

“Was it easy”? “Yes”. “Will you use it”? “No”. Elderly Trying Out a Kinect Interface

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Abstract—This paper describes a qualitative study that seeks to give a rich description of the experiences and viewpoints of elderly about their use of digital technologies in general and videoconferencing in particular. Interviews and workshops were methods for data collection. The workshops included a discussion group session in addition to a session of trying out gesturing as a response to a videoconference call. A prototype of a gestures-based interface for interacting with a videoconference system intended for use in their homes was tried out. The participants had clear views of technologies they used and liked, and they wanted to maintain physical fitness as long as possible. Although they found the gestures easy to perform, they did not want to use this technology in their homes. This apparent self-contradictory response is discussed.

Keywords-elderly; videoconferencing; gestures; Kinect; design.

I. INTRODUCTION

Welfare technology for the elderly is intended to improve their health and quality of life while preserving their autonomy and well-being. The aim is for public health services to be able to take care of an increasing population of elderly. As more people live longer and need care from public services, the elderly that are accepted into care homes are less able to take care of themselves than previously. Elderly who cannot take completely care of themselves live longer in their own homes supported by public care services and welfare technology is expected to play a role in this support.

The term “welfare technology” denotes a rather wide class of technologies. There are several approaches to the development of welfare technology. Some focus on assisted living and remote surveillance [1][2][3], others focus on exercising [4][5][6], while others again focus on communication and socializing [7][8][9].

Social connections are considered important for a healthy life in old age. Loneliness is found to correlate with functional decline and even death [10]. Videoconference technology is one means of supporting connections with and between elderly in their homes. This paper reports from a project where videoconference technology is developed to support communication between elderly in their homes, municipal care personnel, and with friends and family. The elderly do not need to use a PC as the TV set that is already present and familiar to the elderly will be used for the videoconference. To enable also elderly who do not use a PC

to use the videoconferencing technology, an interface based on gestures instead of a mouse or a remote controller will be tried out. The ambition is to base the gestures on previous habits and bodily knowledge which are experienced as easy for the elderly users [11]. A Kinect camera was used to capture and interpret the gestures. The gestures that are chosen build on naturally occurring gestures for greeting someone or answering the phone and will be presented below.

This paper presents the experiences from two workshops with elderly participants. The workshops served a dual purpose of eliciting the elderly participants’ experiences with digital technologies and trying out gesturing as an interface to a videoconference prototype. The workshops were part of a user-centered development process and were aimed at giving input to the design process.

This study is a qualitative case study as the elderly participants’ own views are the focus of the study [12]. A result of the study is that many elderly use more digital technology than they say they do. Even though the elderly participants found the gestures easy to perform, they did not want to use gestures-based videoconferencing in their homes.

The rest of the paper is structured as follows. In the next Section, related works about welfare technology, videoconferencing and gestures-based communication are presented. The method is described in Section III, while Sections IV-V presents findings from the study. In Section VI, the results are discussed, while Section VII concludes the paper.

II. ELDERLY AND THEIR USE OF TECHNOLOGIES

Early work on elderly and technology showed that practical experience from using computers earlier in life reinforced their positive attitudes towards computer use as they grew older [13]. The emotional dimension of staying engaged with life and society, and adapt to changes in technology is important with elderly users of ICT. They are concerned that they can continue living autonomously and continue activities that they value [14][15]. If the technology fits with their lives and values, elderly people can learn new technological skills and use them for their own purposes. In addition to practical purposes, using any device is coupled with affective and emotional experiences, for example expectations, satisfaction, values, joy, or frustration. Also,

the age group between 71-92 years can be active producers of online content and interact with strangers sharing the same interest [14].

However, technology often becomes too difficult to use in practice [9][16]. Assistive technologies installed into the homes do often not meet the elderly person's needs. Some devices become abandoned and some deliberately disabled [1].

