"Robots do not replace a nurse with a beating heart": The publicity around a robotic innovation in elderly care

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Abstract

Purpose

This study investigates the publicity around the implementation of the Zora robot in elderly-care services in Lahti, Finland. The aim was to discover opinions concerning the use of robots in elderly care as well as the arguments and justifications behind those opinions. Zora is a humanoid robot intended to promote mobility and rehabilitation. The Lahti pilot was the first Zora pilot in Finland in public elderly-care services. It received much publicity, both regionally and nationally.

Design/methodology/approach

This study is based on an empirical case study on the implementation of the Zora robot in elderly-care services. The data consist of interviews with personnel who operated Zora and comments from the general public about the 'Zora' robot. Two data sources were used: 1) 107 comments were collected from online and print media, and 2) the personnel (n=39) who worked with Zora were interviewed. The data were analysed by means of interpretative content analysis.

Findings

The results show that public opinion is mainly negative, but that the commentators apparently have little information about the robot and its tasks. The personnel had more positive views; they saw it as a recreational tool, not as a replacement for their own roles.

Originality/value

There is clearly a need for more information, for a better informed discussion on how robots can be used in elderly care and how to involve the general public in this discussion in a constructive way.

Keywords: socially assistive robot; care robot Zora; elderly-care services; public discussion; publicity; care workers

1. Introduction

Due to the megatrend towards an ageing population, technology is expected to play an increasing role in elderly-care services (e.g., Kapadia et al., 2015; Malanowski, 2008; Peine et al., 2015). There is also a high turn-over of nurses and support staff at elderly-care services (Friedland, 2004). Combined with the low number of support workers currently in health care, this means that, in future, there may not be enough people to take care of the elderly. As the age structure of society changes, it will become necessary for a smaller number of qualified care workers and other professionals to take care of an increasing elderly population (Cohen-Mansfield and Biddison, 2007). New approaches and innovations in elderly care are thus being sought in response to these challenges. Novelties are being produced for both caregivers and care-receivers. The types of technology most frequently developed for elderly people are applications that compensate for their physical decline and assist them with daily activities (Fozard, 2005; Vichitvanichphong et al., 2018), thereby supporting the objective of independent living.

Public services for elderly people in Finland include support for family caregivers, home care, support services and institutional care (Ministry of Social Affairs and Health, 2018). A central trend in elderly care has been a shift away from long-term institutional care towards more proactive and preventive services, including services that support living in one's own home (Ministry of Social Affairs and Health, 2018). Recently, robotics has moved into the field of care and welfare (e.g. Kachouie et al., 2014). Service robots for care cover a wide spectrum, from pet-like robots to walking robots utilized in the rehabilitation of bed-ridden patients. While the early service robots were developed to do a single task (e.g. vacuum cleaner robots), contemporary service robots are designed, for instance, as mobile assistants with navigation and manipulation capabilities. Robots used in elderly care fall into three different categories: 1) monitoring robots (observe behaviour and health), 2) assistive robots (offer support to the elderly and/or their caregivers in daily tasks), and 3) socially assistive robots ([SARs] provide companionship) (Wu et al., 2012). Broekens et al. (2009) define SARs as enhancing the health and psychological well-being of the elderly by offering them companionship. SARs are further defined as robots capable of communicating in a human-like manner (Kirby et al., 2013). This means that SARs are designed to assist humans with predefined tasks and to communicate using natural human social-interaction techniques such as speech. SARs can be used for many different types of task, for example, as information-providers in malls or guides in museums (e.g., Aaltonen et al., 2017). However, the use of SARs is still a new approach in elderly-care services (Melkas et al., 2016; Ott, 2012; Compagna and Kohlbacher, 2015).

Acceptance of robots is a delicate issue and one that has been studied in pilots in various countries (e.g. Melkas et al., 2016; Niemelä et al., 2017; Seelye et al., 2012; Vermeersch et al., 2015) as well as in Eurobarometer surveys (European Commission, 2012; 2015). Robot use has elicited both concerns and positive responses. Sharkey and Sharkey (2012) identified six concerns relating to the use of robots in elderly care: (1) a potential reduction in the amount of human contact; (2) an increased feeling of objectification and loss of control; (3) a loss of privacy; (4) a loss of personal liberty; (5) deception and infantilisation; and (6) the circumstances under which elderly people should be allowed to control the robots. Even though these concerns do need to be addressed, there are also positive views. In a recent Finnish case study, elderly clients generally welcomed a robot positively: it provided recreation and stimulated exercise and interaction (Melkas et al., 2016). According to several empirical studies (e.g. Broadbent et al., 2012; Melkas et al., 2016; Sabelli et al., 2011), the elderly people showed a more positive attitude towards the use of robots than the care personnel did. Similar finding has been reported also in the adoption of information and communication technology (ICT) (Hur, 2016).

Media coverage of robots may provide the only information that many people receive about the use of SARs. Le Roux and Maree (2016) point out, although in a different technological context, that attitudes are learned through experience with a product, from information acquired through the mass media or from other individuals. A media study on ageing and technology was recently conducted in Canada by Wolbring and Abdullah (2016). Their focus was on technology in general—not specifically on robots—and they analysed the different perspectives expressed in newspaper articles. To the best of our knowledge, a discussion by the general public concerning the use of robots in elderly care—a focus of the present study—has not been analysed in earlier studies, whether in Finland or elsewhere. At present, public knowledge about the use of robots in care and the types of meaningful task that can be performed by robots still seems vague, and it would appear that the public lacks real information (Tuisku et al., 2017). If public opinions are to be taken into account in decision making, and if there is an attempt to understand the reasons behind these opinions, it is likely that the future design and implementation of robots will be better suited to the needs of citizens (Taipale et al., 2015). It is equally important to understand how the people who work with the robots feel about the public discussion—whether it has an impact on their work, for example; and this is another research theme that has been overlooked.

