ABSTRACT
This paper charts the development of a software platform and applications designed specifically for older people to promote communication and sociability. Through this we attempt to help alleviate isolation or loneliness by providing appropriate informal communication and virtual interaction. The software has been developed using a person-centred design approach that specifically favours simplicity and flexibility of use over functionality and power. Early participation from the older people was in the form of adapted cultural probes [8]. As the design progressed participation took the form of iterative criticism of the design, and informal user tests with older people. The system allows older people to easily discover who else is currently using the system, and therefore potentially available to chat with, interact with or play games with. The games also allow voice chat so players can socialise while playing. The application of this software has the possible use of encouraging intergenerational communication.

Keywords
Person-Centred Design, Older People, Cultural Probes

1. INTRODUCTION
An increasing concern with modern society is that the rise in technology has empowered and supported those people who have been able to take advantage of the available technologies, whilst leaving the remainder technologically alienated and isolated [1]. One group for whom this is certainly a possibility is older adults who are increasing in proportion as well as becoming more isolated through family breakdowns [4] [10]. This paper reports on the work being undertaken at Computing Department at Lancaster University in the UK where some software is being developed to enable seniors to communicate informally with each other for example their friends and families through a computer without the complexity associated with traditional computing platforms.

Our research originated as part of the DIRC (www.dirc.org.uk) initiative, a multi-institutional investigation funded by the EPSRC on dependability in computing systems and continues through Microsoft Research funding. 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 conceptions 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 tasks and avoiding isolation and loneliness. Our investigations found that, even in housing specifically designed for elders with available social facilities, older people felt lonely and isolated. They used the artefacts such as the television as a means of avoiding the consequence of 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 negative preconceptions that this entailed.

2. PROBLEM IDENTIFICATION
“Unfortunately, our common metaphors for computer interaction lead us away from the invisible tool, and towards making the tool the center of attention.” [12]

Lancaster University’s Computing Department is renowned for having a multidisciplinary staff membership consisting of computer experts and social scientists. This multidisciplinary mix has proven extremely successful in a number of software developments and has recently been focused on developing assistive technology and ‘smart homes’ for senior and disabled people as well as ‘CATCH - a Compendium of Assistive Technology Checklists for the Home’, for professionals to determine technology requirements for supporting independence in the home (www.smartthinking.ukideas.com/CATCH.html).

The research team undertook ethnographic field studies with seniors in their own homes over a period of two years. A number of new methods were piloted and adapted to achieve this task including adapting cultural probes [10] [5], technology tours [2] [11], observations, qualitative interviews and open questionnaires [7]. The researchers have worked with a many seniors throughout the UK and allowed them to determine their own technology requirements. As a result of this fieldwork, it was revealed that the seniors’ were less concerned with the introduction and use of high-end technology, such as smart homes, and more concerned with everyday mundane routines and activities such as cleaning their homes, meeting other people and being isolated for much of the time. Participants explained this isolation was due to family
and friends not visiting or having passed away. Many of the older adults found that at weekends they could be alone all weekend. On further investigation this period expanded considerably such that some older people could spend up to a week without seeing another person socially. Many participants had circumnavigated this by employing people to come in to their homes and clean or do other jobs, which provided some level of company at a high price, but many participants were still, at times, chronically lonely.

3. DERIVING OUR SOLUTION

There was no obvious technology solution to preventing or alleviating isolation without bringing more people into the equation. Loneliness and isolation cannot be solved without contact with other people. Yet for many older people in our study, the contact with other people was a source of concern and worry and hence the cycle was extended.

Over many months of work with the older participants, we determined that an informal communication system was what the older people wanted. A system that would indicate when other friends or family were available to be contacted was what the older people required. The system needed to show who was on line and friends or family were available to be contacted was what the older people required. The system needed to show who was on the network but this should not place any obligation on the user to make contact if they did not want to. Contact with others was therefore voluntary. Our participants informed us that often knowing that other people are there and available is enough to console the isolated person and make them feel less alone. Similarly we found in the fieldwork that many seniors were reluctant to make overt contact even with neighbours as they did not wish to cause ‘bother’ to them and did not wish for visitors themselves as this meant a lot of preparation beforehand. Social communications, therefore, needed to be informal, and not require the users to enter into more disclosure than they were happy to. For this reason cameras were ruled out, as the seniors did not want to be seen by others although they would like to see the other people themselves. Avatars were considered as a possibility to replace real pictures but this becomes over complex and possibly of little use to the older people themselves, where as a still picture of the person they are communicating with does help them feel they are talking to a real person.

