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Procedia Manufacturing 3 (2015) 3535 – 3542

Procedia MANUFACTURING

6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015

Designing for technology acceptance in an ageing society through multi-stakeholder collaboration

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Abstract

Among the European countries, the Dutch retirement system is often considered as one of the best. However, as the baby boomer generation enters the retirement age, this situation changes. The increasing ageing phenomenon has presented tremendous challenges on economic prospects and societal wellbeing. Soon, there will be more retirees than the workers. There won't be enough money to provide care up to the current standards for all the pensioners. This means that seniors need to live independently in their own houses longer than they used to. This calls for new means of providing care – mainly over distance and with use of technology. This, however, becomes a problem for the non-tech savvy elderly. In this paper, we describes a case study that designs for technology acceptance in a multi-stakeholders collaboration setting to support elderly people to accept the use of an e-homecare system.

Peer-review under responsibility of AHFE Conference

Keywords: Senior technology acceptance model; Multi-stakeholder; Service design

1. Introduction

The population in the Netherlands has grown "grey" due to a decrease in fertility, a decrease in mortality rate, and a higher life expectancy. According to Centraal Bureau voor de Statistieken-CBS, 65+ populations in the Netherlands is expected to grow to 24% [1]. This phenomenon has put a lot of pressure on social security, pensions, health care and etc. A lot of literature has discussed that Assistive Technologies (ATs) and Information and Communication Technologies (ICTs) may support elderly to improve their quality of life, improve physical and mental health status, delay the onset of serious of serious health problems and reduce family and care-giver burden. [2] However there are a variety of factors preventing elderly users to accept and actually use those technologies or systems. The very individual decline in cognitive, physical and sensory function due to ageing makes it hard to

Peer-review under responsibility of AHFE Conference
doi:10.1016/j.promfg.2015.07.701

define “the elderly” as one consistent group and to design technology specific for elderly use. It is not a surprise that is difficult for many elderly users to grasp the method of using a new device. Despite these difficulties, elderly users are considered as a growing group in most developed countries with huge market potential.

Several models or theories have been proposed to explain the technology acceptance behaviour [3, 4, 5]. Among these studies, Renaud, K. and van Biljon, J. propsed a Senior Technology Acceptance Model (STAM) [6] in the paper “Predicting technology acceptance and adoption by the elderly: a qualitative study” to take into consideration of the unique characteristics, capabilities and limitations of the elderly in the Technology Acceptance. This paper is interested in how to design for technology acceptance for elderly people by using STAM.

Open innovation [7] is a dynamic and continuous process of sharing knowledge, skills and experience within a stakeholder network when developing a product, system and related service. It usually takes place in a multi-stakeholder network who shared common interest or value through the collaboration. This has become a practice when dealing with societal challenge such as ageing health care. To deal with ageing society problem, known as a wicked problem, multi-stakeholder collaboration becomes almost a prerequisite. In the collaboration, stakeholders contribute their knowledge, experiences and skills to co-explore a space to define the problem. This paper introduces a design case which aims at demonstrating how STAM model could be applied as a design tool to support elderly people to accept technology use. In the meanwhile we reflect on how multi-stakeholder setting promotes the mutual influence with iterative design process guided by the STAM model.

The paper is organized as follow. Firstly related literature on ageing and technology acceptance is discussed. Then the design case study is described followed by the design research approach, project result, reflection and discussion are discussed afterwards. Conclusion is given in the end.

2. Literature study

2.1. Ageing

For better understanding the nature of technology usage of elderly people, it is necessary to understand the changes occur while a person is getting old. There are three major areas of changes relate to ageing. [9]Most obvious are physical changes such as limited motor and visual abilities or sensory deficit, illness or disabilities. Hand tremors, difficulty discerning colours or particular sensitivity to glare have significant influence while interacting with screens and devices. Then cognitive slowing is another effect of ageing. Changes are reflected in perception, memory, reasoning and decision making. [9] They may perform poorly on working memory tasks and tasks measure attentional capacity. Seniors are less able to ignore irrelevant stimuli and thoughts because of a decline in the efficiency of their inhibitory attentional mechanisms [10]. The third major change affects social roles and relationships. Elderly may lose their loved ones, disconnect with friends due to immobility or move, often suffer loneliness.

