The extended television: Using tangible computing to meet the needs of older persons at a nursing home

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P.A. Waller, B. Östlund, B. Jönsson. The extended television: Using tangible computing to meet the needs of older persons at a nursing home. Gerontechnology 2008; 7(1):36-47. This paper presents a person-centred model and a tangible computing approach to better adapt television media to meet two important needs of older people: social inclusion in their immediate surroundings and better support for one's own reflections. **Method** The research project was carried out as a part of the construction, planning and implementation of a new nursing home. The implemented infrastructure enabled television watching at three levels: the regular (broadcast programmes), the internal and the personal. The internal level consisted of an in-house broadcast television channel and two media centres placed in common areas. The personal level had individualised functions. The entire concept is referred to as 'extended television'. This paper describes the early implementation phase of the internal television channel and the personal television photo album. It also examines the consequences of a person-centred model and a tangible computing approach. Participation in the use of the 'extended television' together with older people, relatives and care workers, semi-structured dialogues with these people, and observations of the television usage were conducted. Furthermore, the care workers were invited to comment on the prototypes very early in the process. **Results** Both the internal channel and the personal television photo album were used by older residents and iteratively adapted. However, too many factors and routines varied to get statistically sound results. On the other hand, the research shows that the person-centred study design utilised provided positive results in a setting with constantly changing conditions. **Discussion** This design encourages further investigations regarding how new conceptual television design can enrich the everyday lives of older people. The results also indicate the plausibility of television photo albums providing new opportunities for reminiscence compared to traditional ones, and that the internal channel resulted in possibilities for social inclusion in the nursing home examined.

Keywords: tangible computing, social inclusion, reminiscence, photograph

The process of designing technologies for older people is often based on techno-centric rather than person-centred models as argued by Dickinson and Dewsbury[1]. A techno-centric design model represents older people as recipients of technology while a person-centred design seeks to find technological solutions that fit their life experiences, expectations, etc. Furthermore, Dickinson and Dewsbury argue that user-centred design will decrease the likelihood of unsuccessful technology and decrease the unhealthy effects of negative stereotypes, such as seeing ageing as

functional decline. They also mention the challenge in the design phase where the older person is to 'comment on technologies that do not exist yet'.

One way to approach a person-centred model is through the development of tangible computing, which means moving the computing power from desktop computers to known everyday objects that have been present in the user's environment for a long time. In this way 'specialised devices that are organised to work the way we do, in the world and on the move' are constructed[2]. Positive results have been reported on using familiar artefacts and tangible computing to support older people's recollection of memories[3,4] but also to support the relatives' emotional connection to the older person[5,6]. In computing we have reached a level of technical saturation and in order to utilise the possibilities it offers, we should design with respect to human needs and not to computer limitations[2]. In other words, what is needed is not primarily more technical knowledge but knowledge about desired functionality[7]. Tangible computing requires, above all, knowledge about which everyday objects are suitable to use, and the needs the user has in relation to these objects.

Television watching reconsidered

Television is one object that we considered suitable to be part of tangible computing, both from the quantitative use of the television among older people and available results on what watching television means for them. Old people actually watch more television than any other age group, an activity that seems to increase over the adult life span[8,9]. Television media have not, by far, received the same attention from developers as computers, in spite of the increased attention being paid to the development of interactive television. This is in our view an example of how the main focus in the development of artefacts often has been on using the potential of new technology, rather than using the stored potential in the users, which in the case of television consists of about fifty years of experience. Our approach is the opposite. As recommended in a recently published article[10], we do not use interaction patterns originating from the computer paradigm, instead we use older people's long experiences of viewing television.

Television watching is usually regarded as a passive activity, as well as one that makes viewers passive[11]. The care workers in nursing homes often comment that they have a bad conscience because the older people spend such a big part of their day in front of the television. The older people themselves state that relatives interpret their extensive television watching as a sign of loneliness and abandonment[12]. Two Swedish studies, in 1995[12] and 2005[13], show the extent to which and at what times older people watch television, how television watching contributes to meeting their need of maintaining contact with the surrounding world, and how it affects feelings of social inclusion and exclusion. The results show that if the older people spend the larger part of their time at home, television watching contributes to maintaining a feeling of being socially integrated and hence maintaining contacts with the surrounding world. The results indicate that others often misjudge the older people's experience of watching television, which for them does not only mean acquiring information or being entertained, but also provides them with opportunities to reflect in peace and quiet. This need for reflection is highlighted in the results as both part of the ageing process and as something performed when watching television. It is also pointed out that this need for reflection is hard to fulfil in our society where activity and being active is a dominant ideal[12,14].

