ENABLING VISUALLY IMPAIRED PEOPLE TO USE THE INTERNET

Mary Zajicek and Chris Powell

Introduction

Currently available screen reading products allow the visually impaired user to ‘read’ the screen using speech synthesis or Braille display hardware. Most of these applications are only capable of reading one line of the screen at a time and the document is accessed in a sequential manner. They are also general purpose and not specifically designed for Web use. As graphical interface technology develops uninterpreted screen reading becomes less cost effective or effectual\(^1,2,3\)

WebChat has been developed which operates in a different manner. It presents the information contained in a World Wide Web page conceptually using speech\(^4\). The screen is presented as a collection of objects consisting of a heading or link and a block of text. Using function keys the user is able to move around the page selecting headings or links from menus and reading blocks of text. Wherever appropriate different voices are used for conceptually different items of output.

The aim of the research is to present as much real information contained in the Web page to the visually impaired user as possible. A significant problem with speech output is its sequential nature, compared with the concurrency of information provision in a graphical user interface. If the user is momentarily distracted it is difficult to refresh the memory as to what process was interrupted unlike a graphical user interface where the user can simply look at the status of the screen.

This paper describes the application WebChat with particular reference to the facilities made available on the menubar to help users orientate themselves to the contents of a Web page. These are the provision of a headings list, links list, keywords list, and scratch pad.

The work was funded by the Higher Education Funding Council Executive under the Widening Access to Higher Education initiative.

Conceptualising the page
We have re-described the structure of a Web page so that it can be ‘read’ out to a visually impaired user over the telephone. This involved forming a conceptual model of the information content of the page and its interrelationships and presenting it in speech form. The Web page has been presented conceptually as a collection of textual objects (consisting of heading and accompanying paragraph) and links. WebChat provides access to conceptually different parts of the Web page using function keys and different synthesised voices to indicate conceptually different features of text such as headings, links and paragraphs of text.

A graphical interface is essentially concurrent. Many items of information and options are displayed so that the user can engage with any one of them at any time. Importantly the user need only engage in those parts that interest her and ignore the rest.

M. Zajicek and C. Powell are at the School of Computing and Mathematical Sciences, Oxford Brookes, University, Headington, Oxford OX3 OBP

Tel: +44 1865 483683 Fax: +44 1865 483666 Email: mzajicek@brookes.ac.uk

Speech born information is essentially sequential. We have enabled a similar concurrency to that in graphical interfaces by conceptually structuring the page to offer options such as lists of links, or lists of headings, lists of keywords found in the text, or to read out paragraphs of text etc. This is achieved by using a menubar which is accessed by speech or function key.

The conceptually different parts or objects are ordered hierarchically within heading and sequentially down the page. The HTML code which forms the Web page allows for several headings. This feature is used by WebChat to subset the document and give the user the ability to examine only the elements of text of interest.

Using links for orientation

Anchor tags are used to provide the hypertext links to other Web pages. However, usefulness of a link as an aid to determining the content of the document is difficult to determine. Anchors fall into three general classes:

1. Strongly related links,
2. Weakly related links,
3. Links back to the site home page/previous page/top of page.
Only the first of these will be of any real use in determining content. For example, a site about Mickey Mouse may have a link to 'My favourite Mickey Mouse site'. The second being only weakly related may not directly name the relevant content words, for example 'My favourite Animated Characters'. The third is not at all related to the user's line of enquiry, for example 'Back to top of document'.

**Keywords**

Keywords were extracted from Web pages using standard information retrieval techniques. These are usually applied to library searches for significant words in text and are based on the premise that the frequency of word occurrence in an article furnishes a useful measurement of word significance.

Common words with high frequency are referred to as noise words. These are words such as ‘a’ and ‘the’ etc. and are not included in the keyword list. Similarly those which have such a low frequency that they are unlikely to represent the content of the page are discarded.

**The scratch pad**

The scratch pad contains 'bookmarks' to interesting points in the HTML document currently loaded by WebChat. The bookmarks are placed in the scratch pad by the user as they listen to a document or part of a document. As the user hears something of interest, they tap the Enter key on the numeric keypad, and the position of the sentence currently being spoken is recorded in the scratch pad. Once bookmarks have been recorded in the scratch pad, they can be used to revisit their respective sections of the document, in the same way the user of a web browser can use its bookmark system to revisit web sites.

A ScratchPad menu is constructed which contains each sentence referenced by the ScratchPad, grouped under their respective headings. This gives the user an indication of how the sentences fit into the structure of the document. Once an item from the bookmark menu has been selected, the document can be navigated in the usual way using the read next/previous sentence/paragraph functions.

Whilst the scratch pad menu is active, the user can delete the currently 'highlighted' (last to be read out) entry by pressing the Del key. Shift-Del causes the scratch pad to be erased. The scratch pad is also erased whenever a new HTML page is loaded.
Evaluation

The effectiveness of the browsing facility provided by the menubar was evaluated in terms of recall, and precision. It is assumed that the more effective the system the more it will satisfy the user. It is also assumed that precision and recall are sufficient for the measurement of effectiveness.

Users were asked to rate the effectiveness of headings, links, and keywords as indicators of the contents of a page. Table 1. below shows that headings were perceived as being the most useful with keywords coming a close second and links last.

Table 1 Scores for different representations

<table>
<thead>
<tr>
<th>Representation</th>
<th>Total Score</th>
<th>Percentage of available marks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headings</td>
<td>406</td>
<td>58.09</td>
</tr>
<tr>
<td>Anchors</td>
<td>313</td>
<td>45.24</td>
</tr>
<tr>
<td>Keywords</td>
<td>392</td>
<td>55.28</td>
</tr>
</tbody>
</table>

The evaluation outlined above used a somewhat contrived experimental environment. A more valuable evaluation program is planned which will use in-built machine monitoring to see how users actually work with WebChat over a time period in the field.

References


5. Schultz, C. K.; 1968; H. P. Luhn: Pioneer of Information Science - Selected Works; Macmillan; London; Pg. 120.

6. van Rijsbergen C. J.; 1979; Information Retrieval; Butterworths; London; 2, 17.