The Oldest Olds' Perceptions of Social Robots

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Abstract. Social robots are gaining attention as potential tool for improving older adults' social and emotional well-being. A mixed-method study with a panel of older adults 85 years of age and older explored how the oldest old feels about social robots, as well as new technologies in general. Based on responses to a survey and a set of focus groups, it was found that the panel was generally experienced and comfortable regarding use of new technologies. Responses to questions about social robots, however, suggested that there was a mix of perceptions and attitudes. Many participants were able to envision using one, open to interacting with one, and quick to embrace their potential benefits. On the other hand, apprehension to engaging with a social robot was apparent among some participants. Even with some concerns around trust, privacy and security, however, the group overall had no problem understanding the key capabilities and features of social robots, despite having very little to no prior knowledge. The findings indicate the oldest old, although often stereotyped to be slow to accept new technologies, may be open to the possibility of using a social robot as a companion.

Keywords: Social robots · Older adults · Technology adoption · Aging

1 Introduction

The rapid growth of the older population has brought attention to technologies that may help assist older adults, as well as their families and caregivers, with a variety of tasks. While the demographic trend has fostered discussions and research around using and developing technologies to improve physical and cognitive health outcomes and to assist with functional abilities, the potential for new technological advancements to improve older adults' social and emotional well-being has only recently started gaining interest.

Aging brings a crucial need for social engagement and connectedness. More people are living alone in the United States as well as globally, with approximately 15% of households in the world being solo households [1] and 27% of homes in the US today occupied by a single person [2]. The same trend is apparent among the older population, with 26% of older adults 65 years of age or older living alone today [3]. Living alone can bring complications related to social isolation and loneliness. For example, the American Time Use Survey has found that older Americans that live alone spend significantly more time by themselves compared to those that live with a spouse or a partner [4]. In the United Kingdom, it has been reported that of more than 2 million

older adults over 75 years of age living alone, over a million of them go for a month without speaking to a family member, friend or neighbor [5]. In addition to factors related to living arrangements, older adults are also more likely to face barriers to social engagement due to the increased likelihood of experiencing declines in physical mobility [6] and issues with cognitive abilities [7]. Social isolation and loneliness can bring tremendous negative effects to one's health and quality of life. For example, it has been stated that social isolation and loneliness are associated with about a 50% increased risk of early death [8].

As a potential solution to improve emotional and social well-being among older adults, researchers have been investigating to use social robots. Social robots are interactive robotic agents designed to interact with people along social and emotional dimensions, and behave according to human psychology and social norms [9–11]. Recent developments in social robotics offer capabilities for users to directly interact with a physically embodied agent by engaging in verbal and non-verbal behaviors [12, 13].

Results of previous studies on people's interactions with social robots showed that users may be able to use social robots to continuously engage in social interactions and experience emotional companionship even when human engagement is not available to them. In a study by FakhrHosseini et al. [14], essential factors for robotic companionship were explored in a session where 21 participants played an online game with help from two humanoid robots: Nao and Darwin. Findings from this study showed that both robot appearance and verbal and emotional expressions influence users' perception of the robot as their companion. In this case, more human-like phrasing and appearance influenced participants' perceived enjoyment, perceived sociability, trust, and accepting robots as their companion [14]. Another study surveyed undergraduate students to understand how people associate physical and visual characteristics of various social robots with personality traits [10]. Barnes et al. [15] focused on elementary school students to explore how children interact with social robots as an application to assist in STEAM (science, technology, engineering, arts and mathematics) education.

A small number of studies have focused on older adults as potential users of social robots. For example, robotic pets have been developed to help older adults with their loneliness and isolation [16]. A study by Alves-Oliveira et al. [17] reported on findings from a focus group that involved older adults and discussed that older adults were able to envision various examples of social robots assisting with different activities of daily living. A long-term user study by Ostrowski et al. [18] compared usage patterns and preferences across generations – between children, adults and older adults – and reported that older adults' interactions with social robots were anchored in their entertainment and social features. A recent meta-analysis of randomized controlled trials concerning health effects of social robots suggested that interacting with social robots may have positive impacts on quality of life and reduce loneliness [19]. The same study, however, also discussed that studies that investigate the potential effects of social robots on older adults' well-being are rather limited, and that the topic needs to be studied further [19].

