

Designing IT for Older People

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Abstract: Older people are largely excluded from the use of new information and communication technology (IT), a fact which contributes to the tendency for them to become socially isolated and under-stimulated. To understand any group of users, the design team needs to get to know them. Spending time with older people, especially observing and participating in their normal social activities, provides many clues on which to base design decisions. Older people with memory problems often cannot learn new skills, or at least cannot retain them. However, longstanding knowledge remains. For this reason, a design based around an interaction metaphor from earlier technology can prove effective. We briefly introduce the MAMA (Mobile Augmented Memory Aid) project, and describe the hardware and software prototypes that have resulted so far. We go on to present five design principles developed during the project, as a general approach to designing technology for older users. We indicate future work and how our approach can be applied more generally in the area of eInclusion.

1. Introduction

In the developed world today technology plays an increasingly important role in all our lives. Unless the elderly can participate in this, the danger is that they become isolated and under-stimulated. Physical and social isolation are already major problems for a large proportion of the elderly population. As they have aged, many of their older and cohort relatives and friends will have died. Increasing social mobility means that younger relatives and acquaintances tend to move away. The accelerating pace of work and modern lifestyles leave many people with little time for visiting and spending time with older relatives. While younger people increasingly maintain their social networks with technological support, such as mobile phones, text messaging, e-mails and online chatting, older people are often excluded from such networks because they often have not and may be unable to acquire the skills and knowledge needed. The challenge is to design environments that counter-act the tendency for older people to live in isolated situations that work against their mental and physical health. Social contact is known to be important for emotional as well as physical and psychological health and to offset the speed of cognitive decline and the onset of dementia [1] with a strong inverse relationship existing between the strength of social networks and the incidence of dementia among the aged [2].

As people age, most cognitive processes, but especially the conscious recall of recent events and facts, become less efficient, as revealed in the difficulty older people have in recalling newly encountered information, such as how to use a new device. Such findings encourage the development of multimodal interaction techniques suitable for older users. A major challenge is to design and develop technology for the elderly user that is easy and intuitive to use for fulfilling activities. By at least one account of the “design for all” principle [3], such technology might be expected to be usable by broad segments of the population

As in many developed countries, there is a growing population of older people in Sweden, both in relative and absolute terms, who often remain in good physical health while experiencing some problems associated with modern lifestyles related to their mental

condition [4]. Examples of these problems include difficulties with using recently developed technology, such as mobile phones, cable TV and video recorder remote controls, and computer-based services such as e-mail. Other researchers have observed similar difficulties with recent technology [5]. In Sweden in 1995 approximately 2% of the total population (of approximately 8 million) suffered from dementia and almost one million members of the population are estimated to be affected by it in some way, with approximately 20,000 new persons suffer yearly [4]. This increase is matched in the rest of the developed world and can be expected to continue for the foreseeable future. The development is a result of improved living conditions and healthcare but this very success brings problems in terms of resources, especially as improved life expectancy tends to be matched by decreasing birth rates. The result is that in most developed countries the health care service lacks resources to continue supporting older people to a satisfactory level. The workload has increased for many health care staff, which in turn entails increased stress and frequencies of burn out.

Another effect of the stretching of health care resources is that the quality time to interact and take care of each person has decreased, which often means that older people needing some care are under-stimulated, both intellectually and socially. This in itself exacerbates their condition, leading to an increased need of nursing care. The result is a vicious circle, an unsustainable and unsatisfactory situation both for the older people, their relatives, and the nursing staff.

From this negative scenario we perceive a possibility to improve the situation with the help of appropriately designed IT. The aim is to support a more active life with an increase in life quality for elderly people, increased safety and help for the relatives, and increased work satisfaction with reduced stress for the nursing care staff. The principle is simple, but in practice realising this aim is extremely challenging. The key to success is designing for the specific needs and characteristics of the elderly population. In the remainder of this paper we outline a strategy to design for elderly users based on experiences from a project called MAMA (Mobile Augmented Memory Aid).

2. The MAMA Project

MAMA (Mobile Augmented Memory Aid) is a project focused on older people with some kind of memory or communication problem, who live in residential homes. MAMA was a further development of previous research at our laboratory [5]. The overall goal of the project was to examine how information and communication technology (IT) can be used to support and improve memory and communication capacity in senior users with some degree of dementia, as well as to provide an aid to sensory and social stimulation. In this aim, the project resembles work by other researchers, including the CIRCA project [6] and the UTOPIA project [7]. Also, by strengthening the contact with their environment and improving their relations with nursing staff and relatives we hoped to enable conditions for better care and quality of life for this group of people.