Our initial intention was to build software package that could be used on a standard PC but we soon discovered that there are numerous problems with traditional desktop or laptop computers for seniors. Firstly and most important, the older people in our study were by and large computer illiterate and feared anything that resembled a computer. In practical terms of hardware, computer illiterate and feared anything that resembled a computer. In practical terms of hardware, desktop computers require significant amounts of space, often at a premium. Input via a keyboard assumes either some keyboard skills or great patience, and mouse input requires learning a coordination skill, and is awkward for many older people even once they have learnt. Interaction idioms such as double clicking are mechanically difficult for many older people. Laptops suffer from most of these problems, but exacerbate them by having a smaller keyboard, and even more difficult pointing devices.

Modern operating systems are highly complex, and require substantial training or experience to use effectively. For seniors who have limited energy to devote to learning new skills this is daunting and inappropriate. What’s more, most of the functionality offered by such systems is not relevant to seniors.

4. FROM REQUIREMENTS TO DESIGN

The hardware and software needed to be simplified. For the hardware a Tablet PC form factor was chosen, specifically an NEC T400, a slate style tablet, which has no keyboard (although a keyboard can be connected via USB). This particular machine is relatively light, at 1kg (2.2lb) and has a reasonable sized screen, which is important to be able to present information at a useful size. As with all Tablets, it offers stylus-based input. The styluses (figure 1) that are provided with the tablet come in two sizes. One is about the size of a normal biro, the other much smaller. Most older people were much more comfortable using the larger stylus, but so far the selection of available styluses is less than ideal for older people.

![Figure 1](image)

The actual design was informed in large part by observations of older people using computers and prototypes at various stages. From this a number of simple design guidelines were laid down. Having seen that they were disinclined to explore an interface in the way experienced computer users do, one principle was that functionality should be clearly visible, not hidden inside GUI widgets such as dropdowns or in dialog boxes. To keep the complexity to a minimum only a small set of widgets are being used. Buttons, which can be tapped with the stylus, have been tested with older people, and cause few problems. Initially many older people tried, very logically, to tap the button with their finger. Having been told this didn’t work they quickly became used to using the stylus instead. Ideally the hardware would support using a finger for tapping buttons, but pragmatically the problem appears to be solvable by documentation and training since it was very readily learnt.

Writing with a stylus is also relatively familiar, although making it obvious where they on the screen they are ‘allowed’ to write is an important design consideration. Using a consistent visual style for regions that can be written on is important, but it appears that older people are less adept at noticing these relatively subtle cues in the interface. Again, training and documentation may help, but the design needs to assume that these subtle visual cues are not understood, so redundant mechanisms may be required.

The last interaction style that is allowed is dragging. Mechanically this is identical to drawing a line. While we don’t have as much experience with seniors using a drag interaction there have, as yet, been no cases of seniors having trouble with this idiom. However, the objects to be dragged must be very clearly indicated.

Another guideline related to the labelling of user interface elements. Fiske et al suggest [8] that since icons are rarely well understood, textual labels are better. Observations of older users confirm this finding. This lead to a design guideline that all buttons must have a textual label. Iconic labels are optional.
This simple set of guidelines is quite restrictive, but this has proved to be an asset rather than a hindrance, since it serves to concentrate the design on those functions that are of greatest importance.

4.1 Platform Design
As one of the concerns being addressed by the designs was the reluctance to intrude, a presence awareness interface, similar in principle to a Microsoft Messenger Buddy List was developed for the system. The “Chooser” (figure 2), by which we refer to the main screen, displays other users, indicating whether they are online and allows each user of the system to write a short phrase to convey their emotional state or whatever information they wish other users to know. This means users can see at a glance who is available to connect with. Alongside the “buddy list” is a list of potential activities. The exact set of activities depends on which programs have been installed on the device. In accordance with the established guidelines, the buttons for the activities are large, with large text labels, to make them easy to read and easy to tap with the stylus. This means that there is a limit to the number of activities that can be accommodated on the interface, but again this in fact is a useful limitation, since it helps provide an incentive to keep the number of activities (and hence the level of complexity) down. It was also determined by the seniors that if they found that they had reached a point where they required more functionality than the platform could provide then it would be time to start using the full functionality that is provided by Microsoft Windows.

