

# Interface Support for Elderly People with Impaired Sight or Memory

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**Abstract.** In an information society for all, everyone must have equal access to information in order to function effectively. Those that are unable to access vital information, which is increasingly distributed via the Internet, will become marginalised within society.

Elderly people using computers, and hence Internet browsers, for the first time are faced with new ways of thinking and have little experience to draw from. In order to map the task in hand onto a set of tools that will support it, the user must have a strong conceptual model of the underlying system and the dimensions of the task. Users must also remember sequences of events to build up strategies for the computer use. Impairment of short-term memory causes problems in developing conceptual models at the interface and in developing strategies for software use.

This paper addresses the challenges faced by elderly visually impaired people, with poor memories, using the internet to access information. It reports the results of experimentation with a talking interface to help elderly users get up and running on the Internet. The talking interface is a special enhancement of the web browser for visually impaired users called BrookesTalk. Issues of personal support, menu selection, understanding of synthetic speech and memory modeling are also discussed.

## 1. INTRODUCTION

This paper explores interface design issues, which can affect the uptake of Information Technology by older adults with impaired memory using computers for the first time. The work is based on experimentation with a Web browser for visually impaired users called BrookesTalk.

We have developed a special enhancement to BrookesTalk for elderly users with impaired memory, which in essence, tells them where they are in their interaction and what they can do next. The new system was tested with users who had previously been unable to get up and running on the Web with standard non-enhanced BrookesTalk.

The results of testing are reported together with a synthesis of observations of elderly users with memory impairment trying to use a Web browser for the visually impaired for the first time. The way in which these observations can inform interface design for synthetic speech output systems is also discussed.

## 2. ELDERLY VISUALLY IMPAIRED PEOPLE USING THE INTERNET

The problems experienced by elderly visually impaired users were first demonstrated during trials using standard our Web browser for the blind BrookesTalk <http://www.brookes.ac.uk/speech> The software

was distributed free to over 200 blind and evaluated using on-line questionnaire and follow-up telephone interview [Zajicek 99].

Browser uptake by elderly visually impaired first time users was very disappointing, 82% of this group were unable to get up and running on the Web. Analysis of their interaction showed that they were unable to build useful conceptual models of the functionality of BrookesTalk or of the workings of the Web. Their confidence in making the decisions needed for the construction of conceptual models [Zajicek 98] was low and they became confused and frustrated.

These users also found difficulty in understanding the way a computer application works. Some 'borrowed' the model of a video recorder and expected one press of a button to make everything 'happen'. They were afraid that they would 'break' the software if they did something wrong. The concept of dialogue and learning to use a language at the interface through trial-and-error was very new to them. Other problems stemmed from a lack of understanding of the relationship between the function keys and functions they represent and the concept of mapping the task in hand onto the appropriate sequence of functions to achieve a goal.

Elderly visually impaired users interviewed on the telephone appeared not to have the skill or confidence to try out functions to see how they work in order to build up a conceptual model of the system. Impaired memory as described below seriously interferes with exploratory activity that involves remembering many combinations of actions and outcomes.

### **3. SPEAKING FRONT END FOR ELDERLY USERS**

Many factors affect the take up of the Internet by elderly visually impaired users [McMellon 97][Zajicek 00]. Users' perception of the Internet and their levels of confidence and technology acceptance [Zajicek 99] are important factors, but not easy to control at the interaction level. It was assumed that the subject users have a reasonably high level of technology acceptance as they, or their family, had originally requested a trial copy of BrookesTalk.

To accommodate memory loss and visual impairment, a speaking front end was built onto BrookesTalk. The idea was to support the user in their construction of conceptual models by 'talking' them through their interaction. For each possible state of BrookesTalk an optional spoken output is provided. The user is informed as to where they are in the interaction and which actions are possible at this point. Optional further details are also available to describe the consequences of each action. After listening to the message the user chooses an option, presses the appropriate function key and then receives another message describing the new state of the system.

For example the spoken output for those who have just started up BrookesTalk would be:

'Welcome to BrookesTalk your speaking web browser. There is currently no page loaded. Would you like to:

Enter the URL of a page, press F1

Start an Internet search, press F2

Change the settings of the browser, press F7

Hear more details about options available to you, press F3

Repeat the options, press return'

With these messages reinforcing the users' knowledge of the state of the system and explaining to them what they can do next, it was hoped that the development of conceptual models will be supported through repetition and that the user will no longer need to rely on memory. The user can function initially with virtually no conceptual models at all, by using the system in a similar way to a telephone answering system and simply responding to questions.

The aim of the speaking front end was to familiarize the user with the steps needed to achieve Web interaction goals so that eventually the spoken instructions would be superfluous and the user would 'know' which function key to press for the required result.

#### **4. STUDIES WITH THE HELP FACILITY**

A pilot study was performed full details of which can be found in a previous paper [Zajicek 00]

The aim of the study was:

- 1.to determine whether it is possible to increase uptake of the Internet by elderly visually impaired users by offering the computer based support described above
- 2.to determine, if users can use the Web with the support provided, whether they are able to wean themselves off the support and use the browser unaided
- 3.to determine whether the presence of personal support plays a significant role in the uptake of the Internet

The results of the pilot study indicate that personal support is very important for elderly visual impaired users using a computer application for the first time. They also indicate that computer based support has a part to play where memory impairment precludes the building of strategies and experimental learning at the interface. The combined effect of these two factors appears to be significant although the level of their individual effects is unclear at the moment.

