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No thank you to humanized robots: attitudes to care robots in elder care services

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\textbf{ABSTRACT}  
The growing older population will increase the demands on the health and welfare systems, including elder care services. One way of meeting these growing service needs is to shift from traditional care services to technologically oriented services. Robotic innovations are gradually being introduced to elder care services. The aim was to explore attitudes toward the use of care robots in elder care services – specifically focusing on situations and interaction, influence, and emotions in interaction with care robots. Data were obtained from visitors at a welfare technology fair (n = 124). The results show that the most negative attitudes concerned if the care robots were humanized and had emotions. The attitudes toward interacting with care robots in general were predominately positive. In conclusion, concrete usage scenarios in elder care services need to be detected, based both on users’ needs, digital literacy and on the maturity of the technology itself.

\textbf{Introduction}  
The demographic trend with an aging population, comes with an unprecedented set of challenges in terms of healthcare and welfare service provision. Preventive and supportive work is often advocated to focus on allowing older people to live longer in their own homes and on delaying age-related health and social care needs (Bloom et al., 2015; Chelongar & Ajami, 2021; Hudson, Orviska, & Hunady, 2017; World Health Organization (WHO), 2017). Services that enable older people to remain in their own homes is promoted to reduce the burden on health and welfare systems (Coyte, Goodwin, Laporte, & Organization, 2008; Stephens, Breheny, & Mansvelt, 2015). One way of meeting these service needs is the shift from traditional care services to technologically oriented care services. A growing body of evidence suggests that so called welfare technology can support a healthy and independent life and can thereby help people to live with retained integrity, contribute to
efficiency in elder care services and meet individuals’ needs for living independently (European Commission, 2013; Lee & Coughlin, 2015; Peek et al., 2016; Smarr et al., 2014).

Robotic innovations are one kind of welfare technology, which is increasingly introduced to welfare services, including elder care services. Assistive robots for older people can come in the form of rehabilitation robots that focus on physical assistive technology, service robots used to support the basic tasks of independent living, and companion robots that aim to enhance health and social wellbeing (Kachouie, Sedighadeli, Khosla, & Chu, 2014). Robots assisting with monitoring health behaviors in the home environment is another area of use (Hudson et al., 2017). In this paper, we will use the term care robots when referring to robotic innovations utilized in elder care services.

According to Royakkers and van Est (2015), the use of care robots should be viewed in the light of the current development and deployment of home automation. Smart technologies, which are being widely incorporated into our environments, are the prelude to a future home with robots. An increasing number of robotics research in supporting care for older people focuses on integrating robotics technologies into homes (Abou Allaban, Wang, & Padir, 2020). Care robots have been described as having great potential for improving older people’s quality of life (Obayashi, Kodate, & Masuyama, 2018), but can also have positive impacts for family members, care professionals, and the broader society (Khosravi & Ghapanchi, 2016; Melkas, Hennala, Pekkarinen, & Kyrki, 2020). Care robots can assist older people in different ways; for example, by enriching their social lives and connect with families and friends, supporting people with dementia, and by assisting in rehabilitation and physical recovery. Care robots can also assist people when getting out of bed, walking, facilitate mobility by robotic wheelchairs, and helping in tasks like eating, drinking, and managing personal care. Moreover, telepresence robots can enhance contact and interaction with care professionals in a more natural way than when using video calls (Christoforou, Panayides, Avgousti, Masouras, & Pattichis, 2020). Examples of robotic innovations that are currently being tested or used in Sweden are medication reminders and dispensers, social pet-like robots for persons with dementia, eating aids, shower robots, and smart toilets (Swedish National Board of Health and Welfare, 2021).

