VTT Technical Research Centre of Finland

Project METESE: Final report

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Published: 01/01/2018

Document Version
Publisher's final version

PROJECT METESE: FINAL REPORT

Meaningful Technology for Seniors - Safety, Comfort and Joy

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Confidentiality: Public

Executive summary

This document is a final report of the METESE project (2015-2018), which focused on understanding the possibilities and challenges of integrating ICT and robotics technology in elderly care in Finland and in Japan, and learning from the other culture in order to advance utilizing the technology for personal or societal benefit in the context of ageing population.

During the project, we have conducted a number of empirical studies involving different stakeholders from different perspectives to consider the research topic: elderly persons, professional care workers, family caregivers, care service providers and decision makers are all represented in the studies. In addition, a major part of the studies allows direct comparison between Finland and Japan with regard to the integration of ICT and robotics in elderly care. This report presents highlights of the results and insights from these studies.

We have identified general, cross-stakeholder interest and acceptance towards using advanced technology in elderly care - in particular among Finnish end users, from seniors to care workers. Only social robotics seems to be better accepted in Japan. However, both countries face similar challenges in the integration of technology in care from the management perspective: technology is too immature, too expensive, too difficult and effort-needy to be taken widely into use. In addition, support for continuing using the technology after introduction is often missing, leading to wasted money and effort.

Both countries could benefit from still better engagement of the actual end users, elderly people and caregivers, in the design of technology solutions for care. In addition, increasing awareness of the available solutions, education and training as well and support from management and social networks is needed. Overall, efficient integration of technology in elderly care requires also changes in mindset - in how we think of care and arrange care processes - and contemplation of related regulation and policies. This all requires wide discussion of acceptable and desirable ageing and elderly care. This view, then, may be quite different between Finland and Japan: Finnish people may justify use of technology when it supports their personal independence and autonomy, whilst Japanese look for benefits for sustainability of care services.

This document gives an overview of the METESE studies. The articles, in which the studies have been published, are listed in Chapters 3-6 for those readers who are interested in more detailed information. For Finnish readers, there is a shorter summary of METESE project available at Niemelä, Watanabe & al. (2017).

We thank Tekes (current Business Finland), Japan Science and Technology Agency and other parties for funding this project. We also thank Outi Töytäri (TEHY) for participating in the Finnish steering group as an external expert of assistive devices.

Tokyo, 6 June 2018

Marketta Niemelä and Kentaro Watanabe

Contents

1. Introduction

Many nations are facing the trend of ageing population. In the European Union, the share of people aged 65 and over is raising from 19% (2015) to 28% (2060)[1] and in Finland from 20% to 29%[2], respectively (Figure 1). In super-ageing nations such as Japan, the share of older persons is predicted to raise up to over 38% by 2060[3]. This trend is parallel to the development of dependency ratio i.e. how many people under 15 or over 65 years old there are compared to 100 people in working age. In Finland, the dependency ratio is expected to increase from 57,1 (2014) to 76 (2060). In Japan, the dependency ratio will increase from 65,8 (2016) to 93,7 (2060).

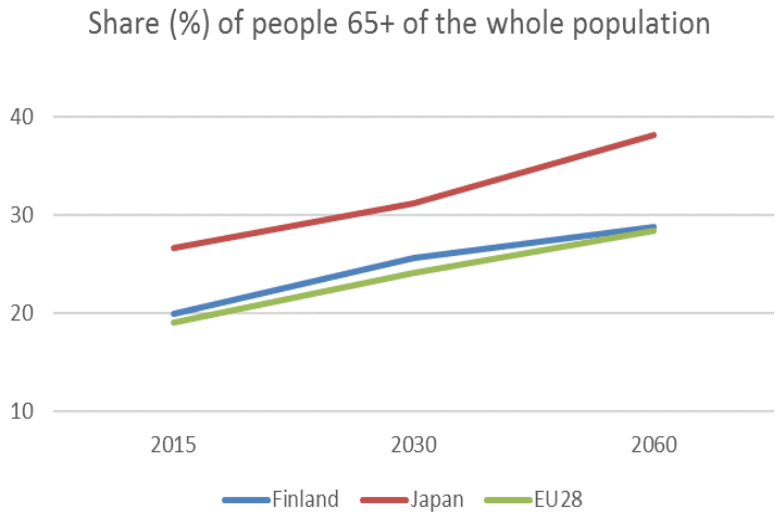

Figure 1. Projections for the share of the people (%) aged 65 and over of the population in Finland, Japan and EU28

Governments are taking actions to be able to provide good quality health and care services to the increasing number of people who need them. As the ageing population is paralleled with decrease in labor force - the number of caregivers and taxpayers - many are looking at technology development as one or partial solution. Especially Japan invests heavily on the development of robots to improve efficiency in care services, to decrease caregivers' physical burden, and to improve the quality of life in care facilities through tools of recreation[4]. In Finland, the Ministry of Social Affairs and Health published quality recommendations for ensuring good ageing and services in 2017-2019[5], in which using technology is raised as one recommendation in parallel to e.g. developing housing services. In particular, the document mentions robotics and automation as an enabler for new services for elderly people, in order to support autonomy and independency of older persons, improve services and develop care work.

