Chapter 20

Software Co-design with Older People

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20.1 Introduction

> *Our Lives are getting evermore technologically demanding. The number of skills necessary to participate fully in modern-day society are continually increasing and so is the expected level of technological know-how.*
>
> (Keates and Clarkson, 2003)

In a world that is orientated towards the healthy and the younger person, designers have been reticent to design inclusively. This is beginning to change due to the overwhelming evidence that older people are likely to be a considerably larger proportion of the population by the year 2020. The notion of 'inclusive design' emphasises the importance of social, human factors in system use. Designers should recognise that solutions devised on the basis of inappropriate investigative strategies and techniques can be debilitating and dis-empowering (Lebbon *et al.*, 2003). Consequently, when considering technology design for older people, traditional technological approaches need to be complemented by detailed investigations into everyday life and user needs, involving the users themselves in the process of investigation and requirements specification as a feature of co-development or 'co-realisation' (Hartswood *et al.*, 2002). Current practice still considers older or disabled people as specific groups set apart from the norm of society for which special demands are placed on the designer in order to produce one-off designs. This paper reports on the development of a person-centred approach to developing a communications and virtual games platform for older people to use in their own homes. We initially consider the methods and research process used in determining people's needs and aspirations, and consider our adoption of cultural probes as a facilitator in this exposition. The paper reflects on the implications of the design in relation to inclusivity and demonstrates that the approach adopted by the research team considered the participants from a person-centred perspective.

Our research originated as part of the DIRC (http://www.dirc.org.uk/) initiative, a multi-institutional investigation funded by the EPSRC on dependability in computing systems. On this project, we worked with a number of older people in the community to design a technology system that would be suitable for them. In the process of this investigation, our original conception of designing some form of smart or ubiquitous home was found to be misguided by the participants whose concerns were mundane, relating to undertaking everyday household tasks and avoiding isolation and loneliness. Our investigations found that, even in housing specifically designed for elders with available social facilities, older people still felt lonely and isolated. We observed how they used the television as a means of avoiding their isolated experience, the television taking the place of the lost partner, in a silent static form.

As a response to the isolation that many of the participants were experiencing, we started to investigate how we could make use of computer-mediated communications as a way to facilitate non-intrusive, informal communications between older people. Critical to this was the development of a system that was both usable by people suffering from many of the normal infirmities of old age and which did not look like a conventional computer with all of the preconceptions that this entailed. We therefore decided to base the support system on tablet computers – simple A4-sized devices which are light and portable and which do not require keyboard skills for interaction. This system is still in development, and crucially the participants have been used to inform the design process throughout.

20.2 Eliciting User Requirements

One of the most complex and time-consuming elements of designing for people is actually the requirements process. In order for the final design to be accessible to and actually used by the target group, it is critical that this group or person is fully engaged with the design process. The process of designing for individuals is a strong tradition at Lancaster University's computing department where a number of technology designs have been undertaken using small groups or individuals. Our methods tend to use a very small group to define the problems in a general sense and to give grounding to the process. The design is roughed out and then presented to a wider group for comments. This leads to the next design stage which is more concrete, and through successive iterations the design becomes more refined and detailed. At several points through the process the emerging design is presented back to the larger group. This process means that needs and aesthetic qualities can be embedded in the design.

Sensitivity to the feelings of the participants who agreed to be part of our studies required a range of sympathetic data gathering techniques. The starting point for this data gathering was the use of cultural probes (Gaver *et al.*, 1999, 2004) which we adapted for our purposes to provide us with design data (Crabtree *et al.*, 2003). Some participants agreed to keep personal diaries of their daily activities. All were also supplied with Polaroid cameras and voice activated Dictaphones in a Cultural Probe pack. In addition to these items, the packs

consisted of a disposable camera, photo album, visitors book, scrapbook, post-it notes, pens, pencils and crayons, a set of postcards addressed to the researcher and a questionnaire. We are currently using a probes pack containing, rather than the other cameras, a digital camera, which only requires a 'point and click' to take a picture.

