the user must be able to navigate using a mouse (or equivalent). Mouse use is slowly being recognised as a freedom for many but a significant problem for others, especially those with poor visibility, low levels of motor co-ordination or just a general lack of computer skills.

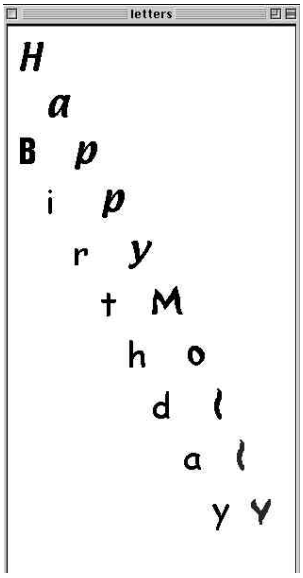
Figure 3 shows the text only version and the order in which the browser presents the material to the user in this case. The browser can distinguish between image descriptions, links to other web pages, and plain text. Lynx, like some other browsers, makes sense of links and does not require a mouse-click to activate links (keyboard commands can be used). There is no information about the layout but if the content has been structured properly, its sequential order will be maintained and comprehensible.

The transition is relatively graceful in the example given. What has not been thought about, and was not until recently included in HTML coding, was the potential to describe in words, the actual images that are missing in the image-free versions of the web page. In the particular case given, there is not much information in the graphical content of the page so this does not matter.

Imagine that the ABC page was from a news report and showed images of a pageant. The text versions of the page could not be considered 'equivalent' to the rich, graphic version that most users were expected to enjoy. In such a case, the sharp contrast between the expected and the actual presentation of the pages might have been quite extensive. The use of short and long descriptions of media objects goes some way

towards solving this problem. Long descriptions are marked by a small hyperlinked 'D'

When pages contain a range of multimedia objects that have been structurally encoded for accessibility, stipulating what forms will be used and how given what media (eg on screen or paper), the browser will determine which version of the object to display. For example, the videos from which the images in this paper were taken, are shown in this paper as black and white photos. The paper, when on the web, will contain the full video version in colour. Some people may then choose to listen to the audio only, or to read the text description of the video clips.



'Graceful transitions' are often inhibited by the graphical designer's use of tables to control screen layout. Given that a browser reads tables from top-left to bottom-right, all that a user could get from the table on the left is 'HaBpiprytMhodlalyy' and even that would only be available after some work! A tag that alerted the user to the arrival of content in tabular form, and only in that form for layout purposes, would not help the user in this case. Such tags, however, are recommended and most usefully supplied in font coloured to blend into the background so only screen readers access them.

The 'structure' of the text in the example is confused with its layout. The text is supposed to be a few easily recognised words but the tabular format, more correctly used for relating two-dimensional information, has distorted the meaning and structure of the text. A simple presentation command which locates text diagonally down the page, if that is the chosen format, should have been used. Then the text's layout would not interfere with the content's structure.

The problem above might have been worse. Many males are colour-blind. If the letters were presented in different colours, and perhaps the background was also coloured, chances are that some of the letters would have blurred into the background. To avoid the problem, some users know to change the settings on their browsers, but this is not always convenient and does depend upon user skills.

Structured content

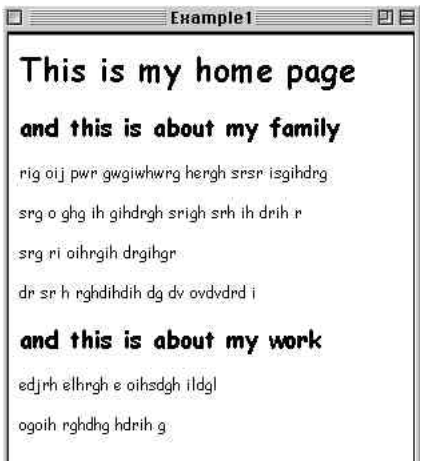
The most versatile web pages have content and layout defined separately. This depends upon content being structured appropriately.

Just as with word processors, it is possible to use the formatting tools of web editors to add features to parts of a page by simply highlighting that section, and as it were, painting on some formatting. In fact, most people achieve their decorations by working in this way. They use text editors, supposedly designed for web development, that do not bother to render correctly the formats they select, but simple convert the direct formatting to HTML code. When viewed on the most common browsers, the pages usually look as the creator wishes, and so nothing is done to

rectify the situation. What lies behind the page presentation, the code, may be very inflexible and make the content inaccessible on other types of browsing devices.

