

User Interfaces for Mobile Web Devices

WWW9 Mobile Workshop Position Paper

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ABSTRACT

Mobile Web devices present lots of different types of challenge. Much work has focussed on solving technological problems and on working out market strategies. Just as critical, though, is the need to find effective user interfaces for these devices. We argue the role of human computer interaction ideas and approaches in this new domain. To illustrate our ideas we present examples of our work on mobile handheld small screen devices.

Keywords: Mobile Web, User Interfaces.

INTRODUCTION

Mobile handheld Web browsing has been described as the (next) killer app for the Web [9]. Many believe that in several years time, there will be more people accessing the Internet via mobile devices (phones, PDAs etc) than via conventional PCs.

The first (and still most widely used) Internet killer app was email. Email succeeds for at least two reasons. First, it meets a key human need; the need to be in touch and to communicate. Secondly, in terms of user interaction, it is simple and straightforward: users quickly grasp the concepts behind creating, sending and receiving messages.

Although a lot of effort is being spent on finding compelling mobile Web services and content – will it be position-based travel information, online banking or pizza ordering? – less has been said about the other critical factor, the user interface. Indeed, it is worth noting that while bodies such as the W3C are working towards ways of providing platform independence for Web materials, there is little explicit consideration of user interaction requirements and abilities. The issues need to be more widely debated.

We have been working on understanding user interface requirements for handheld devices with very small screens for the past 4 years. Our work has involved developing several systems that embody novel approaches to content and services. We have concentrated on visual output with point-and-click input. Others have begun to look at additional input/output modalities for these devices: for example to combine voice control with visual output.

Much of our work has been with industrial collaborators both network operators (like Orange

telecommunications) and content providers (such as Reuters). This contact with commercial developments has been very valuable. One of the goals of our attendance at the workshop is to gauge the relevance of some of our recent innovations (e.g. in interfaces for search engines on handheld computers [7]) and to gain further insight into the sorts of user requirement that are envisaged in the years ahead. Such understanding will help us to guide our research in useful directions.

In the rest of this short position paper we review some of the design issues we have raised during our research in this area. We discuss how past lessons in interface design should not be overlooked in this new area; we warn against over conservatism in interface design; and, we consider the interface aspects of WAP and the W3C proposals for mobile access.

PAST LESSONS OF HCI RESEARCH AND PRACTICE

User centred design methods and processes improve the usability of systems. However, even with conventional interactive systems, it is easy for designers to overlook important HCI factors. In the case of mobile Web technology designers may also believe that the innovative devices are so different from the conventional systems that standard HCI practices are of little relevance. A further barrier to human-centred practices in this sector is cost. To a consumer electronic manufacturer every extra cost in production has to be carefully considered, as selling price is a critical competitive factor. Human factors work adds to the cost of developing new devices such as PDAs producing benefits which are not easily and visibly marketable. For this reason it seems that many devices in the past have been developed with little reference to well-known HCI factors ([12],[13]).

Application of well-known HCI knowledge can improve the design of such devices. General HCI insights are helpful but there is also a body of literature from the 1980s and early 1990s, written even before the Web, which deals with user interfaces on small screens. Then the focus was devices such as first generation cash dispensing ATMs, electronic typewriters and photocopiers. All of these sorts of system could display only a limited number of text lines to communicate with the user. Research looked into the impact of reduced screen size on reading rate [3], comprehension [2] and interaction [11]. This research has new relevance to mobile Web devices [4].

MOVING ON

The PalmPilot series of PDAs has been very successful. The interface has some features – like pop-down menus – that are seen on conventional desktop machines but in other ways it is very different. Many other less popular handhelds use the Windows CE operating system that tries to bring the familiar Windows environment to the small screen.

Designers should pay attention to past usability approaches but should not assume that everything will transfer effectively from the desktop to the handheld environment.

In previous work we have illustrated the need for new approaches. Here we review two cases involving mobile handheld devices.

Mobile 'phone Interaction

Most mobile telephones allow access to functions and services through a series of complicated hierarchical menus. We have found though that this conventional approach is not optimal for the new environment [8].

In conventional computing environments – PCs, workstations etc – menu type interaction has proved popular and effective. Users can be shown complete lists of possible options within the screen display area. This saves them from having to remember a command language, alerts them to the existence of options they may be unaware of and allows them to find features they know are available but the name or exact location of which they cannot recall. But when the method is used on devices with very small screens, it becomes apparent that many of the advantages are lost [11].

In all the mobile 'phones we analysed only one or a small number of options is displayed to a user at a time (see Figure 1 for an example).