The “robot revolution” has been predicted by manufacturers to solve the growing shortage of care professionals; however, the utilization of robot technology is not yet widespread in elder care services (Abdi, Al-Hindawi, Ng, & Vizcaychipi, 2018). Beyond technical limitations, reasons for difficulties in the dissemination of care robots include care professionals’ identities and roles, usability and accessibility problems, fears, and ethical issues (Pekkarinen et al., 2020; Turja, Taipale, Niemelä, & Oinas, 2021). Moreover, the general attitudes toward robots are of fundamental importance in the dissemination of
care robots in elder care services. Individuals’ attitudes toward a technology are known to affect their decisions about its use (Venkatesh, Morris, Davis, & Davis, 2003). Backonja and colleagues (2018) found that older, middle-aged, and younger people were generally supportive of, or neutral, toward robots. They had, regardless of age, similar attitudes – positive as well as negative – regarding the social impacts of and comfort with robots in general. Naneva and colleagues (2020) also concluded that people have a general positive attitude toward care robots. However, people tend to be less positive toward the use of care robots in elder care services (Hudson et al., 2017; Johansson-Pajala & Gustafsson, 2020). Hall and colleagues (2019) found that, regardless of age, people were the least comfortable having their old parents cared for by a robot, compared to how they felt about robots performing tasks in general like lifting things, detecting falls, or taking vital sign assessments (e.g., blood pressure).

Knowledge about current attitudes is essential for the development of the technology and implementation strategies. This is especially relevant in relation to the use of care robots in elder care services, since the attitudes toward using robots in this context seem to be more negative than the attitudes toward the use of robots in general (Hall et al., 2019; Hudson et al., 2017). In the present study we explore the attitudes of the visitors at a fair on welfare technology, which focused on technology that can facilitate a prolonged independent life. Assuming that the visitors would have an interest in welfare technology, our hypothesis was that the attendees would be predominantly positive about the use of care robots in elder care services. Consequently, the aim of the present study is to explore the visitors’ attitudes toward the use of care robots in elder care services, specifically focusing on situations and interaction, influence, and emotions in interaction with care robots.

**Material and methods**

**Design, setting, sample, and data collection**

This study was a cross-sectional descriptive study based on data collected from a welfare technology fair in the mid-east region of Sweden on two separate occasions: in 2018 and 2019. The fair is an annual event that has been running since 2017. It is organized by a local and regional organization for seniors in collaboration with local municipalities, the university, and research and development center. The welfare technology fair aim to inform and demonstrate available assistive technology and welfare technology facilitating prolonged independent life, and it offers presentations on welfare technology research.

Researchers approached visitors at the fair and described the study to interested visitors. Those who agreed to participate were presented a bulletin board displaying several pictures of different care robots used for social,
physical, and mental stimulation, as well as for communication. Some examples were mobile robot assistants designed for supporting older people in their daily lives, social robots used for improving life for people with dementia, shower assistance robots, and humanoid robots designed to assist caregivers – for example by supporting and promoting activity in older people. The interested visitors were then asked to respond to a questionnaire that consists of questions about attitudes toward care robots in elder care services. Each visitor was given the questionnaire in paper and a pencil whereupon they responded to the questionnaire on site and returned their responses to the researchers. Demographic data was gathered regarding gender, age, and education level. The respondents were informed about voluntary participation and confidentiality.

Instrument

The questionnaire in this study was a revised version of the NARS (Nomura, Suzuki, Kanda, & Kato, 2006a), which was developed for measuring peoples’ attitudes toward communication robots in daily life. The questionnaire has also been used to explore differences in peoples’ behavior in live human-robot interactions (Nomura et al., 2006b). Its internal consistency, content and construct validity, and test-retest reliability has previously been confirmed by Nomura and colleagues (2006) and Syrdal and colleagues (2009). The questionnaire consists of 14 items divided into three subscales (Figure 1).

Subscale 1. Situations and interactions with robots
4. I would feel uneasy if I had to use robots in my daily life
7. The word ‘robot’ means nothing to me.
8. I would feel nervous operating a robot in front of other people.
9. I hate the idea that robots or artificial intelligences were making judgments about things within elder care.
10. I would feel very nervous just standing in front of a robot.
12. I would feel paranoid talking with a robot.