Many common editors, especially those used by people who do not know much about HTML code, do this. Two outstanding examples are offered by the Lotus and Microsoft products, neither of which render accessible HTML 4.0. It goes without saying that people who do not know much about HTML, let alone how to make it accessible, are not likely to know there may be a problem with what they are producing. Those who do know to seek out editors that render HTML correctly are unlikely to be able to find editors they can trust.

Structuring of content is a part of the process of creating content and requires a high level of skill. A generation of word processing has resulted in a generation of writers who achieve their effects by text formatting rather than by text structuring. The following examples appear to be the same.



The technical difference is that in the first example the larger text was made large by formatting with a ‘larger font’ action and in the second example, the larger font is displayed because the text is structured as ‘Heading 1” or ‘Heading 2’. The effective difference is that browsers can move from heading to heading on the second page but have no way of knowing where the headings are on the first page.

It is the author’s perhaps old-fashioned view, after many years of watching users being ‘dumbed-down’ by ‘user friendly, ill-structured software’, that when ‘user friendly’ word processors were developed, an opportunity was lost to help users realise that formatting should be associated with content structure. The use of the ‘outline’ feature, hailed by many at the time as likely to help with the writing process, has never been used by the majority of competent word processor users. Generally, they do not know what it does, cannot get much help from it, and anyway have not set up their word processor’s formatting functions so that it will work for them. The consequences of this seemingly irrelevant oversight are now coming back to haunt their readers. Web pages, because they use the powerful computing functions, exacerbate the problem.

Other potential content problems

Content can be developed in many forms but some forms are particularly difficult if not in good format. Content developers should attend to the structure and the substance of their content.

Untagged change of language

Most browsers are set up to limit the language of the web page content. This often has to do with the capabilities for presentation of the characters, among other things. Where the language of a web page includes several languages, this needs to be notified to the user and changes tagged.

Tables

An example will help:

Saturday morning organisation

Person	Sport	Location	Transport
Jeremy	soccer	Maribynong	Bill's Mum
Sally	hockey	Frankston	bus

The table can be rendered by a screen reader as

Caption: Saturday morning organisation
Summary: This table sets out who has to go where, and how, on Saturday morning.
Name: Jeremy, Sport: soccer, Location: Maribynong, Transport: with Bill's Mum
Name: Sally, Sport: hockey, Location: Frankston, Transport: bus

Videos, images and sounds

As already explained (above), ALT-tags can be attached to images and video files to tell the user what role the special object is playing within the content. As seen from the example of the ABC (above) such a tag should be succinct. In such a case, the tag alerts the user to the fact that the image serves a particular purpose but it does not help someone who wants to know what is in the picture. A *long description* solves this problem - explaining that there is blue sky, grass, four people sitting around a rug, ... Such a description can be made available to users. The convention is to place a link to the long description from a 'D' which should follow the object icon, indicating that there is such a long description available.

HTML 4.0 offers elegant ways of including all forms of expression about objects but at the time of writing, not many browsers are set up to make use of the options. The downward compatibility of HTML 4.0 caters for this too.

Image-maps

Unfortunately, many web publishers fail to recognise that image maps are very difficult to make accessible. Where possible, other ways of providing navigation information should be included in the content.

Proprietary software files, requiring plug-ins or special software

The range of web standard formats is increasing. Before using a proprietary solution, content developers should try to find a standard solution. This way, more people will have immediate access to the material.

PDF files

One common way to provide material on the web, especially material that has previously been published, is as 'PDF' files. As the Access! page of the Adobe Website states:

> "Portable Document Format (PDF) is a platform-independent means of exchanging visually rich documents. PDF is fast becoming a pervasive means of communicating richly formatted information on electronic networks including the Internet and its most popular segment, the World Wide Web (WWW). PDF documents are rich in visual layout, and are popular among users capable of appreciating the high-fidelity visual presentation. However, visually impaired users have found PDF documents hard to access. Conventional screen reading technologies ---software that enables a visually impaired user listen to the contents of a computer display--- prove ineffective when reading the rich visual presentation. "

The good news is that the Trace foundation and Adobe (who produced the PDF format, now have developed a service to help users overcome their difficulties. Users can send PDF documents as email attachments to: pdf2txt@sun.trace.wisc.edu -- for plain text and pdf2html@sun.trace.wisc.edu -- for HTML and receive the result of the conversion in the reply (or use a form at http://access.adobe.com).