[1] http://ec.europa.eu/economy_finance/publications/european_economy/2014/pdf/ee8_en.pdf
[2] https://www.stat.fi/til/vaenn/2015/vaenn_2015_2015-10-30_tie_001_fi.html
[3] http://fpcj.jp/wp/wp-content/uploads/2017/04/1db9de3ea4ade06c3023d3ba54dd980f.pdf
[4] http://www.meti.go.jp/english/press/2015/pdf/0123_01b; http://robotcare.jp/?lang=en
[5] http://julkaisut.valtioneuvosto.fi/bitstream/handle/10024/80132/06_2017_Laatusuositusjulkaisu_fi_kansilla.pdf?sequence=1&isAllowed=y

In practice, integration of advanced technologies, ICT or robotics, in elderly care is not straightforward but requires to understand the care service system and the different perspectives of its stakeholders: the elderly persons, both formal and informal caregivers, care service providers, decision makers etc. The METESE project - *Meaningful Technology for Seniors - Safety, Comfort and Joy* - was started to study these perspectives in a systemic manner in order to identify facilitating factors to support the integration or using the technology. In particular, METESE was a collaborative project between Finland and Japan to compare these countries and learn from the other culture. In the project, we have carried out numerous studies for this purpose, and this document gives an overview of them and highlights some of the results with regard to Finnish and Japanese elderly care service system and care work itself, and expectations and acceptance of care technologies among Finnish and Japanese stakeholders.

2. METESE project

The METESE project was formed with the following consortium, funding and research questions.

2.1 The consortium and funding

Research Institutes:

- VTT Technical Research Centre of Finland Ltd.
- National Institute of Advanced Industrial Science and Technology (AIST)

Duration: 4/2015-3/2018 (36 months)

Funding: Japanese-Finnish Research Cooperative Program

- Finland: Tekes (current Business Finland), VTT, Attendo, Hämeenlinna municipality, Lano Group, Robokeskus, Allikko, Evondos
- Japan: JST (Japan Science and Technology Agency)

METESE partners (see Figure 2):

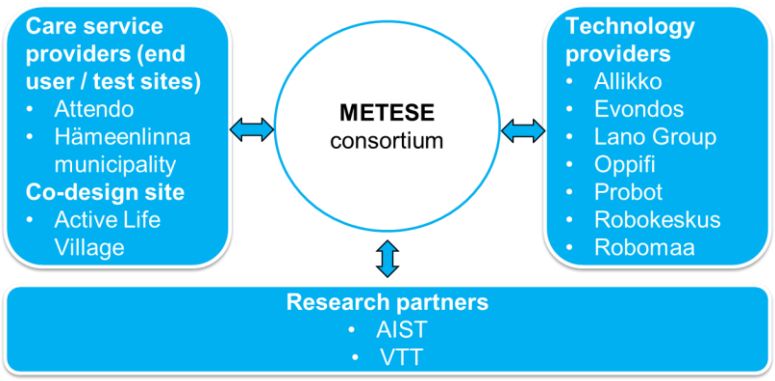

Figure 2. The METESE consortium included research organizations, small and large companies and a middle-sized municipality

2.2 Research questions

The following research questions were formulated in order to organize the project activities when considering the motivation and goals for the project:

1) **How can the access and participation of the elderly in service design be facilitated in developing meaningful solutions that support active aging?**
    a. What kind expectations do older people have towards technologies and services in their everyday life?
    b. What kind of ethical and societal impacts should be considered in service design for the elderly?
    c. How can the acceptance of technology by the elderly be supported in terms of technical features and adaptation processes?
    d. How can the technologies/applications be adopted for wider user application considering the differences in Finland and Japan?
2) **How should technological solutions support the elderly people and be developed in the elderly-care services context?**
    a. What kinds of functions are required to fit technologies to various situations flexibly?
    b. What kinds of interfaces are required in elderly-care services?
3) **How can the entire service system be considered in the design of meaningful technology for the elderly?**
    a. What special requirements and differences exist between Finland and Japan?
    b. What best practices can we identify in terms of service design and technical solutions in Finland and Japan?