Subscale 2. Social influence of robots
1. I would feel uneasy if robots really had emotions.
2. Something bad might happen if robots became more like human beings.
11. I feel that if I depend on robots too much, something bad might happen.
13. I am concerned that robots would be a bad influence on older persons.
14. In the future, I think there will be many robots in the care of the elderly.

Subscale 3. Emotions in interaction with robots
3. I would feel relaxed talking with robots in elder care. *
5. If robots had emotions, I would be able to make friends with them. *
6. I would feel comforted being with robots that have emotions. *

Figure 1. Items sorted by subscales. NARS-rev = Revised version of Negative Attitudes toward Robots Scale (Nomura, Kanda, & Suzuki, 2006a). * = Reversed response.
negative attitudes toward situations and interactions with robots (Subscale 1 – six items), negative attitudes toward social influence of robots (Subscale 2 – five items), and negative attitudes toward emotions in interaction with robots (Subscale 3 – three items). The items are all negatively worded except for the three items in Subscale 3. The responses in Subscale 3 were therefore reversed before analysis.

A five-point Likert scale was used for responses, where 1 corresponds to fully disagree (very positive attitudes) and 5 corresponds to fully agree (very negative attitudes). The maximum total score for the NARS is 70, and for the subscales, 30, 25, and 15, respectively – with higher scores indicating more negative attitudes. In the present study, internal consistency calculated was Cronbach’s alpha .72. The NARS was translated into Swedish and adapted to the current context of elder care by adding the words elder care service or older people into three items (items 3, 9 and 13). The title of the questionnaire stated that it focused on attitudes toward care robots in elder care services. Additionally, a few words were changed to better confirm the nuanced differences of the Swedish language (NARS-rev).

Data analysis

Descriptive statistics of demographic data were calculated. Kruskal–Wallis test was used to analyze differences between three subgroups. Missing values were 1.4% of the entire data and were distributed randomly, thus suggesting no bias, and multiple imputation of missing values was performed. The overall significance level was set at $p \leq .05$. Statistical analyses were performed using IBM SPSS Statistics version 26.0 for Windows.

Results

Description of study sample

The results are based on 124 adults (MD age = 73), of which 82 (66%) were women. The majority were in the age group 66–75 years ($n = 63; 51\%$), and a majority had a university or university college education ($n = 72; 58\%$) (Table 1).

Participants’ attitudes toward robots in elder care services

The median score of the total scale was 38.5 ($q1–q3 = 31.25–46$), indicating an overall slightly negative attitude toward robots in elder care services (Table 2). The median score for Subscale 1. Situations and interaction with robots was 14 ($q1–q3 = 10–18$). Significant variation was found in relation to level of education. Participants with a university or university college level of education held significantly more positive attitudes (MD = 13; $q1–q3 = 10–17$) than participants with an upper
The Table 1. Demographic data for participants (n = 124).

<table>
<thead>
<tr>
<th>Age group</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>19–65 years</td>
<td>23 (19)</td>
</tr>
<tr>
<td>66–75 years</td>
<td>63 (51)</td>
</tr>
<tr>
<td>76–94 years</td>
<td>38 (31)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>82 (66)</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>39 (32)</td>
</tr>
<tr>
<td>Unspecified, n (%)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Highest level of education</td>
<td></td>
</tr>
<tr>
<td>Elementary school, n (%)</td>
<td>19 (15)</td>
</tr>
<tr>
<td>Upper secondary school, n (%)</td>
<td>33 (27)</td>
</tr>
<tr>
<td>University or university college, n (%)</td>
<td>72 (58)</td>
</tr>
</tbody>
</table>

secondary school level of education (MD = 16; q1–q3 = 12–22) when checked for pairwise comparisons between the three levels of education. The median score for Subscale 2. Social influence of robots was 16 (q1–q3 = 13–18). The median score for Subscale 3. Emotions in interaction with robots was 9 (q1–q3 = 7–11.75) (Table 2).