This study investigates the publicity around the implementation of the Zora robot in elderly-care services in Lahti, Finland. Zora is a humanoid robot intended to promote mobility and rehabilitation

(Zorabots, 2018). Publicity is investigated through two data sources: media discussion and interviews with personnel who work with Zora. The data were collected as follows: 1) Comment data were collected from various Finnish media about the implementation of Zora. These included the websites of a newspaper and a tabloid, a news agency's website and text messages (SMSs) published in a newspaper. 2) The management, care workers and students who worked with Zora were interviewed regarding how they saw the media discussion and what their opinions about it were. The aim was to discover the opinions of people coming from these two different perspectives concerning the use of Zora in elderly care and also the arguments and justifications behind these opinions. Two research questions were asked:

1. How is the Zora robot perceived by care workers and by the public?
2. What are the reasons behind these opinions?

Such knowledge may be utilized in the future, for example, to enable communication approaches to be so designed that they will be met by societal understanding and acceptance.

2. Related work

2.1. Acceptance of robotic innovations

Recently, as various pilots have been implemented and experiences with them have been reported, the use of robots in elderly care has received both positive and negative publicity. Because of fears of a potential reduction in the amount of human contact, with social isolation, possible deception and loss of dignity, questions of robot acceptance and ethical issues have attracted special interest (Sharkey and Sharkey, 2012; Whitby, 2008; van Wynsberghe, 2016).

At the societal level, the diffusion of novelties such as robots occurs in different ways and in different 'waves' (Kyrki et al., 2015). The use of robots may be seen as spreading through different user groups (in line with the diffusion of innovations model [DIM] of Rogers, 2010): First, robots are adopted by a relatively small group of 'innovators' and 'early adopters'. The increased understanding about the functions and usability of robots will attract more users, who form the 'early majority'. Once there are plenty of users, robots will be seen as a natural part of the operational environment, which will lead to the 'late majority' accepting the robots into regular use. Finally, the small group of 'laggards' will accept the robots. However, if the experiences of the small group of early adopters are not good enough, or if information about their experience does not

spread effectively, the robotic innovation will fail to cross the gap to be taken into use by even the early majority (Kyrki et al., 2015).

At the individual level, Heerink et al. (2008) show that among elderly people (between 65 and 89 years old) the acceptance of SARs is related to their acceptance of technology in general, such as computers. Technological acceptance is related to how the technology—in this case, robots—is introduced to the users. In the healthcare field, Pai and Huang (2011), for example, show that the quality of the information provided and the quality of the service and system influence the user's intention to use a healthcare information system. Perceived usefulness and perceived ease-of-use are thus mediating constructs. According to the literature review by Kachouie et al. (2014), nearly all the studies reported positive effects from SARs in elderly care, that is, these robots have the potential to enhance elderly well-being and decrease staff workload.

Šabanović (2010) analysed scientists' discourses on the acceptability of robots, based on data collected through participant observation and interviews with robotics researchers in the US and Japan. According to these results, a linear and technologically determinist view of the interaction between robots and society is dominant in the field. In this narrative, the social impact of robotic technologies derives mostly from their technological capabilities, and society is expected to accept and adapt to the technological innovations. Šabanović (2010) proposed a framework of mutual shaping and co-production that explores a dynamic interaction between robotics and society as an alternative approach to the dynamics between society and technology. While that sounds feasible, it seems distant at present, and it would seem that society and its citizens are expected to accept and adapt to major changes without much support. The present study will shed some light on the interaction between robots and society as reflected in the public's comments.

2.2. Factors affecting acceptance

The attitude towards the use of robots in elderly care is an important factor in determining whether the robot will be accepted beyond its early innovators. Over the last few years, many research groups have investigated users' attitudes towards robots. For example, Broadbent et al., (2009) investigated the acceptance of SARs in elderly care and found two possible ways to increase the acceptance of robots. These are: 1) to assess the needs of the human user and to match the robot's role, appearance and behaviour to these needs, and 2) to modify the expectations of users to match them to the robot's abilities. The acceptance of the use of robots in elderly care has mainly been

studied from the perspective of the users—the elderly and the caregivers (e.g. Pino et al., 2015). However, the public discussion that revolves around the use of robots in care is often overlooked. This discussion is an important factor in understanding why the use of robots in elderly care might be seen as problematic and why attitudes towards that type of use are often quite negative. It appears important to analyse public discussion, or in this case media discussion, to understand obstacles to the use of robots in elderly care, or extending the scope more widely, in social and healthcare services.

De Graaf **and** Allouch (2013) investigated the factors that influence the acceptance of SARs. Even though the study participants only interacted with the robot for a short period of time, the researchers were able to identify six variables that were important when evaluating user acceptance: usefulness, adaptability, enjoyment, sociability, companionship and perceived behavioural control. Their results show that enjoyment seems to be the most important factor in the acceptance of a robot. Thus, when SARs are to be introduced, the enjoyment factor should be invested in.

Sabelli et al. (2011) performed an ethnographic study where they gave a socially assistive robot (Robovie) to an elderly-care centre to use for 3.5 months, and then observed how the elderly people and care workers interacted with it over this longer period of time. They found that, at first, the elderly people were cautious about the robot and did not accept it. However, once they became accustomed to it they were more willing to accept it. The care personnel were seen to be eager to use the robot once they witnessed that the elderly were accepting it as a part of their daily activities. Thus, the more experience the users had of the robot, the more willing they were to accept and use it, simultaneously perceiving it more positively. A key factor affecting their acceptance was the small things that the robot did, for example, it greeted the inhabitants as they entered the room where the robot was positioned.

These studies have mainly been based on questionnaires delivered to target groups, and these may not be an accurate reflection of the opinions of the general public (Takayama et al., 2008). One possibility for obtaining real comments from the general public is to collect the comments that they have made in the media; those opinions are generally unfiltered and direct. Comments in the media offer an easy way to understand the public's opinion: readers' comments are widely available on Internet news sites and they are read frequently (Steinfeld et al., 2016). For example, Na and Rhee (2008) report that 84.3% of Internet news users read comments by others at least once a week.

3. Introduction and use of Zora

3.1. Introduction to the Zora robot

The Zora robot is an application based on the NAO robot by Softbank Robotics (Zorabots, 2018) (see Figure 1, left). Zora (or Zorabot) is 57 cm high and includes two speakers and several microphones used to communicate with people. Zora also features two built-in cameras that can be used to capture different situations. Zora is controlled by a tablet computer, and the only requirement is to have a wireless Internet connection so that Zora can be connected to the tablet.