This study focuses on the oldest old population – people 85 years of age or older – to understand the perceptions of social robots among those most likely to experience

age-associated issues affecting social and emotional well-being. While the oldest old population is the most rapidly growing demographic segment [20], research regarding their perceptions and acceptance of various new technologies, including social robots, have not been studied thoroughly. This study aims to further understand older adults' thoughts on social robots by focusing on those most likely to experience age-related changes and needs.

2   Data Collection

In this study, a panel of 20 older adults (10 female), all aged 85 or older, was convened to discuss perceptions, attitudes and experiences around new technologies including social robots. This session was part of an ongoing bimonthly panel of older adults, the MIT AgeLab Lifestyle Leaders, that meets to discuss and deconstruct issues and experiences related to aging. Participants for this session ranged in age from 85 to 99. All of the participants lived independently in the Boston-metro area. The majority of the panel was unmarried by widowhood or divorce, and 6 participants were married or living with a partner. Participants were overall more affluent, educated, and racially-homogenous relative to the US and to other older adults in the Boston-metro area. Due to the skewness in demographic and socio-economic characteristics, this panel is not representative of the 85+ population generally.

Prior to the in-person meeting, the panel was invited to complete a questionnaire, either online or on paper, that included items related to: (1) general technology experience; (2) criteria for choosing to use new technologies; (3) perceptions around possible features that may be offered by social robots; and (4) expectations and concerns around social robots. The in-person meeting began with a brief presentation by a guest speaker about research on social robots and robotic agents. After the presentation, participants were divided into four smaller groups for focus group discussions. The small groups were formed based on the participants' self-assessment of their technology adoption behavior. One group included participants who self-identified themselves as early adopters; one other group included self-rated late adopters; and the two remaining groups included participants who fell in between. The focus groups lasted approximately 60 min and were held concurrently. Moderators asked the participants about: (1) attitudes and experiences related to technology in general, including how they learn about new technologies and how much they trust new systems; (2) expectations and thoughts related to social robots; (3) experiences with and attitudes toward other new technologies- including home systems, mobile devices and vehicle automation. The focus group discussions were recorded and transcribed.

3   Results

The panels' responses were analyzed to gain a better understanding of the oldest olds' experiences and thoughts regarding technology in general, as well as about social robots and related applications.

3.1   General Technology Attitudes and Experience

Participants' responses to survey questions around overall technology use and experience showed that the panel was generally open to and comfortable with new technologies. When asked about overall level of experience with technology in general, only one person indicated being not experienced at all, whereas the majority indicated having some experience (7 participants were somewhat experienced, 4 were quite experienced, and 3 were very experienced). When asked to assess if they would describe themselves as early or late adopters of new technologies, only one person said that s/he avoids new technologies as long as possible. Four participants identified as early adopters and said they would try new technologies as soon as possible, while 3 said they would try after a few other people. When asked about confidence in being able to learn and use new technologies, only one person said that s/he is not at all confident, while the majority indicated being generally confident (4 participants said somewhat confident, 6 said quite confident, and 3 were very confident). The group also indicated that they were generally trusting of technology, with only one person indicating having very low trust in technology. To this question on their overall level of trust in technology, 5 participants said they have medium trust, 4 reported having high trust, and 3 indicated having very high trust. However, the group showed some hesitation when discussing data security and privacy. When asked how much they trust technology to protect and secure their privacy and personal information, 4 participants said that have very low trust, while only one person indicated having very high trust.

The group largely consisted of current technology users, with 13 participants regularly using smartphones. Many also reported using desktop computers (12 participants), laptops (10 participants), tablets (9 participants) and in-vehicle technologies (7 participants). Of those currently using smartphones, 8 were also using voice assistants such as Siri, and 2 participants were using mobile payment services such as Apple Pay. There were a few participants in the panel using different in-home technologies and mobile devices. For example, 2 participants reported using smart speakers such as Amazon Echo/Alexa and one person indicated using an activity tracker such as a Fitbit.

