

# An Empirical Study of Seniors' Perceptions of Mobile Phones as Memory Aids

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**Abstract.** . To determine desired properties of new mobile phone-based memory aids for seniors, we conducted observations and participatory design meetings. We observed a clinical population of individuals with Mild Cognitive Impairment (MCI) participating in a memory intervention session for a period of six weeks. We then conducted a series of participatory design activities with five normally aging seniors who were concerned about memory loss. Based on these two activities, we contribute evidence that mobile PDA phones contain many of the properties that seniors desire in an external aid; however, they lack appropriate software and hardware. Mobile phone designs should be changed to accommodate seniors, but only in coordination with better user support and without removing desirable memory support functions.

**Keywords.** Mobile phones, seniors, memory, memory aids, Mild Cognitive Impairment, PDAs.

## 1. Introduction

Mobile phones are everywhere. Recent figures place the number of GSM-enabled mobile phones sold worldwide to be over 2 billion [13]. While the highest concentration of use is in younger age brackets, one British study found that over 60% of men and women ages 60-64 own mobile phones [15]. This percentage decreases for older age brackets; the same study reports 30% of men aged 80 or older own mobile phones, while less than 20% of women do. While numbers for North America are currently unavailable, rates among North American seniors are likely to be even lower due to slower overall adoption rates and larger geographic areas for providers to cover.

While adoption rates among seniors are low compared to young people, 20-60% may seem reasonable or even surprising. However, we must make a distinction between mobile phone ownership and usage. Simply because a customer purchases a phone does not mean that he or she will use it in ways that are amenable to supporting memory. For instance, a senior might leave the phone in the car for use in emergencies, while a younger person might carry the phone with them. It is practices such as these that influence the capability for mobile phones to serve as successful memory aids, and paint a more accurate picture of than consumer statistics can.

Fading memory is one of the most prominent psychological changes that result from aging. As Cavanaugh, Grady, and Perlmutter note [1], seniors frequently use external memory aids such as calendars, address books, and to-do lists when their own memories fail them. The use of these external memory aids, however, seems limited to either paper-based aids or stationary desktop computer applications. In one study by

Cohen-Mansfield *et al.*, only 3 out of 100 seniors surveyed used electronic memory aids of some form [2]. In the same study, 58% of seniors were interested in purchasing an “electronic memory aid” with an eye towards medication management. They also found that higher education and poor health were positively correlated with the desire to purchase such an aid. In their paper they note that people who wish to purchase such memory aids are also more comfortable with other home electronics such as microwaves or televisions.

From these studies, we see that mobile phones are popular, and that seniors have begun to buy them at moderate rates. Outwardly, it would also appear that hardware and software design problems have been largely solved. The general (and unsurprising) consensus is that mobile devices for seniors should have large buttons, loud volume, and large print [6, 7, 8, 11]. Goebel found that menu selection can be problematic for seniors operating mobile phones, and suggests using mechanical metaphors for menu design [3]. Kurniawan also points out that conceptual models seem to be the major culprit in phone operation difficulties. Less well-understood is the logic behind seniors’ reluctance to purchase mobile phones, although this space has begun to see some attention as well [4, 5].

While the technology community has identified the major barriers to general use, and we have seen commercial mobile phones targeted at seniors [14], it is important to step back from the hardware to look more broadly at the phenomenon occurring. If the hardware problems have been solved, and senior-friendly phones are on the market, why aren’t there more seniors using mobile phones to help their memories?

This paper suggests some of these reasons. We report on an observational study and a participatory design study that inform us about the reasoning behind seniors’ memory-related mobile phone usage patterns. We offer early insights into how some seniors think about mobile phones in light of memory loss. What conceptions about mobile phones do seniors hold? What advantages and disadvantages do phones seem to have over paper-based memory aids? What memory aid systems do they use instead? By discussing mobile phones within the specific context of memory support, we see a different set of benefits and drawbacks from those previously discussed in reports of more general mobile phone usage.

## **2. Method**

To help understand seniors’ conceptions about mobile phones as memory aids, we conducted observations and participatory design sessions. The observations took place in a geriatric hospital and research center, where a geriatric psychologist held weekly two hour long intervention meetings with a group of older people diagnosed with Mild Cognitive Impairment (MCI) and likely to further decline in memory functioning. MCI is a condition thought to be a precursor to Alzheimer’s disease and is characterized by selective impairments to memory while general cognitive skills remain intact (*i.e.*, the absence of dementia) [12]. The seniors in this group were eager to take action against further decline and thus participated in the study.