2.3 Methodology

An analytical framework of elderly-care service systems was introduced in order to evaluate the impact of technologies in the elderly-care service systems (see Chapter 3). For data collection, we have utilized a mixed-method approach: data about end-user perceptions and the perspectives of care organizations and the care service system have been collected via individual interviews, focus group interviews, workshops, questionnaire surveys, observation studies and field studies (Table 1).

The collected data is in significant amount comparable between Finland in Japan: five studies out of eight have been carried out in both countries in order to allow direct comparison in certain questions. Three studies have been conducted only in Finland. Two of them are long-term field studies and one is a focus group study, and they are all about the question of what makes an ICT/robotic technology ‘meaningful’ for elderly people. These studies were arranged only in Finland in order to serve involved companies and the municipality that were interested in utilizing the studied technologies (a digital reminiscence service, a telepresence robot, a social therapy robot) as part of their care services.

Table 1. Summary of the empirical studies carried out in METESE

#	Focus of study	Stakeholder group(s)	Method	Comparative study*
1	Expectations, perceived challenges and potential of ICT and robotic technology integration in elderly care	Managers of care service organizations	Interviews	Yes
2	Attitudes towards ICT and robotic technology in elderly care	65+ seniors Informal caregivers Care workers	Online survey (questionnaire)	Yes
3	Attitudes towards ICT and robotic technology in elderly care	65+ seniors	Focus groups	Yes
4	Co-designing mobile applications for care work	Care workers in homecare and residential care	A series of workshops	Yes
5	Care work in residential care	Care workers in residential care	Time and motion study (shadowing)	Yes
6	Meaningful technology for seniors	Elderly residents in nursing home; active seniors living in home Care workers in nursing home	Long-term field study of a digital reminiscence service for elderly	No
7	Meaningful technology for seniors; Integrating technology in elderly care	Elderly resident in residential care and her family members Care workers in residential care	Long-term field study of a tele-presence robot in residential care	No
8	Meaningful technology for seniors; Integrating technology in elderly care	Care workers in residential care	Focus groups	No

* Similar data has been collected in both Finland and Japan to enable comparison between the countries

3. Analytical framework for elderly care service system

For successful technology development and implementation in the elderly-care setting to innovate services, it is required to understand different, even conflicting technological / non-technological requirements of stakeholders and to adapt the technology to service systems. For that purpose, we introduced an analytical framework of elderly-care service systems (Figure 3). The framework is to analyze expected impacts and required processes to implement technologies for elderly-care. In addition, this framework is used for international comparison of different elderly-care service systems.

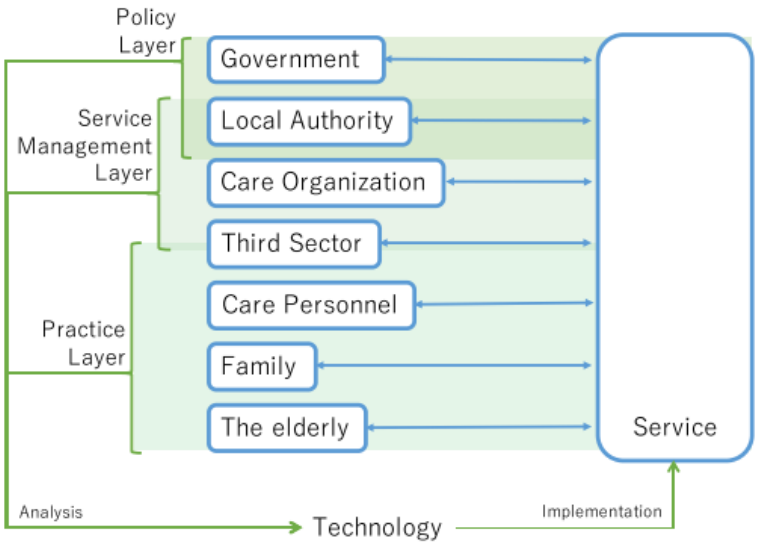

Figure 3. Analytical scheme for elderly-care service system (Watanabe, Hyytinen, & Niemelä, 2017).

In this framework, we adopted service system perspective as the theoretical background. Service system generally consists of multiple stakeholders who relate and interact mutually to create value for them, and technology is considered as one of resources to activate overall service systems.

