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# Accessibility Observations of Visually Impaired Users using the South African National Accessibility Portal

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**Abstract:** Improving the accessibility of Internet web sites and portals is becoming more important as initiatives (such as the South African National Accessibility Portal), which address the marginalisation of persons with disabilities, gather momentum. Improving web site accessibility has proven to be a challenging task with a myriad of standards, accessibility testing tools and few technical guides for implementation. This paper presents the South African National Accessibility Portal (NAP), which is used as a research and test bed for accessibility implementations. It provides an overview of web standards applicable to accessibility, including the WCAG 1.0, the currently accepted web accessibility standard, as well as techniques used in the development of the portal to improve its accessibility. The paper presents some observations with regard to the success of these attempts as gathered from usability evaluations. The combination of technical implementation details and the resultant observations can aid other developers to fast track and improve accessibility for their development.

**Keywords:** Accessibility; Usability; WCAG; HTML; South African National Accessibility Portal; NAP; Visually impaired.

## 1. Introduction

The South African National Accessibility Portal (NAP) is an accessible information-sharing portal for the South African disability sector that promotes inclusivity [1]. The portal Internet presence forms one of the elements being developed as part of the 5 year South African National Accessibility Portal research and development initiative which is aimed at addressing the marginalisation of people with disabilities from the economy and society [2].

Other initiative elements include accessible centres, research into assistive technologies, use of other modalities such as mobile and telephony as well as sustainability models. The portal's main aim is to provide information sharing and a means for communication relevant to people in the disability sector in an accessible manner [3]. Improving web accessibility is an important aspect of web development as it allows more people to access and contribute to the Internet in an effective manner. In the NAP context, improved accessibility empowers more persons with disabilities to live independently, one of the aims of NAP. In addition, accessible web sites enhance service delivery and knowledge dissemination, which are important elements for both industry and government.

Improving web accessibility has proven to be a difficult and elusive task. A variety of standards, laws and guidelines exist, but little is available in terms of technical

 

implementations thereof and usability evaluations with regard to these elements. The challenge in developing an accessible Internet presence is to support all disabilities. This however, sometimes requires contradictory implementations [4]. This paper presents easily implemented techniques, which aim to demystify web accessibility and then measures the effectiveness and success of the implementation through observations of visually impaired users.

The next section provides a brief overview of the various accessibility standards with regard to the Internet. This is followed by a description of techniques as implemented in the portal. Section 4 highlights some observations as extracted from usability experiments with regard to visually impaired users. Section 5 presents recommendations aimed at developers and designers with which the accessibility of their implementations can be improved. The final section contains a conclusion.

## 2. Accessibility Standards Overview

Quite a number of different guidelines and standards exist internationally. South Africa currently does not have its own applicable set of standards. As a consequence, web sites developed in South Africa rarely take cognisance of the standards. The World Wide Web Consortium (W3C) is a global organisation that develops protocols and guidelines for the Web and is seen as the main standardisation body [5]. Standards are important as they ensure interoperability and consistent operation over different platforms and operating systems. The W3C has developed two sets of accessibility guidelines:

The Web Content Accessibility Guidelines (WCAG) [6] provide an international set of guidelines, WCAG version 1.0, which was released in 1999 and WCAG version 2.0, which is currently in development [7]. There are other guidelines besides those listed above. People living in the United States of America have several applicable laws with regard to accessibility, including the Rehabilitation Act of 1973 (specifically Section 508 [8]). People living in the United Kingdom are guided by PAS 78 [9]. Country and organisation independent guidelines are also available. An example is the WCAG Samurai [10]. The WCAG 1.0 is currently regarded as the most important standard with regard to accessibility. The following subsection provides a brief overview of the WCAG 1.0.

### *2.1. Web Content Accessibility Guidelines 1.0*

The Web Content Accessibility Guidelines 1.0 (WCAG 1.0) [6] has 14 guidelines that cover general principles of accessible design. Each guideline has one or more checkpoints that explain how the guideline applies in a specific area. Each checkpoint is assigned a priority level namely Priority 1, Priority 2 and Priority 3. Web content **must** satisfy priority 1 checkpoints, it **should** satisfy priority 2 checkpoints and **may** address priority 3 checkpoints.

