



# Perceptions of Socially Assistive Robots Among Community-Dwelling Older Adults

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**Abstract.** Socially assistive robots (SARs) have many potential benefits for older adults, such as reducing loneliness and assisting with healthcare interventions. However, little is known about how they are perceived by older adults. This study aimed to increase this understanding by using online, semi-structured interviews with community dwelling older adults. Acceptance of SARs was higher in those aged  $\geq 70$  years when compared to those aged 55–69 years. Declining health status was a common influencing factor, with company and assistance with daily activities highlighted as potential advantages. However, there were concerns among those aged  $\geq 70$  years that the introduction of SARs may lead to increased sedentary behaviour and a reduction in physical human contact. Overall, SARs are perceived to be useful among older adults, and developers should be aware that willingness to engage with this type of technology is dependent on several factors such as age and circumstance.

**Keywords:** Social robots · Older adults

## 1 Introduction

Advances in medical care have facilitated a global increase in life expectancy; the UK alone is projected to have one-quarter of the population aged  $\geq 60$  years by 2050 [1]. Subsequently, more people are likely to require long-term care [2, 3]. This may include supporting specific medical conditions associated with aging, as well as reducing instances of loneliness and social isolation, which are also prevalent in older-aged communities [4]. The restrictions on socializing and access to places promoting physical activity, such as gyms, because of the Covid-19 pandemic have intensified these issues within many older communities [5]. Due to the shift in population demographics, there is likely to be a reduction in those able to provide the care needed [6]. Socially assistive robots (SARs) have the potential to relieve some of these additional care needs and may become an integral component of everyday life for older adults [7, 8].

SARs are a form of robotic technology combining visual, audio and movement capabilities [9]. They are usually designed to assist an individual either physically, emotionally, or psychologically with the aim to improve overall quality of life. This assistance may take the form of motivation to be active, aiding rehabilitation or supporting learning [10]. Within older communities, it has been shown that robotic companions may reduce loneliness and isolation, support the self-management of medication, and potentially allow caregivers more free time to spend quality time with their older person [7, 11]. Subsequently, SARs have the potential to reduce agitation and anxiety, as well as support medication adherence [12] and overall improve the quality of life for both older adults and their caregivers [9].

SARs are typically one of two types: (1) Service-type, which are designed to support people when undertaking daily tasks [11] such as vacuuming, lifting, feeding, and monitoring a person [7]. These tasks, usually called Activities of Daily Living (ADLs), are fundamental to live independently within the community [3, 13]. The loss of function in ADLs is a key factor for care-home admission, and therefore maintaining the ability to perform them is of vital importance for older adults [14, 15]. (2) Companion-type, which are designed to support emotional health and psychological wellbeing [11]. Both have been shown to be useful when supporting older adults, however many of these studies have been in care-home settings, rather than within the home of those living independently within the community. The perceptions of SARs within this group are therefore less well understood, although factors such as previous knowledge of robotics and familiarization with technological devices such as smartphones may increase acceptance [16]. With a rise in the adoption of a biopsychosocial approach to ageing support [14], it is important to understand how both types of SAR are viewed by both those who may be requiring care now, and those who may need care in the future.

Through using semi-structured, photo elicitation interviews, this study aimed to understand the perceptions of community-dwelling older adults regarding SARs within their own home.

## 2 Methods

### 2.1 Ethical Approval

Ethical approval for this study was approved by the institutional human research ethics committee (18/19–75V2).