A key feature of our probes was their mundane nature, as they consisted of every-day artefacts which were easily obtained from any main street and therefore were all familiar to the participants. Even if they had not used the devices previously, they had at least been aware of them and considered them to be ordinary (Cheverst *et al.*, 2003). The lack of the 'wow factor' actually assisted in the uptake of the probes. The participants felt happy to engage with the everyday artefacts whereas it is uncertain how they would have responded to-out-of-the-ordinary articles.

The probes have been trialled by Lancaster in a number of settings and projects, including with adults with cognitive impairments in a halfway house, which resulted in the development of a SMS interactive display board that is used by the staff and the residents, as well as pill dispensers (Kember *et al.*, 2002; Cheverst *et al.*, 2003; Clarke *et al.*, 2003; Fitton *et al.*, 2004). The probes have also been adopted for disabled and older people living in the community to assist in designing assistive technology solutions as well as within a sheltered home for older people in which an evaluation of their current technology was undertaken (Dewsbury *et al.*, 2004). For each occasion, the probes were developed and adapted for the people who would use them. For the older people the Dictaphone and cameras were chosen, as they are easy to use as well as requiring little dexterity by the participants. The questionnaires were specifically written for each group to reflect their living styles and their possible lifestyles.

Probes were handed out in ones and twos as special packages, attempting to make the person who has the probes package feel special and important. The probes were left with the participants for a period of time that they determined but no less than two weeks in order for the research team to get a clear idea about their routines and patterns of behaviours. In all groups, the probes were greeted with interest as well as a degree of concern. For many of the older people the probes seemed to be something they would do, but only as they were involved in the research project, although over time the concerns of many of these people were diffused by the participants who had completed the probes and found them both fun and enjoyable.

Our own approach to the use of cultural probes embodies much of Gaver's (Gaver *et al.*, 1999) original propositions but we deviate in a number of significant practices. Entry into the participants' home is often difficult to negotiate. The probes act as a mediation tool between the participants and the research team as well as actively involving and engaging them from the off. This facilitates the sometimes difficult negotiations involved in accessing participants and 'bringing them onboard' so to speak. The probes are used not as artistic works designed to promote inspiration in the minds of participants and researchers but rather as grounded artefacts that enable the participants to share personal aspects of their lives with the researchers. Therefore the probes act as a negotiation and navigation tool to direct the researchers through the layers of personal and sensitive topics that

the participants wish to share with the team. Our emphasis is not placed on older people answering specific questions by using the probes. This is undertaken through the qualitative questionnaire, and rather we provide the probes with as little instruction as possible in order for the participants to generate the data on their own terms.

The probes were well received: in the community, the six older people from a north east town were given and returned the packs, and in the sheltered home where the researchers were present for a longer period, fifteen probes were given and returned. Not all the elements of the probes were fully completed, and the amount of completion seemed to be proportionate to the participant's impairments. The greater their impairments, the less probe material returned completed. This is not wholly surprising, but allowed us to redesign the probe contents each time. Certain items were never used by participants in certain groups including the Dictaphone (A Sony M-430), which might be because this was given to older people who did not like to hear their own voices and therefore felt embarrassed. Also even though the Dictaphone was small and required little skill to use, the buttons were small and not clearly illustrative of their use, requiring considerable strength to push them all the way down to start the recording process. It is not always easy to be sure why certain items were not taken up whilst others were used effectively. The results from the probes have been discussed elsewhere (Cheverst *et al.*, 2003; Clarke *et al.*, 2003; Crabtree *et al.*, 2003)

Although our expectations of the results from the probes were limited we had not anticipated that loneliness and isolation were felt as acutely as they turned out to be. Even in residences where the participant lived with a group of other people of similar ages there was a significant amount of loneliness present. If their friends had family or relations for the weekend, it meant the person might spend the weekend without seeing anyone else even though people were next door to them. The main requirement therefore was a tool to facilitate and support communication. Informal communication was essential as participants did not want to feel obligated to make a formal connection with the other person (Bagnall *et al.*, 2004). The question that struck the design team was how to enhance informal communication by enabling older people to engage with a piece of technology and use it as a communication tool.