The content of television media is, however, poorly adapted to the needs of older people, such as better support for one's

own reflections and social inclusion in their immediate surroundings[12,13]. The fact that television media are used for reflection, even though the content is poorly adapted to this purpose, means that there is an unexploited potential in television media to enrich the older people's ability to reflect. We have taken these two needs as a starting point. At the same time as you maintain a feeling of still being a part of society from the information flow that the television contributes, the supply of television programmes distances you from your immediate surroundings. You end up knowing a lot about what is happening far away, but hardly anything about what is happening in your own neighbourhood.

Based on this background, we decided to conduct a pilot study. The aim of this paper is to inspire further research on how the use of television can become more deliberate and developed in order to correspond to older people's needs and wishes, at home or in nursing homes, and also in the early stages of dementia.

Theory

Reflection and reminiscence

We define 'reflection' as the older person's need for reminiscence. In the field of reminiscence, hidden memories of experiences are activated by objects, pictures, sounds or other triggers and used to increase care workers' understanding of a person. Reminiscence is used particularly in the treatment of persons with dementia and is defined as memory activity; it works as a distribution of hidden memories. These kinds of hidden or unannounced memories are something that we can experience at any age, but they have a tendency to increase as we grow older[15,16]. Digital reminiscence devices have been designed and tried by elderly people with and without dementia[17-19]. Older people's use of television watching to provide for their own reminiscence and social needs will most likely affect their expectations when they move into nursing homes.

Social inclusion in care settings

As older people move into nursing homes their social life and physical surroundings change, which leads to a transition period of adaptation to the new situation. In this transition it is stabilising to develop relationships with other residents[20]. After the transition, older people also often experience the opportunity to tell stories to others as something positive[21]. However, establishing new social contacts can be difficult[22] and positive results have, for example, been reported on providing memory books with photographs and simple sentences to older people to facilitate their communication[23].

Designing for old people

This paper's project is a part of the 'Ageing and Design Programme' that was launched at the Department of Design Sciences at Lund University based on rehabilitation engineering research and gerontological studies[24]. Some of the most important principles of the programme are found in the 'extended television' project. When designing for older people it is a wise rule to change as little as possible[24]. Tangible computing enables the fulfilment of this requirement since familiar technology is used and functionality is supported in a non-intrusive way. This is important, for example, for older people with dementia. However, it is also important that the older person maintains control[25].

Materials and methods

We created the the 'extended television' in connection with the design of a new nursing home in Malmö, in southern Sweden. The 'extended television' consisted of a suite of added television functions, which widened the opportunities for social inclusion in the immediate surroundings and reminiscence for the older residents.

Settings

In the nursing home there are 53 apartments, common day rooms and television rooms. The apartments are spread

over three floors. The first floor is a short-term unit (11 apartments). This unit is excluded from the analysis and further description of the settings, due to the late initialisation of the unit. The televisions in the television rooms are 42″ (107 cm) plasma screens. In each of the apartments there is a 32″ (81 cm) wall-mounted LCD television screen. The private company which runs the nursing home has been active in influencing its architecture and interior design and has a genuine interest in if and how an 'extended television' can enhance the quality of life for the residents. Both the number of older residents that were involved and the number of employed care workers increased during the period of observations, since the apartments were gradually becoming occupied. Floor two and three were filled to 40% capacity by May 2006, 80% at the end of August 2006 and 90% at the end of December 2006. At most, 30 residents were observed. They were of different genders, backgrounds (fisherman, singer, engineer, athlete, care worker, etc.) and ages (between 60 and 100 years). They all had some kind of functional limitation due to, for instance, different kinds of dementia, physical disabilities caused by rheumatism or cancer, and stroke related conditions such as aphasia or memory loss. The majority of the people who lived at the nursing home had some kind of memory loss. All of the permanently employed care workers had traditional health care training and several of them also had other experiences that were especially valuable at the nursing home, such as computer skills, painting, ceramics, baking, hairdressing, etc. There were, except for an imbalance at the opening of the nursing home, approximately the same number of employed care workers as older people. In May 2006, one daytime registered nurse was employed, and in the autumn of 2006 it was decided to also have nurses on duty at night, resulting in the hiring of new nurses (five nurses were needed to cover all shifts).