Zora blinks its eyes and can, for example, walk, dance and move its hands while speaking. It can be used to instruct physical exercise, give dance-shows and play different kinds of games. Zora can also be held in one's lap (much like a baby). It is possible to talk through Zora by writing text in the Zora application. Zora will then speak the typed text out loud with its in-built speech synthesizer. Figure 1 (right) demonstrates an exercise session that was led by Zora in an elderly-care facility.

Insert Figure 1 around here

3.2. Acquisition and use of Zora in Lahti elderly care services

At the end of 2015, the City of Lahti (Health and Social Services) in Southern Finland acquired a Zora robot at a price of 16 500 euros. It was acquired with money that the City of Lahti received from a bequest specifically intended for the purchase of technology. Zora was introduced into the municipal elderly-care services during the pilot period from January 2016 to April 2016 (for more information, see Melkas et al., (2016)). The robot was renamed 'Ilona' (a Finnish name containing the word 'joy', with the direct translation 'as a joy') by the City of Lahti representatives to make the name easier to pronounce and the robot more 'approachable' for the inhabitants. The Lahti pilot was the first Zora pilot in Finland in public elderly-care services.

During this pilot period, the robot was used for rehabilitation in two care homes and a geriatric hospital. The robot was either introduced to the customers in a special session or it acted as part of regular group activities (exercise or literature groups) of the care organisation. The robot instructed

in exercises, played music, performed dances and played interactive memory and guessing games with the inhabitants (see Figure 1). The robot was introduced and then kept for two weeks in the first care home, for four weeks in the second and then for four weeks in the geriatric hospital. It was steered technically by a group of 2–4 healthcare students. The employees in each facility could themselves decide on how to use Zora while it was kept on their premises.

Zora received much publicity during this pilot period, not only regionally but also nationally. In the beginning, the representatives of the City of Lahti were also very active in publicising the robot and the pilot. When the robot was introduced in Lahti, the press in the Lahti region became interested, and several articles were published to introduce the robot to a wider audience and to tell about early experiences of using it. The regional reporter of the Finnish national broadcasting company also became interested, which resulted in reports on regional and national radio, on TV news as well as in online articles.

4. Methods

This study is based on an empirical case study on the implementation of the Zora robot in elderly-care services with the focus on publicity around a robotic innovation. Two different datasets were collected: 1) comments from the media, and 2) interviews of the personnel who worked with Zora. The study followed the ethical principles outlined in the Declaration of Helsinki of 1975, as revised in 2000 and 2008. The interviewees signed an informed consent form. The two data collection methods are described in chapters 4.1 and 4.2. The data analysis is introduced in chapter 4.3.

4.1. Comments from the media

The media data for this study were collected during spring 2016. The authors of this article took part in the Zora robot pilot and thus they had prior knowledge about when and where an article about the use of Zora in Lahti would be published. Thus, all articles and the comments on them were collected. The comments were systematically collected from a local newspaper's SMS feedback column, from the comment fields for the online versions of two published articles, one in a local newspaper and the other in a national tabloid, and from the comment field on the Finnish broadcasting company's website (i.e. the comments related to a national article and to news reports). These articles were open to the public to read and comment on, and thus anyone who accessed an article could leave a comment. All the comments were given anonymously, with the exception of those on the national tabloid article where Facebook profiles were used to give the

comments (these were anonymised for the purpose of this study). The comments were collected from these different channels during January–April 2016, and altogether this dataset consisted of 107 comments. In addition, a confirmatory online search was conducted when the data were analysed to make sure that all articles and related comments had been collected. All the comments from those articles were included in the analysis. In the following, we describe each article in detail. The articles are described in the order of their publication dates.

4.1.1. National tabloid

On 30 January, 2016, an article was published in the print version of a national tabloid. The article entitled 'Ilona-robot cherishes the elderly' described the Zora robot and the first impressions that Zora evoked in the inhabitants of a care facility in Lahti. An online version of the article was published the next day, 31 January, 2016. The online version was a shortened version of the full article, and it was possible to give comments on it using a Facebook profile as a pseudonym. A video was published in conjunction with the article and also in the video section of the national tabloid's website where all videos related to articles are published. It is also possible to comment on these videos through a Facebook profile.

The print version of the tabloid has 287 000 readers per week and there are almost 3 million visitors per week to the website (both desktop and mobile) (source: http://skuuppi.iltalehti.fi/). The print version of the tabloid is sold in practically every store and stand in Finland with an eye-catching, yellow paper scoop. The website of the national tabloid is free for anyone to read, however, some articles are shortened versions of those published in the print version.

Altogether, eight comments were given that related to the online version of the article and two comments were made in relation to the video. The comments were single comments that reflected the opinion of the commentator. The commentators did not acknowledge the comments given by previous commentators, and thus the comments did not form a discussion.

4.1.2. Local newspaper

On 10th of February, 2016, an article entitled 'Care robot Ilona gives kisses to the elderly – cost 16 500 euros to City of Lahti' was published in the paper version of the local newspaper. Like the article in the national tabloid, this article introduced the use of the Zora robot in elderly care. On 11th of February, an online version of the article was published. The online one was a shortened

version but included the possibility of making comments. In the local newspaper, only those who have registered to use the web pages can make comments on articles.

The paper version of the local newspaper reaches 96 000 readers (with a net circulation of 50 000). Approximately 200 000 visitors a week visit the web pages of this local newspaper (source: http://www.mediataloesa.fi/palvelumme/etel%C3%A4-suomen-sanomat). The local newspaper in question is the seventh largest daily newspaper in Finland. Altogether, eight comments were made on this article. All of these were single comments and not responses to previous comments.

4.1.3. SMS column of local newspaper

The comments in the local newspaper's SMS feedback column were not connected to a particular article, but were mainly opinions about the use of robots in elderly care as prompted by various articles published in the newspaper in question. Many Finnish newspapers have feedback columns in which SMSs sent by anyone are published unless they are completely inappropriate. Thus, anyone who knows the number for a column can send an SMS to it.

After the article was published in the local newspaper on 10th of February, 2016, altogether 11 comments related to the use of robots in elderly care were sent via SMS to the paper during February–April 2016. Again, the comments were single opinions and were not dialogic in nature.