In subgroup comparisons (Table 3) for the three subscales, Subscale 2. Social influence of robots included predominantly negative attitudes for three out of five items. Subscale 3. Emotions in interaction with robots included predominantly negative attitudes for two out of three items. Subscale 1. Situations and interaction with robots included predominantly positive attitudes for all six items.

Furthermore, at the single-item level, the participants had more negative attitudes for the following items: 1. I would feel uneasy if robots really had emotions.; 2. Something bad might happen if robots became more like human beings.; 5. If robots had emotions, I would be able to make friends with them.; 6. I would feel comforted being with robots that have emotions.; and 14. In the future, I think there will be many robots in the care of the elderly. The common denominator for items 1, 2, 5, and 6 is that the items explore attitudes toward humanized robots with emotions.

Discussion
The aim of this study was to explore attitudes toward the use of care robots in elder care services, specifically focusing on situations and interaction, influence, and emotions in interaction with care robots. The results indicate an overall slightly negative attitude toward care robots in elder care services. Most negative attitudes were related to humanized robots with emotions, while the most positive attitudes concerned situations and interaction with robots.

Item 14, about whether there will be many care robots in the future elder care services, generated the most negative attitudes (80.6%). Beyond this, the four items (1, 2, 5 and 6) with the most negative attitudes (36.3%–42.7%) were related to care robots being like humans or having emotions (Table 3); feeling uneasy if robots had emotions, that something bad might happen if robots
Table 2. Subgroups comparison of participants’ (n = 124) attitudes toward robots in elder care services – scores for total scale and subscales. Higher scores indicate more negative attitudes.

<table>
<thead>
<tr>
<th>NARS-rev</th>
<th>Total scale</th>
<th>Subscale 1. Situations and interaction with robots</th>
<th>Subscale 2. Social influence of robots, MD</th>
<th>Subscale 3. Emotions in interaction with robots, MD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible range</td>
<td>14–70</td>
<td>6–30</td>
<td>5–25</td>
<td>3–15</td>
</tr>
<tr>
<td>All participants, n = 124</td>
<td>38.5 (31.25–46)</td>
<td>14 (10–18)</td>
<td>16 (13–18)</td>
<td>9 (7–11.75)</td>
</tr>
<tr>
<td>Age group</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19–65 years, n = 23</td>
<td>37 (31–42.5)</td>
<td>12 (10–15)</td>
<td>15 (13–18)</td>
<td>9 (7–10.25)</td>
</tr>
<tr>
<td>66–75 years, n = 63</td>
<td>39 (31.5–45)</td>
<td>14 (10–18)</td>
<td>15 (12–17)</td>
<td>9 (7–11)</td>
</tr>
<tr>
<td>76–94 years, n = 38</td>
<td>41 (34–49)</td>
<td>14 (11–18)</td>
<td>17 (13–18)</td>
<td>9.5 (8–13)</td>
</tr>
<tr>
<td>p-value&lt;sup&gt;a&lt;/sup&gt;</td>
<td>318</td>
<td>289</td>
<td>407</td>
<td>299</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female, n = 82</td>
<td>39 (31–46)</td>
<td>14 (10–18.25)</td>
<td>16 (13–18)</td>
<td>9 (7–11)</td>
</tr>
<tr>
<td>Male, n = 39</td>
<td>36 (32.5–45)</td>
<td>13 (10–17)</td>
<td>14 (13–17.5)</td>
<td>9.5 (8–12)</td>
</tr>
<tr>
<td>Unspecified, n = 3</td>
<td>38 (34–42)</td>
<td>17 (13–17)</td>
<td>16 (15–16.5)</td>
<td>7 (6–9.5)</td>
</tr>
<tr>
<td>p-value&lt;sup&gt;a&lt;/sup&gt;</td>
<td>908</td>
<td>902</td>
<td>654</td>
<td>418</td>
</tr>
<tr>
<td>Highest level of education</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elementary school, n = 19</td>
<td>36 (33.5–44)</td>
<td>13 (10.5–18.5)</td>
<td>15 (12–17.5)</td>
<td>10 (8–10.5)</td>
</tr>
<tr>
<td>Upper secondary school, n = 33</td>
<td>42 (35–51)</td>
<td>16 (12–22)</td>
<td>16 (14–19)</td>
<td>9 (8–12)</td>
</tr>
<tr>
<td>University or university college, n = 72</td>
<td>38 (30–44)</td>
<td>13 (10–17)</td>
<td>15 (13–18)</td>
<td>9 (7–12)</td>
</tr>
<tr>
<td>p-value&lt;sup&gt;a&lt;/sup&gt;</td>
<td>115</td>
<td>020</td>
<td>329</td>
<td>791</td>
</tr>
</tbody>
</table>

