The Perception of Aging and Use of Robots

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Abstract. The implications of robots' design for their acceptance in nursing settings, particularly for elderly people and those involved in their care, have not been thoroughly considered from an information design perspective. This research gap is addressed here, as such a perspective enables consideration of several important socio-cultural aspects of robots, including potentially significant elements of visual culture. Since all these aspects influence views of robots as aids for elderly people, there is a need to understand how robots' design (in terms of appearance) and perceptions of aging influence intended elderly users, their relatives, caregivers and decision-makers. Robots materialize digital technology, both metaphorically and literally. AI and embedded systems enable robots to act, but the shape and materials selected to make them influence our interactions with them. Thus, as shown in this paper, application of an information design perspective can provide deeper insights about the influences of current and historical culture and media on both the perceptions and experiences of aging, and relations of these perceptions and experiences to the acceptance (or lack of acceptance) of robots as tools for nursing old people.

Keywords: Robots · Aging · Culture

1 Introduction

We are facing several major demographic and socio-economic challenges related to the nursing of elderly people. Costs of their care are rising because the population of elderly people is growing, while shortages of nursing staff and caregivers are envisaged due to the resulting demographic imbalance [1]. Potential solutions are offered by rapid developments in health technology, including robots designed to provide support in healthcare, nursing environments and domestic applications. Robots have been made and used for several decades, and portrayed in cultural media for almost a century, but they are minor and not entirely positive elements of elderly people's cultural heritage. Partly for this reason, elderly people have relatively little knowledge of, interest in, and acceptance of, digital technology generally and robots specifically [2]. The resulting resistance to the intrusion of digital technology into their lives is multi-dimensional, and some aspects have been addressed to varying degrees (as outlined in following sections). However, previous studies on robotics and culture have either generally ignored cultural heritage or focused solely on national differences and neglected other potentially relevant cultural factors. More specifically, the implications of robots' design for their acceptance in nursing settings, particularly for elderly people and those involved in their care, have

not been thoroughly considered from an information design perspective. This research gap is addressed here, as such a perspective enables consideration of several important socio-cultural aspects of robots, including potentially significant elements of visual culture. Since all these aspects influence views of robots as aids for elderly people, there is a need to understand how robots' design (in terms of appearance) and perceptions of aging influence intended elderly users, their relatives, caregivers and decision-makers.

Here, I argue that the perception of robots has been strongly influenced by the portrayals of robots in popular culture (which have frequently been scary and threatening), thereby extending previous studies on human responses to robots [3–6]. An early example was the destructive *Maschinenmensch* created by a deranged scientist called Rotwang to resurrect the women he had loved in Fritz Lang's movie *Metropolis* (released in 1927) and the novel with the same title by Thea von Harbou [19]. Since then, robots have played key roles, ranging from intensely malevolent to deeply altruistic, in numerous literary works and movies.

The discussion about technology and old people needs to be contextualized with respect to the perception of robots and how aging is perceived and understood in western culture. This paper discusses the relation between the experience of ageing and the perception of robots intended to play roles in the nursing or healthcare of elderly people from an information design perspective.

Moreover, cultural contexts must be considered to acquire deeper insights into elderly people's views and experience, the wider public's perceptions of elderly people, human responses to robots generally, and robots' potential roles in nursing the elderly specifically. For example, how much does the representation of aging and robots in culture and various media influence views regarding potential roles of robots in nursing old people? The aim of this paper is to contribute insights into how culture and media, current and historic, influence both the perception and experience of aging, and relations of these perceptions and experiences to the acceptance (or lack of acceptance) of robots as tools for nursing old people.

2   Background

According to the EU [7] and Swedish Digitalization Committee [8] we are facing changes that will pervade every part of society. The changes are expected to result in a flexible society where the citizens must be prepared for 'lifelong learning', including the acquisition of digital skills, to enhance both their personal lives and professional prospects [8]. The literality of the term 'lifelong' in this context is debatable, but it does encompass old age (especially the personal elements of lifelong learning). Thus, researchers in both information design and humanities disciplines have considered some relevant aspects of digitalization, but they have largely ignored others, including robots. To address the neglected issues, an information design perspective may be helpful for acquiring nuanced understanding of general perceptions of robots and effects of cultural factors on acceptance of or resistance to them. Moreover, combination of such a perspective with consideration of visual elements of cultural heritages should contribute to understanding of human-computer interaction (HCI) generally, and particularly the

complex relations between the elderly, wider public, technology, cultural factors, and roles of robots in elderly care.