The infrastructure enabled television watching at three levels: the regular (regularly broadcast programmes), the internal and the personal. The personal television is analogous to a personal computer, PC, but perceived as being part of the television and presented on the same screen. All together this is what we call the 'extended television'. On the internal level there were several options: watching the internal channel, digital photographs, DVDs or movies from the open archives of Swedish Television via Internet. The internal channel could easily be installed in all televisions and used to watch movies from a central DVD player or to view daily photographs from the nursing home and receive information about personnel, meals, etc. Watching movies from the Internet, locally stored digital photographs or locally played DVDs could only be done in one common television room and in one day room since it required a television connected to a computer.

One of the authors, P. A. Waller, was present approximately 15 hours a week at the nursing home. His presence was considerably higher, up to 30 hours a week, during installation of the technology, troubleshooting and observations of the initial use of the personal television.

Method

The project was of an action research character with interactive design portions, continuous mutual feedback and direct observations. The design process covered the design of functions for the internal television as well as a personal photo album for the personal television. Different approaches were used for the internal and personal levels – the latter was based on one case study while the former got its input from a continuous presence with the direct purpose of interaction for better understanding the needs and wishes of as many as possible. The two design processes also cross-fertilised each other.

The implementations in this research were tested during the turbulent period that followed the construction of the building. It was impossible to collect controlled and statistically sound results, since there were simply too many factors and routines that varied due to the unpredictable influx of older people, initial labour turnover, adjustments of the technical installations and built environment. The unpredictable influx of residents also made the need for recruitment of care workers unpredictable. On the other hand, the research shows that the study design utilised also provided positive results in a setting with constantly changing conditions. It is supported by recommendations in the literature to make use of pilot studies as a first step and through case studies to fill in for the lack of knowledge concerning therapeutic activities for older people with Alzheimer's disease[26]. The hope is that this project will encourage others to conduct studies in more controlled settings.

Observations, dialogues, interaction

The observations and dialogues were goal-oriented and semi-structured with the outspoken aim of guiding the design processes. The first observations were carried out in July 2006, just after the opening of the nursing home, and the last ones included in this paper were carried out in January 2007. Notes were not taken in front of the older persons, instead they were written down soon after visiting an apartment or a day room.

A method often used in participatory research approaches and a main challenge for us was to involve the end users to interact through the use of mock-ups or prototypes, both through their actions and their comments. Older people are critical and valuable users, since they tend to only accept technology that 'saves energy and makes life easier'[27]. However, a direct approach can not be always applied[25]. Early prototypes can be totally rejected because they are not ready or – on the contrary – totally accepted with the consequence that the user does not want to switch to the final product since it requires too much effort to relearn. Older people with dementia can become upset or confused when trying something that does not work perfectly. We followed the advice of working with carers in the initial design phase to come up with a prototype and then letting the older person use it[25].

Revealing requests on contents

Waller visited more than 50% of the older persons in their apartments (mostly older people without dementia) and visited all day rooms routinely on each visit, to talk with the older persons. Waller also participated together with the older people, relatives and care workers in the use of the functions on the internal level. Furthermore, he trained potential users. The care workers did not have time for long conversations when on duty. Instead appointments were made, or the conversations took place during their coffee breaks.

To some extent the relatives were also involved, both through direct contacts and through contacts via the care workers. The relatives were generally interested in the project and curious about the possibilities for their resident relatives. Information via the care workers was double checked as far as possible for consistency. Even if the care workers often had a prominent role in the design process, their observations and opinions were compared with those of the older people to try to get as close to them as possible. Whenever possible, the opinion of the older person herself took precedence.

Case study: design of photo album

One personal television photo album was designed in an older persons' apartment. This older person, Berit, had Alzheimer's disease with significant short-term memory loss (diagnosed in 2001 and at the time of the study she had a moderately severe cognitive decline [mid-stage Alzheimer's

disease]). She was almost 90 years old. Her husband had taken care of her until he became ill and died. During his illness she moved permanently to a nursing home, approximately one year before this study began. Her two daughters visited her at the nursing home, however, only one of the daughters and her husband were involved in the design process; they are hereafter denoted as Berit's relatives. Information about Berit's preferences was gathered by asking her, relatives and care workers, but also by looking in photo albums, watching television, or having coffee together with Berit, alone or with relatives or care workers.

