

# Methods Used to Predict Older Adult Use of Technology Mediated Memory Aids

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## ABSTRACT

Prospective memory, or remembering to do things in the future, is an important aspect of daily living. However, research studies have shown that prospective memory tasks display an age-related decline. The current study is part of a longer-term project to design a technology mediated prospective memory aid for older adults. In this paper, the methodologies used to investigate the lifestyles of older adults in terms of their use of memory strategies and technology will be described. From this research several themes emerged to predict the factors that are important to older adults and to the design of a memory aid, including memory ageing, physical ageing, social network and activity and ageing attitude. The findings from these methods will be used to support the design of a new interactive memory aid, MultiMinder.

## Categories and Subject Descriptors

H.1.2 [Models and Principles]: User/Machine Systems – software psychology.

## General Terms

Design

## Keywords

Prospective memory, memory aids, older adults.

## 1. INTRODUCTION

Prospective memory (PM) is remembering at some point in the future that something has to be done, without any prompting (Maylor, 1998). PM is pervasive in everyday living and failures in PM can result in a range of consequences, from missing appointments to forgetting to take medication (Groot, Wilson, Evans, & Watson, 2002).

Research into PM is gradually growing, specifically concerning the area of older adults. There have also been recent developments in prospective memory aids for older adults however many of these initially concentrated on designs for cognitively impaired individuals (Neuropage; Hearsh & Treadgold, 1992, Memojog; Szymkowiak et al., 2004). These devices have been shown to support the memory function of the users, more so than traditional methods (Caprani, Greaney, & Porter, 2006).

The current study aims to design a prospective memory aid that

can be used by cognitively healthy older adults to support their day-to-day lifestyles. The lifestyle of this group was explored through multiple methodologies to gain an insight into whether such a device is needed and what features are necessary to fit in with the older users' preferences and requirements.

## 2. BACKGROUND

### 2.1 Prospective Memory in Older Adults

Prospective memory is one area of cognition which is affected by the ageing process (Maylor, 1993). Einstein and McDaniel, (1990) distinguished PM into event- and time-based PM. Event-based PM involves remembering to perform a particular behaviour when prompted by an external cue, such as remembering to phone a friend when you see a picture of her. Time-based PM involves remembering to perform a particular behaviour at a specific time or after a certain amount of time has passed, for example taking medication ten minutes after eating. Time-based PM is believed to be more sensitive to ageing compared to event-based PM, as it is believed to rely more on internal control mechanisms and self-initiated mental activities, such as time monitoring (Henry, McLeod, Phillips, & Crawford, 2004).

Initial studies examining age difference in PM found no significant age-related deficit (Einstein & McDaniel, 1990). However more recent studies have produced outcomes with older adults displaying poorer performance compared to younger counterparts (McDaniel, Einstein, Stout, & Morgan, 2003). One explanation for this decline is that PM is a complex cognitively demanding task which comprises of a number of different processes (McDaniel & Einstein, 1992).

Several frameworks have been developed to try to explain what processes are involved in PM. Dobbs and Reeves (1996) for example claimed that there are six components of PM. These are: meta-knowledge, planning, monitoring, content recall, compliance, and output monitoring. It is suggested that altering the nature of the PM task could consequently alter the components necessary to complete the task (e.g. setting an alarm would eliminate the necessity of monitoring stage). This model highlights how cognitively demanding prospective memory is, as it requires many levels of remembering throughout the process. An interactive reminder system could reduce this memory load by remembering for the user. For example, a reminder system could help organize or plan the task with the older adult, remember the time the task needs to be done, what the tasks do be done are and also, presuming the user accepts the reminder, provide feedback concerning whether the task was completed.

### 2.2 Current Memory Aids

An external memory aid is defined as any device that facilitates memory in some way (Intons-Peterson & Newsome, 1992).

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Research has shown that older adults report to use at least one external aid regularly with the most popular aids being calendars, address books, paper notes and alarm clocks (Cohen-Mansfield, Creedon, Malone, Kirkpatrick, Dutra, & Herman, 2005).

Although the proposed memory aid is aimed at cognitively healthy older adults, previously designed PM aids have commonly targeted cognitively impaired users. This may be because PM decline is more pronounced compared to healthy older adults. Some designs such as MEMOS, a mobile interactive memory aid, have recognized the potential of PM aids for healthy older users and are now adapting their current designs to accommodate for this user group (Thöne-Otto, & Schulze, 2003).

One of the earliest PM aids was Neuropage, a portable paging system for brain injured individuals (Hearsh & Treadgold, 1994). Neuropage was renowned for its simplicity, making it very usable for both cognitive and physical impairments. The users schedule is inputted via a paging company and reminder alerts are sent to the user through the pager at appropriate times. The user only has to press a button to accept the reminder.