One of the biggest challenges in this project was to adjust the design of the prototype to the intended users and their specific needs. Since the target group consisted of people with memory problems it was extremely important to design straightforward and cognitively undemanding interfaces that would place minimal demands on the user's memory, while at the same time providing enough interest to motivate their use. The MAMA project developed several prototypes: four applications and a hardware device in the form of an interaction and information navigation tool called The Book.

2.1 The book

The Book consists of a Tablet PC that is hidden in what looks rather like a normal book. Although we tried other approaches, we found it necessary to find a way to make the technology at hand look and feel like something the users were acquainted with from earlier life experience. Explaining how something new works with this group, but only for a short while. In other words, new skills and knowledge can be briefly acquired, but not retained.

One unsuccessful approach was to use a normal tablet PC, set up to accept simple interactions to access information sources such as a collection of personal photographs. A recurring problem for older users was remembering how to move around in this information space. A design based on using paging buttons located on the touch screen was not as successful as we had expected.

We later tried making the tablet PC look like an ordinary book (Figure 1), and this seemed to be more successful. Users liked the overall design, but were confused by our implementation of page turning, which was initially based on “stroking” the touch screen pages. We then tried a more tangible approach, physically closer to a normal book, with flaps to the right and left controlling paging forward and backward. This design was much more successful with older users, who needed little or no instruction on this function and had no trouble remembering it. In contrast, when we showed the book to younger people none understood how to page through the information without our help, and most tried to do this initially by touching the screen.



Figure 1: The book

When taking advantage of a metaphor in this way one has to consider that the user will make strong predictions about the functionality and behaviour based on the appearance [8, 9, 10, 11]. Although we initially included extra-metaphorical functionality, such as using the touch screen to select and enlarge objects, we gradually pared down the design more and more to match the predictions of the metaphor. In order to implement several different applications on top of the Living Book there is a set of tabs in addition to the page edge flaps, as in an indexed notebook, from where the user can choose which application to run.

2.2 The applications

So far during the project, we have developed four main applications: The Book of My Life, The Song Book, The Book of Proverbs and Memories of Old Times. The **Book of My Life** is a multimedia photo album where episodes from the person’s life are presented (see Figure 2). The idea behind the application is that it should be a support for the user to remember and talk about his/her life, family and so on. In this way, the application is a communication aid aimed at supporting conversation between the user and relatives, other

residents and nursing staff. It could also be used by the nursing staff to understand and learn about the person.



Figure 2 Screen shots from *The Book of My Life*

The **Song Book** is a game that can be played alone but is mostly used by a group as a social game (Figure 3). It starts by letting the user hear and read the first part of a well known old song. These are songs that are no longer broadcast through the media, and which many younger people do not know. But in a residential home for older people they are familiar to almost all the residents. The task is to sing along and continue when the recording stops. The next song is selected by turning the page. The function and the usage of the **Book of Proverbs** is the similar to *The Song Book*, but here the user, alone or in a group, tries to remember the endings of well-known (to this population) proverbs and sayings. The application called **Memories of Old Times** is a presentation consisting of publicly available pictures, video, sound and music from the days when residents were young, designed in much the same way as the *Book of My Life* (Figure 2). As with the *Song Book*, these are mostly materials that are no longer available through the everyday channels of radio and TV.

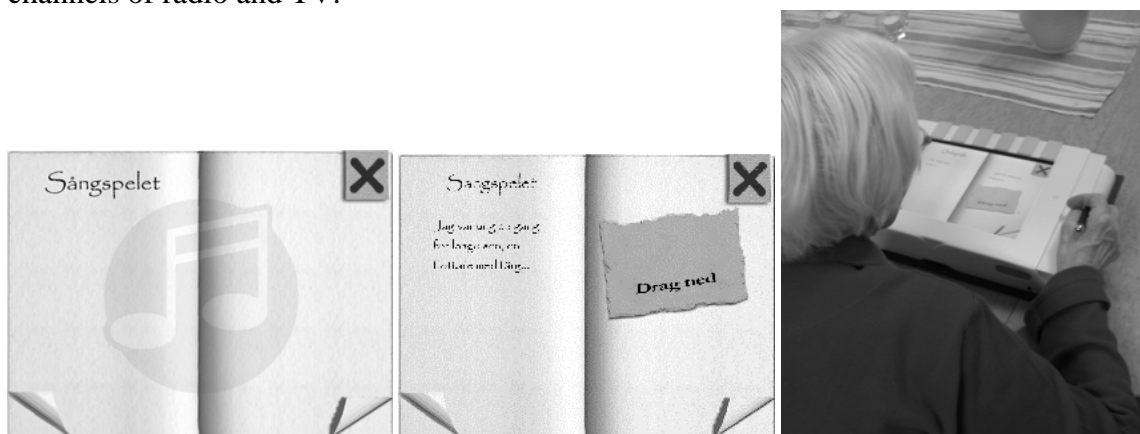


Figure 3 *The Song Book*

3. The Design Approach

3.1 Phase 1: Defining users, identifying needs and requirements

At the start of the design process it is of course very important to identify the intended end users, their needs and requirements. Moreover it is important to investigate if there are several primary user groups and if there are secondary users. A primary user is a user that will directly use the final product, and that is sometimes called the end-user. In the MAMA project for example, there are at least two different types of primary users, the elderly person and different kinds of nursing staff.