These guidelines are aimed at making content accessible, primarily for people with disabilities, but also for user agents (e.g. web browsers, mobile phones, screen readers - software that creates audible output from the text on the screen- and Braille browsers). It is unfortunate that the guidelines provide limited technical implementation details. It thus requires each development house to obtain in-house expertise on accessibility implementation.

Other efforts by the W3C provide for enhanced accessibility through alternative cascading style sheets (CSS) for different media (e.g. aural). Support for these by user agents is limited, with the result that these CSS's are seldom implemented in most web sites.

When analysing this complex landscape, it is clear that no singular method, standard or approach can be used in developing an accessible application. Automated tools are

available to measure the compliance of a site against the various criteria [11,12,13,14]. Unfortunately, these tools measure accessibility differently and also measure different aspects of accessibility. At best, these tools can give an indication of the accessibility of a site, but do not replace user accessibility testing. Therefore, a proven set of techniques is required to ensure the improvement of accessibility for an Internet presence. The next section highlights techniques that were used to improve the accessibility of the NAP.

## 3. Techniques

The availability of standards, comments and opinions regarding the standards does not necessarily translate into practical techniques which a developer can implement to improve accessibility. In this section we present an overview of techniques that can aid developers in improving accessibility for the visually impaired. It is important to note that many of these techniques re-emphasise the need to use correct and valid HTML.

### *3.1. Document Structure*

Each HTML document must contain a <title/> that uniquely identifies that document. Assistive technologies (such as a screen reader used by the visually impaired) read the title element and thus identify the document to the user. In addition, each HTML document must contain at least one, but not more than two <h1/> elements. The text information contained in the <h1/> element must also be contained in the <title/> element. The assistive technologies use the nesting of headers which allows for jumping to the appropriate part of the document. Therefore, the HTML document must be properly structured (all heading elements must be properly nested) as it allows for easy access to relevant parts of the document.

### *3.2. Language*

The primary language of the document should be indicated by the *lang* attribute. Some assistive devices recognise *lang* attributes and will change the language output accordingly. For example, the snippet below sets the default language to English.

```
<html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en" lang="en">
```

### *3.3. Sitemap*

A sitemap enables the user to obtain a global view of the site and assists in easy navigation to specific locations within the web site.

### *3.4. Menu or Navigation Bars*

Menu bars give users easy access to other sources of information or documents. Grouping of related links and consistency in terms of the positioning of these links greatly enhances navigation. Menu or navigation bars are thus very common in HTML documents. Using <ul/> or <ol/> elements to create the menu or navigation bar improves accessibility as the user can easily step through the elements. A heading element (<h2/>) can be associated with the menu bar which provides context to the visually impaired user.

The heading element can be hidden from the visual interface by using hidden messages (as described in the next section). The following snippet illustrates the use of <ul/> to create a menu.

```
<ul title="Portal services">
<h2>Portal services</h2>
<li><a href="viewContent.jsf">Assistive devices</a></li>
<li><a href="viewCommunication.jsf">Communication</a></li>
</ul>
```

### *3.5. Hidden messages*

Messages can be hidden from visual users through the appropriate use of Cascading Style Sheets (CSS). These messages can provide important contextual information to the visually impaired user. The messages are read by the assistive technology, but are not visible on the interface. The CSS code snippet below shows the CSS class used for the creation of hidden messages.

```
.hidden-msg { overflow: hidden;
        position: absolute;
        left: -5000px;
        height: 0;  width: 0;
        font-size:0em; }
```

Hidden messages can be used for navigation, grouping of related links and other elements, to provide additional information for hyperlinks, as well as compulsory element indication. Each of these uses will now be discussed.

- *Hidden Message Navigation:* A combination of hidden text and anchor elements can be used to skip to specific locations within an HTML document. The snippet below shows the definition of a hidden message which would allow a user using an assistive technology to jump to a specific place in the HTML document, thus removing the need for the assistive technology to voice out irrelevant text.

```
<div class="hidden-msg"><a href="#content">Skip to content.</a></div>
<!-- Other HTML source elements-->
<a name="content"></a>
<h2>Recent content additions</h2>
```