Besides these changes, due to the differences in health, wealth, lifestyle, education, living environment and social connectedness, elderly people cannot be treated as a homogeneous group. Even within age category we can differentiate the groups by: pre-seniors/pre-retirees (50-64 years old); the young-old (65-74 years old); the old-old (75-85 years old); the oldest-old (85+) [11]. However, in our case study, we didn’t have a strict requirement of the target elderly participants. On one hand, it is hard to define and select an age range as the target group. On the other hand, we want to explore the difference and commonality of these elderly with different age.

2.2. Seniors and technology

Next to the process of ageing, there are number of other factors influencing the relationship of elderly people and technology. For instance, personal anxiety or stress and having limited self-confidence were the two main obstacles for older women in learning to use computers [11]. The difference between younger and older people was not so much in the actual knowledge of computers but more in their confidence; older people often underestimating their computer knowledge [12]. Older consumers tend to avoid risk and prefer accuracy over speed in making decisions. When left unsure, the elderly will neither act nor make a decision [13]. If interested in new products they may collect information about them, but if they have difficulty interpreting the information and perceive the purchase as

risky, they will choose to do without the product rather than take the risk. Risks of misuse of technology come in many different forms. Among others, the elderly users fear that the product will not perform as desired, may result in harm to life or that their personal data will be abused. The problem of inaccessibility covers both physical inaccessibility as well as financial one and is often related to lack of support and assistance. The biggest issue arises from the lack of intention to use technology has been widely studied, leading to the model of technology acceptance [14].

2.3. Senior Technology Acceptance and Adoption Model (STAM)

In the field of Information System, the Technology Acceptance Model (TAM) [14] is considered as the most influential and commonly employed theory. It has been performed by many researchers with different research purposes, subjects and tasks, applying diverse research methodology under different environments. As we mentioned in the introduction, the Senior Technology Acceptance and Adoption Model (STAM) [6] is one of those models developed based on TAM, which contribute to understanding technology acceptance by senior users.

However, as researchers from design discipline, the purpose of our study is not only validating or developing the model. Instead, we use it as a design guideline to design for technology acceptance for elderly users. The advantage of STAM is that it pays special attention in technology acceptance and adoption among elderly users. It is essential to clarify the distinction between acceptance and adoption of technology. For instance, if adoption means totally embrace technology like a smartphone addicted. Acceptance is more about attitude toward a technology. It could be considered as a pre-adoption stage and has the value for predicting the adoption possibility.

3. Case study

3.1. Case description

Summa College in Eindhoven in the Netherlands provides vocational education for both young and old students in many areas including care and wellbeing for elderly people. In Engelsbergen, one of the districts in the neighborhood of Summa College, the number of people aged over 65 is about 28 %.

Lokaal+ has been set up at Summa College since 2007 to provide, on the one hand, an internship place for students follow elderly-care program, on the other hand, a meeting place for lonely elderly people from the neighborhood. Company A is a leading technology company that developed x e-homecare system for elderly people. By providing facilities and related services, they aim to enable elderly to live more independent in their own houses. The services offered by x e-homecare system are related to health, entertainment, safety, informative and video calling and etc. Despite their strong focus on their target users, there is still lack of acceptance of their system by the intended users. Together with Summa College, students and teachers from Summa, students and staff from Eindhoven University of Technology, this company was looking for additional support to their elderly target group to accept the use of their systems.

3.2. Case approach

This case approach follows a research through design approach. In total two iterations were conducted. The first iteration followed the design driven approach [15]. Based on the initial insights, vision of the design researchers and design directions based on the STAM (Fig. 1), an initial idea was created and evaluated with multi-stakeholder and elderly users. In the second iteration, a mixed-method approach was first take to collect deeper user insights by means of interviews, observations and workshops. The initial idea was then further worked out in a concept and reflected. This concept was then evaluated with the involved multi-stakeholder and the end users. In this figure of STAM, we colored the areas that different stakeholder could contribute and pay their attention. The overlap of the color areas should be paid more attention for designers to deliberate.