A secondary user is someone who is affected and provides or receive information to/from the system. In the MAMA project the nursing staff could also be secondary users

for example when they obtain information from the Book of My Life in order to understand some behaviour in the elderly person. By reading the Book of My Life the staff can consider whether if there is some event in the past that would explain an unusual behaviour. Family members who provide personal materials for the book are also secondary users.

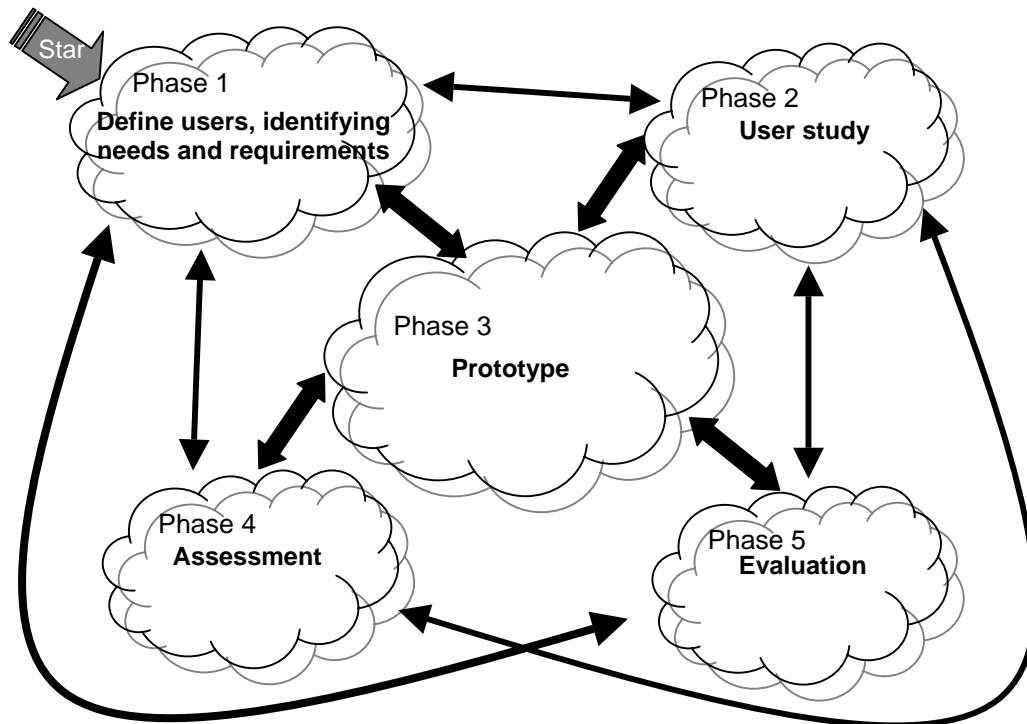


Figure 4 - The design approach

3.2 Phases 2, 3, 4, 5: User study, Prototype, Assessment, and Evaluation

Our design approach is not linear, in fact all later stages are carried out in parallel (see Figure 4). The result from all phases' are sent as input to the other phases.

In Phase 2 of the project, after defining the users, the user study involves being part of the end-users daily life in the environment where the intended system is going to be used. The project team spends time with the user group and actively participates in their daily activities. In the MAMA project the whole project team took part in the daily life of both the elderly people in their activities in the nursing home and also at a day care centre. In addition the project team also interviewed and participated with the nursing staff in their work

The prototype (Phase 3) is a central focus for facilitating communication between the project team (see Figure 4). A first mock-up or prototype should be produced as quickly as possible in order obtain something to communicate about and around. The prototype is both the activity core for the design team as well as the binding part between the different phases in the design and development.

Another important aim of the prototype is to facilitate Phase 4, assessing the impact of the design on the end users. This includes software, interface and interaction aspects, and hardware. It is also important to assess the appropriateness of any metaphor used in the design. Contiguously, in Phase 5, the design is evaluated in a real setting and with the intended end users in order to examine the usability and to obtain comments on the design. The result of these phases is input to the other phases and often results in redesign of the prototype.

The assessment as well as the design of the concept, metaphor, interaction/navigation and interface has continuously to be evaluated in order to guarantee a successful result. The evaluation must be discussed in the whole design team and its results and implications used in further development.