The framework consists of seven stakeholders, which are The elderly, Family, Care personnel, Care organization, Third sector, Local authority, and Government. All the stakeholders are correlated and influenced among one another. However, the strength of each influence can vary according to proximity and intimacy of stakeholders. We set three analytical layers to investigate direct interactions among certain stakeholders, which are Practice Layer, Service Management Layer and Policy Layer. Based on studies for each layer, we integrate the overall influences among every stakeholder. Using this analytical framework, we have analyzed the service systems in both Finland and Japan, according to the aforementioned research questions.

The framework has been published in

- Watanabe, Niemelä, Määttä, Miwa, Fukuda, Nishimura, & Toivonen (2016)
- Watanabe, Hyytinen, & Niemelä (2017)

4. Integrating ICT and robotics in elderly care - attitudes, expectations and perceived challenges

4.1 Interviews of managers and decision makers

While ICT and robotics are expected as potential solutions toward sustainable care, the technology integration process in elderly-care service systems is still cumbersome, especially in the international context. We aimed at clarifying differences of elderly-care service systems at the level of management and organization in Japan and Finland, and how the differences influence on technology integration and diffusion in elderly care services.

Semi-structured interviews with managers in facility care service providers were conducted in both Japan and Finland. The interviewees mentioned a number of potential and actual barriers to integrate technologies in care services (Table 2). Many of them were similar in the two countries. Some of the interviewees in both countries felt it a challenge to change the mindset of care personnel to use technologies at work. Immature technologies and their interfaces also affected the acceptability of technologies for care personnel, which was mentioned in both countries. Another challenge is a “care-by-hand” culture. One interviewee in Japan mentioned that the mindset that care should be done by hand made care personnel reluctant to use technologies. One interviewee in Finland mentioned the negatively toned public image toward technologies, specifically care robots, as a challenge based on her/his experience. This type of notion from the public viewpoint was not heard in the interview in Japan.

Table 2. Barriers to integrate technologies in care facilities (Watanabe, Hyytinen, & Määttä, 2017).

Challenges	Main stakeholders	Japan / Finland
Change in work	Care personnel	Both
Immature technology	Care personnel, the elderly, family	Both
“Care-by-hand” culture	Care organization, care personnel	Both, with different views between Japan and Finland
Public image toward robotics	The elderly, family	Finland
Privacy	The elderly, family	Both
Cost of technologies	Care organization	Both
Limited impact to management	Care organization	Both, but with a positive view in Japan

From the managerial perspective, the cost for new technologies is a big barrier to implement them in both countries, especially for the smaller facilities. One interviewee in Finland stated the investment toward technologies did not help management, because the number of caregivers required for services is fixed by law. This situation was the same in Japan. Meanwhile, the lack of care professionals is serious in Japan and some of the interviewees expected that assistive technologies could reduce the managerial risk from limited human resources.

Although monitoring and alert systems for the safety of residents were expected in both countries, it was not necessarily preferred to use videos for monitoring due to potential threat to privacy.

To enrich the results of this study, we further investigated the practices and challenges of the purchasing process of emerging technologies (such as ICT and robotics) for elderly care in Finland. We carried out three interviews of technology purchase decision makers in different organizations of elderly care. Because utilizing robotics in the daily care work was (and is) still very new in Finland, the expectations were very different compared to e.g. ICT technologies. Social robots were not considered as a necessity for care facilities, and when they were purchased, factors like cost savings and improving efficiency were not at the core. The most important criteria seemed to stem from the curiosity towards new technologies and the possibility to bring different kind of activation and joy to the elderly. Another aspect was

also the PR and marketing value, and the belief that by implementing these types of technologies, the organizations can positively influence the overall attitude towards using robotics in the care industry and even allure new potential workforce to the field. Also having extra funds for procuring such kind of technology was emphasized in the public sector case organization.

These results have been published in

- Määttä, Watanabe, & Miwa (2016)
- Niemelä, Määttä, & Ylikauppila (2016)
- Watanabe, Hyytinen, & Määttä (2017)
- Watanabe, Hyytinen, & Tuovila (2018)

4.2 Questionnaire for elderly people, informal caregivers and professional care workers

This study focuses on the differences in acceptability of care technologies between Finland and Japan. We carried out an online questionnaire survey on the acceptability and needs for care technologies to three groups of target respondents: 1) active seniors (65+ people living at home with no permanent care needs), 2) professional caregivers, and 3) informal caregivers, who all were considered as users of care technologies in the future (Table 3). The questions included such topics as their expectations and requirements for future care services, their lifestyles, general attitude toward technology, specific needs for care technologies and user data.

Table 3. N of the sub-datasets in Finland and Japan.

