Social Robotics to Address Isolation and Depression Among the Aging During and After COVID-19

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Abstract. COVID-19 is exacerbating isolation issues faced by older adults, which may lead to increased risk for depression and other mental health issues. Social robots are being explored for their potential to alleviate these challenges through conversational therapy, companionship, and connectedness regardless of where older adults chose to age in place—from home to long-term care facilities. This is a discussion piece with the objective of raising awareness to the topic of social isolation within older adults and current limitations in the field of social robotics. We discuss the state of the art in social robotics for aging in place and bring attention to remaining challenges for addressing isolation and mental health especially during and after COVID-19. This paper provides a discussion on critical differences between environments where older individuals age, and how designs should account for these variations. Lastly, this paper highlights the physical and mental health issues of caregivers and provides a discussion of challenges that remain toward using social robotics to assist those who take care of the aging population.

Keywords: COVID-19 · Depression · Isolation · Social robotics · Elderly · Long-term care · Independent living · Aging in place · Pandemics

1 Introduction

Aging in place is defined as a situation where a person can age in the place of his or her choosing for the remainder of his or her life [29]. Many older adults are not able to spend their remaining days living inside their own home due to requiring care not possible in their house. This has led technologist to develop solutions to

Supported by Arizona State University, the National Science Foundation, and the Zimin Institute at Arizona State University.

C. Stephanidis et al. (Eds.): HCII 2021, CCIS 1420, pp. 164–171, 2021.
https://doi.org/10.1007/978-3-030-78642-7_22

allow people to age inside their home longer. Examples include smart homes that monitor a person inside the home [12,13]; and wearables and interactive video games that encourage fitness [14,27]. Robots are being developed to aid people living with dementia and range in their functionality from storytelling and playing music, to engaging users in mathematical problem solving or other cognitive tasks [10,15,21]. An example of a low-cost, commercially-available solution is Joy for All's robotic pets, targeted toward people living with dementia, allowing users to feel as if they are caring for an animal, without the physical burden of a pet [6].

Depression and isolation are often felt as people age due to a myriad of circumstances including the environment in which a person ages; less frequent social interactions; and losing or being separated from friends. The impact depression can have on mental health is detrimental and has been compared to smoking [9]. Isolation is commonly experienced irrespective of where a person chooses to age. Social robots are being explored to assist older adults through companionship, conversation therapy, and connectedness to those around them. Yet much work remains before these technologies, such as conversational therapy products, are brought to the market to address feelings of isolation and depression.

Pandemics, such as COVID-19, necessitate social distancing and quarantining, potentially exacerbating the aforementioned emotions of depression and isolation. For many healthy older adults, COVID-19 interrupted regular visits with family and friends due to quarantining, yet some comfort was found in drive-by visits with their family; using plastic barriers for hugging; waving from windows or front doors; and using video services to connect [17]. Seniors in long-term care facilities were unable to participate in the aforementioned limited yet critical social visits and were completely cut-off from visitors outside the medical staff [1].

COVID-19 has called urgency to social robotics to provide comfort to older adults now and in the future. In this paper, we discuss current trends in social robotics, highlight remaining challenges, and provide insight on how to address these barriers in different environments to assist caregivers of older adults.

2 Aging in Place: How Place Affects Aging

A person can age in place inside their home, a family member's home, a nursing home, or an assisted living facility. When examining these locations separately, a common challenge connected all settings: isolation is irrespective of environment.

Older adults who age inside their home can still feel the effects of isolation and depression. These feelings can be stimulated through limited public and private interaction or living alone [9]. Decreased motor skills that prohibit seniors from leaving the house as often as they would prefer can be another contributing factor to isolation. Infrequent visits by family living far away can contribute to isolation. Seniors, in general, are less tech savvy than younger generations, which can create barriers with staying connected among their social circle.

Health problems can leave an individual feeling isolated if he or she does not have anyone to confide in or cannot receive assistance getting to and from doctor appointments. Disability can also lead to an individual feeling alone. Disability resulting from falls such as hip fractures is a common injury leading to immobility. Difficulties with ambulation and transportation can lead to social isolation depending on how long individuals require to recover; how much time they must spend at home alone; and the extent of surgery.

When a person moves from assisted living to a nursing home, there are social consequences. Older adults often lose friends they made at the assisted living facility as well as the relationship with staff members who are familiar with their medical condition and needs [8].