Results

Designing functions on the internal level

The work process was divided into four phases. The first phase consisted of integrating the project into the setting and becoming familiar with the conditions, that is to say the technical applications to be tested and the people involved. In the second phase the older people and the care workers discovered the new possibilities, either by themselves or through an introduction. During the third phase, technical alternatives or modifications were considered with the user's first reactions in mind. In the fourth phase, the older people took more control over their usage of the internal television. All four phases were affected by major repairs of the new televisions.

Phase 1: Project integration

Waller used a digital camera to take photographs of the nursing home surroundings. These photographs were later shown in several day rooms by connecting the digital camera to the television. The slideshows were appreciated, especially on the ward where people with dementia lived. Many older people appreciated having their photograph taken and displayed on the television. These early trials laid the foundation for installing two media centres and developing the internal television channel.

The early design of the internal television channel involved showing care workers examples of how the channel could be used and asking them which features they thought would be useful for the residents. The first version of the internal channel was much like a slideshow presentation where a specific seasonally inspired picture was shown each weekday. This was followed by approximately 20 photographs from outside and inside the nursing home. Digital cameras were purchased and the care workers documented memorable events with photographs, such as the midsummer dinner party. These photographs were later added by the researcher to the slideshow. A code of ethics was adapted for the use of cameras. Photographs were only taken in common areas such as the day rooms, the balconies and outside the nursing home. Furthermore, photographs showing possibly embarrassing situations, for example an older person sitting on a visible urinary protection pad, were not shown on the internal television channel. Care was taken to avoid photographs of older persons who did not wish their photograph to be taken.

By placing a computer next to two televisions in common areas where the care workers could use the computer together with the residents to watch movies, digital images or media from the Internet, the researchers and the care workers were able to understand which functions and media were of interest for the older persons. The computers did not contain any media centre software, such as Microsoft Media Centre Edition, but we still denoted them as media centres.

One of the most important steps in the integration of the research project into the research environment was the creation of a group of four care workers who willingly formed a 'television team'. Their tasks were to:

(i) Try different functions of the 'extended television' and to regularly use the functions of their choice;

(ii) Be a part of the design process; Take notes on what was used, why and how the different residents referred to the possibilities and what the effects were;
(iii) Inform and inspire others in the personnel to try the 'extended television';
(iv) Report technical errors.

Phase 2: Discoveries
It was evident that those who were able to use the television in their apartments did not have a diagnosis of dementia, but many of them had problems handling the original remote control. They did not understand how to operate it, and often got stuck in peculiar modes such as watching two channels at the same time, or with an altered screen resolution.

The internal television channel was seldom switched on by the care workers; however, a rumour spread among the older people without dementia about the channel, inspiring several of them to watch it in their own apartments. The pictures on the internal television channel were seldom updated, though, since the care workers rarely used the cameras on their own to document events and had to rely on the researcher to upload them. This resulted in most of the residents losing interest in watching the internal television channel after a while. A major reason for the low usage of the digital cameras was the turbulent situation that followed after the nursing home first opened.

The media centres were used to organise slideshows containing old (scanned) and new photographs which at times triggered lively discussions among the residents. Furthermore, there was a spontaneous interest from the relatives to use the media centres to interact with their parents or grandparents using personal digital photographs. On several occasions the media centre in the day room for people with a diagnosis of dementia had been used to show streaming media through Internet from the open archives of Swedish Television. When a talk show from the 1960s with a famous Swedish actress was shown, the room went totally quiet. Afterwards, many expressed happy memories of the actress. Several also knew that there was a second part of the show and insisted on seeing it directly.

Phase 3: Alternatives and modifications
The problems of using the remote controls made us consider another remote control that would only have a few buttons. Six buttons were needed: one to turn on the television, two to change channels back and forth, two for increasing or decreasing the volume, and one to turn it off. We did not manage to find a six-button control compatible with the 32″ televisions but used instead a programmable universal remote control with ten large buttons

Figure 1. The universal remote control

(*Figure 1*). A logo was placed in the upper right corner of the internal television channel screen image and on one of the buttons (VVG in *Figure 1*) of the universal remote making it easy to find the internal television channel.

The comments from older persons without dementia indicated that their limited viewing of the internal television channel was due to the limited variation of the contents. The process of uploading photographs was improved so that the care workers could do it themselves and the television team took shape. Within a week, one member started independently to upload pictures, resulting in an increased interest in the internal television channel among the older people (with and without dementia) and care workers. For the internal channel to be attractive there needs to be continuous variation and awareness of the users' interests.