	FINLAND	JAPAN
Active seniors	181	219
Professional caregivers	135	206
Informal caregivers	78	206

With regard to the active seniors, we have found that the Finnish respondent group of active seniors preferred professional caregiver to care for the person, whilst Japanese respondents preferred spouse as a caregiver. In addition, the Finnish respondents preferred home care service in the future, but the Japanese group preferred facility care service more than the Finnish respondents.

The Finnish respondents were more willing to using care support technologies (e.g., walking support, washing and toiletry support, mobility and transfer support, medicine taking support, dementia preventing games) for both their independent living and care services for themselves than the Japanese group. Only with social robots, the Japanese group was more acceptable than the Finnish respondents.

Finally, more Finnish senior respondents expected advanced technologies such as robotics to become more necessary to themselves in the future than the Japanese respondents. On the other hand, a bigger proportion of the Japanese seniors saw that the diffusion of

advanced technologies such as robotics is good or very good for the society, compared to the Finnish respondents.

The Japanese data has been analyzed partially also comparing all three respondent types: active seniors, professional caregivers and informal caregivers. More than 60% of the active seniors responded that they wanted to receive care from their spouses, whilst only around 25% of the professional caregivers or informal caregivers agreed with that. The active seniors and informal caregivers seemed to feel the necessity of technology in their future life more than the professional caregivers.

These results study have been published in

- Miwa, Watanabe, Määttä, Ylikauppila & Niemelä (2017) (Active seniors Finland-Japan)
- Niemelä, Miwa, Ylikauppila & Watanabe (2017) (Active seniors Finland-Japan)
- Miwa, Watanabe, Määttä & Niemelä (2016) (Japan all groups comparison)

4.3 Focus groups of elderly people

To better understand the perspective and attitudes of the main end users - senior people - towards ICT and robotic technologies as supporting independent living and care services, we carried out a series of focus groups for people aged 65+ in Finland and Japan. Three different technologies were demonstrated as illustrated presentations: 1) Depth camera for long-term home monitoring, 2) Medicine dispensing robot for independent living, and 3) Digital reminiscence online service (Figure 4).

Figure 4. The three technologies used a illustrated demonstrators in the focus groups.

Altogether, we had 28 seniors in the focus groups: 20 participants in three groups in Finland and 8 participants in two groups Japan. They evaluated slightly different sets of the technologies.

To highlight some results, elderly people in both countries had challenges in understanding the depth camera monitoring system and its automated data analysis for long-term purposes, e.g., to identify gradual or sudden changes in activity, posture etc. They easily understood the use of the system to monitor falling and emergency situation, which was a needful as well as an acceptable purpose for the system. Also monitoring eating of an elderly people living at home alone was considered good use for the system. In each group, the interest in personal using this system was moderately low.

Concerning the medicine-dispensing robot, it was quite liked by all focus groups. Participants in both countries found it useful to remind taking medicine in time, especially when living alone. The Japanese seniors liked such functionalities than the system speaking when it was time to take the pill. The Finnish participants perceive the technology as needful but were less interested in personally using it. The interview data gives a hint that this may at least partially be due to doubts of reduction of home care workers, but no conclusions can be made before further analysis.

There were some differences between the Finnish and Japanese participants in their perception of the digital reminiscence service. The Finnish senior groups found it interesting especially for storing their memories and family history to their grandchildren and other future generations. Some memories could be public, for instance those that are related to major occurrences in the society such as war: photographs and stories of wartime. In addition, old family traditions were seen important. The Japanese groups was more unsure about using digital reminiscence and they seemed not to be that much interested in sharing family history or past historical events through the service. However, one of the Japanese groups found the service good for sharing memories of the local community and how it has been changing.

These results have been partially published in Niemelä, Kulju, Ylikauppila, & Määttä (2017) (digital reminiscence service).

5. Observations from technology in care work and care facilities

5.1 Co-design workshops for mobile applications in care work

Co-design with end users is an effective approach to adapt technologies to specific use context with its better understanding. We conducted co-design workshops to clarify the differences in the system requirements and usages between Finland and Japan.

As an case of this study, we took up an SNS-like information sharing system that was designed and evaluated in Japan for employees in elderly care facilities. The DANCE system (Figure 5) is a messaging app for sharing hand-over information as a message. Users can send messages with text, photograph, movie file and emoji icons. They can make a comment to each message with text, photograph, movie file and emoji too. One particular feature of DANCE is that every task-oriented information is tagged with a care recipient so that the messages can be sorted chronologically for each care-receiver in the “List of Residents”. DANCE was tested in Finland in workshops, in collaboration with two Finnish elderly care service providers.

