Towel: Real World Mobility on the Web

Simon HARPER, Robert STEVENS, Carole GOBLE
University of Manchester, Oxford Road, Manchester, UK

Key words: Visually Impaired, WWW, Mobility, Travel, Navigation, Orientation, Adaptability, Tools.

Abstract: The ‘Towel’ project seeks to find solutions to problems encountered by both visually impaired and sighted users when travelling in the World Wide Web. Drawing similarities between real-world travel metaphors of visually impaired people and web-based travel metaphors of both visually impaired and sighted people, enhances an understanding of the problem and therefore enables solutions to these travel problems to be more easily identified. By likening web-travel to real-world travel in terms of mobility, navigation, orientation, and mapping, and by fitting web-travel into a real-world travel framework a number of similarities can be identified, and problems characterised. These problems have solutions in the real-world and so these real-world solutions may be of use in addressing web-based travel problems.

1. INTRODUCTION

Browsing the World Wide Web (WWW) can be a complex and difficult task, which is further complicated if the user happens to be visually impaired because the richness of visual navigational cues presented to a sighted user are not appropriate or accessible to a visually impaired user **[Petrie97]**.

Web browsing and searching suggests a degree of travel as well as reading, and while there are a number of WWW Browsers that support the reading task for visually impaired people, few support the task of travelling around a page, a web site or indeed the WWW in general. Many such browsers are concerned with the 'sensory translation' of visual information to auditory information, and are not concerned with enhancing web mobility **[Jones96]**. In a survey, carried out by email, a marked difference can be seen between the navigational speed of sighted users and that of visually impaired users when asked to perform a series of navigational tasks using the 'Internet Movie Database' as the reference site. This survey illustrates how a major part of the www experience, namely movement within a page, from page-to-page and site-to-site, is unsupported in many browsers.

Research already undertaken suggests that these issues need to be addressed with regard to all web users and not just visually impaired people **[Jones96]**. Current research divides movement through the Web into landscape metaphors **[Chen97**] and path metaphors **[Furuta97]**. It is however asserted here that such a separation is unhelpful as real world travel is accomplished with no such segregation.

It is then the aim of this paper to apply holistic real world travel task metaphors encountered in the blind mobility field to web based mobility as it is believed that there are a number of similarities between the tasks and problems encountered in both. It is thought that this transfer from the real to the web-based world will enhance the discourse on travel through the WWW and therefore provide novel solutions to the problems faced by all web travellers, and particularly those with a visual impairment. These solutions would include tools to aid the design and integration of travel components into web design methodologies to aid mobility based on these real world metaphors. They would also include the a degree of adaptability in the user interface to enhance the provision of mobility components based on the incoming information.

2. MOBILITY PRIMER AND TERMINOLOGY REFERENCE

Many important lessons can be learnt from knowledge gained in assisting visually impaired travellers in real world situations. This knowledge can be applied to both visually impaired and sighted web travellers.

Travel can be thought of as the whole experience of moving from one place to another regardless of whether the destination is known at the start of travel or if the journey is initially aimless. In this context a successful journey is one in which the desired location is easily reached. Conventionally, travel or mobility can be separated into two aspects, those of Navigation and Orientation **[Brambring84]**.

- Orientation - can be thought of as knowledge of the basic spatial relationships between objects within the environment **[Bentzen79]**. It is used as a term to suggest a comprehension of a travel environment or objects that relate to travel within the environment. How a person is oriented for travel is crucial to successful travelling. Information about position, direction, desired location, route, route planning etc. are all bound up with the concept of orientation.

- Navigation – in contrast, suggests an ability of movement within the local environment **[Farmer79]**. This navigation can be either by the use of pre-planning using maps or fore-knowledge, or by navigating 'on-the-fly' and as such a knowledge of immediate objects and obstacles, of the formation of the ground (holes, stairs, flooring etc.), and of dangers both moving and stationary are all required.