Interest in the influence of cultural factors on the design of robotic systems and use of robots has increased with the globalization of robotics, science and technology [4]. However, in robotic science a simple approach to culture has been generally adopted, involving grouping people by nationality, age and/or sex [4, 9–11], focusing particularly on differences in traditions between Oriental and Occidental cultures. Notably, people in the West are supposedly discomforted by social and humanoid robots and potential interactions with them due to human exceptionalism [4], while Japanese and Korean people are reportedly more comfortable with robots due to animist beliefs [9–11]. However, more nuanced analysis that does not rely on supposed national or ethnic characteristics (often based on crude historical categorizations) is required [12].

Culture can be defined as the ideas, customs and social behavior of a society, but it is rarely (if ever) perfectly homogenous and generally groups of people within societies have distinguishable subcultures. Buildings, artefacts, ethnicity and language are also parts of a culture, some but not all of which will be shared by all associated subcultures. Everything that is visible and created by people of today or in the past is an element of visual culture. Moreover, visual expressions in technology, design and art are clearly influenced by each other. Cultures can be partly delimited by geographical and political boundaries, but many aspects are cross-national as groups of people distributed over the globe can share common interests and through them create cultures with distinct symbols, vocabularies, lifestyles and dress codes [13]. Thus, a more nuanced definition of the culture of a group of people is needed, which encompasses (*inter alia*) class, lifestyle, gender and sexuality.

Elements of both 'high' and popular culture influence our understanding of phenomena generally [13], collectively providing a lens through which we perceive new and unknown things, and thus our perceptions of aging, old people and robots. However, studies on HCI and the elderly have paid little attention to the influence of cultural expressions such as visual art, movies, theatrical works and literature on our understanding of technology and aging. Many previous sociological studies of aging and culture have ignored the ways cultural texts, literature and movies construct multiple narratives of aging that to some extent conflict with social theories of aging [14]. In recent decades several Swedish novels about the experience of aging have been published, and visual artists have portrayed themselves and friends in the process of aging. However, effects of the representation of aging in literature and visual art on our perceptions of aging have been largely ignored by researchers.

Moreover, there is no coherent definition of old or elderly people [15]. Researchers often divide elderly people into two age-based groups: 65–80 years old and 80 to ca. 90 years old, implicitly defining the elderly as those who have reached standard Western retirement ages and (thus) are no longer contributing productively to the economic development of their societies. However, digital literacy is increasingly required throughout the population to meet numerous challenges [8], so age-related barriers to use of digital technology, especially in the nursing and healthcare of elderly people, must be addressed. To do so it is crucial to understand the development of robots, the

aging population, cultural attachments to the past, the resistance to robots and digital technology associated with aging, and the complex interactions involved.

3   The Perception of Aging

Perceived associations between age and both knowledge and wisdom have profoundly changed recently. Since we admire and desire youth we do not value life experience as much as previous generations. Today people are active in old age compare to previous generations, people turning 65 years old are a target group for travel agencies and various kinds of consumptions. However, people are more active in old age than in previous generations, for example people in their late 60s are a major target group for travel agencies and retailers of various consumer goods.

People who do not yet fit into the categories (however defined) have a very vague idea of what it means to be elderly or old, inferred from paintings, photographs, books, movies and of course relatives and people in the neighborhood. However, both old people's perceptions of themselves and other people's perceptions of them change over time. Moreover, the clothes, norms and activities of elderly people affect both their behavior and the way they are perceived. As we age ourselves, our view of elderly people and our distinctions between the elderly and old change. Notably, people rarely identify themselves as old. This is because age can be regarded as a cultural construction that is symbolically located in a biological metaphor [16], but it is also a process and not a stage [14]. The experience of age is partly individual, but influenced by culture, gender, class, ethnicity and sexuality. However, age is not only something that we experience, it also affects how people are treated. This could partly be explained by age-associated roles that people tend to play. Teenagers and young adults often obviously play various roles, but we rarely recognize the role play among elderly to the same extent, although self-narration is important not only for description of the self, but also for the emergence and reality of identity [17]. The concept of age as an indicator of social status has been criticized [18], but it is still a basis for social discrimination and our expectations of elderly people, particularly in relation to technology.

Aging can also be regarded partly as a negotiation between the inside and outside, the experience of being the same as before but looking different. Simone de Beauvoir suggests that old age is an internalization of the difference between the subject and what she or he represents for the outside world [14]. "Within me it is the Other – that is to say the person I am for the outsider – who is old: and the Other is myself" [14]. Visible effects of aging differ among individuals, early signs may include loss of hair and/or gray hair.