When seniors use the chooser to select an activity, in most cases they will be required to select another user to participate in the activity. To begin an activity the user is required to make a minimum of taps on the screen. Tapping an activity selects it, tapping another user selects them. Once selected tapping ‘start’ activates and initiates the activity. Tapping a selected user or activity deselects it, which allows for a straightforward way to correct errors.

4.2 Chat Design
The design for Chat (Figure 3), although inspired to some extent by instant messenger (IM) applications, deviates from this in a few important ways. Firstly there is an “invitation” step, on entering the chat activity the user writes a short invitation to the person they wish to chat to or determine if the user is ready for communication. This extra step is to allow a way for older users to politely decline a conversation through not accepting the invitation. This step is essential as a major barrier to communication is a sense of not wanting to intrude on another person. If the chat activity simply launched directly into chat,
without giving the other person a way of declining it is more likely that this would be considered intrusive, and therefore the same barriers might reappear, in a similar way that a telephone call can be annoying when it is from someone you do not wish to speak with. Once an invitation has been written and sent, the receiver sees the invitation on screen and can either accept it, in which case the chat begins, or decline, in which case they can if they wish write a brief message saying why, again to allow polite behaviour. Invitations deliberately do not time-out. It was considered better to let the user decide when to stop waiting rather than impose some arbitrary time limit. This is especially true for older people where it may take a few minutes for them to respond if they are away from the tablet when an invitation arrives.

The actual chat is essentially a shared white-boarding system. This has some advantages over conventional IM. It avoids the threading problem within a conversation, of utterances getting out of order, because the position of writing indicates clearly what relates to what. It is also more powerful in that users can draw, scribble, and even play simple games. Of course screen space is limited, and this solved by using a paging system. One user can suggest that a new page is created. When the other user agrees both move to the new page together. This rather involved interaction ensures that both parties are aware of new pages being created, so it avoids one person writing on one page, while the other writes on a different page. The users can look back over old pages at any time by using paging buttons to move back and forth. Scrolling was avoided because it is mechanically awkward, conceptually somewhat confusing (novices often find it upside-down), and it is open to the failure of having the two participants looking at entirely different parts of the system, and therefore not communicating. It would also introduce another interaction style, whereas the paging model can be achieved with button, a widget that is already in use in many other parts of the system.

5. GAMES AS A COMMUNICATIONS FACILITATOR

There are many other applications that we are developing for the platform including email / Internet access and photograph sharing options, but we turn to consider the development of a card game application - FreeCard. As an icebreaker and a common shared experience games can support a means of obviating isolation. It is not required that one needs to know or like a person to play a virtual game with them and get enormous pleasure from doing so. Chris Crawford, remarked in his book "The Art of Computer Game Design" that:
"Games are frequently used (especially by adults) as social lubricants. The game itself is of minor importance to the players; its real significance is its function as a focus around which an evening of socializing will be built. Card games and some light board games serve this function." [6]  

Traditional games provide a social environment where conversations can arise. The game provides a reason for meeting, and an excuse for conversation. Between friends, conversation around a game table will generally not relate to the game itself, although from time to time undoubtedly the game will be referred to. That social experience of gathering with friends is what the game environment aims to replicate. When strangers meet to play a game, conversation may initially revolve more around the game, but it is less certain that this design is so well suited towards strangers playing meeting and playing games since.  

The game environment has been designed, for now, to support card games, as these provide a wide range of games with a wide audience. However, when exploring which games older people played it was found that, amongst the participants, there was a great variation in the games played, and for those games that were known to many, there were significant variations in the rules. The variation of rules and the general desire to keep the design simple lead to the concept of a games environment that is agnostic towards rules. In effect the game environment, ideally, should behave as little more than a virtual table. As with real cards, the rules are agreed between the player and enforced by the players. This is a departure from typical computer-mediated games, where the computer often acts a referee. The advantages of this are considerable. It allows players to play a wider range of games, since they decide on the rules. It simplifies the game interface, since the system doesn’t have to enforce rules and it means the selection of games is simpler, since there is no need to select which rules are being used. It also makes it possible for players to cheat, which in the context of a grandparent playing a game with a grandchild may actually be an advantage too!  