20.3 Promoting Communication

Whilst designing a computer based communications tool, one of the first questions that have to be answered is what hardware platform is appropriate for older people? There are several competing considerations. Many older people are technophobic, unfamiliar with computers or somewhat reticent about learning to use them, so the system should be as natural and simple to use as possible. Some older people have limited space in their homes, especially those living in sheltered accommodation, and they might find difficulty in reading small typeface and thus require a larger screen.

The available hardware options are currently desktop PCs, Laptops, Tablet PCs, and handheld devices such as the Palm. Desktop PCs are importable and take up too much space, Laptops can be awkward to use, and some older people might find them too heavy to move around comfortably. Palm sized devices can be too small for some older people to read easily. This leaves Tablet computers as the best options, specifically slate style tablet PCs. The one actually being used weighs 1kg, which we have found to be generally acceptable. Tablet PCs have few hard buttons, which have been disabled so that they do not produce confusion with the users. Input is via a stylus, which is somewhat familiar to older people since it looks and behaves in a similar way to a simple pen (Figure 20.3). Tablets also generally include 802.11 wireless networking, which makes connecting to the Internet physically much easier than having to deal with wires.

For the software platform, the most obvious choice might be to build applications on a standard OS such as Windows XP. However, these contain very large numbers of interaction options, which can make them hard to learn and could be overwhelming for some users. Instead it was decided to build a system which sits on top of Windows XP, but provides a simpler user experience, hiding the complex Windows GUI.

The software design that emerged over a period of a few months was inspired partly by instant messenger systems. The ability to see quickly who else was available on the system was seen as an essential to allow discrete communication. An important aspect of instant messenger is the ability to advertise "status". Typically systems allow "Online", "Busy" and a small number of other status messages. However, it seemed unnecessary to restrict older people to such a small set of status messages. Instead a simpler and richer option was to provide a small area where they could write a message which would be seen by all their friends and family. Messages can be changed just by wiping the area clean by tapping a button and writing the new message. Early trials of this feature suggested this was both simple enough to be readily understood, and enjoyed. This design meant that most of the screen would be taken up with an "address book", but since the device is focussed on communication, and helping people to see who else is available to communicate with, this has proven a successful option.

The other feature present on the first screen (known as the CHOOSER) is a list of activities (Figure 20.1). Currently we have only tested only one, namely CHAT, which allows synchronous written communications (Figure 20.2). To start an activity the user taps on the activity button and on the other participants, and then taps "Start". The start button allows users to change their minds if they accidentally tap the wrong thing, and also makes the order in which choices are made (people first or activity first) more flexible.

The chat activity design is aimed at being simple but powerful. It presents an interface which looks much like a shared whiteboard. The various participants can write and draw, and see each other's writing and drawing almost instantly. This design helped to avoid a problem with instant messenger style applications, namely threading. In instant messenger it is common (Isaacs *et al.*, 2002) to see more than one conversational thread. For younger people who are familiar with the technology this is generally acceptable, but even for them is can become confusing and hard to follow. The shared whiteboard style design avoids this since responses

are likely to be made near to the original utterance, so the spatial layout can be used to alleviate the confusion threading might cause.

Once the whiteboard fills up the design relies on a paging system. This was instead of a scrolling system, which can be physically awkward with a stylus. Making sure the software was designed in a way that was appropriate for the hardware was a major consideration of the design.