Although we know our chronological age, the aging is abstract and so is recognition of the losses of capacities; it takes a while for people to realize that their eyesight, hearing, strength and stamina are not as good as they were.

This is not the only highly relevant aspect of the embodiment of human experience, i.e. the inextricable linkage between the human body and mind. We need a body in order to be human, and face to face interactions involving gestures play important roles in both communication and emotional relations [20]. Thus, communication is thereby

embodied. Disembodiment occurs when a person's identity becomes separated from their physical presence, as in virtual reality. But the body doesn't really disembody. It simply floats into another space. The essence of it merges in with the other understandings of the body. One's consciousness extends to the edges of one's online identity. The second self becomes as much as the primary self, and one acts through it" [21]. These concepts raise intriguing questions about requirements for "face to face" communication with a robot, and our experience of (and responses to) non-human bodies. We can become emotionally involved with inanimate things, such as objects that remind us of certain times, places or people, and even mundane objects with no such resonance (such as an ordinary cup, lamp, chair or dress) although we receive no responses from them. Familiar objects are often highly valued and old people want to take them if they move to an old people's home, and now or in the very near future those valued things will almost certainly include smart phones, computers and other digital devices.

4   The Perception of Robots

Robots and robotic systems are associated with many apprehensions. It has been suggested robots are related to monsters [22, 23], because both monsters and robots are post-human, they are "the Other" [3]. Monsters are representations of peoples' fear and the world's perceptions. They make us re-evaluate cultural assumptions regarding ethnicity, gender and sexuality, the perception of differences and tolerance in relation to deviations [24].

However, resistance to robots also has deeply rational foundations, in fears that people may be replaced by robots in future labor markets or that robotic systems with Artificial Intelligence (AI) may attack or supplant humans, as in *Terminator* movies released in the 1980s and postulated by thinkers who cannot be easily dismissed such as Stephen Hawking [29]. One of the discussions related to AI concerns whether or not operators in manufacturing industries will serve the robots or vice versa. In increasing applications in these industries humans and robots work close to each other, and share working space. However, humans and robots very rarely handle the same components simultaneously.

Anxieties related to elderly care and robots include fears that inhuman care by robots will replace the human care provided by caregivers and that this will result in losses of caregivers' employment or devaluation of their work. The ambivalence regarding robots generally and as aids for the elderly in daily life is clearly relevant to robots' acceptance, and may be at least partly related to technical capacity being prioritized more than users' needs or responses during robots' developments. In efforts to address this issue, both nursing and healthcare scholars have considered what we can learn from monsters in popular culture [3]. Notably, researchers involved in the *Caring Monster* project found that monsters do not always have "monstrous" characters. Monsters' nature, meaning and position as "the Other" in relation to humans can change over time [3]. The philosopher Mark Coeckelburgh has raised a related discussion regarding what he calls doom scenarios [25] in relation to robots in elderly care. He argues that robots and other information technologies will inevitably become accepted parts of old people's lives, that it

may not even be possible to discuss the elderly's capabilities independently of technology, and that technology must be defined [26].

However, many people's ideas about humans' relations with robots are imaginary, since most people have little or no personal experience of real robots. Thus, their ideas about robots emanate mostly from movies, TV programs, exhibitions or visits to manufacturing companies with various levels of automation. An interesting factor is that robots' appearances depend on their purposes, and we do not even recognize some (such as automatic lawn movers and vacuum cleaners) as robots. When customers visit some shops of the Japanese clothes manufacturing and retailing company Uniqlo they may meet a robot, called Wakamaru, designed by Toshiyuki Kita and made by Mitsubishi. Wakamura is a commercial product intended to increase the company's profits, but it is interesting from a perception perspective. Originally designed to assist the elderly or disabled, these robots are supposed to have abilities not only to pick out the right pants for you, but also to make eye contact and participate in a simple conversation. The harmless-looking little figure interacts and communicates with customers by using its AI to "look at them" through eye-like sensors and following their movements (Uniqlo.com). The interaction based on "eye contact" creates an emotional relation that is one-way but seems two-way because the robot apparently "looks at us" when we look into its "eyes" [5]. A two-armed robot called YuMi, produced by ABB Corporate Research, is also interesting in this respect. It was originally intended to participate in automated assembly processes, but when it was introduced it was displayed together with a painting by the robot in a department store window in Stockholm. The reason for showing the robot in that context was unclear since it was in an interior design setting, but it was probably at least partly intended to play down the presence of a robot, to create acceptance. When YuMi was first demonstrated by ABB the company emphasized its ability to interact with users by following their motion patterns, which created a feeling of communication between the humans and robot.