4.1.4. Broadcasting company

On 6th of April, 2016, a story about Zora was published on the Finnish broadcasting company's website with an accompanying video entitled 'Robots are coming to welfare services – Video: In Lahti, a care robot exercises and drones on'. On another page, there was a story entitled 'Would you like a robot to take care of you when you are old?' Below that, there was a comment box to allow commenting by anyone (i.e. registration was not a requirement for giving comments). Altogether, 72 comments were given in response to that question. All the pseudonyms of the commentators were different, so it is assumed that all commentators were different.

It was possible to either write a new comment or to reply to a previous comment. Forty-five 'fresh' comments were given that were not responses to previous comments. Of those 45 comments, 16 received between one and four responses (the average number of responses was two). Although these comments were given as responses to previous comments, they were not all dialogic in nature.

Twenty-five comments were identified as responses to previous comments, while the others were individual comments that did not relate to a previous one.

4.2. Comments from interviews

The interview data were collected during the pilot, more precisely, in March–April 2016. The data for this study consists of 1) three interviews with the management, 2) five focus group interviews with care personnel, and 3) a focus group interview with students. Altogether, 39 persons were interviewed (3 management, 30 care workers and 6 students). All the interviewees were staff members who were somehow in contact with Zora during the pilot period. The choice of using different types of interview methods (group/individual) was due to the work in shifts, for example.

The interviews dealt with topics such as primary reactions, experiences during the implementation and familiarization phase, experienced and anticipated benefits and challenges, impacts on work practices and perceptions concerning the suitability and applicability of the robot for elderly inhabitants. In this article, we concentrate first on the reactions of the public to Zora and then on the interviewees' own (positive and negative) opinions of Zora.

4.2.1. Management
Three members of management were interviewed in personal interviews. All of them were present at the meeting when Zora was presented to the stakeholders and the decision was made to acquire Zora for the city of Lahti.

4.2.2. Care personnel
Five focus group interviews were conducted with care personnel. Altogether, 30 people took part in these focus group interviews. Each group consisted of 2 to 15 participants, and one additional interview involved a phone call with just one person. The interviewees were mainly nurses, assistant nurses, physiotherapists or occupational therapists. Most of them had interacted with Zora during the pilot period.

4.2.3. Students
Six (4 female, 2 male) students were interviewed in one focus group session. They were all physiotherapy students. They participated in the Zora pilot as part of a course at their university of

applied sciences. During the pilot, it was mainly these students who operated Zora and who introduced care personnel to its operation.

4.3. Data analysis

The data were analysed by means of interpretative content analysis (Mayring, 2000). Comments from the media were first organized by the tone of the comment, whether it was positive or negative. Then, these comments were analysed and organised by content. Comments with similar content were grouped together, and the category was given a name that represented the topic. The comments were also identified according to their source.

The interviews were transcribed and then also analysed by means of interpretative content analysis. The transcripts of the interviews were first read thoroughly so that the content was fully understood. Then, those comments made in relation to publicity were gathered and analysed.

5. Results

5.1. Media analysis

Table 1 describes the comments given in the various media sources. The comments were divided according to their tone into positive, neutral or negative. If a comment included different aspects (e.g. both positive and negative), it was counted as two half comments.

Insert Table 1 around here

As can be seen in Table 1, most of the comments represented negative attitudes towards the use of robots in elderly care (71.5%). The positive and negative media comments were then considered separately.

5.1.1.Positive views

Table 2 presents the categories into which the positive media comments were divided with the number of comments in each category according to source. Each category is presented with an example comment, translated from Finnish into English.

Insert Table 2 around here

Altogether, six categories were identified that expressed positive comments. Most of the positive comments were given on the broadcasting company's website. The other datasets consisted mainly of negative comments. The comments in category 1 reflect positive attitudes towards the use of robots, but little explanation was given in support of these comments. Some of the comments were given as a response to a negative comment, and thus the reasoning is from the angle of the negative comment. The tone of the comments in category 2 is neutral. These comments compare the use of robots to any other assistive home device that people use today and take for granted, for example, a coffee maker or a washing machine. That is, the robot is seen as having the capacity to make people's lives easier. The comments in category 3 acknowledge the fact that robots cannot replace human contact but still see the possibility of, for example, robots enabling one to live on one's own for a longer period of time. In category 4, the comments acknowledge that, if a robot is acquired, the people caregivers can focus on human-human interactions. Comments in category 5 compare the work of a robot with the work of a person and say that in some tasks the robot would work more accurately and consistently than humans. Although, there were only two comments in category 6, it was clear that they did not fit into any other category. Both involve the use of robots with other groups of people. What was interesting about this category was the fact that neither of the comments came from the broadcasting company's website, although most of the positive comments came from there.

The positive comments indicate complete acceptance of the possibility of being taken care of by a robot. However, the commentators did raise some limitations regarding the use of robots; for example, a robot could take care of 'technical' things provided a human doctor was available when needed, for example, to prescribe medication.

The largest number of positive comments was in the category: 'The robot as an assistive device'. These commentators compared robots to any other appliance that is there to make people's everyday lives easier, such as a coffee maker or a toaster. The positive comments also acknowledged the fact that a robot might offer an elderly person the possibility of living independently at home for a longer period of time. That is, the well-being of the elderly is increased when they can get help with everyday tasks at home. It would seem that people with a positive view of robots are able to invent uses for different types of robot (even though the articles here dealt only with the Zora robot).

5.1.2. Negative views

Nine categories were identified from the negative comments (see Table 3). Table 3 shows the number of comments in each category, and it includes examples of comments from each category.

Insert Table 3 around here

Negative views were given in every dataset. In many of the comments in category 7, the price of a robot was compared to the salary of a person, suggesting that a person could be hired for the price of a robot. They also considered issues such as current unemployment levels in Finland. Category 8 consists of comments that express concern about how the care workers would spend their time with the robot, that is, does it in fact help in care because it needs human supervision? Most of the negative comments were in this category. Category 9 involves an often black-and-white discussion on the use of robots in elderly care and expresses the concern that there would not be sufficient human care for the elderly. In category 10, the public raise the concern that, in the future, robots will take care of people and thus care workers will lose their jobs. The comments in category 11 express the fear that a robot might not function correctly and might do something it was not programmed to do.