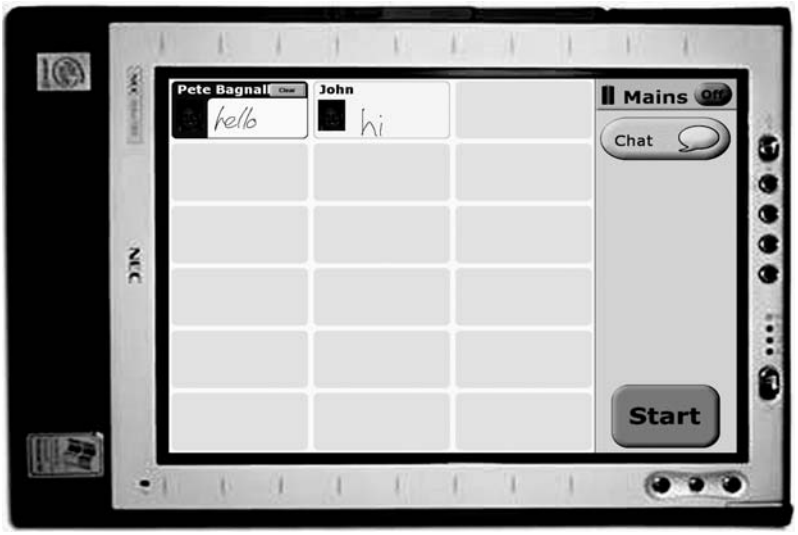

Figure 20.1. The CHOOSER

Through discussions with the participants we were informed that entering data via keyboard and a mouse was not suitable for many people: we therefore opted for a stylus entry. The tablet comes with two styli. One fits into the casing of the tablet, but unfortunately is too thin for the majority of our participants. The larger stylus however, being about the same dimensions as a biro, was found to be acceptable by the participants. The stylus has a button which has been disabled as this caused an unnecessary complication for some users and therefore acts just like a normal pen. This was found to be a useful analogy for the participants to use in order to get over certain technophobic issues.

To operate the system, all the user is required to do is turn it on and then the choices are simple choices. To illustrate, Figure 20.1 shows the CHOOSER page displaying the other network users, the computer recognises this automatically, and then the user is required to choose what application they wish to use, in this case they have a choice of one: 'CHAT'. By selecting who they wish to chat with, selecting CHAT, and then pressing the start button they go into chat mode. They are then prompted to write an optional invitation. Once they have written this the invitation is presented to the people they selected who can then accept or reject the request and if accepted the CHAT mode begins (Figure 20.2). The simplicity of the platform is its strength: it allows the users to do many things but the options are always the minimum possible for the task. As we add more applications the

CHOOSER page will fill up on the right hand side but the choices will always be limited and there are a maximum number of add-ons that are allowed. Therefore, if users wish to undertake a series of complex tasks such as email, accessing the web, editing and managing photographs *etc*., they have the option of choosing from a limited number of tasks.

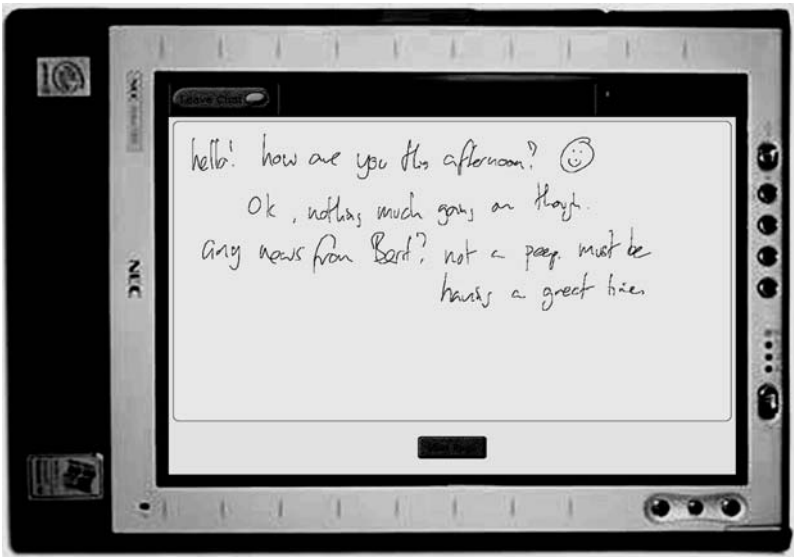

Figure 20.2. The tablet in "CHAT mode"

Figurer 20.3. The different styluses proved a useful comparisson

20.4 Communicating through Games

Surprisingly or at least surprising to anyone who spends any time observing the daily life of older people, little attention has been paid to the role of games in the lives of older adults. Our ethnographic studies have highlighted how games – crosswords, card games, Scrabble *etc.* – were an important and valued part of their individual and social lives. Games appear important for a number of reasons. Firstly, as a source of entertainment and enjoyment; secondly as a mechanism to develop new social contacts and reinforce existing friendships; and finally as

therapy, slowing down memory loss and maintaining motor skills as well as improving self-esteem and independence. We see particular benefits arising where games facilitate social interaction. To support both individual and social game playing requires research to help understand the most effective means of interaction with computing platforms and how we can support, for example, people talking during games, player awareness, coordination, *etc*.