More recent developments such as Memojog (Szymkowiak, Morrison, Shah, Gregor, Evans, Newall et al., 2004) have taken into account not only the cognitive and physical needs of cognitively impaired users, but also the social needs surrounding them and their carers. Memojog was designed as a reminder system built on a PDA platform for brain injured and cognitively impaired older users. The user's schedule is inputted by the user, carer or care professional and reminders are issued to the user. The user can accept, postpone or ignore the reminder, in which case the carer is alerted. Memojog is also equipped to store personal information for the user, an aspect that was found to be popular in its evaluation.

Evaluations of these devices have yielded positive effects on memory performance with the help of the aid (e.g., participants were more likely to remember to take medication and meet appointments on time with the help of an electronic aid compared to without an aid). This supports previous research which found that younger as well as older adults benefit from the use of external aids (Einstein & McDaniel, 1990). The success of these electronic devices could be attributed to their compatibility with their target user, supporting prospective memory and in particular time-based PM, which, as previously mentioned is believed to be particularly sensitive to ageing.

### **3. QUALITATIVE DATA GATHERING**

#### **3.1 Methodology**

To gather information about older adult's needs and preferences in relation to PM and technology, multiple methods were used to validate each other in the form of methodological triangulation. These data gathering methods included interviews (with professionals and older adults), observations (of older adults' daily activities) and focus groups (of older adults' technology needs). The information that was obtained from these methods was used in the conceptual and physical design of MultiMinder. The older adults that participated in the research were aged 60 years and over, were cognitively healthy and lived relatively independently (i.e., may rely on others to drive them or do heavy lifting etc.). Apart from the focus group method, home visits were organized prior to the research method to help the participants become familiarized with the researcher's presence.

#### **3.1.1 Interviews**

Interviews were conducted with 10 older adults and 3 professionals working with older adults. The older participants were questioned about their lifestyles, physical and memory abilities, the memory strategies that they use and the positive and negative features of these strategies. The professional participants were asked similar questions in relation to the older adults that they work with.

#### **3.1.2 Observations**

The observations were carried out with 4 older adults in their home. The purpose of the observations was to observe the participants as they carried out daily tasks, such as cooking, preparing and eating lunch, cleaning or doing errands, paying particular attention to cognitive, physical and psychosocial issues. Participants were asked to do the daily activities that they had previously planned or would have done on a standard day.

#### **3.1.3 Focus Groups**

Focus groups were carried out to discuss the cognitive, physical and psychosocial needs and preferences of older adults in terms of technology design and to obtain feedback on conceptual design ideas. Two groups of older adults from the Active Retirement Association (ARA) participated, 6 people in one and 4 people in the second group. ARA is an organisation set up as a social outlet to facilitate the pursuit of hobbies, leisure activities and education for people after retirement.

### **3.2 Inductive Qualitative Analysis**

The method used to analyse the research data was the approach known as inductive thematic analysis. An inductive approach concentrates on identifying themes that are linked to the data themselves (Braun & Clarke, 2006). As a hypothesis was not already formed prior to interviewing, this approach allowed for the themes to emerge from the interview transcripts.

According to Thomas (2003) the purposes underlying the development of the general inductive approach are to reduce the raw data into a brief format, to establish links between the research objectives and the summary findings and to develop a model about the underlying processes evident in the raw data. Thomas claims that the inductive approach is intended to aid an understanding of the meaning in complex data through the development of summary themes or categories from the raw data. This is a more straightforward approach to qualitative analysis compared to other traditional approaches (Thomas, 2003).

The process of the inductive approach follows the transcription of the raw data, multiple readings of the text, coding and categorising the data, identifying themes, using diagrams to display the data and making conclusions about the findings.

#### **3.2.1 Emerging Themes**

Four themes were identified to represent the important issues in older adults' lifestyles in terms of their daily needs and preferences. The themes were divided into four main themes, each containing three sub-themes. These are displayed in Table 1 below. These themes will be used as guidelines for the design of a technology mediated memory aid so that the system features will be relevant to the older user's needs and preferences and fit into their daily lifestyle.

**Table 1. Summary of themes and sub-themes identified in the lifestyles of older adults**

		Themes			
		Memory Ageing	Physical Ageing	Ageing Attitude	Social Network & Activity
Sub-Themes	Reminder strategies	Physical problems	Expected problems	Providing/receiving support	
	Perceived problems/abilities	Assistive technology	Negative attitude from internal/external sources	Social activity with family/friends/community	
	Learning	Affect on task performance	Positive Attitude	Influence of social network on technology use	

### 3.2.2 Key Findings

Throughout the data gathering process many interesting information was gathered that is key to the development of an interactive memory aid.

From the interviews it was found that all of the participants used three or more memory strategies frequently with the majority of those being used in the home (e.g. calendars, diaries, paper notes, putting objects in conspicuous places etc.). Although the participants identified many positive features of these strategies, many negative features were also identified. The most common responses given when asked the positive features of the memory strategies used were; that the memory aid reminded them to do a task, was easy to display, it was handy or easy to use, it could be thrown away or kept if needed, and it helped them to organise their time. The most common responses given when asked the negative features were that; the reminder might fail to remind them, looks messy if not thrown away, difficult to display, take up too much space to save and they might lose it.

