CASE STUDY: DESIGNING FOR WEB ACCESSIBILITY

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ABSTRACT
There is still a large percentage of web resources that are inaccessible to many individuals. The authors previously developed a meta-method for evaluating the accessibility of existing web resources and now feel there is a need to provide advice on designing for accessibility during the development lifecycle. Despite the large quantity of resources on accessible design now available, there is still a shortage of practical information for web developers on the steps to be taken towards implementation. More importantly, it is difficult to ascertain where exactly to place accessibility within the developer’s successful, structured development lifecycle. This paper details a series of steps used by the authors to provide some structure to designing their web resource to be accessible. These steps include using existing tools and techniques and combines this with what the authors call “accessible sense”.

KEYWORDS
Accessibility, Usability, Disability, Evaluation, Design, Development.

1. INTRODUCTION
The need to produce accessible World Wide Web resources has been shown to be vitally important and the reasons are more evident than ever. As much as legal imperatives have been a huge incentive in the UK, US, Australia and elsewhere, there are many other reasons why accessibility is being considered. These include the need to provide a product to the widest possible market and on a wide range of browsing platforms. Industry is now starting to see the commercial benefits of accessibility.

Support is already available (Rowan et al, 2000; Sloan et al, 2000) for reviewing and auditing existing web sites for accessibility. However there is a need for a procedural, step-by-step guide to aid in the design and development of new accessible web sites, a guide which this paper aims to initiate.

Ensuring the accessibility of a web resource throughout the development lifecycle need not be a cause for distress for web designers and web developers. The authors believe that incorporating accessibility into an appropriate methodology, such as WebML, need not compromise the goal of designing a visually attractive, innovative web site. Accessibility should not be seen as constraining creative ability but as an additional skill, bringing with it the opportunity to demonstrate creative talents to a wider variety of people.

2. DESIGNING FOR WEB ACCESSIBILITY

2.1 Development of a suitable approach
The authors believe that a stronger emphasis needs to be placed on accessibility. In particular, it should be made a structured part of the software development process and should be considered as important as requirements gathering. Used iteratively, accessibility should be considered and revisited at every stage of development.

The approach detailed in this paper was developed during the redevelopment of the authors' own web site (www.dmag.org.uk) and was subsequently used in the development of a similarly sized resource for a third party (www.contractwise.co.uk). For the group's own web site, it was particularly important to ensure
optimal accessibility but also in a reasonable length of time. It is possible to develop an accessible web resource by retro-fitting accessibility at the end; however the effort required can be considerable and the resulting level of accessibility can vary substantially.

The approach which was eventually developed is described below. The steps in the development are described in the order in which they are carried out by the authors.

2.2 Accessible Design Approach

The following list describes the stages in the approach:

1. Structure and Planning
2. Accessibility Research
3. Navigation and Template Design
4. Feature Provision
5. Accessibility Check of Template
6. Amendments to Template Design
7. Expansion Strategy
8. Add Content
9. Final Accessibility Check

2.2.1 Structure and Planning

The first step is to consider the purpose of the web site. It is important from the start to identify the users, know who they might be and what they expect to achieve from the web site. In all cases it is important that the web site reflects the needs of the customer and not the client or the developer. Customer driven web sites are far more usable and accessible because they are focussed on easing user task completion. They provide, for example, useful navigational aids for the user rather than the navigational features resembling the hierarchical structure of the company (Nielsen, 2000a).

In developing the authors' own web site, producing a site map first was extremely beneficial. It clearly highlighted some areas that were not needed but more importantly highlighted areas requiring significant reorganisation. It was not until the ideal hierarchy was laid out clearly that the authors realised it could be far more user-centred. The Services area, for example, reflected the group's own model of the services they provide, rather than the model a typical user would prefer to see. Additionally, producing a site map helped to determine the main areas into which information fell and thus provided the top level links to be used for navigation.

2.2.2 Accessibility Research

As much as this approach has been developed to help designers who are not experts in the field of accessibility, it is important that everyone involved in the design and development of the web site has a basic understanding of the main concepts and knows where to go for help.

The first place to look for information is the World Wide Web Consortium (W3C) Web Content Accessibility Guidelines (WCAG) (W3C, 1999). These guidelines have been ordered by priority, and project workers should familiarise themselves with at least the Level One Priority Guidelines, if not all three levels.

Becoming familiar with accessibility need not be repeated in every project because many of the main issues will have been committed to memory. Nevertheless, an occasional review of current thinking will always be useful.