### 2.2 Data Collection

33 individual, semi-structured photo-elicitation interviews were conducted online with older adults aged 55–82 years. These were divided into 2 groups, “younger”, aged 55–69 years ( $n = 17$ ; women = 8, men = 9, mean age = 61.9 years, SD = 4.0 years) and “older”, aged  $\geq 70$  years ( $n = 16$ , women = 10, men = 6, mean age = 74 years, SD = 4.5 years). Participants chose the video call software which they were most comfortable with, such as Zoom, Microsoft Teams, WhatsApp and Facebook Messenger. All participants were living independently in the UK, with interviews occurring between July 2020

and February 2021. Interviews lasted for an average of 42 min (SD 12 min) and were all conducted by the same researcher (NC). As these were semi-structured interviews, there was some variation in the order of discussions, however an interview script was used to ensure all participants were given an opportunity to discuss important details relating to SARs. The prompt questions are provided here:

1. Can you tell me about any experience or knowledge you have of social robots?
  - a. What is a social robot?
  - b. What do you think of when you think of the term 'social robot'?

### 2.2.1 < Show the Picture of the Robots >

2. What do you like/dislike about the social robots shown here? Ask this question for each robot.
3. Which shape/type is best?
  - a. Why?
4. How do you think a robot may help you carry out activities of daily living / your usual routine?
5. Can you think of anything that a robot may be able to help you with that you currently find difficult to do or cannot do?
6. Would you want any of these robots in your home? Why?
  - a. Are there any rooms you would or would not want a robot in? e.g., bathroom; bedroom
7. What barriers might there be in introducing something like this into care homes or into the homes of older adults?
8. What advantages might there be in introducing something like this into care homes or into the homes of older adults?

Images of the chosen SAR designs (Fig. 1) were only shown after the participant had explained their prior knowledge or experience and described what they thought a social robot may look like. Within this study, a humanoid and animal-like robot were selected due to the tendency of humans to anthropomorphize non-human entities, which can influence the perception of their competency and place in society [26]. Our focus for this study was the social aspect of SARs, and therefore these designs were considered the most appropriate. The functions of each robot design were then explained to the participants by the interviewer, and discussion surrounding their potential usefulness, or lack thereof, followed. The interviewer was able to reformulate, re-order or clarify questions during the interview to gain a deeper understanding of the participants opinions and thoughts.

## 2.3 Data Analysis

a realist thematic approach was used to analyze each interview [17]. This approach values both the qualitative and quantitative aspects of interview data [18, 19]. Three authors were involved in the transcript analysis process (DM, JJ, NC), with discussions used to settle disputes related to the coding and theme identification within the transcripts. 4 key themes were identified: existing knowledge, factors influencing acceptance, perceived advantages, and perceived disadvantages.



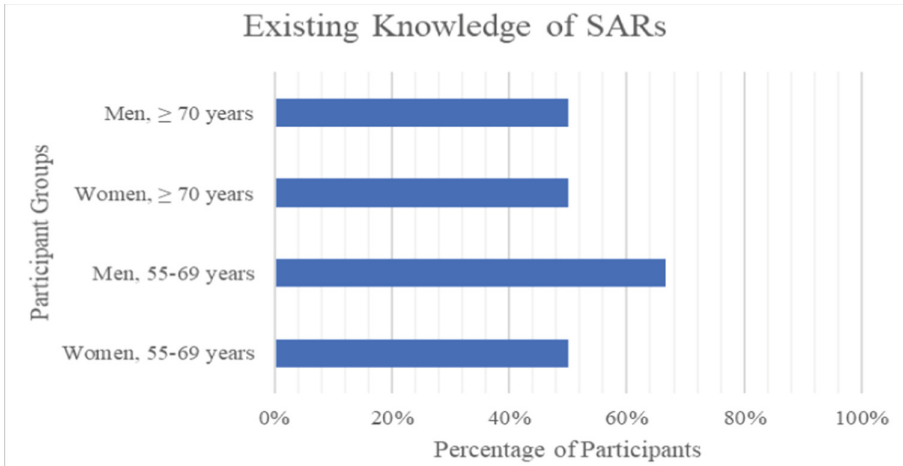
**Fig. 1.** Images used during the interviews to illustrate the different types of companion robots

## 3 Results

### 3.1 Existing Knowledge of SARs

Existing knowledge (Fig. 2) was highest within men aged 55–69 years ( $n = 6$ , 67%), with one explaining their “hands-on” experience through work: *“our chairman’s got a robot that he uses that goes around with a video camera... it goes around the office, yeah. And it talks to people.”*