#### **5. OBSERVING ELDERLY USERS WITH ENHANCED BROOKESTALK**

Observation of users interacting with the enhanced version of BrookesTalk provide several indicators for further research and are worth recording to provide a more complete picture of the special considerations needed for this user group. Some basic principles can also be set out for synthetic speech output and a start can be made on assembling factors for user modeling so that in the future it may be possible to predict users' performance at a synthetic speech output interface and adjust the interface accordingly.

## 5.1 Information Overload With Synthesized Speech Messages

The idea behind computer based support is that users who do not know how to map their task in hand onto the tools available at the interface in terms of actions behind function keys will be told what they can do and how to do it. The hope is that familiarity with the sets of actions needed to operate the browser, will eventually be retained in chrystalline memory i.e. the form of memory that is retained in later life [Park 98].

The enhanced version of BrookesTalk is simply providing an explanation of the current state and what can be done next. However it was found that elderly visually impaired users were unable to absorb long synthetic speech output descriptions such as the one described in Section 3.

There was too much information and they could not remember all the instructions. They were unable to complete a model of the workings of the system as had been hoped and commonly simply chose the last option. An example of the further details option, which describes the options in more detail and in a language further removed from computer terms, is given below.

‘You have just started the browser and have no page loaded. You might want to first change the setting for the browser such as the speed of the voice, the size of the text and other things which affect how the browser works, or you might want to load a page.

Which of the three would you like to do: .....

This option failed to provide more useful information or clarify the choice of options. It simply added to the confusion and created anxiety. This demonstrates further that these facilities, which might be of benefit to younger users in helping them to work out what is happening at the interface, are not accessible to elderly users as they rely on the absorption of large amounts of information and good memory.

## 5.2 A Measurement for Memory

A free recall memory test [Postman 65] was applied to the subject users to see if there was a link between, memory levels as shown by the test and their performance at the interface. The observed phenomena, of users’ remembering the first options or the last options most frequently, primacy and recency, were seen to hold. A link was also found between the score on the memory test and users’ performance at the interface.

It is possible therefore to use this test as a component of a user modeling framework. The ultimate aim of our work is to adapt dialogues to user’s memory levels and other indicators [Gardner 99] [Marghetto 99] [McMellon 97] [Park 98]. It is not only crucial that some users are provided with a low functionality easy to use interface, but those who can manage larger selection sets must be provided with them otherwise they will find the interface intolerably pedestrian. We will investigate the use of the memory test and other indicators to model users and customize interfaces according to the model.

## **6. STRUCTURING A NEW DIALOGUE**

At the outset of experimentation the aim was to support elderly users towards the full use of standard interfaces. This was possible with some users, but others were not able to absorb the information provided and use it to learn how to interact with a computer interface.

It is clear from observation of some users struggling to recall long synthetic speech messages, that for these people, messages must be simpler and shorter since these elderly users cannot absorb or remember large amounts of information. BrookesTalk is operated using twelve function keys. In the enhanced system used for experimentation, we divided the function keys into two conceptual groups, those that were involved with page and those that were concerned with different views of the page once it was loaded.

Grouping functions provides for a smaller set of function keys to select between at any one time and therefore shorter messages and less to remember. However conceptual groupings of options in speech output interfaces rely on the user understanding the concepts behind the groupings in order to know where the functions may be found. This knowledge cannot be assumed with first time Internet users and is not required of sighted users making selections on a Graphical User Interface as they can see the selection and refer back to it at any time.

We observed that a smaller number of selections in any one message makes operation easier. However smaller numbers of selections means a larger number of groupings with all the attendant conceptual problems. The ideal choice is between two functions with the most commonly required option appearing last.

It has been decided that as reduction in selection is paramount, the functionality of the system must also be reduced. The advantage gained by presenting several different views of the page is lost when the user cannot even load a page. There is little point in providing a wide range of views of the Web page to elderly users if they cannot visualize them.

A reduced functionality version of BrookesTalk will be built with 'Load URL', 'Perform a search', only one way of reading the page (document mode) and the ability to follow links.

## **7. GUIDELINES FOR SPOKEN INTERFACES FOR THIS GROUP**

The following recommendations are made for systems with synthesized speech output messages for elderly users:

- reduce functionality wherever possible. Look closely at functions at the interface and remove those that require a conceptual background.
- capitalize on primacy and recency effects in the presentation of selections, for those with memory impairment
- cut choice down to a minimum and place the default choice in the last position
- wherever possible do not use technical terms

## 8. CONCLUSIONS

On the whole the speaking front end improved usability of the system for those with sight and memory impairment. However it also introduced more human-computer interface design issues concerning the length and structure of speech output and functionality of systems.

The introduction of elderly visually impaired users with poor memory to Information Technology is challenging as they have a short supply of precisely those skills, which are necessary for the use of standard interfaces. The strategy at the Speech Project is to pilot different dialogue designs on a system with reduced functionality. We will also investigate the use of the memory test and other indicators [Gardner 99][Marighetto 99][McMellon 97][Park 98] to model users and customize interfaces according to the model.

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