Category 12 deals with opinions expressed by commentators that they could not see any benefits that the robot might introduce into the care of the elderly. That is, the robot could equally well be replaced with, for example, a video instructor. Category 13 expresses people's concerns about how care workers will cope when innovations are presented to them without proper training. It seems natural that some people will be afraid of this type of progress, and category 14 indicates this. People expressed their fears that once robots were introduced into care, they would go on to take

over the world. It would seem that the fears expressed in this category were related to science fiction movies. Category 15 includes comments that represent an overall negative attitude towards robots but do not fall into any of the previous eight categories and do not formulate into any additional categories. They were mostly replies to previous comments.

The category that received the largest number of negative comments was 'A loss of human care'. Respondents were concerned lest the elderly would lose their access to human care when robots were introduced into elderly care. Comments in the category 'Robots taking jobs' reveal that people do harbour such a fear. It is frequently not understood that while robots may participate in different work tasks, they will alter the job descriptions of humans rather than make them redundant (Autor, 2015).

Overall, it seems that the negative commentators had very negative attitudes towards the use of robots in elderly care and no hints were found of positive attitudes. The comments were frequently written in a fairly 'aggressive' manner.

5.1.3. Neutral views

Two comments were given that were categorized as neutral (see Table 4). These were both given as responses to previous comments and were categorized as replies.

Insert Table 4 around here

The number of neutral comments was small. It can be speculated that this was due to the characteristics of the media channels and to the general style adopted in writing comments. Alternatively, it might be due to the nature of the commentators themselves, but this low number supports the notion that the discussion is fairly black-and-white although based on vague knowledge. The small number of neutral comments may also indicate that people want to take a stand on this delicate issue and thus they wish to show their opinion on the matter through the tone of their comment. The tone of these neutral comments differed significantly from that of the positive and negative comments, but this may be 'lost in translation'. The comments also followed a discussion and even though they do not directly mention robots, they form part of the robot discussion.

5.2. Interviews

5.2.1. Management

Management saw Zora very positively and all three of them expressed positive attitudes towards Zora. When the Zora robot was first introduced to them at a management meeting, the management generally experienced an instant 'crush' towards the robot: '*It was interesting to notice the enthusiasm towards the robot, people immediately thought that we should have this, some sort of crush-reaction happened and people went outside of systematic thinking. This was because we have had the idea of trying to get new experiences and insights into technology*'.

Some comments were made about Zora from a more personal perspective: '*This was something I wanted to try, whether it fits with social and healthcare services. I myself work a lot with technology. Robot is not that different from our other devices. We have much more complicated devices than Zora. Zora is one tool among others*'. '*I am very excited about this* [Zora] *and it is wonderful that I am allowed to be excited, now I do not have to hold back anymore. If I stop being excited about work, then I need to change* [my occupation]'. It was clear that management group were enthusiastic about Zora and were able to see the benefits of it from an early stage. They also wanted to be seen as forerunners who were willing to try new technological solutions.

The management had also followed the public's comments. They considered public discussion to be important so that people could understand the use of robots in welfare services. Naturally, the publicity had affected those who had made the decision to purchase the robot and the nature of the publicity had surprised them: '*Most surprising has been that I have received direct phone calls and the whole of our management has been insulted saying that we despise people. I received both emails and phone calls. As an office-bearer I could do nothing but listen and say, "Thank you for your feedback". Luckily, we have the support of upper management,* [name removed] *who said that this is part of being a forerunner. Unlike the negative feedback, no positive feedback has come via phone or email. But in practical situations, I have received positive feedback*'.

While the management had decided that they would not reply publicly to the media discussions, they had followed the discussion and replied to some of the comments in their interviews. For example, they noted that the funding for Zora should have been communicated better since the

public seemed not to know where the funding for Zora had come from: '*We did not use the city's funds but a fund from a will*'.

The management had not expected the public to be so negative about Zora when they themselves saw it so positively: '*It has surprised me how people can be so uncomprehending and prejudiced, are people really so poor at looking and reading? Is the gap really this big—what kind of image do people have of elderly-care services? Do* [we] *still have that much to do, what kind of an impression do people have of the elderly persons living in elderly care? That brought me "back to earth". On the other hand, it really is important that since we bought this kind of robot the discussions have arisen. People are starting to realise and understand what this is about and who does what with it. Maybe, at some point, a robot can replace something, but never the human presence*'.

5.2.2. Care personnel

The care personnel only heard about the acquisition of Zora after it was already purchased so they had no part in the purchase process. They experienced both fears and interest in relation to the use of Zora: '*But I have fears. Need to be in the service of humanity. Generally, it has been spoken about that the robots will take over. They will change a lot, is it going too far? What about that little person, is that fragile elderly person to be home alone at the end among the robots?*' In contrast, a nurse noted: '*I have no fears. I have heard about them, though. But I belong to the younger generation; I know that we need to take care of you* [the older generation]. *I think that Zora is wonderful, but I do not see it as my own tool in the future*'.

The care personnel had also noticed the articles in the media and they had received comments themselves about the use of Zora, for example: '*I have talked about it with many people. I thought that people do not watch the news, but actually, people do. I have then told* [about Zora]*, I have spoken with many persons, quite positively. They have been asking what we have done with it and so on*'. The care personnel were unanimous regarding the fact that Zora could not replace them, which was one of the most important arguments that arose in the media discussion. They had hoped that the publicity around Zora would be better organized and that the public would be informed about the important facts. For example, the comment was made: '*People are quick to comment when they do not know. This is still in the early phase, so there is limited knowledge about what can be done with it, how it will evolve; people should be told that it is still under development*'. Other comments discussed the acquisition: '*[It] should have been brought up, where the money came from, etc., and that it won't replace anyone*', and '*there should have been articles in newspapers*

that clearly explained where the money came from and what it [Zora] *does. The articles suggest that the money is taken away from something, away from care. These are misunderstandings'.*

Care personnel had also received face-to-face comments about the acquisition of Zora, mostly about the funding: '*It should be clearly told that the acquisition used money that was intended for technological development, the Zora was acquired with that money. The comments have been humorous but it still needs to be said that no taxpayers' money was used!*'

The care personnel had noted the public discussion, and despite the comments in the media had been negative, most of them had positive feelings about Zora. They mostly saw Zora as a tool that could be used to bring variation into the daily lives of the elderly. They also wished that they had more time to get to know Zora and its functions. It was evident from the interviews that the care personnel felt that the public lacked knowledge about the acquisition of Zora. The largest number of comments was about the funding for Zora, and the personnel felt that the articles should have communicated to the public about Zora's funding. The public's concerns could have been reduced had they had more knowledge about the funding. The care workers had hoped that the publicity about Zora would be handled in a more constructive manner. As it was now, the care personnel were the ones who received negative comments face-to-face even though it was not they who had decided on its acquisition.