A. Videoconferencing

An experiment with using videoconferencing with elderly functioned well in semi-controlled environments in a lab [17]. When the videoconferencing equipment was moved into the homes of the elderly and put into use there, it did not function so well [9]. Various difficulties arose. Elderly who managed to use the remote controller and the TV set and respond to videoconference calls in the controlled test, did not respond with the same high level of fidelity when they were in their own homes where contextual and contingent events got their attention and priority. Also, light conditions in the homes turned out to be different and less favourable for the video camera than in the lab, and this caused the view to be of less quality for the nurse in the other end. In one case, a woman was in her bed and did not answer the call within time.

The different responses between lab conditions and the home will be of importance if this technology is considered for use in a real life work setting. The nurse may need to contact the person in a traditional way, for example visit the home in question or telephone the elderly, if there is no response. The no-response could indicate that a serious situation has occurred, and the nurse will need to find out. The video call will in this situation mainly provide her with extra work as she will have to resort to the traditional means for contacting the elderly person at home if the call is not answered.

B. Experiences with Kinect camera

The Kinect camera is developed as a motion-sensing input device for gaming computers. The camera comes with software specifically tailored to recognize certain gestures and movements, and is used in a variety of contexts and applications. The Kinect with its software can interpret specific gestures, making completely hands-free control of electronic devices possible. It uses an infrared projector and camera and a special microchip to track the movement of objects and individuals in three dimensions. There are expectations that gesture interaction will be experienced as natural and easy as it builds on bodily communication and movements [18][19]. However, gestures-based interaction needs to be learned for sufficient precision [20]. A mutual adaptation takes place: users have to adapt to the technology by learning to move in particular ways, and the algorithms adapt to the users' movements [21].

To be read by the camera so that the user's "skeleton" can be detected and movements identified with sufficient precision, the Kinect requires exaggerated gestures.

Controlling oneself to perform the exaggerated movements may be difficult. To be able to move in a way that is recognized by the algorithms, the user benefitted from being able to "technomorphise"; that is, adapt to how the user believes that the machine will interpret his or her movements [19]. Although the gestures need to be learned, hands free control open for a larger space for possible human computer interactions.

The Kinect is used in many applications related to elderly and health care, in particular to encourage older adults to exercise [4][22][6]. A literature review from 2014 of Kinect applications in elderly care classify its use into fall detection, fall risk reduction, evaluation of Kinect's spatial accuracy, rehabilitation methods and exercise games [23]. The camera's accuracy is discussed by [22] who finds that the camera lacks precision in some situations, for example when a user is in wheelchairs, or when body parts are occluded. There is a perceptual asymmetry between the Kinect user and the computer, in terms of the resources available for both parties to interpret the interaction. The user perceives the whole space where the Kinect is situated, while the computer only "senses" the users' movements through a motion recognition camera. Only gestures that function as input is "seen" and identified by the algorithms [24].

III. METHODOLOGY AND METHOD

This study is a qualitative interpretive case study [25][26][27]. In two workshops, 22 elderly participants discussed their experiences with and views on digital technology. They were also invited to try gesturing to the Kinect camera in a simulated response to an incoming videoconference call. Interpretive research aims to understand what gives meaning for other people and takes as the starting point that our knowledge about other people's thoughts and experiences comes from social interactions. The methods for data gathering were interviews and participant observation in the two workshops.

Interviews: As a preparation for the workshops, two women in their seventies were interviewed about their experiences and use of digital technologies. The in-depth interviews lasted about one hour and a half, and took place in their homes in the fall of 2015. The women were recruited through a women's NGO for health and society. The interviews were recorded and transcribed. Topics from the analysis of the interviews were used in the guidelines for the discussion groups in the workshops. The two interviewees did not participate in the workshops.

The workshops consisted of a discussion group session where each participant was invited to try out the selected gestures to a Kinect camera. The workshops took place in the spring of 2016. They served a double purpose: discussing the participants' experiences with and thoughts of using digital technologies in their homes as well as trying out the prototype for gesture interaction with an incoming video conference call. The project wanted to test whether the selected gestures were easy to perform.

In the discussion group, the participants were engaged in talking about their views of using videoconferencing from the living room TV set in their homes. The videoconference

prototype functioned in the discussion group as a “thing to think with” [28] in the way that it triggered the participants to express concrete viewpoints on videoconferencing technology. The author and other members of the project acted as facilitators in the discussion group, and two project members run the gesturing test. The author had planned and arranged the workshop, and took notes during the discussion. The participants did not want the discussion recorded.