MD = median, NARS-rev = Revised version of Negative Attitudes toward Robots Scale (Nomura, Kanda, & Suzuki, 2006). q<sub>1</sub>–q<sub>3</sub> = the 25th and the 75th percentile – Tukey’s Hinges, <sup>a</sup> = Kruskal-Wallis test – Asymp. Sig.
became more like humans, to be comforted by robots with emotions, or become friends with robots with emotions. For the latter four items, between 30.6% and 41.1% of the participants neither agreed nor disagreed (neutral attitudes), which suggests an uncertainty in the matter.

The idea of care robots being like humans or having emotions, may be connected to their appearance. Robots with humanoid appearances tend to be less accepted than machine-like robots (Wu, Fassert, & Rigaud, 2012), although older persons with mild cognitive impairments appear to prefer socially assistive robots that were human-like, with expressive faces and arm gestures. They perceived those robots to be more useful and were more inclined to keep them in their homes (Morita, Lin, Nejat, & Mihailidis, 2019).

Table 3. Participants’ (n = 124) attitudes toward robots in elder care services – scores on a single-item level divided for subscales. Number of participants who state their agreement vs. disagreement vs. indifference toward the respective item.

<table>
<thead>
<tr>
<th>NARS-rev</th>
<th>Agree (negative attitudes)</th>
<th>Disagree (positive attitudes)</th>
<th>Neither agree nor disagree (neutral attitudes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subscale 1. Situations and interaction with robots</td>
<td>27 (21.8)</td>
<td>81 (65.3)</td>
<td>16 (12.9)</td>
</tr>
<tr>
<td>4. I would feel uneasy if I had to use robots in my daily life</td>
<td>38 (30.6)</td>
<td>56 (45.2)</td>
<td>30 (24.2)</td>
</tr>
<tr>
<td>7. The word ‘robot’ means nothing to me.</td>
<td>21 (16.9)</td>
<td>83 (66.9)</td>
<td>20 (16.1)</td>
</tr>
<tr>
<td>8. I would feel nervous operating a robot in front of other people.</td>
<td>39 (31.5)</td>
<td>49 (39.5)</td>
<td>36 (29)</td>
</tr>
<tr>
<td>9. I would hate the idea that robots or artificial intelligences were making judgments about things within elder care.</td>
<td>24 (19.4)</td>
<td>79 (63.7)</td>
<td>21 (16.9)</td>
</tr>
<tr>
<td>10. I would feel very nervous just standing in front of a robot.</td>
<td>24 (19.4)</td>
<td>81 (65.3)</td>
<td>19 (15.3)</td>
</tr>
<tr>
<td>Subscale 2. Social influence of robots</td>
<td>47 (37.9)</td>
<td>36 (29)</td>
<td>41 (33.1)</td>
</tr>
<tr>
<td>1. I would feel uneasy if robots really had emotions.</td>
<td>48 (38.7)</td>
<td>38 (30.6)</td>
<td>38 (30.6)</td>
</tr>
<tr>
<td>2. Something bad might happen if robots became more like human beings.</td>
<td>28 (22.6)</td>
<td>56 (45.2)</td>
<td>40 (32.3)</td>
</tr>
<tr>
<td>11. I feel that if I depend on robots too much, something bad might happen.</td>
<td>29 (23.4)</td>
<td>71 (57.3)</td>
<td>24 (19.4)</td>
</tr>
<tr>
<td>12. I would feel paranoid talking with a robot.</td>
<td>100 (80.6)</td>
<td>9 (7.3)</td>
<td>15 (12.1)</td>
</tr>
<tr>
<td>Subscale 3. Emotions in interaction with robots</td>
<td>Disagree (negative attitudes)</td>
<td>Agree (positive attitudes)</td>
<td>Neither agree nor disagree (neutral attitudes)</td>
</tr>
<tr>
<td>3. I would feel relaxed talking with robots in the elder care. *</td>
<td>34 (27.4)</td>
<td>60 (48.4)</td>
<td>30 (24.2)</td>
</tr>
<tr>
<td>5. If robots had emotions, I would be able to make friends with them. *</td>
<td>53 (42.7)</td>
<td>27 (21.8)</td>
<td>44 (35.5)</td>
</tr>
<tr>
<td>6. I would feel comforted being with robots that have emotions. *</td>
<td>45 (36.3)</td>
<td>28 (22.6)</td>
<td>51 (41.1)</td>
</tr>
</tbody>
</table>