5.2.3. Students

The students who operated the robot were mainly positive or else neutral about the robot. They generally saw it as a device that could bring joy and possibilities into the rehabilitation of the elderly: '*The robot is part of a recreational event, it is just part of an event. It is a device that is used to create an interaction*'. '*It is not just a thing that you put there. It supports the interaction between the personnel and the customer very well*'. '*The contact that happened between us, Zora and the elderly persons was at times very delightful*'.

One student noted that '*at the beginning I thought that if this is about to replace a nurse, it is the worst possible invention. But when I was able to turn my thinking away from that direction and think that this is useful, then I was able to see it in a new way and see the positive side. It's just that people are thinking about where the money goes* [with the robot]'.

Based on the students' comments, it became apparent that they saw the robot positively and thought about it as a recreational tool for the elderly. They never saw it as a replacement for nurses but rather as a tool to add a new kind of content to the elderly people's exercises.

Students had also noted the comments in the newspapers: '*Comments in the newspapers were amusing to me. I started my morning by going to* [name removed] *and reading in the newspaper that I go there to mislead the people and to make fun of the grannies* [laughter]'. This indicates that even though they acknowledged the comments, they continued their work with Zora.

Students also noted the kinds of negative arguments that were used in the public discussion and gave their own points of view: '*Those people who say that the robots will replace a nurse, they do not have a realistic understanding about the use of a robot, these people have only seen Terminator, not a 50 centimetre high robot. How could it replace a nurse? It cannot lift a person off the toilet, give CPR, distribute medicines or give a diagnosis. Such a terrible delusion, even though in the newspaper there were clear indications about what the robot can do, there are still those excessive generalisation that Skype is coming and that nurses are going*'.

The comments in the newspapers made the students feel that they had to justify their work with the Zora robot and to do something 'visible' with it so that the people who had commented negatively on its acquisition could see the benefits of Zora: '*that kind of feeling that this expensive [*robot*] was bought and when the people outside heard about it, there was pressure to do something so that people are able to see* [Zora]*, and justify that this device that costs the same amount as a small car is a sensible purchase and a good decision*'. The students were able to take the comments with humour although the comments related directly to their work.

6. Discussion

This study investigated attitudes and opinions towards the use of robots in elderly care. Two different datasets were used, but they were both concerned with the same phenomenon: the publicity around a robot pilot. The publicity was considered from two sides: the people who interfaced with the robot (in this case the management, care workers and students); and the people who read about, listened to or watched something and then commented on what they had read, heard or seen (the public). In this modern world where information technology is within everyone's

reach, people tend to comment anonymously over the Internet about many different things. These anonymous comments were used as our data source for the public opinion.

A classification of the comments in the media resulted in six categories of positive comments and nine categories of negative comments. These categories reflected different views or opinions that readers held towards the Zora robot. In addition, there were a few ambivalent or conditional views that included both positive and negative aspects; for instance, that the use of a robot would be acceptable provided the people could still get necessary medication from a caregiver. The results showed that the overall attitude was negative, with 70% of the comments being classified as negative. These results are in line with the results of the Eurobarometer (2012), which stated that almost 80% of the respondents would not accept the use of robots in health care, and with results noted by Sharkey and Sharkey (2012). It seems that media discussion concerning the use of robots in social and health care is typically quite black-and-white, as was also observed in this study. There were only two comments that were multi-faceted, that is, contained both positive and negative aspects.

The negative comments given were similar to the six concerns about the use of robots in elderly care listed by Sharkey and Sharkey (2012), which were mentioned in the introduction to this paper. For example, the category 'loss of human care' deals with similar issues as two concerns that Sharkey and Sharkey (2012) reported: (1) a potential reduction in the amount of human contact and (2) an increase in feelings of objectification and loss of control. Zwijsen et al. (2011) also reported that the elderly need and miss human contact in their daily lives—especially in care homes. Thus, it seems that the concerns and reactions are similar, regardless of the country. In earlier research, robot use in healthcare related contexts was mainly considered negatively due to people considering it inhumane for a robot to take care of a person. That attitude is expressed even when there is no question of care workers being replaced by robots. The belief that the use of socially assistive robots is aimed at replacing human beings or human tasks is probably related to the production sphere in which that logic does apply and where the introduction of robots was primarily aimed at replacing workers with machines, which were considered more efficient. This line of thought can lead to the fear that the same logic will be repeated in the field of care (Taipale et al., 2015).

The persons interviewed who worked with the robot had noticed the comments in the media. Some found them somewhat disturbing in relation to their own work. The main concern for the people who worked with Zora was that the funding of the Zora robot was not communicated to the public. Furthermore, the comments in the media did not reflect the fact that the Zora robot was not intended

to replace human contact, rather to provide help for the care personnel and bring change into the daily routine of the elderly. The care personnel who had used Zora mentioned that it would not replace them in their work. They also noted that they would need more time to learn how to use Zora in order to realise its full potential. The management, particularly, saw the Zora positively. They were enthusiastic about it and considered Lahti to be a forerunner in elderly-care services in Finland. The management had also noted the comments in the media and received direct phone calls. They noted that they should have communicated the purchase of Zora a bit differently so that the public could have been as positive in their response to it as they themselves were.

Based on the results, it would seem that, at present, the use of robots in social and healthcare services and in everyday life is accepted by the so-called innovators (see Rogers, 2010). In this case, the early adopters are the managers who were eager to pilot Zora in elderly-care facilities in Lahti. However, to increase the interest of the early majority, it is important to increase the number of pilots and to spread information about their results, both the benefits and the pitfalls. In this case, the early majority were the care personnel who worked with Zora; they seemed to have hesitations at first, but in the end they accepted Zora with a few reservations. Thus, it is now up to the innovators and the early majority to increase public knowledge about this pilot, for example, through publicity that reaches the late majority. The comments in the media reflect the late majority very well because these commentators expressed their doubts about the use of robots in welfare services. The culture of piloting is an opportunity to increase experience-based knowledge regarding the systemic and human impacts of socially assistive robots as well as the resources needed, such as skills and expertise (Kyrki et al., 2015). It is thus important that the comments and ideas of the general public are acknowledged early on so that they too can accept the use of the new innovations. If appropriate innovations are to be used in future, it is not enough that only the innovators motivate for the use of robots in elderly care.