Figure 1. Mobile 'phone display showing sub-menu and navigation. Third sub-option of menu two displayed. The next level in the tree can be reached by pressing Select and the previous by Back.

Users scroll through the menu list using some form of scroll key(s). The need to scroll, select a main option, scroll through a sub-menu and so on, leads to the user having to make a large number of key presses to explore and use the device's functionality.

One of the 'phones we looked at, for example, would require the user to make 110 separate key presses to view all the possible options available. On the same 'phone we calculated that the average number of key presses to access a feature was 8.2. This figure assumes that the user does not make any mistakes - i.e., they know which main option and suboptions they need to select and only

press the scroll key the minimum number of times necessary at each level of the hierarchy. In the real world, where users make errors, we would expect this average to be much higher. We tested this hypothesis by carrying out a user experiment and found the average presses to function was 16.5.

In an attempt to reduce the number of key presses we developed a novel scheme. Instead of using menus, users 'spell-out' the function/service required using the alphabetic letters on the numeric keys (e.g. '1' can represent 'ABC'). In user experiments, the average number of key presses using this method reduced to 9.5 and user satisfaction was higher. For full details of the approach and the experiments see [8].

Mobile Web Browsing

Most Web pages are designed for conventional large screen viewing. We wanted to assess the impact on user interaction of using such pages with the small display areas found on PDAs [4].

Our evaluations suggested that Web navigation needs rethinking for small screen situations to provide systematic, direct access mechanisms.

WebTwig [5][6] was developed to demonstrate alternative approaches for handheld browsing. The tool presents an outline view of any site (see Figure 2) and users can manipulate this view as they attempt to identify useful areas.

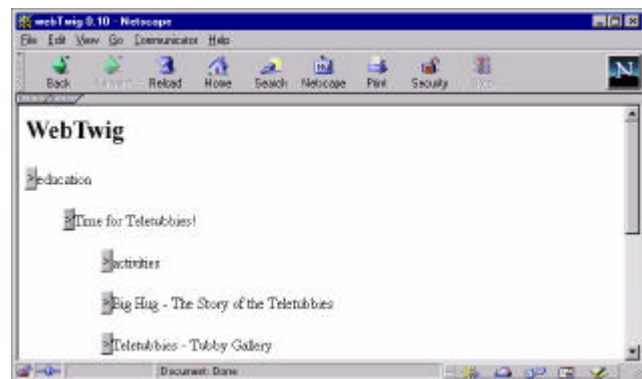


Figure 2. Conventional and WebTwig view of site. Top screenshot is the view on a small screen without any site adaptation; the bottom illustration shows an example of the site view via WebTwig – note the structured display of topics and the arrow icons which allow users to expand/ collapse topics.

User evaluations of our system suggest benefits of the approach. Recent work by others amplifies our findings [1]. We have recently begun to extend our work to consider appropriate search interfaces [7].

WAP INTERFACES AND BEYOND

The WAP forum¹ is working on specifications of protocols that enable Web-like services on wireless devices. The interface uses a card metaphor and the designers claim that it is highly appropriate and usable. However, some HCI experts (e.g. [10]) have raised doubts about its effectiveness.

We suggest that further extensive user trials (by the WAP forum, service providers and independent researchers) are needed to inform the evolution of the WAP scheme.

The World Wide Web Consortium (W3C) are also developing a framework which will enable Web content to be accessed on a diverse range of devices [14]. This framework will allow a document to exist in multiple variants, each variant specifying the type of support needed by the browser to display its contents. Device capabilities and user preferences will also be captured. The information about documents, devices and users will be used to automatically adapt a Web page to best suit the device and user.

This framework may present some interesting opportunities for developing more effective mobile interfaces. As we have illustrated, content needs to change not just on the presentational level but interactionally as well. Ways of specifying appropriate interaction methods for different devices would facilitate effective user interface design.

The W3C work not only considers graphical user input/output but other modalities including speech and touch (for Braille output for instance). Until now, we have focussed on GUIs on handheld computers. Clearly, there will be interesting interaction possibilities by combining or substituting modalities. As with graphical input/output, though, researchers and developers must not try to just solve the technological problems. User-centred issues must be at the heart of the process.

CONCLUSIONS

Millions (possibly even a billion) people will be accessing Web services from mobile devices in the near future. Technological advances and business possibilities are driving the developments. For these new devices and services to really have impact, though, work needs to be done on understanding how users will interact with them and what approaches will lead to more effective usability.

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¹ www.wapforum.org