In order to better understand the oldest old population's thoughts and decisions around acceptance and adoption of new technologies, the panel was asked about the characteristics or features they look for when they buy or start using new technologies. For this question, a selection of technology adoption factors described by Lee [21] were used, including practical benefits, ease of learning and use, availability of technical support services, cost/affordability, reputation of company/brand, support from family/friends, emotional benefits, familiarity, ability to work with other things, ability to work over time, and positive social image or associations. A few more features were added to comprehensively cover various technology characteristics, including enabling safety and security, good physical design or appearance, novelty or innovativeness, and prestige. As shown in Fig. 1, the panel indicated that they primarily consider the utility and value when they decide to buy or use new technologies, with 16 participants selecting practical benefits as adoption criteria. Only a few participants indicated that they evaluate the physical appearance, social image, novelty or prestige, further supporting that their decisions around technology adoption are value-driven. Key factors around the effort and/or resources needed were chosen by many participants as well,

with 15 participants indicating that they think about ease of learning and use, 13 participants choosing availability of technical support services as one of their main criteria, and 12 participants reporting that they consider cost/affordability. A fair number of participants also sought assurance, with 10 choosing reputation of company/brand and 9 choosing support from family/friends as key factors.
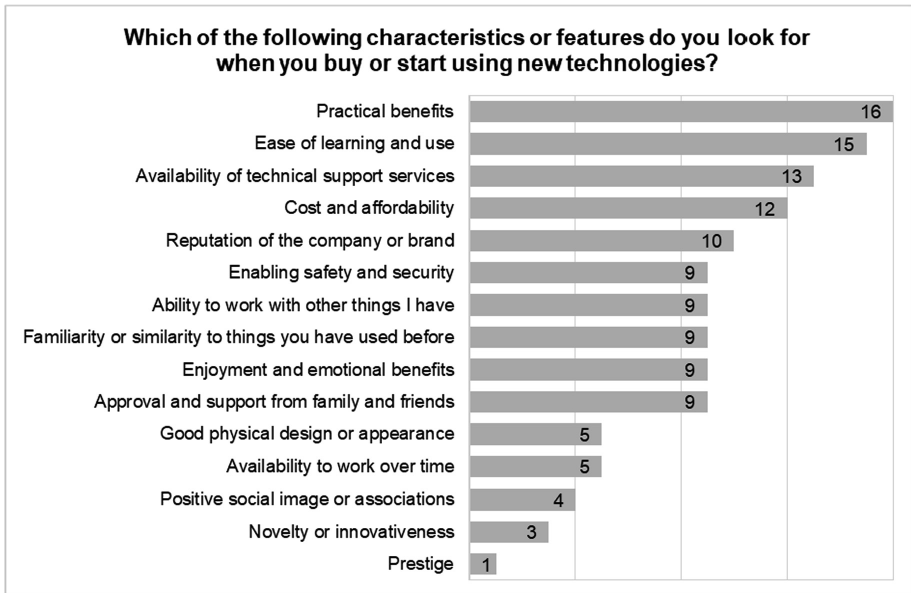
Which of the following characteristics or features do you look for when you buy or start using new technologies?

Characteristic	Count
Practical benefits	16
Ease of learning and use	15
Availability of technical support services	13
Cost and affordability	12
Reputation of the company or brand	10
Enabling safety and security	9
Ability to work with other things I have	9
Familiarity or similarity to things you have used before	9
Enjoyment and emotional benefits	9
Approval and support from family and friends	9
Good physical design or appearance	5
Availability to work over time	5
Positive social image or associations	4
Novelty or innovativeness	3
Prestige	1