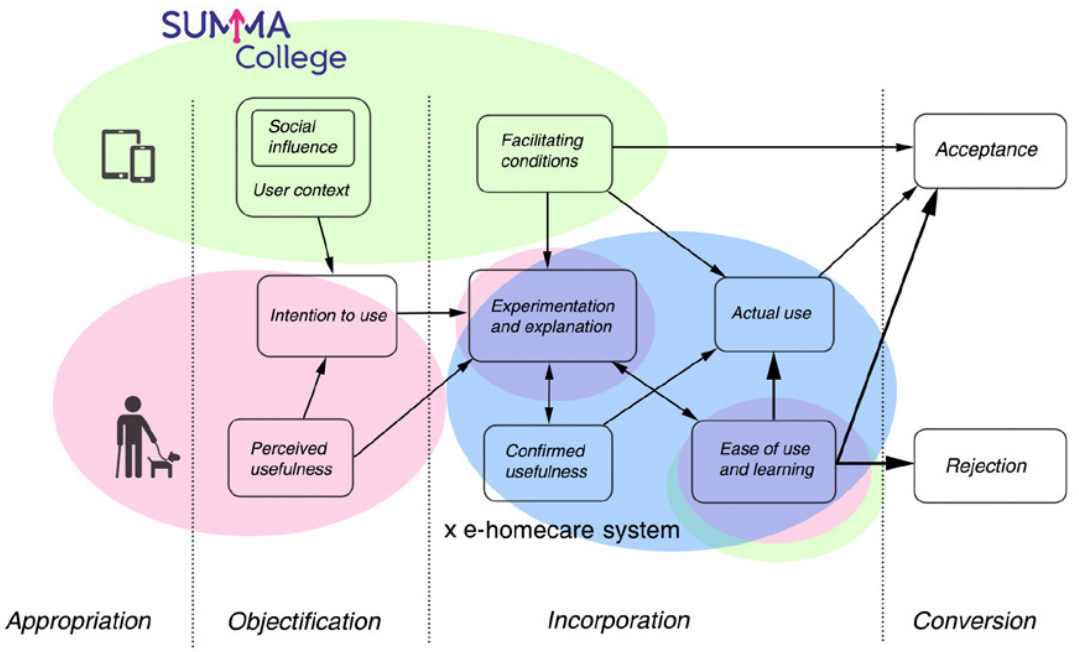

Fig. 1. Senior Technology Acceptance Model: Areas marked in green correspond to Summa College's responsibility; In blue correspond to x e-homecare system, in pink to the aim of this project.

3.3. Case result

3.3.1. First iteration

From the interest of the stakeholders, and the variables in the STAM model, the potential contribution of the different stakeholders in supporting elderly technology acceptance can be identified. Summa College is really interested in providing a new learning context through the project. Company A wants to gain insights about elderly users' attitude and understanding about the x e-homecare system. So the second author of this paper designed a design course for the master ID students at Eindhoven University of Technology. In this course stakeholders engaged different expertise and knowledge in an education and open innovation set up. The first week of this course is a pressure cooker program, which was designed according to Theory U [16]. It was applied to empathize with the perspectives of different stakeholders, in the meanwhile, combining first and second person perspective from a learning theory. During this week the students worked closely with experts and students from Summa College, expert from Company A, an expert from a local care organization and researchers in this project.

The resulted initial idea is the SED playing cards based on the quartet game rules (Fig. 2. a). In each quartet, one function of the x e-homecare system such as contact doctor by video calling is explained. The first card from the quartet explains the meaning to the elderly. The other three cards explain how to complete the task step by step. With four steps, the elderly or students could gain the knowledge of how this system works and possibilities it offers. According to the STAM, we use this idea designed a workshop as the experimentation and explanation (Fig. 1.) to probe the feedbacks from different stakeholders. This is for understanding the connection of the multi-stakeholder network, gaining insights of attitude towards technology acceptance from different perspectives