Phase 4: Users taking control

The increased use of the internal channel and the need for variation made us remove the limitation on the number of photographs in the slideshow. As the slideshow grew in length, we broke it down into separate shows for different floors of the nursing home and broadcast them at different times. When the older residents with dementia watched the internal television channel, they mainly did so together in their day room. However, several people without dementia watched the internal channel in their own apartments. The older people themselves, care workers, and relatives all took the initiative to spread the usage. Both older persons with and without dementia reacted positively to seeing themselves on the television channel. Also, they often commented on the events that took place, or on an event which was associated with it. However, some of the older people who enjoyed watching the channel did not switch it on themselves, and in those cases it was the care workers and the relatives who initiated usage. The relatives used the channel to communicate with their older relative, either by asking questions or talking about the content. There seems to be an interest in photographs showing activities that took place a month ago, as well as in recent photographs. Suggestions have been made to include music, old movies and accounts of trips. Maintenance in the cable television network made it necessary to change the frequency of the internal television channel and to reinstall the television channel in the televisions.

Case study: Berit

It was clear that viewing photographs on a television was a promising idea and as we became better acquainted with the older persons at the nursing home, we were told by Berit's relatives that she used to be interested in looking at her photo albums. Her relatives were informed of the project and four suggestions were made: use the television as a diary, a calendar, a mailbox or a photo album. The television photo album function was chosen and informed consents were signed by the daughter, some of the care workers and Berit's trustee.

Design of the television photo album

Approximately five hours of looking at traditional photo albums with Berit, spread over five sessions, confirmed her interest in this activity. She was always attentive when she saw her photographs, looked happy and often said 'great'. However, she did not suggest looking at photographs, although the albums were left visible. We had a good idea of what and whom she recognised and how she reacted. She was, for example, interested in photographs of her late husband. Emotions were involved and on one occasion she started singing. She indicated that the older black and white photographs were too small for her to see. Forty photographs were initially selected to be in her personal television photo album on the basis of Berit's positive associations with them. The non-dig-

ital images chosen were scanned and digital photographs from relatives were included. This became the first version of Berit's digital photo album.

It was clear from the beginning that Berit had problems operating her television using the original remote control. Based on our positive experiences with the universal remote control (*Figure 1*) we gave one to Berit. She was trained in using it by one of the researchers and her daughter with limited success, making it clear that another interface was needed for Berit to interact with her digital photo album. The authors came up with the idea for her to use a wooden photo frame with integrated remote control buttons to browse among the photographs, shown in full screen on the television (not in the photo frame). This would merge two activities familiar to Berit: looking at a photograph in a frame and watching television (she had photographs in frames in her apartment and had been watching television before she developed dementia). The photographs were not categorised, thus keeping Berit from having to make choices that could cause stress. Menus on the television screen were avoided to keep the interaction with the television simple, as well as to maintain the feeling of watching television. The photograph in the handheld frame was one of her own and the hope was that this would prompt her to want to view the television photo album. The idea was that this interaction should be easier to learn than that of the universal remote control.

A wooden photo frame was fitted with an IR remote control unit that had an inbuilt button and two external buttons connected with hidden cables (*Figure 2*). The glass was replaced with glass fibre, and the screws painted over to avoid any problems with nickel allergy. The upper yellow button was the on/off switch. The white button next to the photograph browsed in one direction and the green button in the other. These buttons stand out physically and are easy to find and push. The colours of the buttons were chosen to contrast against the black background of the photo frame. One care worker who knew Berit tried the first version of the television photo album, browsing through the selected photographs with the photo frame control. This care worker needed an explanation how to use the photo frame but was open to the idea of using it. She agreed that Berit should not use the universal remote control and affirmed the need to rearrange the furniture in Berit's apartment to make it easier for her to view the television screen. Berit and her relatives gave their consent to rearranging the furniture and an armchair was placed in front of the television. No confusion due to relocation was observed by relatives and researchers or reported by care workers. This is probably due to the fact that Berit did not use this part of the apartment when she was alone.