Overall, most existing knowledge in all groups was as a result of media coverage, although many participants stated that this knowledge was limited: *“I can’t remember where I read it... or it might have been on one of these science programs on the telly... but I thought it was a good idea.”* ( $n = 9/33$ , 27%; younger men = 2/9, 22%; younger women = 3/8, 38%; older men = 2/6, 33%; older women = 2/10, 20%). However, as existing knowledge of SARs specifically was somewhat superficial, there was little difference between those with and without previous knowledge. Only one person had “real-life” experience with a social robot, which was not in a care environment and therefore did not influence their understanding of SARs within this context. As a result, further analysis did not separate those with existing knowledge from those without.



**Fig. 2.** Percentage of each participant group with existing knowledge of SARs

### 3.2 Factors Influencing SAR Acceptance

The robot design had a large impact on overall acceptance, whether for immediate use or at a time in the future, with the humanoid design being considered more useful in all groups (Fig. 3). The older groups, both male and female, were overall more interested in having humanoid robotic assistance at some time in the future, with 80% of older women and 66% of older men stating that they would consider one in the future, and 17% of older men stating they would have one now. One of the main reasons for this was the idea that the humanoid could be more physically helpful when carrying out daily tasks, especially for someone living alone ( $n = 7/33$ , 21%; younger females =  $2/8$ , 25%, older females =  $2/10$ , 20%; older males =  $3/6$ , 50%): *“I would say, for somebody on their own, who is not able to do everything, then I would say they’re a very good idea. And I’d go for the robot rather than the dog, because the robots... can do more things to somebody on their own than a dog would.”*

Housing situation, and whether one lived alone or with a companion was also a key reason given for why an individual may consider having an SAR in the future ( $7/33$ , 21%; younger females =  $1/8$ , 13%; older females =  $3/10$ , 30%; older males =  $3/6$ , 50%): *“if I was on my own then I might probably consider something like that but as it is at the moment, with [the two of us] being here erm I don’t think I would bother.”*

The acceptance of technology in a more general sense was also identified as a prominent influencing factor, particularly within the younger group ( $10/33$ , 30%; younger females =  $3/8$ , 38%; younger males =  $3/9$ , 33%; older females =  $2/10$ , 20%; older males =  $2/6$ , 33%), with one participant highlighting that the more a technology is seen and available the more accepted it is: *“I think if they’re around all the time then people become less aware of them, if you see what I mean... so they’d become part of the furniture... Once they become part of the furniture, then they’re not interfering, they’re not, sort of – you’re not aware of them is what I think I’m getting at.”* However, there was also a sense that this type of technology may never be fully accepted ( $7/33$ , 21%;

younger females = 2/8, 25%; younger males = 2/9, 22%; older females = 2/10, 20%; older males = 1/6, 17%): “some people are just pure techno-phobes. They just don’t like – they still want the telephone that you can put your finger in and that”.

However, there was also a feeling within all groups that social robots are not needed within society (7/33, 21%; younger females = 1/8, 13%; younger males = 1/9, 11%; older females = 3/10, 30%; older males = 2/6, 33%), and would replace human contact which was perceived as a very negative thing and was the main reason given for not wanting either robot: “I personally don’t need one... I think, in the current climate I’m even more aware of the fact that trying to replace human contact with robotic contact is not really what elderly people need.”