When an older adult moves in with younger family members, this can cause the informal caregiver to feel isolated and depressed. Usually, informal caregivers have additional people inside the house they provide care to. Caregivers often neglect their own health to assist other people inside the residence which can cause their mental and physical health to decline [16]. For example, they often stop socializing with friends and feel they have no time for themselves.

3 COVID-19, Isolation, and Depression

While isolation and depression are present outside of pandemics, these feelings are heightened during events that require quarantining and social distancing, such as COVID-19. Seniors are more at risk for developing severe illness from COVID-19 than other demographics, which could lead to hospitalization, intensive care, or even death [1]. Therefore, older adults were encouraged to isolate more than the general population. On June 25th, 2020, the Center for Disease Control and Prevention (CDC) reported 8 out of 10 deaths related to COVID-19 were adults 65 and older [1]. In response, many stores created special "Senior Hours" early in the morning for the elderly to shop without the general population [24]. Older adults were encouraged to switch medication from 30- to 90-day supplies as well as store enough food for extended quarantining to help minimize exposure [22]. Grandparents were isolated from their grandchildren who they previously saw regularly, leading to increases in separation anxiety [17]. Grandparents were afraid they would miss watching their grandchildren grow up; their grandchildren would forget them; or their grandchildren would not want to spend as much time with them after the pandemic [17].

For seniors who have underlying health issues, many communities came together to complete shopping and deliver the necessary supplies for community members [19], allowing more at risk demographics to stay safely inside their homes. Concerns for contracting COVID-19 are higher inside care facilities. Many facilities restricted or banned visitors to reduce the risk of infection [1]. In addition, facilities practiced social distancing from other patients [1].

One in three people in the United States serve as an informal caregiver and frequently experience physical and mental stress [26], which can lead to fatigue, anxiety, and/or depression [2]. Informal caregivers are usually the spouse or the adult, female child. During COVID-19, caregivers had to take extreme caution in caring for their loved ones, which included limiting time spent outside their homes; disinfecting groceries and items after shopping; disinfecting mail; and creating a secondary caregiver alternative in case they fell ill [7]. Once caregivers were done sanitizing the outside provisions, they had to sanitize themselves by changing from "outside clothes" to "inside clothes", and taking a shower and washing their hair [7]. Caregivers were advised to not wear jewelry outside the home and wear hair back to reduce the risk of it carrying COVID-19 particles [7]. Finally, caregivers were encouraged to frequently wash their hands up to their elbow [7]. Resources for dealing with the extreme stress and isolation felt from sheltering at home while caring for an older adult include taking short breaks, and contacting loved ones and/or support groups [2,3,25,28].

4 Social Robotics to Assist with Isolation and Depression

Currently, many social robotic applications have only been tested as pilot studies and there are no commercially available conversational robots on the market. Joy for All created a robotic puppy, kitten, and cat intended to sooth older adults living with dementia [6]. These robotic pets interact with the user by barking when conversation is detected. Here, we report only the research in social robotics related to conversational strategies.

In 2019, Magyar et al. [20] developed an autonomous dialogue system to learn conversations from humans to assist older adults living with dementia. The team used a small robot, resembling a baby, which allowed patients to hold onto it for extended periods of time, promoting longer conversations. Magyar et al. reported this work as the first study to demonstrate robots being used to reduce dementia related symptoms such as depression. The had five participants.

Cruz-Sandoval et al. [11] developed a robot named Eva to interact with persons living with dementia by using conversational strategies recommended to caregivers. Eva is semi-autonomous and can handle simple conversations but requires a human operator for more complex interactions. Through her remote app, a human operator can send commands to Eva to play songs, prompt predefined activities (e.g., greetings), change the emotion on her face, and convey personalized phrases. Cruz-Sandoval et al. reported that conversational strategies increased interaction with the robot. The study took place in 2019 in Mexico and included twelve patients who participated in twenty-three group sessions.

Khosla et al. [18] studied how older adults living with dementia in at-home care interacted with a robot named Betty in 2019 over three months. Betty was capable of playing users' favorite songs while dancing, providing the news, telling stories, sharing daily reminders, engaging users in cognitive games, and serving as a medium for SMS messages, phone calls, and video messaging to family members. Results showed users engaged with the robot at least three

to six times a day. Videos of the sessions were recorded and showed caregivers preforming other tasks in the background while loved ones engaged with Betty. Four out of the five participants reported feeling that Betty was a friend, showing the potential of social robotics for assisting older adults and their caregivers.

