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How the web continues to fail people with disabilities

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Abstract

The digital divide is most often understood as that between the IT haves and have-nots. However, if there is one minority group that can be, and often is excluded from the world wide web, even if they have a computer, it is disabled people. The Special Educational Needs and Disabilities Act 2001 (SENDA) extended the provisions within the Disability Discrimination Act 1995 regarding the provision of services to the education sector. Yet accessible web design, dependent on professional coding standards, adherence to guidelines, and user testing, remains rare on the web. This paper examines the background to professional coding standards, and adherence to guidelines, in an attempt to find out why the web continues to fail people with disabilities.

It begins by examining the progress of the transition in the 1990s from old style HTML to strict XHTML. It applauds the vision behind that transition, charts its progress identifying the principle constituencies that it involves – and how well each has played its part. It then focuses on the further problem of the requirement for user testing to iron out anomalies not covered by standards and guidelines. It concludes that validating XHTML code is desirable, but that user testing also needs to be undertaken. It identifies the complex and heterogeneous network of interrelated concerns through which the needs of disabled web users remain unheeded.

To support its argument, the paper details the results of two studies – 1) of the homepages of 778 public bodies and blue chip companies, which found only 8% of homepages validated against any declared Document Type Declarations (DTD), and 2) a wider research project on employment websites which also included disabled user testing and a number of focus groups and interviews with disabled users and web development companies.

Introduction

"The transition strategy from Hypertext Mark-Up Language (HTML), as it is practiced today, to HTML based on Extensible Mark-Up Language (XML) in the future is difficult," (Berners-Lee, 1998) wrote Tim Berners-Lee, Director of the World Wide Web Consortium (W3C), in September 1998.

The vision of that transition brings together a number of distinct issues, from the purely computationally efficient, to the ethically and morally virtuous. There has been a good deal of excellent work on the importance of standards (Hanseth 2000, Brunsson 2002, Schmidt 1998, Grindley, P. 1995). What the concept entails, in a nutshell, is no less simple – and no

less fundamental – a development as the standardisation in the industrial revolution of the length and width of nails and screws. This put an end to the bespoke smelting of every screw and nail in every machine available to industry, and made an invaluable contribution to the efficiency and productivity of every industrial endeavour (Keep, 2005). The establishing of strict global standards for web coding is no less simple – and no less fundamental – an exercise for the information age.

Now, web development is in many respects not an unusual skill, in that it ranges from the hobbyist, through the cottage industry, to the blue chip and the public professional. What is unusual is that the platform upon which this range of skills is presented is the same. To make use of the dramatic analogy often used by sociologists (Goffman 1990; Butler 1993) – and indeed by the sociologists of technology, in particular actor-network theorists (Law 1992; Latour 1993) – it is as if the children's living-room Christmas play for the grandparents, the school gym-hall drama, the touring small-scale theatre production, and the grand opera, were all to appear one after another on the same stage. To impose standards upon all of these diverse levels of skill, in order better to control and improve the quality of service provided by the stage, is a tall order. To ensure, additionally, that an induction loop is provided in the theatre for the hard of hearing, and that auditory commentaries are available for the blind, is both morally imperative, and extremely difficult to ask of those at the hobbyist end of the spectrum. Yet it is perhaps precisely because of this range of skill levels sharing the same platform, that there is also apparent, on the web, a great range of compliance with the latest standards for code languages.

The British Standard Whitworth System, in fixing a set of standards for the threads of screw bolts, wrested control of the workplace from the artisans who used to handcraft each screw and bolt for each new machine, and passed that control to the capitalist entrepreneurs who could now for the first time simply buy a packet of standard screws. The W3C standards for web coding wrested control of the web, in the mid-1990s, from the likes of Microsoft and Netscape, (Phillips, 1998) who wanted to define HTML for their own entrepreneurial proprietary purposes, locating it within a non-proprietary, non-profit-making global standards body. Yet – as the research detailed in this paper underlines – web developers – the artisans of the web – still persist in refusing to adopt the latest versions of XHTML in their practice. There are undoubtedly many complex reasons why this is the case, including the lack of notice yet paid by the manufacturers of WYSIWIG web authoring software to adhere to the recommendations of the W3C.