- *Hidden Message Grouping Information:* Hidden text messages are also used to identify the start and end of groupings of information within the content, like menu or navigation bars. The HTML snippet below illustrates the use of a hidden message which provides more contextual information with regard to the menu grouping.

```
<div class="hidden-msg"><h2>Start of services</h2></div>
<ul title="Portal services">
 <li><a href="viewContent.jsf">Assistive devices</a></li>
</ul>
<div class="hidden-msg"><h2>End of services</h2></div>
```

- *Compulsory Elements:* Hidden text messages are used to indicate compulsory elements. This message will be read by an assistive technology, clearly identifying the compulsory elements to the user. The HTML snippet below shows the creation of an association between the <label/> and the <input/> element through the use of the *for* attribute as specified in the <label/>. The <label/> wraps the hidden message, thus forcing a binding between the hidden message, <label/> and <input/>.

```
<label for="firstname"><span class="hidden-msg">This field is compulsory</span>Name:</label>
<input id="firstname" type="text" name="firstname" />
```

- *Additional information for hyperlinks:* In some instances visual representation is used to provide contextual information to the user. Through the use of hidden messages the same contextual information can be provided to a visually impaired user.

### *3.6. Forms*

Form controls should make use of appropriate label elements where the label is associated with a specific input element. This allows the assistive technology to provide contextual information when a user is accessing an input form field. In the snippet below the <label/> utilises the *for* attribute to bind it to the <input/>. This allows the assistive technology to indicate the dependency to the user.

```
<label for="firstname">Name:</label>
<input id="firstname" type="text" name="firstname" />
```

### *3.7. Layout*

The layout of the website should be consistent. Navigation bars and content should always be at the same location to assist users with navigation.

The use of Cascading Style Sheets (CSS) allows for the manipulation of layout. Visually, content may appear at a specific position, even though the content might be positioned elsewhere in the HTML source. Using this feature, the more important elements can be located earlier in the HTML source, which allows it to be read first by the assistive technologies.

Tables should be used to organise data and not for visual layout of the page. Therefore use CSS for the visual layout. Nested tables should not be used to organise data because it is not accessible for screen readers. If a table is used to display tabular data, a *caption* attribute should be supplied that provides a short description of the table's purpose.

### *3.8. Error messages*

A modern trend is to display the error message next to the form field where the error occurred. However, this requires the assistive technology to read the whole page up to the location of the message. It is thus more advisable to place the message at the start of the <form/> element where it will be read as soon as possible.

### *3.9. Non-text content*

For non-text elements, such as images, supply an equivalent text description through the use of the *alt* attribute. This facilitates understanding and comprehension. If an image is not intended to convey information and is for decorative purposes only, the *alt* attribute should

not contain any text. Shown below is a snippet where the *alt* is used to provide a textual description of the image.

```
<img src="WheelchairImage.jpg" alt="Image of a motorised wheelchair"/>
```

### *3.10. Visual representation*

Some visually impaired users do not have access to assistive technologies. In these cases, accessibility for low-vision users can be improved through larger fonts and colour contrasts. Through the use of CSS the user can be provided with options that utilise larger fonts or different colour contrast combinations.

## 4. Observations

A complete set of usability and accessibility evaluation experiments where conducted during October 2007 at the UNISA Usability Laboratory to measure the ease of use and effectiveness of the portal. The detailed findings for all the different disabilities will be reported at a later stage. However, informal observations of visually impaired users have highlighted some issues, as well as successes, of the implemented techniques (as described in Section 3), which impacted on the accessibility of the portal. These observations are presented below.

Even though the portal was designed with accessibility as a fundamental requirement, visually impaired users using assistive technologies did have difficulties in navigating through the site. The portal utilises a hierarchical mechanism to group appropriate content elements. Some of the visually impaired users did not realise that a hierarchy was used. The hierarchy required them to traverse through the structure to reach relevant content. Based on the difficulty experienced by the user, we can deduce that the hidden information messages and general feedback to the user were not informative enough to guide the user.

Another issue was the positioning of relevant elements in the document. As the user traversed through the hierarchy, the same page gets redisplayed, but with additional elements being rendered. Unfortunately, these elements were positioned lower down in the source page, thus requiring the user to listen to a lot of text before realising that additional information has been added. Often the users did not listen to the whole page, and thus did not realise that additional information had been added, leaving the user with the impression that the navigation did not succeed. The portal utilises the manipulation of the content positioning through the style sheets. However, it has not placed the additional (newly rendered) information early enough in the source document to meaningfully reduce the amount of text to be voiced.