The gesturing test was set up as a wizard-of-oz test simulating an incoming videoconference call. The sound of a telephone ringing could be heard, and the TV screen showed a large icon of a green vibrating telephone receiver. When the participant performed the selected gesture, the ringing stopped and a simulated videoconference session was set up. The participant was after some time encouraged to perform the same gesture to close the call.

The TV screen connected with the PC and Kinect camera was located in the same room at some distance from the discussion group. After trying the gestures in front of the Kinect camera, the participants were asked a few questions about which gestures they preferred. The Kinect session was video recorded and transcribed. The notes were transcribed afterwards. After both workshops, the facilitators discussed their notes. The analysis consisted of looking for recurrent issues in the transcription of the interviews, the notes from the discussion groups and the video recordings.

The first workshop took place in a municipality in the south east of the country, called South Mun in this paper. The six participants were recruited from a women’s NGO for health and society in South Mun. They were all active in their community and of good health. They did not receive any municipal care services in their homes. We did not ask for their exact age; however, they volunteered information about being in their seventies.

The second workshop took place in a day care centre for elderly located in the north of Norway, here called North Mun. The sixteen participants lived in their own homes and received varying degrees of municipal care services. They were recruited through the day care centre. This group was on the average older than the first group, many were in their eighties and the oldest was 95 years old. All participants had some physical or cognitive issues. Some was very cognitively alert but had some physical challenges, while others suffered from some degree of dementia. This day our workshop was scheduled by the personnel as the (entertainment) event for the day.

All six participants in the first workshop tried the gestures, while nine out of sixteen in the second. The personnel at the care centre took an active role in facilitating the second workshop and encouraging the participants to try the gesturing. Since they knew their clients, they could talk in a loud voice to someone with reduced hearing or comment on their knowledge of the participants’ life situation or technology experience, or in other ways act as interpreters between their clients and us, the outside guests.

IV. TRYING OUT GESTURES

The Kinect was programmed to recognize three specific arm movements for accepting an incoming videoconference

call: a) hand waving like you say “hello”, b) grabbing with the arm like picking up the telephone receiver, and c) merely moving the arm to an upwards and sideways position at one’s right side. In the women’s group at South Mun, all six participants tried the gestures, and nine out of fifteen participants in North Mun volunteered to try out the movements to be recognized by the Kinect.

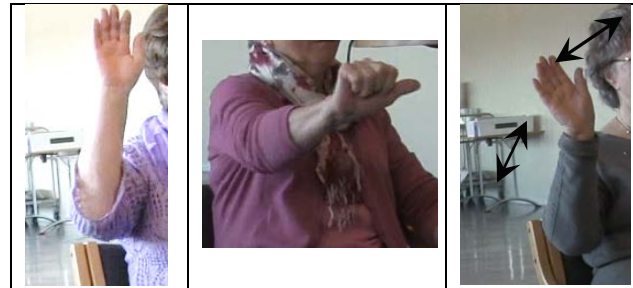


Figure 1. The three gestures for answering a call: a) hand up, b) grab “the receiver”, c) waving hello.

All participants that tried out the gestures for interacting with the prototype received oral instruction before and during the test. The participants in North Mun needed more follow up instructions. In some cases, there were some technical problems, for example the Kinect camera did not recognize the body or hand of the participant in front and the participant had to wait a little while the test leader tinkered with the technology. When the Kinect did not recognize the test user’s “skeleton” or she did not immediately succeed, she became insecure as to how the gesture should be performed. The test leader provided instructions and guided the movements in detail if necessary for the user to succeed. With detailed guidance, most participants succeeded in performing all three gestures with adequate response from the Kinect. In some occasions, they had to try more than once before the Kinect recognised the gesture. One woman did very well with the arm gestures, and it turned out that she had played Kinect games with her grandchild.

The participants preferred different gestures. In South Mun, they were asked to rank their preferences, and four out of six preferred the hand up gesture, see Figure 1 a). None preferred the “grab the receiver” gesture (Figure 1 b), while two preferred the hand waving (Figure 1 c). Table I shows their preferences in detail. P1-P6 represents the preferences of each participant, where Roman numeral i is considered the easiest gesture. Hand up was considered the easiest overall and received the lowest overall score.