The World Wide Web Consortium, established by Berners-Lee in 1994, is a non-profit-making, academic body. In the political climate of global capitalism, however, the W3C is a cautious organisation. They publish Formal Recommendations, rather than standards. They do not engage in any direct lobbying of the industry concerning compliance. Indeed their victory over Microsoft and Netscape in the Browser Wars of the mid-late 1990s was something achieved rather through the vigorous lobbying of external organisations such as the Web Standards Project, (WaSP 1998) formed to enable web developers to avoid the increasingly necessary expense of creating multiple versions of their websites individually tailored to increasingly different browsers. Nonetheless, it is clear that the standardisation of code languages implicit in a W3C Formal Recommendation carries with it the intent of those who contributed to its making, and the W3C is an inherently non-proprietary, public sector body for whom the interests of private commercial enterprises will at best be secondary. Ultimately, indeed, a W3C Formal Recommendation, seen in this light, can only serve one master, the Director of the W3C, inventor of the web, Tim Berners-Lee.

In short, the evolution of standards for the web, unlike the simpler example of the British Standard Whitworth screw thread, is a very heterogeneous network of very complex relations between an inventor seeking the next level of his invention, corporations seeking market dominance, and advanced web developers seeking a level playing field in the

browser market to facilitate cross-browser coding. The subsequent lack of use of such standards, as evidenced in this paper, is equally heterogeneous. The implications for those dependent on standards-based web-authoring, however, not least students within learning environments covered by the legal requirements of SENDA, are severe, and result in a digital divide even within the most hi-tech educational establishments with laptops and wireless for every student.

W3C Document Type Declarations (DTDs)

Web pages, originally merely text with the odd image added to spice things up, increasingly became, during the mid-1990s, a 'virtual' extension of the already mature desk-top-publishing revolution, which had seen the printing industry massively computerised over a very short period of time. HTML 3, a formal recommendation of the W3C in the mid90s, contained a wide range of new visual formatting properties, in response to the increasing interest in what could be achieved presentationally on the web.

There were essentially three main players in this online development: Netscape, Microsoft, and the W3C. While Netscape and Microsoft vied for control of the web with their own, proprietary, unwieldy new versions of HTML, the W3C began creating a new foundational language for the future of the web: Extensible Mark-up Language (XML), and a new presentational language: Cascading Style Sheets (CSS).

The W3C's new versions of HTML, following HTML3, shifted it across to this new, XML foundation, first through the publication of HTML 4, and then XHTML. Both these new kinds of HTML, published in the late 1990s, came in two flavours: Strict, and Transitional. When using Strict (X)HTML, visual formatting was now to be achieved exclusively through the use of CSS. The Transitional flavour of these new versions of HTML allowed web designers to continue using older, HTML 3 visual formatting code until such time as the makers of browsers had caught up, and were properly supporting the use of CSS. The Transitional DTD thus included "presentation attributes and elements that W3C expects to phase out as support for style sheets matures," and the admonishment that, "Authors should use the Strict DTD when possible, but may use the Transitional DTD when support for presentation attributes and elements is required." (W3C 1999b) In the summer of 2001, XHTML1.1 was published, with no Transitional version. After the failure of XHTML2, HTML5 is now in preparation at the W3C.

Steven Pemberton, Chair of HTML and Forms Working Groups at the W3C, when asked about the Transitional versions of HTML, in the course of an email correspondence with the author during February 2005, said, "As far as I am concerned the phase-out is more or less complete." Asked for a direct quote regarding what kind of HTML to use, he replied: "people should be using strict DTDs and validating against them." The transition is over.

Browsers

But of course this is far from the whole story. User Agents – the browsers through which web pages are viewed – have of course had to change and develop with this transition. "HTML browsers accept any input, correct or incorrect, and try to make something sensible of it," as the W3C's FAQ page on XHTML explains. "This error-correction makes browsers very hard to write, especially if all browsers are expected to do the same thing. It has also meant that huge numbers of HTML documents are incorrect, because since they display OK in the browser, the author isn't aware of the errors. This makes it incredibly difficult to write new web user agents since documents claiming to be HTML are often so poor." (W3C 2004) As things stand, however, at the time of writing, the browsers used by the vast majority of people worldwide are by and large XHTML compatible, and fully capable of supporting style sheets, making the continued use of a Transitional DTD quite unnecessary.