NARS-rev = Revised version of Negative Attitudes toward Robots Scale (Nomura, Kanda, & Suzuki, 2006). Participants’ responses of 1 and 2 = positive attitudes, 3 = neutral attitudes, and 4 and 5 = negative attitudes. * = Reversed response
There is, however, a concern among care professionals that human-like or pet-like care robots may deceive persons with cognitive impairments into believing they are real (Wangmo, Lipps, Kressig, & Ienca, 2019). Prior research has identified negative aspects of humanizing social robots as overtrust and unrealistic expectations of a robot’s autonomy and capabilities, as well as attachment issues and feelings of eeriness or discomfort (Giger, Piçarra, Alves-Oliveira, Oliveira, & Arriaga, 2019).

Currently, robots do not meet necessary conditions for having inherent emotions as they lack consciousness and feelings. However, Qureshi and colleagues (2018) state that for a natural social human–robot interaction, it is essential that robots learn human-like social skills – which the authors see as possible. Other works claim that the future robots can learn to create the appearance of emotions, and of being next to human (Coeckelbergh, 2010; Royakkers & van Est, 2015); facilitating the establishment of mutual psychological understandings in the interaction between humans and robots (Sciuitti, Mara, Tagliasco, & Sandini, 2018). The question is whether these human-like social skills are even desirable in care robots? Technical possibilities themselves tend to determine the development of care robots, and other essential aspects, such as the actual end-users’ needs or organizational and cultural views, are seldom considered (Niemelä & Melkas, 2019). Moreover, other studies establish that robots may be able to lift, to fetch and carry, to give medication reminders, and to read vital signs, but they cannot replace human interactions regarding, for instance, the needs of comfort or in dignity-compromising situations (Gallagher, Nåden, & Karterud, 2016; Sundgren, Stolt, & Suhonen, 2020). However, considering the rapid technological development as well as limited access to care professionals, it is difficult to predict the future. Until recently, robots were mainly used in industries, but are now moving out of the factories and into our homes and elder care services. Despite the future opportunities this provides, we need to reflect on whether the ultimate goal should be to create autonomous, socially, and morally capable machines, or should we just stop at robots being able to support well-being in simpler and more direct ways (Royakkers & van Est, 2015)?