TABLE I. PRIORITIES OF PARTICIPANTS TRYING THE GESTURES

	P1	P2	P3	P4	P5	P6	Score
Hand up	ii	i	ii	i	i	i	8
Grab	iii	ii	iii	ii	ii	ii	14
Wave	i	iii	i	iii	iii	iii	14

The Kinect recognition algorithm was only programmed for right-handed movements, and left handed gestures were not recognized. Of the nine elderly at the day care centre that

tested the gestures, two preferred to use the left hand. One of them had a painful right handed shoulder, and he needed to be reminded of using his right hand several times during the test. He seemed to have some pain or discomfort from using the right hand.

One man reacted to the hand up gesture. He said that it resembled a “Heil Hitler” movement of the arm. The movement is not similar but the man obviously associated this gesture with the nazi greeting. He made this comment several times when he responded with the hand up gesture during the test.

The workshop at the day care centre was scheduled as the main program for the day we visited there. Participants that had finished their gestures testing, hang around the TV set and watched the others perform. As the day progressed, more of the participants gathered around in the TV set, and created an atmosphere with funny comments, laughter and sometimes bantering to the one trying out the gestures.

In some occasions, the user performed the movement successfully; however, a slight delay between the ringing sound and the gesture that can be seen on the videotape indicate that the participant does not move the arm as a response to the ringing sound, but according to the instructions by the test leader.

In both workshops, the participants observed the test leader tinkering with the technology. They observed him while setting up the PC, TV and Kinect before the test session. In some occasions, some tests could not be performed because the camera did not pick up their skeleton even after several attempts.

Most participants stated that that the gestures were easy. They preferred different movements, seemingly independently of the ease with which they succeeded in answering the simulated incoming conference call. To the question about what she found easiest, one woman responded “I think it is simple as it is, that we answer the phone the usual way”.

V. EXPERIENCES AND VIEWPOINTS

One of the elderly women who was interviewed as a preparation for the workshops, accepted the interview request with the comment that she was “not so experienced with technology”. However, during the interview, she described a lot of digital technologies that she used. She said that she used her tablet a lot, and talked about using e-mail, Facebook, online banking, and reporting the reading of the electricity meter online. She started using Facebook when her childhood friends who lived on another part of the country asked her to join so that they could keep in touch. She did not use Skype because she did not like the interface, but she used Facetime with her granddaughter who lived in another part of the country.

She had downloaded and installed an app for buying public transport tickets and found it very practical while moving about. She preferred one app for cloud storage of her family pictures instead of another, and explained that she preferred the one with less clicks to show the pictures. She upgrades the operating system and the apps herself, and when in doubt about what to do, she asked her children or

grandchildren. She demonstrated that she was very familiar with the TV set and the remote controller, and she switched between sources to let me hear online radio stations through the TV set. However, she didn’t like if her grandchildren rearranged the cable connections between the devices during a visit without putting it back together before they left. She felt unsure about how to put it back together.

All the women who participated in the discussion group in South Mun were retired and in their seventies. Some volunteered information about their earlier professional life: two had worked as a school teacher, one as a kindergarten teacher, and one had worked in a bank. They describe days with lots of activities. During the summer season, they often go to their summer houses or are active in other ways so they are not available for meetings between May and August. They stay in touch or take care of their grandchildren. They are active with organizational work in their NGO, where documents and minutes from meetings are emailed as pdf-files to the mostly retired female members. Most of them are physically active, although to different degrees. Except for the participant working in the bank, they had little or no practical experience from using computers in their previous working life.

As with the interviewee mentioned above, the participants use more technology than they explicitly say when first asked. They all use ICT in some ways, although it does not look like ICT to them. Most of them had smart phones. One described herself as “not clever” with technology. She “has cut out the PC”, and uses her iPad and the iPhone. She uses online banking apps on both these devices, depending on whether she is at home or in the cabin, and reads online newspapers. She has used Facetime on her iPhone for contact with her grandchildren, but she did not use it so often. She finds that it does not give her so much even though she can see snippets of her grandchildren at the summer house or on fishing trips. On later consideration, she remembers a recent occasion where her son had lost his phone at a shopping mall, but could borrow an iPad and get in touch with her through facetime to her iPad when she did not answer her own telephone. On this occasion, she found Facetime very useful.