Figure 5. DANCE messaging app with timeline features
(Fukuda, Watanabe, Miwa, Ylikauppila, Lammi, Niemelä, & Nishimura, (2017)

The feedback was generally positive. The authors observed both Japanese and Finnish care facilities share several expected usages of the system, specifically of the photo and video functions.

This study has been published in Fukuda, Watanabe, Miwa, Ylikauppila, Lammi, Niemelä, Nishimura (2017).

5.2 Time and motion study in care facilities

We conducted international comparison about the nursing-care service processes. We conducted a study at a group home in Japan and two nursing-care facilities in Finland. Similar types of facilities were selected, each of which has approximately 10 elderly people with dementia and 2 to 4 caregivers in each unit. We measured their nursing care service processes using time and motion study and statistically analyzed their process.

From the macroscopic view, the rates of time spent on each operation were similar among three facilities. The elderly's behaviors that require caregivers' assistance, and the time required for the assistance, were in general common.

This study is published in Miwa, Watanabe, Ylikauppila, Kulju & Niemelä (accepted to be published in ICServ2018, 2018).

6. Meaningful technology for elderly people

This section describes three field studies carried out in order to better understand the aspects and challenges of meaningful technologies for elderly people and the integration of the technologies in care services (in Finland). The technologies used in the field studies were a digital reminiscence service, a telepresence robot and a social therapy robot.

6.1 Digital reminiscence for seniors living at home

Reminiscence as a mental and social process gains more meaningfulness when people get older. It is however unknown how well elderly people take digital or online tools into use for reminiscence outside a therapy context. The potential user group should be quite notable: for instance in Finland, 53% of 65-74 years old Finnish citizens use the internet daily or almost daily[6]. However, do elderly people find digital reminiscence service meaningful and useful for their personal use?

We carried out a study focusing on the needs and potential of a reminiscence digital tool to support well-being of seniors living at home. We used two methods of investigation. First, we carried out two focus groups, one with seniors (also referred in Chapter 3.3 *Focus groups of elderly people*) and another with homecare workers, who pondered digital reminiscence as part of homecare and from the perspective of seniors as homecare clients. Second, we recruited a group of seniors for a two-month field trial to use a digital reminiscence tool in their weekly group meetings. We interviewed the group and observed their using the tool. The study was carried out by using Epooq, an online reminiscence service as a tool to demonstrate digital reminiscence (Figure 6).

Figure 6. Left: The main window of the online reminiscence service (on a web browser). Right: A group of volunteer active seniors used Epooq weekly in their meetings.

Epooq is an online reminiscence service for storing and sharing personal memories and life experiences. Memories are stored as ”treasure chests”, which soar on the “sky” above the “clouds of memories”. The chests are filled with the memories “worthy of gold”. A memory can consist of text, images, video or audio clips. Other functionalities allow the user to share the memories, link them to themes and navigate the time line of memories.

The results show that whilst reminiscence is perceived important social and family activity for the seniors, and they are quite familiar with using computers and Internet in their daily life, there still are challenges for the seniors to utilize digital tools for reminiscence. In particular, digital tools should better support the social aspects of reminiscence. Usability of the service is critical.

This study is published in Niemelä, Kulju, Ylikauppila, & Määttä (2017).

[6] Official Statistics of Finland (OSF): Use of information and communications technology by individuals [e-publication], http://www.stat.fi/til/sutivi/index_en.html, Helsinki (2016)

6.2 A telepresence robot in residential care

Elderly people moving into assisted living facilities often face profound changes in their daily routines and social relationships, which may lead to feelings of social isolation and even to depression. Telepresence robots can alleviate this by enabling easily accessible virtual presence of family members and other close ones at the ward. Telepresence robots have been tested in different care environments with mainly positive responses, but there are still challenges, both technical and non-technical, that hinder the wider adoption of the robots in residential care settings.

In this study, we searched for more understanding of the non-technical challenges by exploring the use of a telepresence robot Double in a residential care facility. In a 12-week field trial, we installed a telepresence robot in a room of a long-term care home resident for communicating with her family members (Figure 7).

Figure 7. The telepresence robot was placed in the room of the primary user in the care home (on the left). The resident could press a separate button to send an SMS request to her daughter to connect (in the middle). Her daughter used a laptop to connect with the resident (on the right).

The main data was collected in pre- and post-interviews representing the perspectives of the resident, her family members and care workers at the ward. We also carried out user observations, keeping a log of the use of the robot, and videotaping call sessions of one daughter through the robot.

The results confirm the potential of telepresence robots in assisted living in order to increase the presence of family members to the resident and vice versa. Telepresence robots appear to be quite a mature technology to be taken into use in care facilities, to alleviate the breaking of earlier social routines and networks and to reduce the related feelings of isolation that the residents in assisted living often confront.