2008	IE7	IE6	IE5	Fx	Moz	S	O
April	24.9%	28.9%	1.0%	39.1%	1.0%	2.2%	1.4%

Table 1 Browser Usage Statistics April 08 (W3Schools.com 2008)

Of the above Browsers, support for XHTML and CSS is excellent in Internet Explorer 7 (IE7), Firefox (Fx), Mozilla (Moz), Safari (S) and in Opera (O). Internet Explorer 6 (IE6) and Internet Explorer 5 (IE5) have problems with some style sheet positioning. Thus the overwhelming majority of people accessing the W3Schools website do so with an XHTML compatible browser fully supporting style sheets. Browsers are, of course, free, and the tiny percentage of users still using an older browser can easily be guided to where they can update their software.

Web accessibility

Parallel with the development and publication of XHTML, the W3C undertook an exercise entitled the Web Accessibility Initiative, (WAI) which in 1999 published its Web Content Accessibility Guidelines (WCAG). As part of the initiative, new elements and attributes were introduced into the code to help make it more accessible to disabled people. Thus HTML 4 and XHTML 1.0, published in revised versions the same year, contained these elements in both Strict and Transitional flavours, as does XHTML1.1. The WAI also published, in the following years, the Authoring Tool Accessibility Guidelines (ATAC), and User Agent Accessibility Guidelines (UAAG). It is these standards for those making websites, the software tools many use to make them, and the browsers through which they are accessed, that have been increasingly accepted by governments in numerous countries, as the de facto global standards for web accessibility.

To provide web developers with a graded approach to the implementation of accessibility, three ‘levels’ of the WCAG have been defined: Levels A, AA and AAA. Of particular note are three Guidelines included as of Level AA priority: 3.2, 11.1 and 11.2. Guideline 3.2 of the WCAG states: “Create documents that validate to published formal grammars”. Guideline 11.1 states “Use W3C technologies when they are available and appropriate for a task and use the latest versions when supported.” In a climate where nearly all browsers support the latest versions of XHTML and CSS, it would seem that the WCAG are expressly recommending that this is the way web pages should be made. The fact that Guideline 11.2 states “Avoid deprecated features of W3C technologies” would suggest that it is the Strict DTD of HTML 4.01 or XHTML 1.0 that should be used, in any case, if the latest version, XHTML 1.1, is not used.

Amongst those responsible for the creation of the forthcoming WCAG 2.0, there is ongoing discussion about the relationship between accessibility and validity. “People agree that validity is a good first step towards accessibility and that validity does not guarantee accessibility,” opens the summary at the W3C website. (W3C 2008) Essentially, there are those who feel that XHTML code that validates against the DTD laid down by the W3C is essential, and should be a Level A priority, and those who feel that accessibility is the highest priority, and that the recommendations may at times be behind advances in making pages accessible – in short that invalid code may at times be more accessible than valid code.

In the findings of the second of the two research projects discussed in this paper validity, whilst an important part of what makes a webpage accessible, is found not to be enough. Meanwhile legislation and directives around the world aimed at preventing discrimination

against, and promoting equality of opportunity for, disabled people, have made the construction of websites in compliance with the WCAG 1.0 a legal requirement. Most governmental directives specify Level AA as the minimum requirement.

To return to the theatrical analogy with which we began this section, it is clear that the children's living-room Christmas play for the grandparents will likely never reach the standards required of the Grand Opera. But the standards of professionalism set by those at the top of the profession will inevitably impact upon those below, with the implication that the onus is upon those web developers and authoring tool manufacturers responsible for the public sector and blue chip private sector websites to improve their own standards, if the web is ever to be generally accessible to those with disabilities.

Study of international websites

A study of the homepages of 778 websites undertaken by the author, shows that the vast majority of websites lag years behind the times, and continue to be written in mid-90s badly formed HTML. In order to provide some fresh data towards the contention in this paper, it was necessary to undertake some quantitative research. Selecting the number and provenance of websites to test, and against what to test them, presents a range of problems.