After returning to the discussion group after trying out gesturing, the participants gave some immediate feedback from their experience with the videoconference and the Kinect camera. Many express concerns that videoconferencing will come instead of and not in addition to the care personnel’s physical contact with their clients. However, one woman commented that she could have benefitted from videoconferencing to stay in touch when she a few years ago broke one arm and leg at the same time and had to stay indoors for three months while recovering.

One expresses doubt as to how simple the technology will be in practical use. She compared it with the introduction of online banking, where many problems occurred and nobody was there to help. One woman had experience from playing gestures-based computer games (from a different technology) with her grandchildren, and she was slightly familiar with gesturing commands.

One woman responded to whether she will use the videoconference technology with the Kinect that she would not have used it. She “would go and pick up the phone. I need to move about, and not rot while sitting”. Another said that this technology “is for those who are well versed and would like to keep in touch”. One added that her late mother who suffered from dementia could not have used it, as “one will need a good head” to use it. Another said it was suitable for those who have “a good head and a lousy body”, indicating that the interaction requires some understanding of the technology and that it is most useful for those who cannot move about easily. This they all agreed to.

Activities that are learned at an earlier stage in life can be kept up into old age and also into some degree of dementia [16]. On this basis, the participants were asked whether they would consider taking videoconferencing into use before they strictly needed it, so that its use could become an established habit before they get too old to learn. They all responded “no”. Many of the participants who said that they would not want this technology at home, suggested that others might find it useful, for example if you are young and computer savvy but bedridden for some reason.

The participants at the day care centre in North Mun were in average older and less healthy and active. Some was cognitively challenged with various degrees of dementia, while others were cognitively clear but had various physical health issues that required care. They all received a minimum of municipal services, at a minimum they were accepted into regular meetings at this centre based on their application. The centre had a waiting list and accepts clients based on their needs. Some received care services in their homes as well.

Some of the participants there had previous experience from using computers in their working life, although they did not use digital technologies now. One woman said that she had had a mobile phone but that she did not use it anymore. She used a land line telephone at home. One woman had talked with her son in the US via Skype when visiting her daughter. Her daughter had set up the call.

After he had tried the gesturing, one man found the videoconferencing could be useful in his life situation. He asked if he could be called from a country abroad, because he has a grandchild there. Another man though it could be good for his son, who was “very intelligent” but bedridden.

In North Mun the winter weather can be quite cold and windy with lots of snow. When asked if they would consider videoconferencing as a means to keep in touch during periods with challenging weather in the winter months, one said with pride “We are northerners! We are used to ice and snow! As long as I can move about, I would prefer going down to [the café at the shopping centre] and meet the others there.”

VI. DISCUSSION

The dual objective of the workshops functioned well to stimulate the participants to tell us about their experiences with using digital technologies and their viewpoints on gesturing for videoconferencing which they tried out. The

workshops were neither intended as a user study aimed at providing quantitative data about e.g. the time to respond to an incoming call nor a usability test where the user is asked to do several tasks with the equipment to be tested [29]. The prototype was too unfinished to appear as a product to be tested in a controlled environment.

This paper seeks to give a rich description of the elderly participants’ experiences and viewpoints. However, as this study did not try out videoconferencing via other kinds of interfaces, we cannot differentiate between their viewpoints about this prototype for a gesturing interface and videoconferencing with more traditional interfaces.

The title of this paper is a quote from several brief interviews done immediately after the participants had tried the gesturing. Even though they found the gestures easy to perform with success, they did not want to use such technology at home. In addition to the TV screen, which is familiar to them and in regular use, the technology includes one unpopular device, the PC, and one mostly unfamiliar device, the Kinect camera. This result is in line with several studies about use of technology in the home.