The study also provides insight about how the increased presence of family members may affect the care work (Figure 8). In assisted living, the care staff gets easily involved, even if the new technology was meant to be used by the resident and family members only. Their acceptance for the technology is thus essential. Adopting telepresence robots should be co-designed with care workers so that common rules for privacy and control can be established already in the early phase.

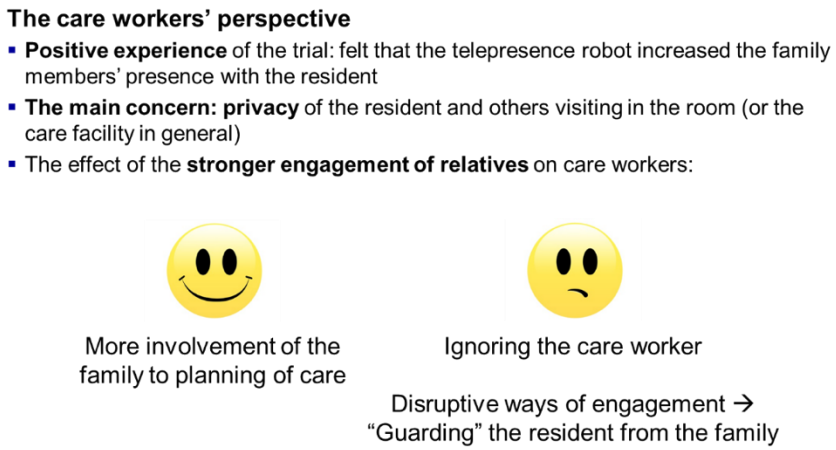

Figure 8. Care workers' perspective to the adoption of a telepresence robot in residential care.

This study is published in

- Aaltonen, Niemelä & Tammela (2017)
- Niemelä, van Aerschot, Tammela & Aaltonen (2017) (the paper received the Award of the Best Conference Paper).

6.3 Social therapy robot in residential care

Paro the therapy robot seal (Figure 9) is one of the few robot applications that has gained commercial success and has been in long-term use in care facilities. For older users with memory illness, Paro has been reported to decrease anxiety and depression, and increase social communication. Professional caregivers have perceived Paro as positive and useful for the elderly. They typically use Paro as an activity to stimulate or entertain residents and only sometimes as a socio-pedagogic tool. Paro has also improved the moods of the elderly residents, which has caused decrease in mental impoverishment of the nursing staff.

Figure 9. Paro the therapy robot

In this study, we wanted to investigate more the actual value and impact of Paro from the perspective of the caregiver and care work. For this regard, we carried out and analyzed three focus group interviews with altogether 10 professional caregivers in three dementia care homes, which had had access to Paro for at least one year. (However, Paro had circulated between departments so the caregivers in one department typically used Paro 1-2 months at a time and could have periods of several months of non-use.)

The main value of Paro for caregivers was in the positive impact that the robot has on the resident's emotions and functional ability: the caregiver perceives the old person calming down, activating to talk and reminisce, and caring other (i.e. Paro), which supports the old person to perceive himself as an active doer, not just a passive receiver of care. Caregivers would benefit from use examples, sharing Paro practices with other facilities departments and other support to learn to better utilize the potential of Paro, so they could develop expertise on how its positive impact depends on the attitude of the caregiver and the older users themselves, their personality, mood, and other factors.

This study has been published in

- Niemelä, Ylikauppila, & Talja (2016)
- Niemelä, Määttä, & Ylikauppila (2016)

7. Summary and discussion

The METESE project has focused on understanding the possibilities and challenges of integrating ICT and robotics technology in elderly care in Finland and in Japan, and learning from the other culture in order to advance utilization of the technology appropriately for personal or societal benefit. In particular, the expected increase in elderly people and a lack of caregivers in Japan is severe. Technology can be one, crucial part of the solution. Also, in Finland, increasing demographic dependency ratio is notable in the next 10-15 years, and technology can be used to support independent living of elderly people, their ageing in place, efficiency of care work and quality of life in care facilities.

Managers of care services in Finland and Japan seem to share many worries with regard to integration of technology in elderly care. Change of care work is a difficult aim to achieve, in particular because the adopted technology is found to be too expensive and immature and it takes more time and effort than actually giving back. Also, the mindset that care is something done by human hand may hinder adoption of "care technology", even if the original purpose was to release care workers' time from carrying out routine or secondary tasks to social and interactive tasks with the cared person.