Applets

Most screen readers, for a start, are not Java savvy. Many low-end computers which people use to browse the web are similar. Alternatives should be provided where these perform functions. For instance, if a form can replace an applet, it should!

Style Sheets

Once the content has been prepared in a suitable array of forms, the issue of layout arises (see below). Where should the different objects be if they are to appear on the screen?

The W3C approach to this is to offer a standardised way of defining and transmitting information about the sets of style definitions to be applied to the content as required. A single page of content may have a style specified for screen presentation, another set for printing of the content, yet another for an audio version of the same content,

and so on. The user may also have style definitions that make the most use of their capabilities. Styles are defined on ‘style sheets’ that associates each style with its presentation device. A section of content, tagged as a heading, for example, could be in large bold text on one person's screen, in red on another's and read in a gruff voice to a third user. Style sheets are associated with content by a link defined within the computer readable section of the web resource.

Sample of user settings for MS Internet Explorer 4

The order of priority for these style definitions has been set (recently) with the user having the ultimate control. Many users do not know of the control they have, or do not need to exercise it, but those who depend upon particular styles need to have that control. The order implies multiple possibilities for any single presentation.

The aim of style sheets is to provide definitions of styles that are applied to elements of the content, each element being defined according to its structural role. The roles of elements are extensible: commonly used categories such as levels of headings, indentations, and some objects, such as horizontal lines, are given default values by browsing software (not always the same default values). Other roles can be defined by style sheet authors, allowing for vast flexibility to be defined by the CSS language.

Within an organisation producing material for the web, there may be a house style, a departmental style and a personal style that users want applied to their material.

There are relevant factors that weigh against the wide use of style sheets and style language. As the W3C team say in their technical guide,

> "until most users have browsers that support style sheets, not every presentation idiom may be expressed satisfactorily with style sheets."

The author recommends to all that they learn to use style sheets as soon as possible - whether for web pages or the range of other kinds of documents with which they might work. W3C provide a table that identifies which style elements are implemented by which browsers.

Layout is better defined after content is developed

Recently the author has worked with large teams developing web sites for public access. In order to ensure these sites will be universally accessible, the graphic designers have been required to use style sheets and compliant HTML 4.0.

Unfortunately, experience has shown that the more conventional practices of developing 'Photoshop' versions of mock-up pages for client 'look and feel' testing, or even hard-coded pages using web editors that generate HTML, can leave a designer with a significant problem of conversion into HTML with style sheets. An alternative approach, that of challenging the designer to establish 'look and feel' in style sheet form, for application to any web content, is recommended. For this reason, the author has suggested that page layout comes after the content has been specified, if not after content has been developed.

Conclusion

Universal web accessibility for content requires the satisfaction of two criteria:

- Web content should be published in a form which makes one publication accessible to all, and in doing this, publishers should realise the principle of
- Media independent equivalence.

Although it is not easy to develop and publish universally accessible web content, there is significant value for those who may otherwise miss out and the creator's efforts will be rewarded. Working within the guidelines is a more successful approach than trying to bring inaccessible material within the accessibility criteria. All web content intended for the public should be carefully tested both against the technical specifications for valid HTML and CSS, but also against the guidelines for general accessibility qualities.

More technical section

Universal accessibility standards

The process of developing universally accessible web pages is tracked by three major documents:

- W3C Web Content Accessibility Guidelines 1.0: (http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505/:)
- Techniques for meeting these standards are explained in Techniques for Web Content Accessibility Guidelines 1.0 (W3C Note, 5 May 1999) http://www.w3.org/TR/WAI-WEBCONTENT-TECHS/
- A compliance checklist is available at http://www.w3.org/TR/WAI-WEBCONTENT/full-checklist.html

CSS

Although W3C has developed standards for style sheet use, many of the browsers currently in use in Australia do not comply with the standards, particularly those in CSS Version 2.0. Consequently, CSS Version 1.0 may be better in some circumstances.