Experts from the technology company, Summa College, the care organization and researchers in this project found this idea very appealing. Some elderly people who participating the workshop at Lokaal+ during the design process admitted that technology becomes less scary when it is introduced in such a playful way. Some mentioned that the game itself distracted them from reading the information on cards. They were more focused on winning or losing than on learning. There are also elderly users with rich experience of using technology commented that the

idea of dividing the using process into clear steps very useful. The technology company realized such an idea could create a different way of promoting their e-homecare system than traditional marketing approach. The elderly can perceive the value of their technology product proactively then being convinced. Experts from Summa College believed that this idea and the related workshop can provide their non-technical care students an easy and friendly way to learn the technological product in care with elderly people together, which can offer them experience to support elderly using e-heath care service more often in the future. Expert from the care organization also welcomed the idea to train their caregivers with future technologies, also support the elderly to use them. From all those reflections of stakeholders we could summarize the idea reinforce the collaboration between different stakeholders. From the report of the students we confirmed that using STAM in a multi-stakeholders setting could help the students focus on the common interest of stakeholders to propose design ideas. And the iterative design process allows them to jump between different perspectives, in the meanwhile build the empathy.

3.3.2. Second iteration

Based on the summary of the first iteration we organized and involved in some workshops and activities with mixed methods, including collage workshops to probe the lifestyle of elderly, words selection workshop to test their attitudes to technologies, Semi-structured interviews and observation technology class at Lokaal+ for their learning mindset and habit(Fig. 2. b), etc. In this iteration, we kept exploring the context from different angles to define the possible design space in the multi-stakeholder setting. At the same time, we developed the concept focus on the ease of use and learning. Through an iterative design process, many prototypes from lo-fi to hi-fi have been built and reflected together with stakeholders. In the end, the final concept Te[a]ch You was shaped through this dynamic research project after two iterations.

The concept is both a service of the e-homecare system and an educational tool in a form of card sets collection. (Fig. 3 a, b) We designed a serious of tasks related to the elderly's needs as the content of Te[a]ch You card sets. Each set of them explains how to perform certain desirable tasks for seniors with the use of a modern technology step by step. The new card sets provide means for independent using and educational setting, as well as a playful aspect which supports building of mental models. Te[a]ch you is not only a physical product but also a range of services based on a vast network of stakeholders in the care industry.

Even though the scope of the project was aimed at elderly user as the primary group, it is possible to offer this solution to a much wider audience. In particular, anyone needs assistance in learning about technology. Besides, seniors don't like product or service specially aimed at "elderly".

"When designing for the elderly and when addressing potential users we need to take into account to prevent services and products for the old as being considered irrelevant to their target audience – as being viewed as 'something for somebody a bit older, not for me.'" [9]

a  b 

Fig. 2. (a) SED cards evaluation workshop; (b) technology class observation.

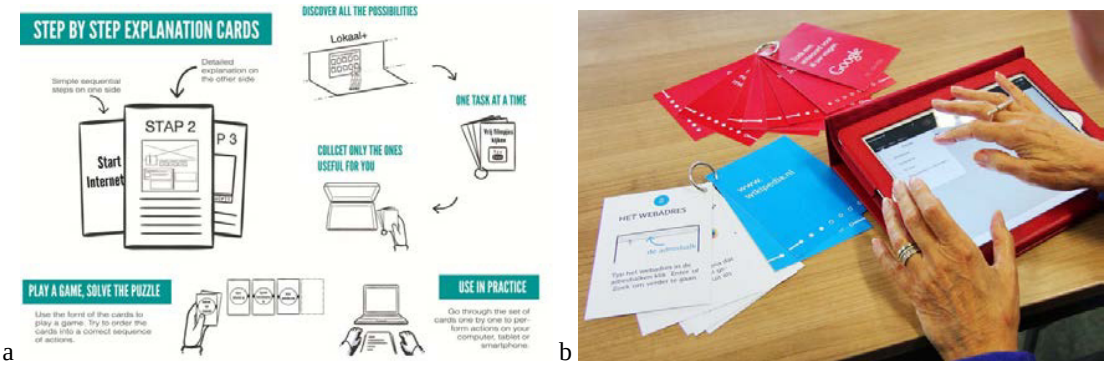

Fig. 3 (a) concept explanation; (b) final concept user test.