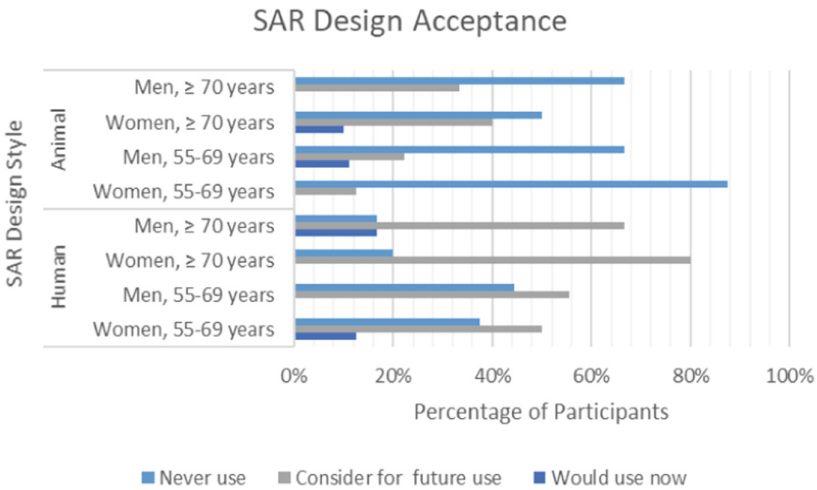


Fig. 3. Relative acceptance of SARs within each participant group

### 3.3 Advantages of Social Robots

The humanoid design was considered advantageous by all groups as it could assist with activities in relation to daily living (15/33, 45%; younger females = 4/8, 50%; younger males = 3/9, 33%; older females = 6/10, 60%; older males = 2/6, 33%): “I’m sure that in the house of the future, tasks that become onerous as you get older – washing up and basic tasks – I suppose it might be useful...And lifting and shifting things.”

Company was also highlighted as a particular advantage of the humanoid robot especially (18/33, 55%; younger females = 4/8, 50%; younger males = 6/9, 33%; older females = 5/10, 50%; older males = 3/6, 50%): “if you’re sat here on your own day in and day out, to have something like that, I should think, could save your sanity because at least you would talk to something, and they’re answering you.”

Some participants identified that there was potential for the humanoid SAR to assist with healthcare (3/33, 9%; younger females = 1/8, 13%; younger males = 1/9, 11%; older males = 1/6, 17%): “it’s like a big iPad type thing... you could just say “oh, I don’t

*feel very well, could you phone the doctor please” ...then it could just come next to you so you don’t have to reach for the phone or something.”*

Although considered less useful overall than the humanoid design, there were a few perceived advantages in all groups to the animal-type SAR, namely the simplicity of the design and the idea that it could be a practical replacement for a living pet (2/33, 6%; younger males = 1/9, 11%; older females = 1/10, 10%): *“if you are not able to look after a pet and you had always had a pet then a cyber-pet is quite a good idea because you don’t have to feed it, don’t have to take it for a walk – it’s just there when you want it.”*

### 3.4 Disadvantages of Social Robots

Regardless of design, one of the main disadvantages highlighted by males in particular was that they are considered intrusive (5/33, 15%; younger males = 3/9, 33%; older males = 2/6, 33%): *“I’d find that quite scary really – you know, you look round and it’s following you. It’s a step too far... it’s just sort of like ... what am I thinking of... well it’s just too intrusive really.”*

The older group expressed concerns that the introduction of an SAR might increase sedentary behaviour though removing the need to complete certain household jobs (3/33, 9%; older females = 1/10, 10%; older males = 2/6, 33%): *“I think there will be robotics that will do most of the tasks in our house. Perhaps even to our detriment, we might all become bone-idle and never do anything and you’d just atrophy. You atrophy because you don’t do anything, and everything is done for you.”* The older group were also concerned that the animal design might increase fall risk within the home (2/33, 6%; older females = 1/10, 10%; older males = 1/6, 17%): *“as you get older there is always the possibility that you are going to fall more easily and having more things moving about just increases the risk of you falling.”*

Usability of SARs was considered a potential barrier to acceptance for those who may be less familiar with technology in general (3/33, 9%; younger females = 1/8, 13%, older females = 1/10, 10%; older males = 1/6, 17%), *“how able the older person is to actually be able to control it. That would be the biggest concern I would have.”*. Alongside this, cost was also considered a large disadvantage by the younger group (2/33, 6%; younger females = 1/8, 13%; younger males = 1/9, 11%): *“they’re going to be a ridiculous amount of money though aren’t they, these blooming robot things.”*