Fig. 1. Key characteristics considered when buying or using new technologies

3.2 Oldest Olds' Perceptions and Acceptance of Social Robots

While the panel generally indicated favorable attitudes and experiences towards new technologies in general, responses specific to social robots showed a mix of positive and negative thoughts and feelings. When presented with the statement "I feel positively about robot technologies", only 2 participants said they strongly agree and 7 said they somewhat agree with the statement. When presented with the statement "I can imagine having a robot in my home", only 2 participants said they strongly agree and 6 said they somewhat agree with the statement, while 4 participants said they strongly disagree. The panel showed a wide range of responses when asked how much they would be willing to pay for a social robot. While 5 participants selected "$0 – I would never buy one", 5 other participants said that they would be willing to pay $500 or more. The sense of hesitation was evident in the focus groups as well. For example, in one of the focus groups with self-identified early adopters, a participant said "As I listened to [researcher's presentation about social robots] I found I was defensive. It threatened my independence."

While the group showed some hesitation around using a social robot, they also indicated that they could envision benefits of having one. For instance, when asked if how much they agree or disagree with the statement "I think social robots would be useful to me", their responses averaged at 3.28 on a scale from 1 for strongly disagree to 5 for strongly agree. Some positive attitudes were observed during the focus groups. For example, in one of the focus groups, a few self-rated early adopters said "I think it'd be fun to have one" and "This new technology will help me appreciate life more fully." Some of the panelists were able to imagine specific situations where having a social robot would be beneficial for them. For example, some thought of it as "an incredible teaching tool," envisioned that it could enable them to do things like "going to a concert virtually, and thought it would be helpful in certain settings (e.g., "if you're stuck at home without anything going on, you're better off with them," "it would be a great help medically," "could help me to remember a birthday for example – it could actually make you more independent"). The panel's responses to the questionnaire also showed that they thought a social robot may be useful for a variety of different tasks and beneficial in various aspects of life, ranging from intervening in emergency situations to assisting social communications, as summarized in Fig. 2.
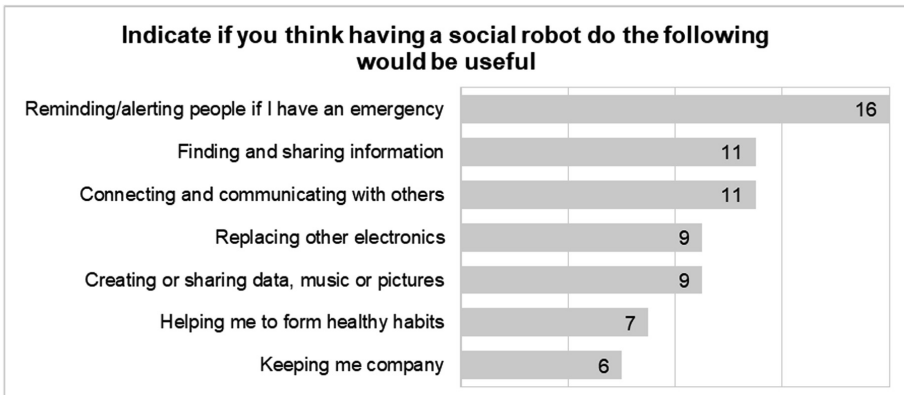

Fig. 2. Responses on potential usefulness of a social robot for various tasks

Participants' positive expectation around a social robot to intervene in case of emergency was echoed in their responses to the question regarding the types of information or actions they would trust a social robot with. While only few participants indicated that they would trust a social robot with information regarding their social relationships, finances and personal beliefs, more participants said that they would trust a social robot regarding home security and personal emergency alerts, as summarized in Fig. 3.