HTML 4.0

HTML 4.0 (http://www.w3.org/TR/1998/REC-html40-19980424) should be used in conjunction with cascading style sheets.

There are two possibilities:

- HTML 4.0 Transitional - Most people writing Web pages for the general public to access will want to take advantage of HTML 4.0 features including style sheets but nonetheless to make small adjustments to mark-up for the benefit of those viewing the pages with older browsers which can't understand style sheets. These include using BODY with bgcolor, text and link attributes.
- HTML 4.0 Strict - Use this for really clean structural mark-up, free of any tags associated with layout. Use it together with W3C's Cascading Style Sheet language (CSS) to get the all the font, color, and layout effects.

see http://www.w3.org/MarkUp/

Compliance with standards

Compliance with universal accessibility standards involves testing at a number of levels:

- metadata
- any requirements for plug-ins or special software
- the (necessary?) use of applets
- structure
- content,
- layout and
- HTML and CSS.

HTML Tidy is a utility which can be used to convert ill-formed HTML into well-formed HTML. It is available at http://www.w3.org/People/Raggett/tidy/. HTML Kit is an extension of HTML Tidy that makes its use even easier.

See http://www.w3.org/People/Raggett/tidy.exe

For Mac users, http://www.geocities.com/SiliconValley/1057/tidy.html offers help.

Validating HTML 4.0

W3C's HTML 4.0 validation service is available at http://validator.w3.org/ This validator is smart enough to know if it is looking for HTML 4.0 Strict or Transitional. It checks code and shows errors.

Validating CSS

W3C's CSS2 validation service is available at http://jigsaw.w3.org/css-validator/. It checks and corrects CSS code.

Validating 'Bobby' compliance

The Bobby tester is available at http://www.cast.org/Bobby/ Bobby testing does not guarantee compliance but rather helps identify coding which is not compliant.

Checking Lynx compliance

Web pages can be tested using Lynx and Amaya browsers. Lynx is available free from the web at http://lynx.browser.org and Amaya, the editor-browser developed by W3C, is available at http://www.w3.org/Amaya/ Amaya shows errors in code. It is available only for Unix and PC-based computers.

Validating guideline compliance

W3C Guidelines provide a number of criteria against which testing can be conducted, In particular, the web pages should satisfy the W3C checklist. The W3C Checklist is available at

http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990324/full-checklist.html.

Summary guidelines

- Provide equivalent alternatives to auditory and visual content;
- Don't rely on colour alone;
- Use mark-up and style sheets and do so properly;
- Clarify natural language usage;
- Create tables that transform gracefully;
- Ensure that pages featuring new technologies transform gracefully;
- Ensure user control of time-sensitive content changes;
- Ensure direct accessibility of embedded user interfaces;
- Design for device-independence;
- Use interim solutions;
- Use W3C technologies and HTML 4.0 and CSS 1.0 guidelines;
- Provide context and orientation information;
- Provide clear navigation mechanisms, and
- Ensure that documents are clear and simple.
- In all places where there may be difficulties with layout, hidden background-matching text should be used to inform users with vision disabilities of ways of interpreting or using the available text.

For more information see:

http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505/

[i] "Access to multimedia technology by people with sensory disabilities", March 13, 1998. Washington, DC: National Council on Disability or http://www.ncd.gov/publications/sensory.html#9

[ii] National Center for Health Statistics see National Center for Health Statistics (NCHS). (1994). Data from the National Health Interview Survey, series 10, no. 188, table 1. U.S. Department of Health and Human Services.

[iii] Georgia Institute of Technology (1996). (http://www.cc.gatech.edu/gvu/user_surveys/survey-04-1996)

[iv] Kirchner, C., and Harkins, D. (1991). *Issues and Strategies Toward Improving Employment of the Blind and Visually Impaired in Illinois*. New York: American Foundation for the Blind.

[v] http://w3.org/html

[vi] http://w3.org/css

[vii] PICS (Platform for Internet Content Selection) ratings are used to filter resources according to a predetermined set of criteria selected by the user and checked for by the user's browser.

[viii] http://w3.org/PICS

[ix] http://purl.org/dc

[x] http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505/

[xi] informal communications

[xii] http://www.abc.net.au/learn/