The purpose of these five sessions was to teach seniors internal memory strategies in an effort to keep them autonomous for longer periods during subsequent memory decline. As part of the program, the psychologist asked the seniors to keep a paper organizer with them at all times. As the seniors began to use their new organizers (called “memory books”), we were able to note their hesitations and triumphs during

the process of adopting a new external memory aid. During each meeting we listened and took notes, but did not interact directly with the participants. This method permitted us to examine how they used and understood paper-based memory aids without the added intricacies of introducing a new technology. Because sessions were conducted in groups, voiced concerns were met with further confirmation or disagreement from others in the study, providing rich discussion.

Following the completion of the MCI intervention group, we convened a participatory design team [10] with normally aging seniors who reported trouble remembering names. Participatory design is a method of software development where design is conducted *with* users rather than *for* users. We met as a group or one-on-one periodically for over six months. As a team, the seniors designed their own mobile phone software for memory support and provided rationales for their design choices (elaboration of the methodology may be found in [8, 9]). At the end of the design sessions, we offered interested participants the opportunity to try a mobile PDA/phone (iMate K-JAM model) for a month. During the meetings, the seniors directed much of the discussion and our primary role was to offer expertise on mobile phone technology and moderate the sessions. The participatory approach emphasized the legitimacy and importance of all concerns, no matter how small or trivial, yielding themes that may otherwise go unspoken in more formal methods. Likewise, the autonomy we provided to the seniors during the sessions allowed them to focus their attention on matters important to them rather than those pre-determined by the researchers.

### *2.1. Participants*

There were six older people involved in the MCI intervention group. Specific ages were not provided, but all were over 60. The group consisted of three males and three females. Of the six participants, one actively used a mobile phone (Palm Treo) to organize himself. One used a weekly paper planner, which she carried in her purse. Of the remainder, some kept wall calendars at home, while others used nothing at all. This pre-existing variety in memory aid usage yielded interesting and sometimes conflicting viewpoints about the relative merits of those aids.

Five older women ranging from 55 to 86 years of age were included in the participatory design group. Two of them owned mobile phones. One carried her phone in her purse, but never used it unless she needed to call someone in case of an emergency. The other kept her mobile phone in the glove compartment of her car in case of emergencies. The remaining three did not own mobile phones of any kind. All five owned home desktop computers and joined the study based on an interest in learning more about mobile phones. We videotaped each session and transcribed the conversations for analysis purposes.

### *2.2. Results*

After the 12 month period of observing and working with seniors, we reviewed our notes and transcripts to find themes across the two studies. We roughly organize these points into a “pro/con” listing. In truth, however, there are dynamic and important tensions between these “benefits” and “drawbacks” that require further study.

### 2.2.1. *The Case for Mobile Phones as Memory Aids*

In our studies, a number of statements indicated that mobile phones have potential for use as a memory aid for seniors. We present each of the properties of mobile phones that make them especially promising as a platform for memory support for seniors.

*Portability.* The seniors in both groups wanted access to their personal information at all times. The geriatric psychologist in the MCI group further stressed the importance of portability of any aid. One senior shared a story where she received an appointment follow-up card from her doctor with the date of her next exam on it. Because she did not have a pocket organizer, she put it in her purse and resolved to write it on her calendar when she returned home. When she finally checked her purse and found the card again, the appointment had already passed. She lamented that if she had a pocket planner (or mobile phone), she would have been able to enter the appointment right away at the doctor's office. Unlike some memory aids like wall calendars, mobile phones provide portability to support memory anywhere.

*Easy backups.* One participant noted that she fears losing her paper notebook because "it would be tragic... my whole life is in here." However, making backups of her notebook is time and labor intensive. Mobile phones can provide fast and reliable synchronization with home computers. While the seniors were excited when informed about this prospect, they seriously doubted their technical ability to synchronize a phone with a computer. Indeed, conducting this process with current mobile phones is probably still too difficult for novices to initiate.

*Flexibility and revisions.* Seniors felt frustrated with paper when they made mistakes and had to erase or cross out errors. They also disliked how paper memory aids such as calendars limited their ability write in extensive details (*e.g.*, because of the size of the pre-printed boxes). This caused the seniors to write entries across multiple pages or include sticky notes on particular entries. This, in turn, led to clutter and dissatisfaction with the readability of the result. Phones, on the other hand, allow easy revision of information and virtually unlimited space to enter details without contributing to visual clutter.