The portal provides a combination of hidden text and anchor elements with which a user can jump to the location of the additional information. However, this functionality was hardly ever used. This confirms the previous observation that the informational messages were not informative enough.

Users also experienced difficulties with form elements, specifically with the upload of files through the browser provided file upload control. The HTML *<input name="uploadedfile" type="file"/>* results in a browser specific widget control. This browser control is not accessible and varies in behaviour between Firefox and Internet Explorer. If an error occurs, the previously entered file name is removed from the input field, thus requiring the user to reselect the file to be uploaded. If an error occurs on the submit, the error message needs to be read first to indicate to the user that something went wrong. In the current portal implementation the error message was not read in a timely fashion, thus confusing the user.

Browser implementations vary with regard to their actions when the *Enter key* is pressed while the user is completing a form. This leads to inconsistent behaviour and confusion for the end user. It is recommended that the default behaviour be forced to always submit the form.

Even though a sitemap is highly recommended, the typical usage pattern was through the search functionality. The importance of an up-to-date search index thus increases.

The importance of informative messages increases dramatically for a visually impaired user, especially after completion of tasks such as registration or login (e.g. to indicate that the task has successfully been completed). These messages need to be precise, relevant and descriptive.

Many of the techniques presented in Section 3 have enhanced the user's ability to interact with the portal. The use of a descriptive <title/> combined with the <h1/> provides good contextual information for the user. The properly nested heading structure enhances navigation in a document. The use of menu bars grouped by <ul/> also adds to the ease of navigation in the portal. Users were able to effectively populate forms (excluding the form file upload issue described earlier) through the binding of the <label/> and <input/> elements. Appropriate text descriptions of non-text elements (such as images) through the *alt* attribute helped in providing information and thus the required insight.

These and other observations, as well as the successful interaction with the portal by visually impaired users, indicate that the National Accessibility Portal is accessible for a visually impaired user. However, it is also clear that some problems exist with regard to general usability, e.g. the lack of feedback messages after completion of tasks and the use of a deep hierarchy to structure content. It is therefore important to design and implement a web site to be accessible, and at the same time usable.

## 5. Recommendations

Through the observations of visually impaired users' usage of the portal, recommendations can be made to improve web site accessibility. For the developers, it is important to develop the HTML pages according to the published W3C HTML standards. Standards compliance improves accessibility for user-agents. Implementing the techniques described above further removes accessibility barriers. HTML page designers need to be aware of layout and position needs, to allow for early voicing of important elements by the screen readers. Consistency in layout improves usability as the user intuitively picks up the structure of the page. Finally, informative feedback messages and appropriate header text aid the user in navigation and task execution.

## 6. Conclusion

To develop an Internet presence that can be regarded as accessible, cognisance of a large number of factors needs to be taken. A multitude of standards and guides exist but they do not provide clear technical recipes useful for development. Accessibility is a very complex and challenging environment and cannot be addressed from one viewpoint only.

This paper presented a high level overview of the accessibility standards that was used as a basis in the development of the South African National Accessibility Portal. This was followed by a section describing more technical development details useful for developers of accessible websites. In Section 4, we presented observations of visually impaired users interacting with the South African National Accessibility Portal, while Section 5 contains recommendations for developers and designers.

From these observations it is clear that even though the portal can be regarded as accessible, some challenges remain which are not addressed by the standards, guidelines or technical implementation.

Awareness of accessibility and usability is not addressed by standards, but rather through Internet community uptake and the desire to empower more people (including persons with disabilities). Awareness needs to be raised. Experience in the development of accessible and usable web sites is only gained by implementing and then conducting accessibility and usability experiments, something which is not normally included in the development cycle. It is hoped that with the recognition of the importance of this aspect (as it impacts on industry and government's ability to improve service delivery, knowledge dissemination and enables inclusivity), this specialised skill set will be developed in the development community. The combination of technical implementation details and the observations as presented here can aid other developers to fast track and improve accessibility for their development and help build the specialised skill set required.

Further research and development into the elements of accessibility will continue and will result in a better understanding of the requirements to build an accessible Internet presence. Future collaboration with the W3C office hosted at Meraka [15] and the South African French Programme for Information Science and Technology (SAFeTI) will enhance the research.

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