From the evaluation of those workshops and other related activities, three different contexts for the use of the cards can be concluded. 1. For the absolute beginners who never used certain technology before, there is a need of extra assistance even when using the card set. They need to build the mental model of basic interaction principle of a technology product/service system. It also because the card sets are device-neutral designed. 2. The card sets create opportunities for group classes and/or involvement of care students from Summa College or care givers from care organizations in the service. This usage got many positive feedbacks from elderly people validate the social influence and facilitating play important role in technology acceptance. 3. The card sets can be used independently by people with certain affinity with their own devices. For those experienced users, it not necessary to strictly follow the steps in card but use it as a reminder to form the habit of interaction with technology.

3.4. Discussion

In the setting of multi-stakeholder collaboration, the goal of this project was to lower the threshold of technology use among elderly people. Additional requirements came from the context of Summa College and Company A who developed x e-homecare system as main stakeholders. According to the summary of context exploration and reflection of the first iteration, the goal for Summa College is involving care students into the service process to gain insights and experience of support the elderly people using learning and using technology system. While the goal for company A who developed x e-health system is to gain insights of elderly users and sell their system in the end. To define a design space with common interest, researchers need to act like glue with the multi-stakeholder network. From the positive feedbacks of the concepts we'd like to prose the STAM as a design tool for designing product system and related service for elderly users. It helps designers mapping and thinking the connection in a multi-stakeholder setting. And the final concept evaluation also consistent with the result of STAM study by Karen and Judy [6] that the dominant influence of ease of use in full-adoption, which even stronger for the elderly group.

The research was primarily limited by the availability of the participants. Besides it is the knowledge of the Dutch language for the first and third authors. Being able to facilitate a research sessions in a native or fluent language as well as better starting knowledge of cultural and political aspects would have ensured a better understanding of project's context. It would have also greatly improved the pace of the whole work.

A more thorough and structured evaluation of the finished concept including one on one sessions with seniors as well as a session with active participation of Summa students and teachers would have given more in depth results. Even though planned it was cancelled due to long holiday period at Summa College thus lack of access to participants. The participants who took part in the research were all somewhat connected to Summa College – they regularly attended activities at Lokaa+ or came for a one time visit. This means that they represented a group of already active and social seniors, open for new opportunities and often even volunteering. It would have been beneficial to include more isolated elderly in the study.

As an open innovation project, it also offers open ended possibilities. It can be used in several contexts which allows for future use in many situations and for many organization. It can be used in technology classes as well as

on its own, can be used for many different devices. On top of that it creates new possibilities for Summa students and other businesses. However, more work is needed to be done in order to establish a successful business. More sets of cards need to be carefully developed, an educational curriculum and training created around it as well as establishing business contacts.

Due to the current positive feedbacks from stakeholders, we want to propose STAM as a design tool for designing product/system with related service for senior users in a multi-stakeholder setting. However, more works needs to be done and we also have planned to conduct further project to validate this proposal.

4. Conclusion

This paper reported a case study which proposed a new perspective to tackle the challenge of lowering the technology threshold among elderly users. It was developed within Samen Slim Zorgen Thuis project involving Summa College, technology company A and elderly people from the local community as stakeholders. The final concept proposed an educational tool in a form of card sets collection as well as educational services build around it. The evaluation of the case gave promising results. Elderly were capable of using the tool and seemed genuinely interested in learning new activities involving technology. They especially valued the possibility to keep the cards to later remember what they have learned. From a feasibility point, it is a low cost solution that it has a very low threshold to use. As it is a solution known to seniors, it requires no additional learning curve.

From a business point of view, this project offers open ended possibilities which also meet the requirements of different stakeholders. The concept could be applied in different context for personal learning or organization training, etc. It can be used in technology classes as well as a special system. On top of that it creates a possibility to explore the technology learning process of elderly user with a low cost yet interactive way.

Acknowledgements

First we want to thank all the students who dedicated their time and enthusiasm in this research project, especially Barbara Wajda, who collected most of the data and contributed a lot to the final concept development, also Victor Donker and other students who proposed the initial idea and contributed in the first iteration study.

Furthermore we would like to thank the employees of Summa College: Hilde Meijs, Susan Metz, Marc Zwamborn and Jolanda van den Bersselaar for creating opportunities for us to conduct the research within Samen Slim Zorgen Thuis project.

Last but not least, great thanks should be given to all the seniors and employees at Lokaal+ for allowing us to participate in their activities and providing their helpful feedbacks and many pleasant conversations.

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