Other studies, producing not dissimilar results, have been undertaken, testing a fairly random selection of sites (Marincu and McMullin, 2004). Given the nature of the web, however, as discussed above, it would seem more appropriate to test only the makers of governmental and blue-chip company websites for compliance, rather than include within the survey the hobbyist and cottage industry web developer. Similarly, the tests to be undertaken should give us information not only on the use of, and validation against DTDs (Marincu and McMullin, 2004) but also whether style sheets (CSS) have been employed.

The sites selected to be studied were as follows: first of all the countries to be studied were narrowed down to: Australia, the United States, and the EU. Within the EU, the UK was singled out, along with Italy, Germany and France. These were selected as the four major nation states in the union. The range of sites in each of these countries to be studied were then narrowed down to governmental homepages for central and local or state government institutions, and for the US, UK and Australia, the published lists of top private companies.

The tests undertaken were firstly, whether the homepage included a DTD, and secondly whether it was Strict or Transitional, and thirdly whether it validated at the W3C validator against that DTD. Additionally, each page was tested to see whether it contained a link to an external style sheet (CSS) file.

The results

It was found that only 8% of all the homepages tested actually validated against the declared DTD. Sites which did not declare a DTD did not validate against any DTD at all. Only 2.5% of all the homepages tested used a Strict DTD, (18 sites in total) and only 10 of those validated against that DTD – barely more than 1.5% of the total. Only 57% of all the homepages tested included a DTD at all, and the overwhelming majority, some 55% of all homepages tested, used a Transitional DTD. Only 51 of these validated against that Transitional DTD – just 6% of the total.

There is, however, relatively good use of CSS – 78% of all tested homepages had a link to an external stylesheet. While it is true that a good many of these may have only one or two properties, and therefore not reflect proper separation between structure and content for accessibility, it is nonetheless encouraging to see that knowledge of CSS and its use is at least widespread. A summary of the results are represented in Table 2 overleaf.

UK

	Total Sites		DTD?	Strict DTD	Trans DTD	Valid?	CSS?
Central Govt	3	No.	3	0	3	1	3
		%	100%	0%	100%	33%	100%
Counties & Unitaries	203	No.	150	6	152	40	170
		%	70%	3%	75%	20%	84%
Companies (FTSE 100)	98	No.	61	2	59	5	75
		%	62%	2%	60%	5%	77%
UK Total	**304**	**No.**	**222**	**8**	**214**	**46**	**248**
		%	**73%**	**3%**	**70%**	**15%**	**82%**

US

	Total Sites		DTD?	Strict DTD	Trans DTD	Valid?	CSS?
Central Govt	4	No.	1	0	1	0	3
		%	25%	0%	25%	0%	75%
States	50	No.	32	0	32	1	40
		%	64%	0%	64%	2%	80%
Cities	100	No.	45	2	43	0	72
		%	45%	2%	43%	0%	72%
Companies (Fortune 100)	100	No.	44	1	43	2	76
		%	44%	1%	43%	2%	76%
US Total	**254**	**No.**	**122**	**3**	**119**	**3**	**191**
		%	**48%**	**1%**	**47%**	**1%**	**75%**

Australia

	Total Sites		DTD?	Strict DTD	Trans DTD	Valid?	CSS?
Central Govt	3	No.	2	0	2	1	3
		%	67%	0%	67%	33%	100%
States	8	No.	4	0	4	0	7
		%	50%	0%	50%	0%	88%
Cities	23	No.	13	20	13	1	16
		%	57%	87%	57%	4%	70%
Companies (Listed co's)	120	No.	45	2	43	4	87
		%	38%	2%	36%	3%	73%
Australia Total	**154**	**No.**	**64**	**22**	**62**	**6**	**113**
		%	**42%**	**14%**	**40%**	**4%**	**73%**

France

	Total Sites		DTD?	Strict DTD	Trans DTD	Valid?	CSS?
Central Govt	3	No.	2	1	1	0	2
		%	67%	33%	33%	0%	67%
Regions	24	No.	9	0	9	2	15
		%	38%	0%	38%	8%	63%
France Total	**27**	**No.**	**11**	**1**	**10**	**2**	**17**
		%	**41%**	**4%**	**37%**	**7%**	**63%**

continued…

Germany

	Total Sites		DTD?	Strict DTD	Trans DTD	Valid?	CSS?
Central Govt	3	No.	3	0	3	0	3
		%	100%	0%	100%	0%	100%
States	16	No.	11	0	11	0	13
		%	69%	0%	69%	0%	81%
Germany Total	19	No.	14	0	14	0	16
		%	74%	0%	74%	0%	84%