*Proactive alarms.* One recurring problem with current memory aids is that the seniors often forget to check them, and therefore lose any benefit of the aid. As one woman noted about her new paper organizer, "I have no need to look at my book. It's not fun." For forgetful or reluctant seniors, mobile phones can initiate a review session by ringing or displaying an alarm. All seniors saw the value of these alarms, and suggested the phone could "help me remember to take my medication" or "remind me to call someone later in the afternoon." At the same time, the seniors disliked phones that "ring all the time" or otherwise disrupted their activities. Participants clearly denounced people who use their mobile phones in public places such as busses or movie theatres, and were wary of becoming similarly "rude."

*Consolidated information.* One participant noted he has trouble remembering everything he must take with him when he leaves the house: "I have to remember my keys, my wallet, my memory book, and my phone." By combining the functions of paper organizers with the phone, the number of items that seniors must carry (and potential to forget them) decreases. Further, keeping several kinds of information in one place (*i.e.*, combining a calendar with an address book on the phone) offers seniors a "go-to place" for the information they require.

*Interactivity.* Computationally enhanced memory aids serve as rich grounds for unique applications beyond traditional personal information management. For instance,

some seniors liked the idea of playing games to keep their memories sharp. Many cited Nintendo's Brain Age and "use it or lose it" articles they read in the newspaper. The participatory design team discussed the idea of having a memory game to play while waiting in public places like a bus stop or at the doctor's office. However, some seniors saw gaming as "something young people do" and strongly disliked the idea of having games on a mobile phone.

In addition, computation allows seniors flexibility in attempting to recall information. One woman said "If I was going to a wedding, I would want to go to the phone and say 'wedding' ...and then the computer would give me a list of all the people there." The ability to search offers a profound benefit over paper aids. Using keyword search as a retrieval mechanism (rather than, for example, the date of the wedding) further allows complex associations between concepts to exist.

*Ease of carrying.* The men in the MCI intervention group often failed to carry their paper organizers with them. When they were asked why they did not carry them, they reported that they have no place to put them. Unlike the women in the group, the men did not carry purses or bags and felt foolish carrying the paper organizer everywhere. The man who used a Palm Treo, however, proudly demonstrated how he keeps his phone on a belt clip. Paper memory aids that have sufficient room to write and sections for organizing various types of information can become quite large and bulky. Mobile phones are lightweight and commonplace, and permit people to carry them without additional baggage or social stigma.

*Creating a routine of use.* Having a mobile phone was seen to promote the establishment and execution of a routine of use. Members of the MCI group felt it was not only important to *have* information (such as a phone number), but also to know where to *find* information (such as in an address book). The seniors shared stories of having to coordinate between several paper memory aids located in different places in the house in order to accomplish a single task (*e.g.*, calling a person on a particular date requires the address book and the calendar). This, in turn, led to some confusion about where to write things down, and where to find them. Mobile phones allow seniors to establish a single pre-set place to find information and a routine place to enter new information.

*Communications support.* Several seniors noted that they relied on their spouses, neighbors, children, and grandchildren to help them remember. One woman often left notes on the refrigerator that were intended as memory aids for her granddaughter (*e.g.*, "Pick up milk"). Mobile phones provide more advanced methods of administering such "communicative reminders" including text messaging, phone calls, and voicemail.

### 2.2.2. *The Case against Mobile Phones as Memory Aids*

While mobile phones offer many benefits over paper-based aids, designers must still overcome several challenges in order to make phones more desirable memory aids for seniors.

*Poor conceptual design.* Participants were confused by the conceptual designs of software that exists on phones. Rather than thinking in terms of objects or data structures, the seniors thought in terms of complex relationships between people, times, places, activities, and responsibilities. For instance, one senior felt that to-do lists should be stored in a notepad application on the phone. Another, however, felt that it made more sense to write to-do lists on the calendar, which more accurately reflected her current practice. Current mobile phones usually provide a single, uncompromising

way to enter and retrieve information. Using such a system forces the senior to “think like a computer” rather than accommodating more personally meaningful styles of memory organization.