3. EGOCENTRICITY

Because navigation entails some form of mapping and knowledge storage, an understanding of how information is stored and processed in the brain can be useful in mobility research. Cognitive or mental mapping is an abstraction of the real world, covering the mental abilities that allow us to collect, organise, store, recall, and manipulate information about the spatial environment and real world surroundings **[Dodds82]**. In the context of travel, this means everyday spatial environments. Thus information is stored to make sure navigation is possible, (‘how to get there’). In addition, other cognitive knowledge is used to discover ‘where to go’ **[Collins84]**.

There are additional features of mobility by visually disabled people that are pertinent to web travel. These features mainly relate to cognitive mapping and how visually impaired people mentally visualise the world, and as such are useful for inclusion in any mobility model as feedback can be tailored to enhance these mental visualisation characteristics **[Dodds82]**. Many visually impaired people have a tendency to think of the real world in a ‘egocentric’ manner, such that descriptions of distance and journey become associated with the traveller and not the environment **[Dodds82]**. A sighted person may say “walk to pedestrian crossing and then continue on to the bank” where as a visually impaired person may say “walk 20 metres ahead, then from the tactile surface walk 10 metres to the North West of that position and you are at the Bank”. It can be seen that the specification of distance and direction is far more exacting and the traveller relies on a limited amount of external information to reach the destination. Visually impaired travellers also break their journey into shorter stages and orientate themselves within the journey a greater number of times. On average a visually impaired traveller orientates themselves every 40 metres compared to a sighted travel who does so every 100 metres. The mental maps created by visually impaired travellers therefore have a tendency to be egocentric, exact, and divided into smaller more manageable steps. Tailoring feedback to enhance these traits would therefore enhance the mapping process for visually impaired (and sighted) travellers **[Dodds82]**.

4. PARALLELS BETWEEN REAL WORLD MOBILITY FOR WEB MOBILITY PROBLEMS

4.1 Preview and Probing

In real world blind mobility, a lack of preview of upcoming information is one of the major issues to be addressed. Consequently, this preview is supported by both electronic and non-electronic means and travel aids range from the conventional cane and long cane through to laser obstacle detectors. However, in all cases the travel aid performs a ‘probing’ task such that a limited amount of preview is given **[Brabyn82]**. This amount is limited because in travel experiments complex information was found to not be easily assimilated by non-visual means and therefore too much information was found to be as unhelpful as too little **[Blenkhorn97a]**.

In a web-mobility context, the lack of previews of both upcoming hyperlinks and information relating to movement on the web page itself suggests that some degree of ‘probing’ must be implemented so that a limited preview can be obtained **[Jones96]**. Indeed if a user is observed traversing the web, they can be seen to select a hyperlink, preview the contents (by clicking or placing the caret over the link to see the destination) and return if the contents are not applicable. This probing is continued until each hyperlink is previewed, and interesting contents are found **[Cool96]**. Therefore, too much information may be the presentation of the entire page, when probing, and too little may be the presentation of just the hyperlink.

4.2 External Memory

Blind mobility solutions exist to accomplish obstacle avoidance and are based on both enhancing preview (as described above), planning to avoid obstacles through knowledge of the environment (orientation), and on navigating oneself around obstacles based on a knowledge of ones orientation within that environment **[Gollege91]**. Planning[1] to avoid obstacles suggests a certain knowledge of an end goal to be achieved, while this is true in many cases it is not always known at the outset and related travel information may be used in transit as the goal becomes more evident. These problems are addressed in blind mobility by the provision of electronic or tactile maps, by using knowledge gained from previous travellers of the area (similar to a guidebook) **[Blenkhorn94]** or by the provision of information points giving complex information about an area, and by in-route guidance systems such that location within an area is pin-pointed to a finer or courser granularity **[Blenkhorn97]**.