Berit's usage of the television photo album

During the first three days after installation, Berit viewed the television photo album on four occasions. Each lasted between 30 minutes and one hour, and all the photographs were often viewed several times on each occasion. At the beginning she did not want to control any function of the television photo album, and trusted the

Figure 2. The first working prototype of the photo frame remote control with a small yellow on/off button, and large white and green browsing buttons to the left and right of the photograph

designer to change photographs. However, she clearly enjoyed the images, and often seemed to think about the contents in the images. She spoke in more detail than while looking at the same photographs in the traditional album and also recognised more of the photographs than before. This was probably due to the larger format that makes more details visible, the selection of recognisable photographs and by looking at the photographs repeatedly. If she was asked to change photograph, she sometimes pushed the forward button, imitating the designer's behaviour; at other times she said "No, that is for you to do". When she pushed the button, she was looking down at the photograph in the photo frame, clearly anticipating something to happen there. She did not let go of the button, probably since she did not see any change. If she was reminded by the designer to look up at the television she did not always notice that the photograph had changed. This can be due to short-term memory loss. A short recording of her singing was added to one image which made her look at the television screen.

On the third occasion she was handed the television photo album remote after the television had been switched on. She repeatedly pushed one of the large buttons, let it go, looked at the television screen and commented. One of the images was missing and a white screen appeared instead. She experienced this as the end of the photo album. After this, an empty image was always included since she appeared to be pleased that the photo album slideshow had ended. This may be because she was standing and did not find a convenient way to hold the photo frame remote control.

On the fourth occasion she did not want to change photographs herself, which can be either due to memory loss or increased insecurity since she had visitors from other apartments in her room. Weeks after this intense period of using the photo frame, she easily found her way back to operating the television photo album herself by imitating the researcher's use of the photo frame as she was handed it. Even though Berit herself never suggested watching the television photo album, it was an enjoyable activity for her that she was never forced into. Furthermore, by watching the photographs on the television, the relatives could easily watch the photographs with her.

Case study summary

There was a clear difference when Berit's experience was included in the design process of the new television photo album remote control, compared to just giving her the universal remote control to use. She never pushed the buttons on the universal remote herself and needed to be convinced to use it even after many hours of television watching. But she was able to remember how to browse among the photographs using the photo frame remote and she also did it on her own. On several occasions, though, Berit did not want to change pictures herself, most likely from a feeling of insecurity. Due to time constraints a second improved version of the photo frame was not developed. The photographs inspired her to more verbal reflections on the content than the traditional photo album did, and she also recognised the photographs more easily. Furthermore, it would not have been possible to handle printed photographs of the same enlargement as the television screen with the same ease as with the television photo album. It is thus plausible to assume that the television photo album provides new opportunities for reminiscence when compared to traditional ones. Due to time constraints, Berit's archive of music and home movies was not added to the television photo album. However, this possibility should be considered as a major advantage of the television photo album compared to traditional photo albums or printed photographs.

Conclusions

The results clearly demonstrated that the internal television channel gave information about the immediate surroundings that was enjoyable or useful for several of the older people and their relatives. It became a tool for reminiscence and interaction between the older people, the care workers and relatives and increased the possibilities of social inclusion in the nursing home.

The results make it plausible that the television is a suitable artefact in tangible computing solutions for older people with dementia and their recollection of memories. One reason for this is that the television can offer new functionality that fits into old routines, such as using the television for reminiscence. Furthermore, the television photo album offered new opportunities for reminiscence when compared to old photo albums and the pilot study strongly encourages further investigations regarding how new conceptual television design can enrich the everyday lives of older people.

The main conclusion from the result presented in this article is the fact that user-driven design processes improve understanding of the way care work is conducted and the development of new technology. This work started with determining the older person's wishes and continued by listening to their opinions. Consequently, the positive results of the design process clearly support the use of a person-centred model. The case study with Berit was important, not only for tailoring the television photo album but also because it provided an understanding of how older people in the nursing home act and think. This understanding was used in the design process of functionality on the internal level as a starting point for the semi- structured dialogues with the older people, care workers and relatives. However, it was a lengthy process which required time to learn how to interact with people who have Alzheimer's disease.

It was fruitful to involve the older person, relatives, as well as care workers since everyone contributed constructively with knowledge and inspiration to the design process. The team of care workers working with the project was necessary for integrating the technology and gaining information about the usage of the 'extended television'. They will also play a key role in the project's continuation.

To sum up, it makes a difference to consider technology as contextual and as a part of an old person's routines and experiences. The potential for the use of new technology and development of new ideas lay both within the new technological solutions and in the individual user.

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