Italy

	Total Sites		DTD?	Strict DTD	Trans DTD	Valid?	CSS?
Central Govt	3	No.	3	0	3	0	3
		%	100%	0%	100%	0%	100%
Regions	20	No.	12	6	6	6	16
		%	60%	30%	30%	30%	80%
Italy Total	23	No.	15	6	9	6	19
		%	65%	26%	39%	26%	83%

Global

	Total Sites		DTD?	Strict DTD	Valid Strict DTD	Trans DTD	Valid Trans DTD	Tot Valid DTD's	Tot Valid DTD's in sector	Use of Ext. CSS?
Public Sector	392	No.	262	9	4	253	40	44	44	315
		%	67%	3%	44%	65%	16%	17%	11%	80%
Private Sector	386	No.	186	11	8	175	11	19	19	289
		%	48%	6%	73%	94%	6%	10%	5%	75%
Total	778	No.	448	20	12	428	51	63	63	604
		%	58%	4%	60%	96%	12%	14%	8%	78%
			% of all in sector	% of those with DTD	% of Strict	% of those with DTD	% of Trans	% with DTD	% of all in sector	% of all in sector

Table 2 A summary of the results of the study of 778 website homepages

Analysis

Fully 21% of the 203 UK council websites tested boasted valid code. This can be ascribed to the injunction in the principal technical policy document for Implementing Electronic Government in the UK, the eGovernment Interoperability Framework, to use web standards promoted by the W3C. (eEnvoy, 2004) When compared to the UK's EU partners, it is an impressive result. Six out of 20 of Italy's regions had valid websites, two of France's 24 regions, and none of Germany's 16 states. Of the four main central government websites tested for each EU country only one had valid code – the UK Prime Minister's website at pm.gov.uk. In the US, not one single public sector website tested had valid code. In Australia, only 2 of the 34 public sector websites tested had valid code. In the US only two of the top 100 companies in the Fortune 500 list boasted valid code on their websites. In Australia only four of the 120 listed companies boasted valid code, and in the UK only six of the FTSE 100 company websites had valid code, when tested.

In summary, we can say that using a strict DTD and ensuring that web pages validate against that DTD is not only a low priority for the overwhelming majority of websites in our test, it is extremely rare.

How can this be explained? If the makers of browser software are keenly competing, now, on the basis of how compliant they are with W3C standards (WaSP, 2005), and it is not the fault of the W3C, or of public policy, who then is to blame for the continuance of 'tag soup'? Can we simply blame web developers themselves, who seem to remain reluctant to implement such standards in their own work? Is this a case where the artisans, as with the Victorian makers of bespoke screws, are refusing to cede the control they still retain over

the development process? Is it merely ignorance in the wider market that such standards exist? Is it the fault of the authoring tool manufacturers?

In fact, it would appear that not only are web developers reluctant to implement the standards, but the standards themselves are not really adequate. The Web Content Accessibility Guidelines 2.0 have been the subject of heated discussion for the last eight years, and still not published as a formal recommendation. HTML itself is still the subject of heated debate, with numerous factions and working groups within the web development community arguing over the best way forward (Holzschlag, 2007). Many web developers may indeed be simply ploughing on with what they know and will pay heed to standards once those responsible for them have settled on something stable. Others still may point to the extraordinary speed of development within ICT over recent years with the suggestion that professionalisation and standards creation simply cannot keep up with fast-paced development and that cutting edge web developers will always be ahead of standards. The advent of Web 2.0, furthermore, and the implication that it in fact hands web creation increasingly over to the amateur, can itself be claimed as a further bar to the use of professional standards, though the tools that Web 2.0 provides should of course themselves be created to the highest standards and enable amateurs to create web content that adheres to such standards without themselves being aware of them – such, at least is the thrust of the Authoring Tool Accessibility Guidelines which covers not just software packages such as Dreamweaver and others but also Web 2.0 content-creation tools. The digital divide for disabled people, however, will continue so long as this situation continues to result in a general lack of compliance to professional standards of coding, guidelines, and testing.