*Complexity.* One participant said she would only use a mobile phone if it was “absolutely no harder than a television.” This point connotes two suggestions for mobile phones. The first is that some mobile phones do not promote skill transfer; that is, their interfaces are so unlike normal landline telephones that the seniors were unsure about how to operate them. One example of this is the presence of green and red “pick up” and “hang up” buttons. Even between mobile phones, manufacturers have yet to create standards that promote skill transfer – once a senior learns how to use one mobile phone, it is not necessarily clear how to use another one.

The second suggestion that the seniors were hinting at with the “television” comment is their desire for information appliances that have singular purposes. Just as televisions do not allow you to enter contact information for friends, the seniors disliked the idea of a phone that doubled as a planner. There was a clear sentiment that phones should be phones, and planners should be planners. Some seniors saw the attempts to converge the two as being misguided and unnecessarily complicating things.

*Hardware designed inappropriately for seniors.* Seniors had trouble with both input and output aspects of mobile phones. In user tests we performed with 2 seniors in the focus group, they commonly pushed additional buttons by mistake as they were holding the phone. For example, while trying to push a key on the front of the phone, one participant pushed a key on the side of the phone with her thumb, causing a different application to launch and losing her place.

Two different participants who wore hearing aids noted that they cannot use the phone without first putting their hearing aids on, and then adjusting the volume settings. Poor hearing also prompted seniors to suggest very loud ringtones and speaker volumes. Unlike young people with keen eyesight, the seniors had to take time to prepare to use the phone – finding their glasses, adjusting the screen distance, increasing the volume, *etc.* Overall the sentiment was that using a mobile phone demanded the individual’s full attention, and should be used with care. This demand on attention was sometimes seen as too much of a burden for completing simple tasks.

We asked the seniors in the focus group to name the top three hardware problems they foresaw with mobile phones. The most important was button size – they all felt anxious about having to push small keys in a precise order. The second item was screen size – seniors felt they would have trouble reading small text. Third, they worried about maintaining a firm grip on the phone itself. They wanted a more rugged model that could withstand drops and provided more finger traction. These findings concur with those provided by questionnaires and focus groups conducted by Kurniawan [5].

*Radiation and health concerns.* One senior had a fear of using a mobile phone due to reports that the radiation from the phone could cause brain damage or cancer. This was especially important for her because her friend recently died of too much radiation due to chemotherapy. While the seniors did see the phone as a valuable tool in the case of emergencies, they also felt hesitant about using the technology without being certain of health consequences.

*Fear of changing routines.* Overall, the seniors were hesitant to change their pre-existing routines in favor of adopting a set of new memory aids. This notion occurred for various reasons. One woman in the MCI group felt her brain would become “lazy” if she used a paper organizer. Her logic was that by writing things down, she denied her brain the opportunity to challenge itself by remembering. Not needing a memory aid

was also a point of pride for some seniors; they felt that by using one, it would be admitting they had a memory problem. Despite their decision to participate in memory-oriented research, some seniors felt that their memories were behaving normally enough that they did not need additional support from any aid – phone or otherwise. They cited their long-standing routines for remembering to complete tasks, and adopted the adage “if it’s not broken, don’t fix it.”

A similar concern arose from the participatory design group; one participant worried that she would be utterly lost if she were to lose her notebook. When encouraged to imagine using a mobile phone instead, she became nervous. She was not willing to give up her current reliable system because she did not entirely trust the mobile phone. She insisted that if she were to adopt a new memory aid, she would continue to use her old system in addition to it. At the same time, managing two separate memory aid systems was seen to be too much work.

*Fear of breaking the phone.* Participants worried they might break the phone somehow. The sleek, small design of some phones conveyed fragility instead of sophistication. One participant thought that all phones and computers should come with a built-in message indicating that if there was ever an error, it was *not* the user’s fault. The seniors felt it was important to rely upon instructions as well; rather than confidently exploring a phone, they wanted “concise, step-by-step instructions written by a native English speaker, and in large print.”

*Impersonal nature of technology.* The memory aids that the seniors currently use are all highly customized. One woman noted that it took her a long time to “find just the right notebook for me.” Many people created their own organizational schemes using folders or notes because they could not find a pre-existing memory aid that seemed to mesh with the way that they thought. These schemes were sometimes very personal. For instance, one woman did not use a traditional paper memory aid; instead, she had a “memory drawer.” This was a kitchen drawer that contained reminders of various types and for various purposes – pieces of paper, appointment cards, her glasses case, her hearing aid, *etc.* Some items in the drawer were for her to take with her when she left the house, while others were for more managerial tasks such as making appointments.