## 4 Discussion

This study aimed to understand the perceptions of community-dwelling older adults regarding SARs within their own home, and what the advantages / disadvantages of them may be. Overall, older adults perceived SARs to have potential use in the future, with those aged over 70 years showing more acceptance than those aged 55–69 years. This is similar to Arras & Cerqui [20] who found that older adults were more accepting of robots than those aged under 18. It is interesting that older adults are consistently being shown to be more accepting to new, robotic technology than their younger counterparts despite stereotypes often believing the opposite – that older adults are less accepting to

technology than younger people [7]. This highlights the need for constant engagement with older communities in the creation and development of SARs, especially as they are often the intended target audience for such technology. However, in both this study and that by Arras & Cerqui [20], robots were perceived as being able to contribute to an improved quality of life, but this should not be at the expense of real, human social contact.

The perception that introducing robots may lead to reduced human-to-human contact was a key influencing factor, particularly among women aged  $\geq 70$  years, and was cited as a reason to not have one. This may be linked to a higher incidence of loneliness among this population due to the unequal distribution of risk factors such as death of a partner among men and women [21] and the subsequent need to maintain social relationships. This is echoed in one of the main reasons for having a social robot in older age for many participants being “company.” Although these technologies are often developed to assist healthcare and allow older adults to live at home for as long as possible [9], development of future systems should be careful to not completely replace human care with technological assistance. Human interaction can provide emotional connections that even the smartest technology is unable to replicate. These emotional connections cannot be underestimated in the care of older adults, as they are known to link closely with other factors such as depressive symptoms and subsequent reductions in physical activity and overall health.

The design of the robot, and the subsequent acceptance of it, depends on its perceived use. The humanoid design was perceived as being potentially more useful due to the ability to help with everyday tasks. Pfadenhauer & Dukat [22] suggests that decisions surrounding the usefulness of a robot are dependent on how well an individual perceives that their needs are being met elsewhere. This may help to explain why older adults are more accepting of robots than their younger counterparts, as they are more aware of activities which they may struggle with and have an appreciation of the help they may need in future. The animal-type robot was considered much less useful than the humanoid version amongst all groups, possibly as it was perceived to be less physically helpful. Although animal design robots have been shown to provide emotional support, this has often been demonstrated in isolated individuals, or those with cognitive impairment who may find it difficult to make or maintain social connections [12]. Healthy, community dwelling individuals are likely to be maintaining emotional connections to other individuals and are therefore less likely to require a robotic companion to meet those needs.

It should be noted that the interviews were conducted during, and just after the UK government introduced lockdown restrictions limiting in-person socializing due to COVID-19. Therefore, issues such as reduced human contact, isolation and the need for human company may have been at the forefront of people’s minds. It has also been suggested that the opinions of an individual towards robots is heavily reliant on the opinions of others around them such as family and medical staff [23, 24] as well as previous experience of technology in general [16]. As these interviews were conducted on-line, the participants already had a good knowledge of, and were comfortable using, various technologies. Future work should consider including participants with limited knowledge or comfort with technology as well as other stakeholders including caregivers



such as family and medical professionals. Participatory design, or co-design with older adults has also been suggested as a means of actively engaging this community with robots and robotic design [25] and should be considered in future work. The use of physical robots rather than images alone is also suggested for future work in this area.

## 5 Conclusion

In conclusion, older adults aged  $\geq 70$  years are more likely to accept socially assistive robots than those aged 55–69 years, although most would only consider them for future use. The risk of losing human contact was a major issue, however many saw the potential in the humanoid design and considered that it may be useful for supporting independent living of older adults. Acceptance is closely linked to the perceived needs of the individuals and therefore may change over time, and with changing circumstances such as health and living situation. Developers should be aware of this and continue to involve older adults in the development of SAR technology.

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