The interest around the potential for a social robot to assist in health-related issues was also apparent in the panel's responses to the question "Which of the following would you want to talk to your social robot about?" As illustrated in Fig. 4, health matters was chosen by the highest number of participants as the topic they would like
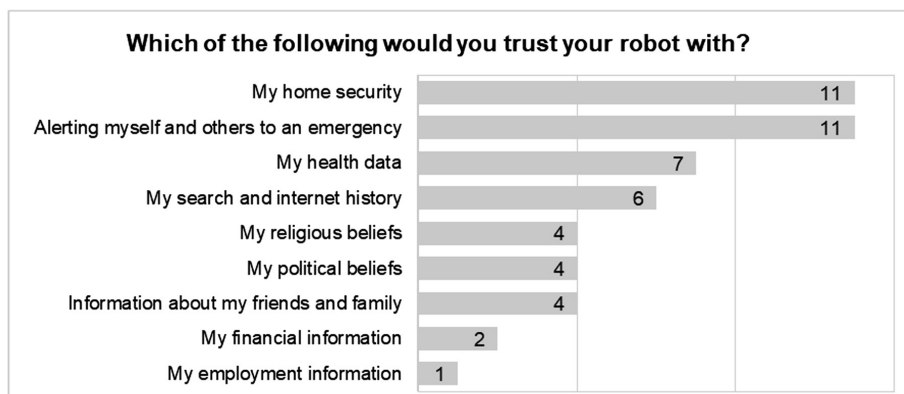
Which of the following would you trust your robot with?

My home security	11
Alerting myself and others to an emergency	11
My health data	7
My search and internet history	6
My religious beliefs	4
My political beliefs	4
Information about my friends and family	4
My financial information	2
My employment information	1

Fig. 3. Responses on trusting a social robot with information and actions

to chat about. However, several participants also chose current events, weather, finances and money, and politics as potential conversation topics that they would like to engage in with a social robot. This suggests that the group expects a social robot to be a casual and informal companion, rather than a healthcare device or an emergency response system. Data summarized in Fig. 4 also hints at the apparent apprehensiveness among some participants, with 4 participants indicating that they would not want to talk with a social robot regardless of the conversation topic.
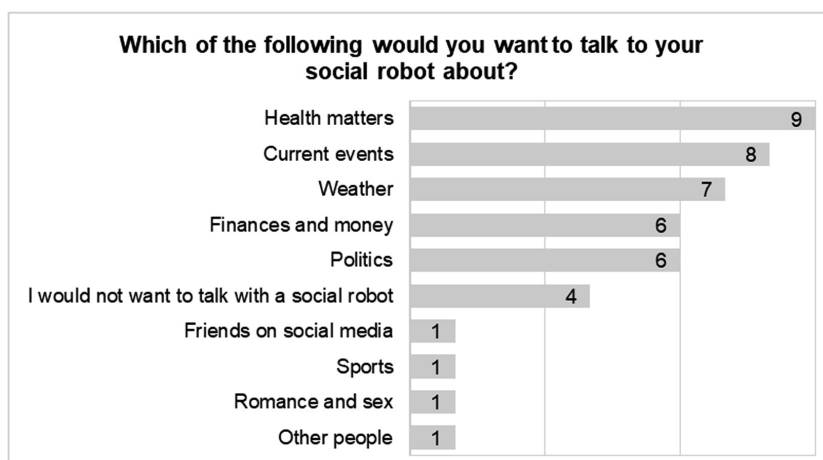
Which of the following would you want to talk to your social robot about?

Health matters	9
Current events	8
Weather	7
Finances and money	6
Politics	6
I would not want to talk with a social robot	4
Friends on social media	1
Sports	1
Romance and sex	1
Other people	1

Fig. 4. Responses to possible topics for interactions with a social robot

The panel's responses to a question on preferred personality traits for a social robot further confirmed that they sought informal and easy companionship. While the majority of the panel indicated that they would want a social robot to be respectful,

caring, agreeable and/or friendly, as shown in Fig. 5, qualities such as authoritative, neurotic and formal were not chosen by any participant. This also suggests that the group's expectations around the capabilities and values of social robots generally conform to the qualities and features as described in existing definitions and offered by social robots that are currently available or near-market.
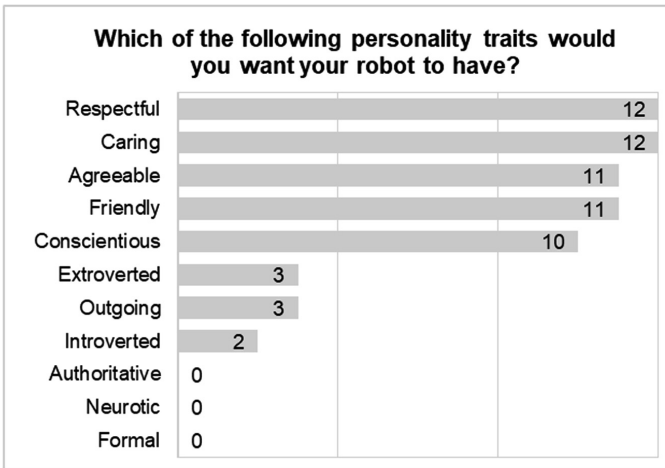