This inability to customize is exacerbated by mobile phones. With paper, seniors can often rip, paste over, or edit some of the pages. With software, however, this is nearly impossible. Software applications that allow seniors to customize how their personal information is entered and retrieved has yet to be realized.

### **3. Conclusion**

Based on our observational study and subsequent participatory design group, we highlighted promising aspects of mobile phones as memory aids. The widespread availability and pre-existing familiarity with phones may make them one of the most feasible platforms for memory support technologies. In the years to come, it is likely that the baby boomer generation, already familiar with mobile phones, will have a desire to use them more intensively for memory-related tasks than the current generation of seniors.

However, we have also shown that using mobile phones as memory aids comes with a series of barriers. Some problems can be solved by better design and standardization, but some are complex and tied up in social or emotional concerns.

Commercial phones targeted at seniors often miss this mark; they remove an enormous amount of functionality in attempting to “solve” the design problem, while failing to support memory or ease more fundamental tensions about using a phone in the first place [8]. We have suggested some of the reasons why even senior-friendly phones often fail to be good memory aids for seniors.

It is critical that technologists understand pre-existing practices and seek to enhance them, rather than replace them. While full-blown standalone systems for supporting memory may have maximum effectiveness once deployed, there is a clear need to create flexible, open-ended tools that allow seniors to incorporate the technology into their own lives as they see fit. In other words, even the best system will be useless if no one uses it. If our studies of current memory aids are any indication, the unique ways in which seniors adopt new memory aids may surprise us.

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#### References

- [1] Cavanaugh, J.C., Grady, J.G., and Perlmutter, M. (1983). Forgetting and the use of memory aids in 20 to 70 year old's everyday life. *International Journal of Aging and Human Development*, 17, 113-122.
- [2] Cohen-Mansfield, J., Creedon, M. A., Malone, T. B., Kirkpatrick, M. J., Dutra, L. A., and Herman, R. P. (2005). *Journal of Applied Gerontology*, 24(1), 3-20.
- [3] Goebel, M. (2007). Ergonomic design of computerized devices for elderly persons – the challenge of matching antagonistic requirements. *Universal Access in HCI (HCII 2007)*, 894-903.
- [4] Kim, H., Heo, J., Shim, J., Kim, M., Park, S., and Park, S. (2007). Contextual research on elderly users' needs for developing universal design mobile phone. *Universal Access in HCI (HCII 2007)*, 950-959.
- [5] Kurniawan, S. (2006). An exploratory study of how older women use mobile phones. In *Proceedings of Ubicomp 2006*, 103–122.
- [6] Kurniawan, S. (2007). Mobile phone design for older persons. *interactions*, 24(4), 24-25.
- [7] Leonard, V. K., Jacko, J. A., and Pizzimenti, J. J. (2005). An exploratory investigation of handheld computer interaction for older adults with visual impairments. *Proc. ASSETS 2005*, 12-19.
- [8] Massimi, M., Baecker, R., and Wu, M. (2007). Using participatory activities with seniors to critique, build, and evaluate mobile phones. In *Proceedings of ASSETS 2007*.
- [9] Massimi, M. (2007). *Participatory design of mobile phone software for seniors*. Unpublished Master's thesis, University of Toronto, Toronto, Ontario, Canada.
- [10] Muller, M. and Kuhn, S. (1993). Participatory design. *Communications of the ACM*, 36(6), 24-28.
- [11] Omori, M., Watanabe, T., Takai, J., Takada, H., and Miyao, M. (2002). Visibility and characteristics of the mobile phones for elderly people. *Behaviour & Information Technology*, 21(5), 313-316.
- [12] Petersen, R. C. (Ed.) *Mild Cognitive Impairment: Aging to Alzheimer's Disease*. Oxford University Press (2003).
- [13] Reuters. Mobile phone market seen to reach 2 billion users in '05. *USA Today*. Retrieved from [http://www.usatoday.com/tech/wireless/phones/2005-01-19-wless-outlook-05\\_x.htm](http://www.usatoday.com/tech/wireless/phones/2005-01-19-wless-outlook-05_x.htm). 2005. Last accessed May 23, 2007.
- [14] SilverPhone Easy5. Retrieved from <http://www.silverphone.co.uk/mobilephone/info.php>. 2004. Last accessed April 25, 2007.
- [15] UK National Statistics Department for Work and Pensions. (2002). Lifestyles and Leisure Interests. In *Focus on Older People: 2005* (pp. 83–92). London, UK.