Since the system will not referee the game, the need for players to communicate increases. They need to prompt people when it’s their turn, to enforce rules, and to decide which game will be played. But since the purpose of the system is to increase sociability, increasing the need for conversation is actually a benefit, not an inconvenience. The ideal medium for this communications channel is clearly voice. It is rapid, simple, and doesn’t clutter the virtual game-table interface as a visual communication medium (such as the chat activity) would. The tablet hardware has both speakers and a microphone, so it is possible to use voice communication without additional hardware. It is possible that older people will find this somewhat unnatural, since they are not generally familiar with hands-free telephony style systems. For this reason, and to gain improved audio quality it may be better to provide a headset, although this then becomes more cumbersome. There is also the issue of compatibility with hearing aids, so it is very likely that a range of solutions are required to cater for a range of needs and preferences.  

Currently we are exploring the use of Skype (www.skype.com) for supporting a multiple-player audio conference. Skype’s audio conferencing facility is currently limited to a maximum of five participants. As a consequence, FreeCard can be played by a maximum of five players even though theoretically, more players could be supported. Our practical experience using the facility is that the sound quality degenerates dramatically with an increase in participants. The quality is very impressive for two players.  

The game platform automatically instigates the creation of a Skype session without any additional work on the part of the users. From the users perspective audio conferencing is simply part of the game activity.  

The user interface design of FreeCard (figure 4) aims to be reminiscent of a game table. One of the aspects of this is the relative positions of the various players. With a real card game the players hand is held between the player and the table, and so with the interface the natural place for the players hand is at the bottom of the screen, closest to the player when the tablet is resting in the lap. Since in many games where players sit relative to one another

![Figure 4 - FreeCard Game Prototype](image-url)
move ‘seat’ midway through a session, and a player always appears at the bottom of the screen, moving from one seat to another would mean the table would need to be rotated. It is likely that this would be somewhat confusing since the player would appear to return to where they were originally. Not allowing this is the simplest way to avoid the issue, although other solutions may be tried in the future.

The participants also expressed views on how their hand should be laid out. They preferred that cards should be laid out with their full face showing, rather than allowing a card to partly obscure another. It is possible that this reflects a difficulty with reading the smaller numbers in the corner of the cards. Future card designs will aim to address this issue with alternative card designs, as well as layouts.

6. CONCLUSION

It is difficult to draw firm conclusions at this time, although we know the system works and that older people in the UK are enjoying using it. We are currently putting Broadband connections in to participant’s homes in order to undertake longer and more rigorous studies of its efficacy and usage. A clear indication at this stage is that the systems will have much wider applications that its initial design specification. For this reason we will be developing an installation package CD ROM to be given to friends and relatives of the users, so that they can use the system. This will take considerable work as this will require allowing keyboard and mouse support and usage on a standard PC.

Moreover, the implementation of the platform and the activities that it supports separate the user interface from most of the underlying engineering [3]. The user interface that is being deployed includes some configurability for colour schemes but future plans include allowing UIs that are more suited to desktop or laptop computers, without stylus capability. At the moment the software can be used with Wacom style tablets without modification. We also consider that this disconnection of the UI is advantageous as we are able to make special UIs for people with specific eye conditions, or people who speak other languages.

It is also envisaged that part of the system could be implemented on mobile devices, such as mobile phones or PDAs, which would allow much greater contact between young and old generations. One possibility here includes allowing younger users to take photographs with a mobile phone and upload it directly to a senior relative. At this stage we can see many ways in which this devise can be further developed to support communication between older people, but we also consider the software has considerable applicability for use with children, people with learning difficulties and disabled people who have limited functionality.

7. ACKNOWLEDGMENTS

The authors would like to thank Age Concern Carnforth and MHA Care Group for their assistance and support in this project. This work was partially funded in the UK by the Engineering and Physical Sciences Research Council as part of the DIRC Interdisciplinary Research Collaboration and partially funded by Microsoft Research as part of their ‘Create, Play and Learn’ collaborative research programme.

8. REFERENCES