In 2019, Iwabuchi et al. [15] introduced a conversational robot named Sota to help people living with dementia. The robot could greet individuals, ask the user's name, offer topics to discuss, and offer emotion evoking conversations, and play Japanese word games. Participants interacted with Sota for fifteen minutes. Sota was reported as offering positive conversational support; however, the number of participants is unknown.

Abdollahi et al. [5] conducted a pilot study in 2017 with a robot named Ryan. The robot was capable of engaging users through simple question-directed conversation, displaying a photo album along with the story behind each picture, changing facial expressions, or reminding them of their daily schedule. Six participants were selected to have 24/7 access to Ryan inside their home for four to six weeks. The paper reported that participants spent on average two hours interacting with the robot per day. Moreover, users enjoyed having Ryan as a companion, and the interest in interacting with Ryan did not decrease with time.

5 Limitations in the Field

There is a limited amount of research being done around conversational robotics and virtually none for healthy older adults. State-of-the-art technology is still in pilot testing mode, and very few participants are involved during testing.

Much of the technology mentioned above is for older adults living with dementia as opposed to healthy older adults. This could deter healthy older adults from using one of these robotic applications due to a misalignment of needs. The robot in [18] which could have potential given the findings of doll therapy, which has shown to help people living with dementia by providing health benefits associated with caring for another person [23]. The form of a baby could deter healthy older adults given that the robot may feel too childlike instead of filling the role of a companion. Khosla et al. [18] showed that users were engaged with their social robots for extended periods of time, demonstrating the potential for this technology to reduce feelings of isolation and depression.

While hardware, software, and artificial intelligence are advancing at a rapid pace, social robotics is still in its infancy. As of today, no robotic platforms for conversational therapy have made it to market. While apps exist, such as PyxHealth [4], social robots are still nascent. One barrier to their exploration and use is their high cost. Low cost robotic platforms are needed to increase the likelihood of people purchasing and adopting these devices in their homes.

Social robots need to be capable of handling complex and interactive dialogue. Currently, robotic conversation is simple and nonreciprocal. For applications to become widely accepted, communications should be veridical, adaptive, reciprocal, and multimodal. Dyadic interactions between humans include social non-verbal cues such as facial expressions, body language, and hand gestures;

reciprocal engagements; and contextual information from past. None of the current applications are capable of mimicking these behaviors. To reach a wider market, such features will be essential to social companion robots.

The aforementioned challenges leave gaps in the literature including the following questions: Will healthy older adults be willing to accept a social robot for companionship? What physical features of a social robot are important to healthy and burdened adults? What additional tasks or functions, if any, should a social robot be able to perform?

6 Discussion

Isolation and depression were felt by older adults and caregivers before the COVID-19 pandemic. Being forced to shelter at home, sanitizing their provisions, leaving their residence, and being isolated from family and friends has only exacerbated these feelings and taken a toll on their mental health. The recommendation for caregivers is to reach out to a friend or family member for support. Moreover, feelings of isolation and depression among seniors before the pandemic have likely increased due to further restrictions on social interaction. Social robotics have the potential to augment and enhance social interactions during times of isolation, both for older adults and caregivers; yet, as of today, no commercial products exist.

Isolation is felt by caregivers and older adults in all locations they choose to age in place. Most research to address isolation is happening inside care facilities, but other locations, such as the home, are in need of attention. Researchers are urged to shift their area of focus from assisted living to in-home settings to accommodate the majority of seniors aging in home, and work to include healthy older adults in their experiments to enhance the applicability of the devices they develop. By diversify the participant pool, we will gain a better understanding of social robot features valued by healthy older adults as well those requiring assistance. These differences will provide insight into how to generalize social robots to assist as many people suffering from isolation and depression as possible.

COVID-19 has called attention to the urgency and importance of conversational social robotics. These technologies have the potential to assist seniors who are isolated during the time of the pandemic and long after. Caregivers could benefit from the use of a social robot in the home by allowing them to focus on other activities inside the home, take time for themselves, and converse with the robot to release stress. Social robotics capable of engaging the user in veridical, reciprocal, and engaging conversation could alleviate isolation and depression felt by older adults in any location they choose to age.

Acknowledgements. The authors thank Arizona State University, the National Science Foundation (Grant No. 1828010), and the Zimin Institute at Arizona State University for their funding support. Views expressed are those of the authors and do not necessarily reflect those of the NSF.

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