2.2.3 Navigation and Template Design

Decide early on in the design stage what navigational aids will be used throughout the site. The site map normally acts as a good indicator of the kinds of navigational aids that will be required. The authors have found two navigational aids to be particularly successful, these are:

1. **Top Level Links** – typically as a list down the left hand side of each page, or a 'tab system' along the top.
2. **The Breadcrumbs Trail** – indicating the location of the current page in relation to the rest of the site and providing links to higher levels.
The most important thing about the navigational aids is to ensure they are consistent. Insisting that users adapt to a new paradigm every time they visit a new page or section of the site causes both accessibility and usability problems.

Having agreed what navigational aids to use, a template can begin to be developed, allowing early feedback to be gained from users.

The template should be developed using Cascading Style Sheets. This allows users to retain control over the presentation of the information, particularly important for dyslexic or visually impaired users who may wish to alter the appearance of text and backgrounds etc.

**2.2.4 Feature Provision**

One further step to carry out here is to provide features that enhance the user experience. These features may come in various forms:

- **Features that help all users** – this means features that provide all users with help or a short cut to use the site such as ‘top of page’ links on longer pages.
- **Features that help users with specific needs** – in particular this means features that may be hidden from most users but are available to people with certain disabilities. For example, the use of a ‘skip to main content’ hidden link for users of text-to-speech browsing environments and other non-graphic browsers gives the opportunity of by-passing groups of navigational links to directly access the main body of the page. Such features are greatly appreciated by those who require them, but do not detract from the usability of the site for those who do not require them.

Within the authors' web site, a variety of features including the ‘top of the page’ feature were used. This has been well received by all evaluators but in particular sighted evaluators found it can increase the speed in which the site can be used. Additionally, the ‘skip to main content’ feature mentioned here was also provided. This is something that our non-sighted evaluators found particularly useful. Our site does not have a large amount of links and components of information to go through before getting to the main body of the page, but even so, adding a skip facility improved the overall use of the site for these users and was simple to develop (DMAG, 2002).

**2.2.5 Accessibility Check of Template**

Once the template has been developed and before any content has been added, it is important to check the accessibility of the site so far. For this the authors suggest three steps to be carried out:

1. Test with Automatic Validation Tools
2. Test with Different Browsers under various conditions
3. Inspection and User Testing

The combination of these three stages should help bring to the surface the majority of potential accessibility problems.

**2.2.5.1 Test with automatic validation tools**

Automatic Validation Tools provide a fast and easy means of identifying some of the major accessibility barriers present in a site. Two of the most effective tools are:

- **Bobby** (www.cast.org/bobby) - a popular automatic accessibility evaluation tool, the results of which provide important, although incomplete, information regarding accessibility levels of a site.
- **W3C HTML Validation Tool** (validator.w3c.org) - not an accessibility evaluation tool as such; but it checks the HTML source code behind a web page for compliance with the HTML standard as specified in the code of the page.

**2.2.5.2 Test in different browsers under various conditions**

It is very important for designers and developers to realise that there is no ‘standard’ browsing environment for the Internet. Therefore it is important to check that what works in one browser continues to work in alternative browsers. At this stage of development we recommend that designers check the web resources using at a minimum the following browser platforms: Internet Explorer, Netscape, Opera and the Lynx text-only browser.
Additionally, as recommended by the W3C, the site should be viewed under various browsing conditions, such as:

- graphics not loaded
- frames not loaded
- style sheets not loaded
- scripts disabled
- using keyboard only

These are intended to simulate browsing conditions under which certain users will be forced to work, particularly where legacy technology is involved.

This is also an ideal stage to test with assistive technologies, in particular screen reading technology. If you do not have access to this technology through a particular user with disabilities, the authors recommend downloading a trial version of IBM HomePage Reader (www-3.ibm.com/able/hpr.html).

2.2.5.3 Inspection and user testing

It is very important that the web resources are evaluated objectively at every stage in the development lifecycle. As a result of the accessibility research conducted by the team, all those involved should be able to assess the template for accessibility in accordance with, at least, the Level 1 priority guidelines. Other general considerations include:

- Use of white space, clarity etc
- Colours with suitable contrast
- Use of structural HTML elements and style sheets to show headers, tables and text in a suitable and clear format
- Suitable implementation of navigational aids
- Access to email or telephone support from the homepage should the user require help

It is always hard to be objective as a designer though, so the best solution is still to bring in a group of representative end users. This does not have to cost anything and it need not be a large scale user evaluation. It could involve people working in other parts of the company or friends and family, as long as they can be counted on for being objective.

If possible, contact should be made with a blind or visually impaired user and they should be asked to comment on the ease of use of the template as it stands. Observing a user evaluation by a blind or visually impaired user of your site is both an educational and productive experience.