A limitation of this study is that the comments vary according to the media type (newspaper, tabloid, or broadcasting company's website) and the comment system (SMS or website). The sources appear to have an impact on the comments made. It might be, for example, that comments sent via SMS come from people who normally read the paper version of a local newspaper and, after reading a story, feel the urge to give their opinion immediately. It was important to pursue all the different sources of comments about the introduction of robots in order to understand how wide the interest is in the use of robots in elderly care. However, the number of comments used in this study is comparable to that in other studies looking at media comments: Lee (2012) reports that, on average, one article receives approximately eight comments. In our case, an even higher number of

comments was received. Further, it has been shown that when an article is newsworthy, it is bound to receive comments from readers (Weber, 2014). This response supports the notion that the use of robots in welfare services is a delicate issue and thus should be open for comment.

The comments in the media were given anonymously, and thus it is not possible to discover the role or background knowledge of the commentators. It would have been interesting to examine whether there were differences between different groups. It is also probable that the people who give their opinions in these forums are active personalities who will express their opinions readily. More reserved-type personalities may not participate in this kind of discussion. The study does, however, open a discussion about how to involve the public in the development of care services: it provides space for people to express their ideas and for their concerns to be taken seriously. There is an obvious need for more discussion on how to use robots in elderly care and how to involve the general public in such deliberations in a constructive way. A media discussion does not take place in a vacuum; it also impacts its surroundings. It could be characterized as a forum for 'pre-acceptance' viewpoints. For example, Broadbent et al. (2010) report that acceptance of robots is affected by prior exposure to robots in literature or in entertainment media. Ultimately, the view of how robots are perceived and what roles they play is socially and culturally constructed through social interaction (e.g. Jones, 2017; Šabanović, 2014). Thus, it is important to acknowledge the media discussion as an arena of this interaction. Further, it may be difficult to broaden the research scope to involve many different robots, but in the future it may at least be possible to broaden the scope to consider different functions of the same robot. This study dealt with this issue by analysing the use of a robot in elderly care from two different perspectives: from the perspective of those who used the robot and from the perspective of public discussion.

7. Conclusion

The study confirms that more research is needed to investigate the opinions of the general public and the reasons behind those opinions. Based on the results, it would seem that the use of robots may not be viewed entirely negatively, but the context of their use in elderly care is the factor of greatest concern. The comments clearly show that the general public will need more information— and also practical examples—on how robots can be used in elderly care. The comments from interviews verified that when there is experience of robots, the response to them is more positive. Thus, the comments on the media seem to be more at an 'opinion level', whereas the comments from the interviews are based on experience. Based on these results, it was clear that the public also

needs reassurance that robots are not intended to replace human nurses, but rather to function as additional tools for elderly users and for professionals, or to provide recreation for the elderly. It is important that the unfiltered views of the public regarding the use of socially assistive robots in health care are understood so that they can be taken into account when introducing robots into new environments. For example, the public could be involved in the implementation process and in the design of robots' tasks, for instance, by organising joint workshops.

It seems that public engagement is an important factor in the acceptance of the use of socially assistive robots (e.g. Wilkinson et al., 2011) because it may be difficult to accept innovations that come 'from above', but when services are co-produced attitudes may change (Šabanović, 2010). Thus, to follow the discussion that revolves around the use of robots in elderly care is to find the opportunities and potholes that will have an important effect on the purchase of robots in welfare services and also to guide how they should be introduced to the public. Further, societal acceptance of robots has many different aspects: the public discussion, the different robot pilots (e.g. Niemelä et al. 2017), the experiences of early innovators, and the acceptance of the use of robots in daily working life and so on. For example, how the robots are introduced to care personnel (to those who will use the robots) will eventually have an effect on the customers' experience of the robots. It is important to facilitate societal acceptance for this major socio-technical transition by increasing and refining the knowledge of the general public so that they can see that the appropriate use of robots in elderly care may be an opportunity rather than a threat. The media must carry its share of responsibility in bringing about this transition.

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Figure and Table legends

Figure 1. Left: The Zora robot; right: Zora instructing exercises for the elderly (photos: Satu Pekkarinen).

Table 1: Different types of comments

Table 2. Positive comments
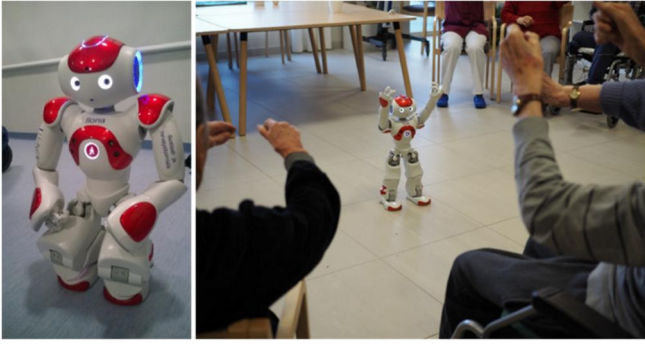
Table 3. Negative comments

Table 4. Neutral comments

Figure 1

Dataset	Number of comments		
	Positive	Neutral	Negative
National tabloid (NT)	1	-	9
Local newspaper (LN)	0.5	-	13.5
SMS column (SMS)	-	-	11
Broadcasting company (BC)	26+(2x0.5)	2	42+(2x0.5)