Fig. 5. Preferred personality traits and qualities for a social robot

During the small group discussions, conversations were also formed around the possible physical forms that a social robot could take. Opinions and expectations among the group were generally divided. For example, some preferred a social robot to take a human-like form (e.g., "I think I can identify with it more if it's a person – make it look like a human being"), whereas others favored other forms (e.g., "I think a human-like form is faking something you don't need," "I'd like it to be a little animal. I'd want it to move around.") Some didn't have a clear preference and were open to possibilities (e.g., "It doesn't make any difference. The human animal is very adaptive and you can get used to something very quickly." "What bothers me about robots is that they don't have individual looks. Would it be possible to give different possibilities within one robot? Maybe a teenager? Or a 40-year-old who is more politically aware? Different points of view, different jokes. In some way simulate the diversity of your own real life.") Responses to related questions in the questionnaire also indicated diversity in preferences among the group. When asked what they wanted a social robot to look like, only 2 participants said human-like and 1 person said animal-like, while 5 participants said that they don't care and another 5 preferred it to be more ambient. When asked what they want the robot to sound like, no one chose a female voice or a robotic voice. Responding to this question, 4 participants chose a male voice, 5 said that they didn't care or preferred some other type of sound, while a gender-neural voice was the most popular option with 7 participants choosing it.

4   Conclusion and Discussion

Social robots are posed to deliver multidimensional features and values – including social engagement, emotional attachment and intellectual stimulation – to users across the age spectrum. With capabilities to behave and interact in accordance with human social norms, social robots may be able to serve as social and emotional companions to older adults who are more likely than their younger counterparts to experience social isolation and loneliness.

In this study with a panel of older adults 85 years of age and older, a mixed-method approach was used to better understand how the oldest old view and perceive social robots. An in-person meeting with 20 older adults in the metro Boston area was convened for a set of in-depth focus groups in addition to a questionnaire that was completed prior to the session.

Responses to the questionnaire and the focus group questions revealed that the majority of the panel reported being experienced with technology, confident about learning and using new technologies, and eager to try new technologies before others. When discussing social robots, on the other hand, there was a mix of responses and attitudes, with several participants unwilling to have one or to interact with one. These responses and attitudes can largely be attributed to concerns around trust, security and privacy, as well as to uncertainties around potential impact on independence.

Despite the general sense of apprehensiveness around social robots in comparison to new technologies in general, results also indicated that the group quickly understood the overall concept of social robots as well as some of the key capabilities based only on a brief presentation, with limited to no prior knowledge. In contrast to beliefs around older adults' relative conservatism in willingness to try new technologies, participants in this study were generally open to the possibility of using a social robot as a companion, as well as these robots' abilities to mimic and follow human norms and social conventions. The group indicated that they would value possible practical features, such as intervening in emergency situations and chatting about health matters, which may be more relevant and specific to this demographic group compared to younger generations. However, the panel was also able to imagine social robots being helpful for a variety of situations and user segments, as suggested in the comment, "It's good for everyone."

It should be noted, however, that the panel only included a select group of older adults 85 years and older that is geographically limited and skewed in terms of level of education, physical and cognitive health, and overall wealth. The group was also mostly currently online on a regular basis and relatively technology savvy compared to the general population. While the findings may represent the perceptions and attitudes of the oldest old that fit within these boundaries, they may not apply to a broader group of older adults. A possible direction for future research on the topic would be to gather responses from a more diverse sample to better understand how the oldest old population across various characteristics and backgrounds feel about social robots and new technologies.

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