2.2.6 Amendments to template design

Any problems identified by these three accessibility checks should be addressed at this stage. Redesigning the template in this way to adhere to accessibility guidelines and good practice should mean that, once the content has been added, the only problems existing in the site will be with the content itself on a page by page basis. Of course, if those responsible for adding the content have undertaken some accessibility research as suggested, then the amount of problems introduced to the site during that process should be minimised.

2.2.7 Expansion Strategy

So far, the development team should have arrived at a satisfactory template design, with perhaps a few alternative templates to be used for different types of pages. Any useful features should have been added and the templates should have been checked for accessibility and usability. Before moving on to adding content, the development team should sit down and think about the potential for future expansion of the site. A short term projection will succeed in producing a site ready for immediate release. However, depending on the nature of the site, it may be necessary to prepare the site for expansion some time after the initial release. To avoid the need for a complete redesign when this expansion comes along, the team should ensure that a suitable expansion strategy is in place. In the authors' experience, many sites are highly accessible upon release, but soon become inaccessible due to the lack of an expansion strategy and the subsequent addition or amendment of content in a haphazard manner. Elements of a successful expansion strategy may include:

- **Server-side Scripting** – Allows content to be created dynamically, reducing the need for manual maintenance.
- **Include files** – Providing run-time inclusion of code makes a huge difference to the maintainability of a site by allowing code which is common to a number of pages, e.g. browser
detection, to be contained in a single file. This can then be edited once and the changes will take effect throughout the site.

- **XML-based navigation** – Using an XML file to create a hierarchical representation of every page in the site. A very simple implementation may include two XML elements for each page: the URL and a short textual description of the content. This XML file can then be traversed when a page is requested, using a standard function to produce navigational aids like the ‘breadcrumbs trail’ automatically.

- **XML-based display** – Using XML with an appropriate style sheet language to separate content from display. Server-side scripting allows the XML content to be rendered in an appropriate way depending on the user agent. XML-based content also increases maintainability and reduces the likelihood of introducing accessibility problems while adding or amending content in the site.

### 2.2.8 Add Content

Once all of these decisions have been made, the development team is ready to add the content to the site. As previously pointed out, all members of the team should, by now, have a strong idea of the main accessibility issues and should therefore be able to avoid introducing accessibility problems during this stage. Of course, the propensity for error can never be entirely eliminated from the process, so it is necessary to continue checking the site as content is being added. One method employed by the authors is to keep several browser platforms open at all times during development, allowing changes to be monitored as they are made, by simply refreshing or reloading the page in each browser.

### 2.2.9 Final Accessibility Check

Once all content has been added, the site must be checked thoroughly. The three accessibility checks described above should once again be employed - Testing with Automatic Validation Tools, with different Browsers under various conditions and inspection and User Testing.

Further checks include proof-reading and ensuring the general clarity of any information provided on the site.

The site should also be tested once more with a set of users, preferably two groups: sighted users and non-sighted users.

#### 2.2.9.1 Test with Sighted Users

It is important once all the content has been added and the accessibility level is optimal, that the web resource be tested by around 5 sighted users. This is in line with Nielsen’s recommendation (Nielsen, 2000b) that, for efficient and productive usability testing, five is the optimum number of evaluators.

The sighted users should be asked to carry out a number of tasks identified as being typical of what people would use the site for. Problems and difficulty with tasks should be noted. They should also record personal feelings about the site through the completion of a questionnaire. Observation will often reveal user behaviour which indicates usability problems with the site.

#### 2.2.9.2 Test with Non-Sighted Users

Further evaluation should take place with blind or visually impaired users now that the content has been added to the site. They should be asked to complete the same set of tasks as the sighted users and again their feelings about the site should be recorded by the observer.

Testing the authors' site with non-sighted users provided unexpected results. Being evaluators whom the authors' were familiar with, having worked with on commercial accessibility audits, the authors were very used to these evaluators being critical. Fortunately, they had no real problems with the site, and in fact they commented on how much they enjoyed using it, due in part to the use of the ‘skip to main content’ feature. This made them realise instantly that their needs had been taken into consideration.

### 3. CONCLUSION

While accessibility remains an issue for web site owners and users around the world, it can be difficult for designers and developers to bridge the gap between desire to incorporate accessibility and knowledge to do
so. Currently there is no practical and usable development methodology to help non-expert developers provide an accessible design; instead the combination of ‘accessible sense’ and appropriate use of the accessibility evaluation approach must be adopted. The steps described in this paper have been found to be extremely effective for designing accessible web sites and providing support to designers developing accessible web resources of their own. Furthermore, these web resources have then proceeded to receive considerable praise from both sighted and non-sighted users.

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