This is also the case in web mobility where a search for a specific goal may be instigated at the outset or where a user may choose to browse without much idea of a goal until well into browsing **[Cunliffe97]**. Therefore, to find and avoid obstacles (like Feints - options that are not available can be thought of as obstacles) encountered 'on-the-fly'. A web traveller, therefore needs some form of preview. They also need to be supplied with fore knowledge of an area, or be supplied with it in-route, and have some knowledge of ones orientation within an environment. These obstacles like feints, graphics, and frames may also change with the context and task being performed, a graphic while an obstacle in the context of information searching, may be useful as a marker in the context of navigation.

4.3 Cueing

Orientation or 'where-ness' (detecting cyclic behaviour, direction and distance) is important in blind mobility as it enables travellers to navigate with some degree of accuracy. However, problems exist for visually impaired travellers, because they do not have the luxury of visual cues to base these judgements on. Therefore, the environment must be updated such that cues are provided in an appropriate manner, giving explicit orientation information such that navigational information can be detected. This is accomplished using tactile surfaces' or by using audible road signals, and by the placement of specific electronic devices known as ‘waypoint’ markers **[Blenkhorn97]**, so that this explicit information can be given.

The similarities between real-world and web mobility for visually disabled people suggests that the provision of some form of explicit, appropriate, orientation method (such as waypoint devices) would be an

[1] In real world mobility.

advantage when travelling in the virtual web environment. This would mean that a user can make a choice as to whether they want to be at the current location and if not how to best attempt to get to their perceived destination **[Petrie97]**. Visited hyperlinks change colour giving a visual cue that is not present when travelling the web as a visually impaired person.

4.4 Feedback

Supporting the general mobility task by providing appropriate explicit feedback, returned implicitly from many objects, is also undertaken by many real world travel aids. This functionality is mainly included as an addition to a travel aid fulfilling a different task. The premise of these additions is that much feedback is implicit and can be assimilated at speed, if the recipient is sighted. This is not the case however, if the recipient has a visual impairment as the cues, and complexity of the cues, often depend on the recipient having vision and being able to assimilate this complex visual information at a fast speed **[Jaffe92]**. A long cane is an obstacle detection device that enables a limited tactile preview of upcoming obstacles, however by tapping it against obstacles, auditory feedback is created such that the user has a more complete picture of an object. This multiple feedback is replicated in electronic devices such as the 'VA-Bionic Laser Cane" which gives different tones to signify distance and direction. It can be seen that these travel aids provide explicit feedback (sometimes using sound, sometimes speech) such that feedback appropriate to the user is given.

Therefore, when making any web journey an analysis of all implicit feedback should be taken, and this information should be expressed in an appropriate and explicit way so that the general task of movement is supported **[Spink96] [Petrie97]**. It should also take into account the natural mental mapping methods[2] for individuals with a visual impairment or sighted individuals with temporarily restricted vision, and be speedily assimilate-able regardless of complexity. Progress bars, moving 'Netscape' graphics, and percentage-loaded notifications all employ visual feedback mechanisms that are not usable by visually impaired people.

5. PROPOSAL FOR FUTURE RESEARCH

Applying knowledge about real world mobility to web based mobility problems can enhance the travel experience for visually impaired users.

[2] As described in the previous section.

Because all users share some of the characteristics of visually impaired travellers when travelling off the viewable area these enhancements can also be applied to sighted users too. The use of egocentric description, accurate journey information, and more frequent orientation points are directly related to the lack of preview found in real world travel, which is also encountered frequently in web based journeys.

By analysing real world travel solutions for visually impaired people, in the context of web travel, a framework can be generated. This framework will enable a critique of web design and design methodologies to be facilitated such that lessons learned with regard to web mobility can be incorporated into design methods and practice. Browsers can then include a mobility model that takes on board these lessons and applies them to web mobility. By doing this, solutions established for visually impaired travellers in the real world are applied to all web travel thereby solving problems faced by all web travellers, sighted or unsighted. It is envisaged that this mobility framework will be practically applied by using a set of XML-DTDs and a browser plug-in to implement the framework once suitably defined such that accurate testing can be accomplished. Tools that automatically enhance the travel information provided in web pages and over web sites can then be created so that any automatically generated output is tailored to fill the spaces in the mobility information left by manually designed output.

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