The ability to chat between older people allows for informal communication. Clearly the application allows users to write and draw pictures, thereby giving alternative communication methods, but the chat application is simply designed to facilitate interaction which could then continue in other ways (phone, visits, *etc*.). We are now investigating how to supplement this system with applications that allow closer engagement with the computing platform and have begun to develop a card games platform for the tablets which will enable a range of multi-player games to be played with each player interacting with other remote players through their tablet computers. Note that this is not, primarily, a system to play games with a computer – rather, it is a means for people who may be housebound to play games and interact with their friends. As Lindley (2004) suggests:

> *"games are not simply games, they are perhaps more accurately referred to as ludic systems, systems that integrate game play with other formal systems of interaction and time structure."*

We have therefore designed the games support facilities to be flexible and to allow games to be played as determined by the tablet users (Figure 20.4).

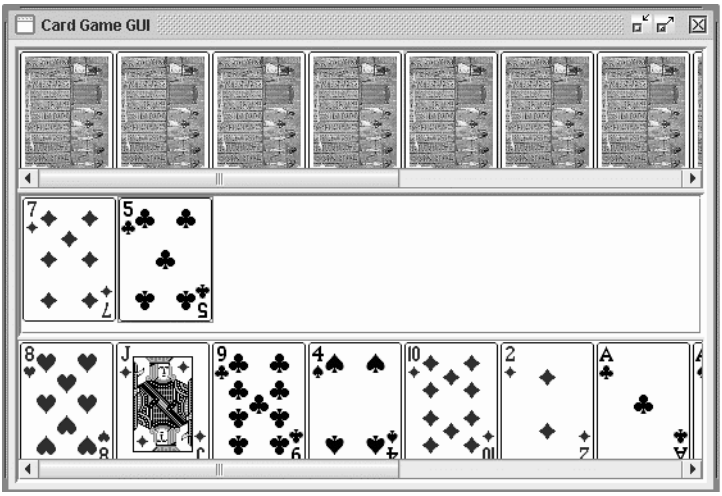

Figure 20.4. The FREECARD games console with all hands showing

Existing computer based games remove decisions on rules from human agents to computer systems. While this approach has its own merits, it denies the player

the flexibility of traditional games. Ideally, it would be nice to provide unintelligent game objects which allow players to manipulate the objects during the play. For example, it should be possible to play a different game with the same game objects as with their physical counterparts. Our approach strives to achieve the flexibilty exhibited by traditional games through decoupling rules from game objects and transferring them to the player. The consequence of the rule transfer is the need to support communication between players. Clearly doing this by written contact is not feasible as it would be too cumbersome; we are therefore using Skype (http://www.skype.com/) to allow real time verbal communications between the tablet users. The tablets already have basic microphones and speakers built into them and therefore this voice transfer application achieves a basic connection between users relatively simply. This allows social chat between players as well as discussions on the game itself. Games therefore perform a number of interesting communicatory functions, in that they provide a source of entertainment and an event; this is a social event, which can also be a learning event and a physical event.

20.5 Concluding Thoughts

The development of the tablet platform and applications continues, the tablets successfully transmit the writing from one to another in real time and the chat and games applications have been developed to a beta stage. They are currently being tested with participants in their own homes. The technology developed is a direct result of the co-working relationship that the team have built up with the participants. Without them there would be no design, and without them there would be no improvements. Throughout the course of this research we have attempted to work with the participants as equals in the project and reflect their wishes in the final designs. It has been a learning experience for all members of the team. We also see that although the applications have been developed on tablets for tablet PCs there is no reason why we cannot use them on standard computers. Similarly, although the applications were developed for older people by older people, there is no reason why they cannot have as much worth with other people in the wider world.

20.6 Acknowledgements

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