3.3 The design team

The MAMA project team consisted of several different types of people: the intended user group, a professional designer, technicians and programmers, a researcher who acted as project leader, as well as nursing and care staff. These different partners each tend to use different kinds of language that often creates problems and misunderstandings. Differences in age are also potentially problematic, as the users are older people but the designers and programmers are typically much younger.

In order to achieve the aim of meeting the older people's needs, the communication has to be in terms that all can readily understand, to ensure that the users feel confident enough to participate in the design work. It is also important to design the communication process to minimise those areas where the users have weakness, for example complex, abstract arguments that depend heavily on memory and logical inference to be understandable.

We explored the use of actual prototypes to facilitate communication between the partners in the project team. The prototype facilitated the conversation and reduced the likelihood of misunderstanding, as suggested by earlier work in HCI design for the general population [12]. But for this to work there must be a project leader who can facilitate the conversation by creating an atmosphere where everybody feels that they can verbalise their opinion.

4 Conclusions

Our approach to designing for the older user can be summarised as the following set of guidelines. Although each is motivated with reference to our experiences with the MAMA project, we suggest that these can serve as the basis for a general approach to designing for eInclusion.

4.1 Become an anthropologist

As a designer it is very hard to understand how older people think, how they do things and what obstacles they experience. As a result of this it is very important to work with suitable ethnographic methods, for example by spending time participating and observing the behaviour and language of the intended end-users in a real setting. A good deal of work has been carried out using ethnographic methods to inform IT design [13, 14, 15], but most has addressed specific environments and activities rather than user groups.

During the project we spent time observing two groups: one at a residential home and another at a day care centre. We participated in all their activities in order to learn and understand their situation. The development of the different prototypes was conducted with an evolutionary approach. Throughout the development we tested different mock-ups and prototypes with the same groups of people in order to get feedback for the development process. Nursing staff also participated with comments and explanations about our object of study.

4.2 Base the design on familiar (earlier) artefacts

Many older people have problems to learn how to handle new technology and also to remember that knowledge. An effective approach is to base any interface metaphors on a well-known artefact, some thing or activity that they have used or done since they were

younger [6], capitalising on what has been called technology generation [16, 17]. Our impressions in this process were not that problems of understanding came from complexity *per se*, but rather from unfamiliarity (although the two tend to go together with this group of users). And in this, it was not how familiar the user was with the device recently, but rather whether the users were familiar with the device (or a very similar one) in their younger years. We found that older users could understand and use complex devices, but could not remember how to do so. It is not sufficient to give the visual appearance of a long familiar physical object, as attempted by IBM with their RealThings designs [18]. It is important to tap into the long-standing physical motor programs with realistic tangibility, too.

In the MAMA project we based the interaction and navigation around the metaphor of a book. The next guideline follows from this one.

4.3 Hide the technology

Our target population was not computer literate, nor were they familiar with recent technical devices such as mobile phones, DVD players, or even cable TV decoder boxes. In fact, they generally appeared intimidated by any new technology, and assumed they would not be able to use it and would break it.

We decided that we had to hide the technology and this led to the idea of a book-like device that is used in more or less the same way as a normal book, by turning pages, etc.. The pilot test of the prototype showed that it was a successful concept and that the users did not view it as a computer, but as a book.

4.4 Provide both motivation and challenge

It is very important that an application is motivating to use and that there is a story or something similar that drives the use of the application. Even so, it is also important that the application does not provide everything. Any activity must be at least somewhat challenging for the user in order to create a feeling of achievement and so to encourage continued use of the application. This is a difficult balance, since some challenge must be present but not enough to intimidate the user.

With the book prototypes we experimented with different features before deciding that the challenge, which creates the motivation to learn to use and to continue using the device, should reside in the content, not the form. Hence, the games with materials that required completion by the user were developed, and proved very popular and motivating.

4.5 Create a coherent package of hardware and software

With the aim of achieving a natural and intuitive use of the design it is very important that the hardware and the software complement each other, and fit together seamlessly. The aim is to create an interaction and navigation style that is natural to the kind of task that is supposed to be performed with the application on the particular device on which it runs.

In the MAMA project we packaged the applications naturally as sections of the book. The different applications became different “chapters” of the book and within a “chapter” the user stepped forward or back linearly, by turning “pages”.

4.6 Future work

In the future we intend to carry out more extensive exploration of the applicability of our design approach to the development of technological support for increased quality of life for the ageing population. Application areas that we see as important include

communication aids, health monitoring and information systems, and social and solitary entertainment.

Acknowledgements

The work described was carried out at the Interactive Institute in Umeå as part of the EC-funded project VITAL, funded under the Regional Structural Funds - Goal 1 initiative.

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