Participants reported to experiencing age-related physical problems; however they felt that these problems had less of an impact on their lifestyles compared to non-age related problems (e.g., knee replacement after a fall).

The observations supported the information found from the interviews. The participants were observed using external memory aids whilst carrying out their daily tasks, such as using an oven timer when baking and using the calendar when filling in a form. Age-related physical problems were not observed to greatly impact how the participant carried out their tasks. However, noticeably age-related changes to behaviour included wearing glasses to read or holding written text at a distance to read. One participant suffering from hip problems adapted to her condition by using the furniture to lean on when doing tasks and a walking stick when moving from room to room.

Findings from the focus group consisted of older adults experiences with different technologies, such as different devices (mobile phones, digital television etc.) and different styles of input (touch screens). Although older adults initially doubted their experience, they gradually realized that their experience was quite diverse. The majority of the participants used mobile phones, however many only used the call features. Other types of

technology that the participants reported using included; digital cameras, the Internet, ticket machines at the airport or train station. All of the older adults said that they found touch screens "terribly easy to use, usually straightforward and if you do something wrong you can cancel it". They said that it was important for them that a device is simple to use and learn, allows the user to return from errors made, has a help option and does what it is supposed to do in only a few steps. It was also thought that technology should accommodate for sensory and fine motor problems, for example, it should have a large screen with large text, ("the bigger the better"), have audio output that can be adjusted to the users hearing ability, and have buttons or an input device that are easy to manipulate.

The focus group participants were also asked to give feedback about computer icons in relation to which ones best represented their purpose. The older adults strongly agreed about which icons they preferred. A common thread that was evident was that the icons that were chosen were not the icons that are used by computer software packages. The groups were more likely to choose real world images to represent a function, such as an image of an ear to display the volume option rather than an image of a speaker. As one participant put it, "that means nothing to me".

The information that was obtained from these research methods was used for the conceptual design of a reminder system.

## 4. DESIGN AND DEVELOPMENT

### 4.1 Conceptual Design

The conceptual design that was developed to accommodate for older adults needs and preferences as identified from the research methods was a multiple reminder system, named MultiMinder.

The data gathering methods showed that the majority of the older participants lead active lifestyles. The idea behind MultiMinder is that it will be a PM aid to assist the older user to organise their time and to remind them of things they have to do in the future. From the interviews it was found that older adults use three or more memory aids in their home with the calendar, diary and paper notes being the most common. Following this, the reminder system will include a digital calendar section, a memos section, a contacts section and a digital timer section (see Figure 1).

The advantage of this design over other memory aids will be that it will contain features suitable for older adults' sensory and physical abilities, while also accommodating for cognitive (e.g. will require limited input or learning effort, will support time and event based prospective memory) and psychosocial needs (e.g. assist the user to organise their social activities, and support the older user without marking them out as different or old). The system will use a touch-screen pen (on a Tablet PC platform) that will allow the user to manipulate the memory aid in the same way that they used traditional memory aids (writing their message on the screen as opposed to typing it). The purpose of MultiMinder will be to act as a reminder system, displayed in the home, which can be referred to when needed and which will alert the user to appointments they have made.

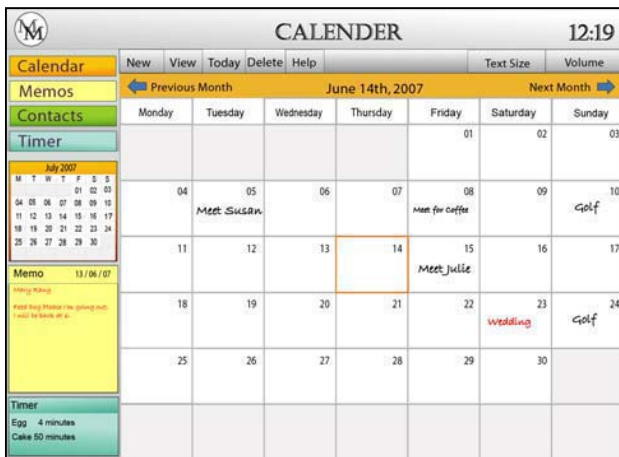


Figure 1. MultiMinder calendar screen

## 4.2 Future Work

The next stage of this research will be to design a low-fidelity prototype of the reminder system to test on the older user. This prototype will be redesigned and tested until a suitable prototype design is developed.

## 5. CONCLUSIONS

It was important when setting out to research the design of a reminder system that the cognitive, physical and psychosocial needs of the older user were identified, both in their day-to-day routines and in terms of their use of memory aids and technology.

The data gathering methods supported the idea that a PM aid would be of benefit to the older user. It was found that older adults frequently use memory aids in their home and although they find these methods satisfactory, many disadvantages were reported concerning the memory aids that they use. The intention for the current design study is to design a reminder system to contain all of the features that older adults find beneficial about the memory aids that they use and they technology that they use and to eliminate the negative aspects.

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