Table 1

#	Name of the category	Amount / Dataset				Example comments
		NT	LN	SMS	BC	
1	Overall positive attitude towards robots	-	-	-	6	*"I believe that these science fiction stories are one reason why people are so afraid of robots. I can tell you that I have read and watched many "bad robot" stories and a few "good robot" stories as well. I have built and programmed robots, and keep track of their development, from care robots and sex robots to industry robots and research robots. Thus, I believe my general view on robots is much better informed than yours but I think that robots are not yet ready to be used, but will be in the near future. And I think that they are a good solution. […]"* (BC)
2	The robot as an assistive device	-	-	-	14	*"Would you like a person to wash your laundry instead of a washing machine? Would you like a person to take you to run your errands in a carriage that the person is pulling instead of driving yourself? […] You are not reading this message from your computer? Everyone living in a welfare state uses robots that do the work of approximately 100 people in their normal everyday activities. Why are so many people afraid of adding the work-share of one more person on top of that?"* (BC)
3	Independence through robots	-	-	-	10	*"A robot cannot replace all human interaction. But at their best, robots allow you to maintain independence until the end."* (BC)
4	More reasonable work tasks for human caregivers	-	-	-	3	*"People can then focus on human interaction."* (BC) *"The task of a person is to be human: to discuss, ponder, comfort, surprise."* (BC)
5	Consistent and accurate work of robots	-	-	-	10	*"[…] Probably a robot does some chores automatically. Takes out garbage and cleans, for example, every time you do not need its services. This kind of robot is not easy to make, but it is not impossible either, or even very difficult when one slices the problems into pieces. We already have, for example, cooking robots and we already have robots that recognize speech."* (BC)
6	Use of robots with other groups as well (e.g. children)	1	1	-	-	*"Care robots also in a kindergarten. It would create savings and kids would love it."* (NT) *"Interesting and fun technology where students can test their abilities and evolve in their field. Similar devices will most likely have diverse usages in future."* (LN)

#	Name of the category	Amount / Dataset				Example comments
		NT	LN	SMS	BC	
7	The price and funding of the robot	1	5	3	4	*"Many unemployed could come to work and be cheaper and more eco-friendly than robots, and they would not get hacked. They could have an aptitude test to work in the field and one year of study instead of 3-5 years, more education could be given on a regular basis or when needed."* (BC) *"I could pay 100 euros for a second-hand one. That is how much toy robots cost."* (LN) *"With the money that was invested in this thing we might have hired a real person for months, if not years. Sad to read, a machine is a machine and a human is human. I wonder who makes these decisions and with what motives?"* (NT)
8	Use of the caregivers' time	-	3	2	-	*"I wish that the robot could take care of the elderly. In another story it was clear that the robot needs a supervisor the whole time. Why not have the supervisor give the exercise instructions and dance the Macarena? […]"* (LN) *"Nurses bring the residents to take part in the exercise, the robot instructs them, the nurses take the residents back to their own rooms. Tell me how this saves money?"* (SMS)
9	A loss of human care	4	3	2	20	*"I really do not want a robot to take care of me. The elderly now are not ready for robots, because a robot does not replace a humane human voice or a hand that can help or comfort when needed. Robots can be used in forestry or industry but not in any case in care."* (BC) *"Elderly people do not accept a robot as a care-giver. Insist on having a human instead because you have earned humane treatment and respect."* (SMS) *"A person, also an elderly person, needs contact with a real human who is a warm, empathetic listener and does not care for cold robots. Is this what the care and respect of the elderly has become? 'Robots' do not replace a nurse with a beating heart. Disgraceful!"* (NT)

10	Robots taking jobs	2	1	1	5	*"And commercial media is enthusiastic about this entrepreneurship innovation that saves the personnel costs of care companies. The limitation is that a robot cannot be used in medical care". Duh, we already have these rental doctors."* (LN) *"People as unemployed and robots as employees? Humanity or greed? O.o"* (NT)
11	Technology fails	-	-	-	5	*"How about, while lifting, the finger is caught in the middle and a robot cannot hear you scream, and the emergency button has fallen on the floor?"* (BC) *"At their worst, they* [robots] *push you in between a wall and a toilet."* (BC)
12	Benefits of a robot	-	-	-	2	*"This introduction to human-looking robots is ridiculous. Much more benefit is gained by developing different types of functional aids. I laughed myself almost sick, when I was watching on television a robot that instructed exercises. Better results would have been achieved with a large TV screen where a pretty young girl could have instructed on the exercises. The results would have been better, and many times cheaper. […]."* (BC)
13	Impacts on well-being at work (i.e., if people like their jobs)	-	-	-	3	*"When human employees are feeling well and they like what they do in their jobs without a rush and a profit target ([…]), a client will be well and humanely taken care of, opinions will be heard and the best effort will be put into their well-being."* (BC) *"Yes, when one has been a patient some time, it makes one wonder how the care workers previously had the strength to move the patients. Nowadays, there are aid devices but helping hands are not hired any more. Instead, more salary is demanded. even by going on strike[…]"* (BC)
14	The fear of progress	1	-	-	8	*"It would be my pleasure to believe in mankind more than this, but if this is where mankind is going, it is an unpleasant direction. Similarly to Sea Capten* [one commentator], *I can only say that luckily my own years to live are limited and I can only hope that this "development" does not impact me. I feel sorry for the victims in the "future". The victims of humanity itself, that is. What kind of a person develops these?"* (BC) *"The world in year 3000 is a kingdom of robots. Robots will take the power from mankind. Luckily I and my husband will not be here to see the fight "Robots vs. Mankind".* (NT)

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15	Overall negative attitude towards robots	1	2	3	7	*"I am an elderly person, but I have never been asked, how I want to be taken care of someday, when there is the need. These robot-enthusiasts sound as silly as the nerds that develop the programmes. There is always a new user interface, one after another, for the computer or the* [mobile] *phone, even though the old one is still good enough."* (BC) *"A joint care robot? Everyone should acquire their own kissing and hugging robot."* (LN) *"Sad, and pathetic…What else can elderly people do than to laugh at this kind of silly thing, and at the lack of nurses. Similarly, a small baby will laugh at a clumsy cane doll….."* (NT)

Table 3.

#	Name of the category	Amount / Dataset				Example comments
		NT	LN	SMS	BC	
16	Replies to comments	-	-	-	2	*"Esteemed relative, I am sorry if you have had this unpleasant experience with nurses. I hope that you have contacted the official channels about the matter and hopefully you find objective supporters. […] Have a nice Spring and I hope that you have a good life!"* (BC) *"[…] We Finnish people might be a tad too proud and too self-satisfied in thinking that we do not need any help. But where is it said that one cannot turn to loved ones, and to by passers, if needed? Those situations can become wonderful encounters and one finds out that the random by-passer is indeed a good person."* (BC)

Table 4.

"Robots do not replace a nurse with a beating heart": The publicity around a robotic innovation in elderly care

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