When it comes to actual end users, it seems that Finnish seniors (as well as both formal and informal care workers[7]) tend to perceive technologies supporting their independent living and care more positively than their Japanese counterparts do. There may be several explanations for the higher acceptance; for instance, Finnish elderly people also seem to have higher use rate of tablets and smart phones and so they are more used to personal technology in their everyday life. The questionnaire survey also indicates differences in care culture, as Japanese seniors would like to be taken care by their spouse, and Finnish by a professional caregiver.

To support the integration of technology in care, both elderly people and caregivers, formal and informal, are in a key role. A useful technology can still just be introduced to the interested end users and left unused after some period of time. To ensure end users' willingness to permanently adopt a technology, activities such as increasing awareness of available solutions and their benefits, education, training and other support from management and social networks is needed. Maybe changing the mindset is the most

[7] Based on the collected questionnaire data; not published yet

important: to learn to think that we really can change the way we arrange our daily lives or care services with technology in a profoundly different way. In order to achieve this, the integration of technology should go hand in hand with public discussion of what is desired and acceptable elderly care, reflection of regulation and policies and so on. Viewing the integration of technology in elderly care through the framework of socio-technical transition[8], as a systemic change, gives tools to anticipate and manage the change in the big picture.

With regard to the research questions set in the beginning of the project, we summarize the answers in the Table 4 below.

Table 4. Summary of the research question and main results in METESE.

Research question	**Main results**
1) How can the access and participation of the elderly in service design be facilitated in developing meaningful solutions that support active aging?	
a. What kind expectations do older people have towards technologies and services in their everyday life?	Expectations for usefulness and usability are common to all users. Still, interest towards using technology can be different: Whilst Finnish people may be more interested in using care technologies in general, Japanese tend to be more open to communication robots.
b. What kind of ethical and societal impacts should be considered in service design for the elderly?	Privacy is important with monitoring technologies and telepresence, which are found generally useful. Finnish people may be more interested in the increased personal autonomy and independence that using technology can provide for them, whilst Japanese may want to decrease burden of their family and community.
c. How can the acceptance of technology by the elderly (and other end users) be supported in terms of technical features and adaptation processes?	Good design in usability is important to all users. Both older users and care workers need training and support in learning to use a new technology, and later, after the novelty value has decreased, support to continue the use. Maintenance for the technology needs to provided. The long-term use depends on the benefits of the technology, whether they are increased mobility, better social connectivity or otherwise increased quality of life or care. Price and costs are a critical factor.
d. How can the technologies/applications be adopted for wider user application considering the differences in Finland and Japan?	With the systemic change, more technologies come available and their price decreases. Introducing examples of technology use and disseminating their benefits increases knowledge and acceptance. In Finland, supporting people's autonomy and independence with technology may be more important than the benefits for society and community, which is central in Japan. Educating and training of care workers for technology use is important, perhaps even more important in Japan. In Finland, care services should better learn to accept and utilize social robotics.
2) How should technological solutions support the elderly people and be developed in the elderly-care services context?	
a. What kinds of functions are required to fit technologies to various situations flexibly?	In addition to the technological features including interfaces, related service activities such as increasing awareness of available solutions and their benefits, education, training and other support from management and social networks are necessary.
b. What kinds of interfaces are required in elderly-care services?	Very simple and reliable - care workers do not have or want to use their time learning use of technology instead of carrying out their core job, care. With education, more technology-oriented care workers can come to workforce. For elderly people, their little experience of new technologies and possibly reduced cognitive skills make learning difficult. The situation is likely to chance in the coming years.

[8] E.g., Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study. Research Policy, 31(8–9), 1257–1274.

3) How can the entire service system be considered in the design of meaningful technology for the elderly?	
a. What special requirements and differences exist between Finland and Japan?	Japan is facing more severe ageing of population and lack of caregivers than Finland. Japan has put effort in replacing the shrinking nursing care workforce with robots. The strategy in Finland is to advance and support independent living, ageing in place and home care. Considering integration of technology in care, Finland could learn from Japanese product design and Japan from Finnish care service system and care technology education.
b. What best practices can we identify in terms of service design and technical solutions in Finland and Japan?	Some Japanese care robots could be adopted in Finnish elderly care. Also Japanese open test and experiment sites (care facilities in collaboration with municipality/prefecture and manufacturing companies) demonstrating different care technologies in real use would increase awareness of the technologies and their benefits. On the other hand, care service providers In Finland already rely widely on information systems and digital services, which increases efficiency of service provision. In addition, monitoring technologies of elderly people in facilities and at home are used for care planning and control. These could be introduced in Japan.

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