The most positive attitudes were found in Subscale 1, which deals with situations and interactions with robots. The four items (4, 8, 10 and 12) generating the most positive attitudes (63.7%–66.9%) were related to (Table 3): using robots in daily life, operating a robot in front of others, standing in front of a robot, or talking with robots. Between 12.9% and 16.9% of the participants neither agreed nor disagreed (neutral attitudes) to the above-mentioned items. The findings correspond to previous research concluding that people generally have a positive view of care robots and are willing to interact with them (Naneva et al., 2020). More surprising is that these positive attitudes seem to also apply to elder care services; a result that differs from those of previous studies (Hall et al., 2019; Hudson et al., 2019). Moreover, the majority of the participants were between 66–94 years of age, suggesting that older people themselves are positive
about interacting with robots, as is previously reported by Backonja and colleagues (2018). Participants with a university or university college degree held significantly more positive attitudes toward interactions with robots than those with an upper secondary school education (p = .020). It should also be mentioned that the specific situations in which robot interactions can occur were not further explored in the present study. Therefore, it is not possible to determine what kind of care robot the participants had in mind when they responded to the NARS-rev. The fair itself referred to specific kinds of care robots (e.g., care robots used for social, physical, and mental stimulation), though participants may still have had other forms of robots in mind. According to previous research, the situations in which care robots are expected to be supportive often differ. Care professionals found robot assistance most suitable for ergonomically challenging work, and for tasks outside of actual nursing work (Turja, Van Aerschot, Särkikoski, & Oksanen, 2018), whereas robots providing social and emotional support raised more value-based questions among the care professionals. Turja and Parvainen (2020) use the terms effective and affective robots, where robots of an effective design are used as tools for the care professionals, and robots of an affective design can complement care by providing social companionship. Older people, on the other hand, want robots to be able to execute complex tasks that match the personal preferences of the user, in a manner comparable to care delivered by humans (Bedaf, Marti, Amirabdollahian, & de Witte, 2018). Thus, there may be an ongoing shift toward using robots in elder care services – but the place and role of robots in elder care and the forms of interaction between robots and human caregivers are all pathways still being forged (Pekkarinen et al., 2020).

**Methodological considerations**

There are several limitations to this study. Considering that the participants were visiting a welfare technology fair indicate that they had an interest in welfare technology solutions, which introduced a selection bias. The sample may therefore not be representative and the results cannot be generalized to the general population. Furthermore, 11 of the 14 items included in NARS are negatively worded i.e., beginning with a negative bias, thereby necessitating more positive attitudes to offset the inherent negativity of the wording, requiring more positive attitudes than if the items had been neutrally or positively worded. On the other hand, NARS is the only scale measuring attitudes toward robots for which extensive psychometric information has been published since 2006 (Krägeloh, Bharatharaj, Sasthan Kutty, Nirmala, & Huang, 2019). Another factor that may have affected the result is that a majority of the participants were women. Previous research has shown that men are more likely to prefer robots than women (Nomura, 2017); with more male participants, the results may have differed.
Another limitation is that the questionnaire (NARS) was translated into Swedish, and minor adjustments were made to emphasize that the focus was elder care services. The act of creating adjustments could be seen as a threat to the study’s overall validity. When using standardized measures across cultures, certain artifacts that originate from different cultures may impact both the internal consistency as well as the validity when applied to other cultures (Syrdal et al., 2009). The overall attitudes toward care robots were in the present study slightly negative, though one item had a major impact on the results (item 14 – in the future, I think there will be many robots in the care of the elderly). If said item is disregarded, then the overall attitudes would rather be slightly positive, MD = 34 (27–41) rather than MD = 38.5 (31.25–46).

**Conclusions**

In contrast to our hypothesis, the attitudes of visitors at a welfare technology fair were overall slightly negative toward care robots. The most negative attitudes concerned if the care robots were humanized and had emotions. On the other hand, the attitudes toward interacting with care robots in general (e.g., talking to, operating, and making use of in daily life) were predominately positive. Having a university or university college degree contributed to more positive attitudes toward interaction with robots.

The use of care robots can be part of a solution to the challenges which ongoing demographic changes pose to healthcare systems. Care robots may contribute to increased independence and autonomy by allowing older people to live longer in their own homes, thereby delaying age-related health and social care needs. However, humanized robots with emotions are, according to the present study, nothing to strive for. The challenge lies in detecting concrete usage scenarios in elder care services, which are based on users’ needs and digital literacy, and on the maturity of the deployed technology itself.

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