Accessibility audit of employment websites

Many studies of the accessibility of various categories of website have been undertaken, (e.g. Ritchie et al, 2003; Guo et al. 2005). Research undertaken by City University for the Disability Rights Commission and published in April 2004, (DRC 2004), which examined over 1000 UK websites across all sectors, and the study of some 300 or more European Government websites published at the Ministerial eGovernment Conference in November 2005, (eGovernment Unit, 2005; Thompson, 2003) all used a broadly similar combination of strict pass/fail audit against the W3C's Web Content Accessibility Guidelines (W3C, 1999a), to assess the accessibility of websites. It is clear that a combination of IT audit and user testing is needed because a simple automated software check against the guidelines, as commented elsewhere (Kreps et al, 2006a and 2006b) is insufficient to address all the issues.

In the course of the research project, "Combating eDiscrimination in the North West" (Kreps & Wheeler 2008) a list of employment related websites was drawn up covering both regional and national job adverts, and both public and private sector job opportunities in the North West of the UK. Of the 112 websites in this list 27 were local to Greater Manchester, 22 from the wider North West region, 53 were national employment services covering all regions, and 10 employment agencies. These 112 websites were subjected to a rigorous audit against each of the 65 checkpoints of the Web Content Accessibility Guidelines 1.0. 15 of the websites passed all Level A checkpoints. None passed all Level AA checkpoints.

More interesting however, were the results of the disabled user testing, the interviews with web development companies, and the process of working with one of them to produce an accessible website for the project. In this project even those sites which had adhered, more or less, to professional standards of coding, nonetheless failed to produce accessible websites. In the interviews with web development companies it became clear that, "All interviewees generally agreed that the testing of websites would be important, but few of

them actually did significant accessibility testing before delivering websites to clients." (Kreps & Wheeler, 2008). During the process of creating an accessible website for the project, moreover, which was being constantly tested by one of the researchers, who is blind, using HAL, contact was made with technical experts at Dolphin, manufacturers of the HAL screen reader, to try to track down and resolve seemingly intractable problems. In the end it was discovered that, "Coding up forms according to the guidelines, in short, worked fine in isolation, and the screen reader had no problems interpreting it properly. Within the design that had been produced, however, properly positioned using Cascading Style Sheets with structural html, the form ceased to work. An unusual, technically valid but counter-intuitive coding structure needed to be adopted, before the screen reader would work with it." (Kreps & Wheeler 2008)

In the final summary of this report, the following paragraph indicates something alluded to earlier in this paper:

"Different versions of XHTML and CSS, the range of different browsers with differing implementations of same, and the range of different assistive technologies with differing support and responses to same, altogether, present too many variables and potential for unusual outcomes, for a simple professional approach to coding to be sufficient. User testing will likely find problems needing attention."

Conclusion

The research discussed in this paper points to the heterogeneous nature of the complex network of relations governing the evolution of the web, and to the great range of different skill levels of those producing content for the web. Those engaged in producing websites for government bodies and blue chip companies, at the top of the profession, moreover, for the various reasons discussed above, are by and large not responding well to the urge for professional standards and compliance with painstakingly developed Guidelines for making the web more accessible. Furthermore, due to the heterogeneous nature of the web, such standards and guidelines, although an important foundation, are often insufficient to ensure accessibility for disabled people.

Clearly there is a need, despite its problems, either for even greater standardisation and professionalisation, in an attempt to iron out the anomalies that are revealed in the eDiscrimination project, or for web developers (at least those at the top of the profession) not only to professionalise their approach to the use of strict code, but to acknowledge that user testing is required before going live with a new site. As the eDiscrimination project found, when interviewing web development companies willing to talk to the researchers: "All interviewees generally agreed that the testing of websites would be important, but few of them actually did significant accessibility testing before delivering websites to clients." (Kreps & Wheeler 2008) Standards and Guidelines have been drawn up, legislation and directives are in place mandating their use, and user testing is promoted in many studies as the final step needed to ensure accessibility. But the strange and contorted network of competing influences, inadequate standards, and speed of development, continues to leave disabled people on the wrong side of a digital divide.

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