As technology makes some old tasks obsolete, new tasks emerge – and the new tasks belong to a different domain than the old, familiar task. New tasks may increase the level of complexity around the user [30]. Setting up and maintaining home networks is a challenge for families [31]. The participants in both workshops could observe that the technology to be tried out needed some tinkering to function properly – if at all. They can anticipate problems with actual installation and maintenance of the Kinect camera and the accompanying PC in their homes, where many already have some unused technology [32][33][1].

Technology that is entered into the homes of people without their interest in that particular technology will often stay unused. Nansen et al. found that even though the older participants in their study both mastered the Kinect and found it fun to do, they preferred their usual activities to the Kinect: an old woman would rather watch tennis on TV, and her husband would rather stay outdoors working with the plants in his garden in daytime and doing his jigsaw puzzles when inside. There was no room for new activities with the Kinect in their habitual daily life [21].

Elderly people in the study of Culén did not consider technology to be a solution to their needs for social contact [8]. Loe argues that old women use or reject old and new technologies in their daily life according to how nicely it fits into their lives; whether the technology functions for continuity and control in their lives or the opposite [15]. Their considerations go “beyond usability” [14]: Without a personal objective for taking some technology into use, the experience will not necessarily be meaningful or useful. Elderly’s understandings of usefulness “point to the relevance of perceptions and feelings of safety and self-efficacy” [14]. ICT introduced for personal growth is perceived differently than ICT for compensating for reduced capabilities. Loss of independence is feared by the elderly [14]. This finding is in line with the views of the participants who said they would prefer to maintain physical fitness by walking to the café or moving about to pick up the phone.

The Kinect experience when gaming is about having fun. The exaggerated movements that is required for the Kinect camera to recognise the gestures are easily laughed about, and laughing together is what makes it fun [19]. We saw that the participants in North Mun were laughing and bantering when they watched some of the others. Gestures, such as turning lights on or off in a smart house with exaggerated movements are not fun, and Harper and Mentis argue that the Kinect is not fit for controlling the lights or doors in for example a smart house (ibid.). A question is whether gesturing to a Kinect camera that will need to be always on will be a good way to interact with a videoconferencing service for elderly people who want to stay healthy. In line with [15], perhaps this technology will fit better into the lives of technology interested people with health issues that immobilises them and confine them to the home. The Kinect is a more familiar technology with younger people.

Design that builds on elderly's habits and competences will be in a better position to fit smoothly into their lives. Habits enable elderly people to continue life as they cherish it. Their habits will be a resource for continuing life as they know it into their really old days. Habits can be a resource for design [16]. To get in touch with elderly people's habits and activities, participatory design will be well suited with its focus on user participation and situated practices [34]. Early engagement of elderly participants in the design process helped to support their engagement in the design process [35]. Voicing their values is an important prerequisite for elderly people's participation in design [36]. The elderly participants' response after trying the gesturing created a challenge for the design team, who decided that the next design step would be to try out various button-based interfaces to the videoconferencing. Further research will show how the future elderly users will respond to such an interface.

VII. CONCLUSION

The elderly women in their seventies used more digital technologies than they explicitly state at first. They use smartphones and tablets, but avoid using a PC. They have some experience with Facetime, which they prefer over Skype. They do have some experience with Skype, which they mostly use when it is administered by children or grandchildren to keep in touch with family members.

All participants in the two groups expressed concern that they would prefer to meet people physically. They want to maintain physical fitness by moving about as long as possible, for example by walking to the café for meeting friends or moving outdoors even in wintery weather. Some found that if they were physically restrained from moving about, videoconferencing with a Kinect interface could be useful.

Most participants succeeded in performing the gestures, although with guidance to fine tune their movements. Even though they said the gestures were easy to perform in front of the Kinect and the TV screen, almost all the participants said that they are not interested in taking videoconference technology with Kinect interface in use in their homes. They

found the gestures easy to do, but did not want the equipment at home. They considered the gestures for videoconferencing with Kinect as requiring "intelligence" or "a good head".

The elderly workshop participants' responses show that they take more than usability into account when they consider technology for use in their homes. The results of this study indicate that they consider their own competence to use and maintain the technology as well as how the technology will fit into their lives and support activities they cherish – to support their need for well-being and autonomy as they continuously adapt to growing older.

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