5   Robots' Appearance

Robots materialize digital technology, both metaphorically and literally. AI and embedded systems enable them to act, but the shape and materials selected to make them influence our interactions with them. Robots that are designed as humans are often experienced as uncanny as they are humanlike but not human.

There could be several reasons for this. One is the metaphoric link between robotic nature and lack of emotionality or empathy with other people. Another is the cognitive dissonance associated with encountering something that cannot be readily defined, understood and categorized as (for instance) a species, animal or human. Thus, it conflicts with our organization of knowledge, thinking and understanding of the environment, raising uncertainties about suitable responses.

Representations of bodies in cultural artefacts may also be important. From early Christianity the body was covered in visual representations, and naked bodies were not portrayed in Western art until the Renaissance. From then until modernism the naked female body was the most frequent motif in art. It was not until early 20th century when

the male body became interestingly for the artist. Artists also portrayed the male body, to a lesser extent, particularly strong muscular bodies of working class or peasant men in the early 20th century [27]. Nevertheless, despite interest in the body's appearance there has been general acceptance of the Cartesian concept that the body is separate from the mind, which controls intellectual activities and the body (but not in the modern sense of body control in terms of self-monitoring, maintaining fitness etc.). Today we accept that our bodies are part of our identities and not separated from our minds. However, the Cartesian separation of mind and body might invoke a perception that robots' bodies are similar to ours, but not sufficiently familiar, and their intelligence may be out of control and alien.

Thus, robots' visual designs influence our perceptions of them, and we may even apply gender stereotypes to them, as people tend to think that robots with "male" and "female" torsos are respectively suitable for traditionally male and female tasks [28]. In addition, research indicates that people respond to single communication modalities (face, head, body, voice, locomotion) but this is not necessarily related to a higher degree of anthropomorphism [5]. These response patterns will probably influence the acceptance of robots in various contexts, and an intriguing question is whether robots will cement traditional stereotypical gender roles and codes or loosen them. The relationship between bodies' representations and gendered expectations of robots has been apparent at least since Rotwang made a female robot that met traditional ideals of beautiful women in *Metropolis*.

6   Living with Robots

Living with robots will not necessarily lead to replacement of humans. It could provide people with support that will increase their ability to meet friends and relatives, thereby strengthening their social life. In many cases robots may re-embody people who have lost full physical capacities. An example of a successful robot is the telepresence robot Giraff, which enables elderly people to remain in their homes for longer and retain connections with friends and family members who are elsewhere in the most personal manner possible. The robot can be moved around and display images of remote friends, family, doctors or nurses on its screen, almost as if they were in the same room.

Moreover, combination of the Giraff's telepresence capabilities and the Giraff Plus solution can help elderly people avoid needs to visit the hospital or a doctor (which can be very trying, especially if they have pain, movement problems or bad eyesight). The latter involves placement of sensors around a user's home to collect environmental and physiological data. The environmental sensors can detect motion, pressure, use of household appliances and the status of other fittings. For example, if a door or window is open a signal can be sent through the system to a caretaker, while the physiological sensors can measure blood-pressure, -oxygen and -sugar levels and send the information to the healthcare provider.

The Giraffe is already on the market but there is still no robotic guide dog. This is problematic for old people with bad eyesight, which could hinder them from taking walks by themselves, especially if they live in a large city with many people on the

streets and heavy traffic. If young people lose their eyesight, they get mobility training and learn to walk with a stick and a guide dog. For an elderly person, this is probably too demanding, and it takes a while for the dog and its owner to get to know each other and learn how to communicate.

However, there would be numerous advantages if a user's stick and guide dog could be replaced by a robotic dog that could guide the user smoothly and safely along pedestrian paths and across streets through the ability to recognize traffic and people. Such a robot could also recognize routes and can tell the user where he or she is. The user could take walks whenever he or she wanted and be totally independent of a human assistant. In addition, the robotic dog could carry groceries from the store back home. For an old person of today this may seem like science fiction, but probably not for an old person in the near future. Today, many children and young adults are familiar with robots as toys, cleaning appliances and gardening devices. Robots are already parts of their daily lives, some of which they will have emotional attachments to and probably take with them as important souvenirs if and when they move to a home for the elderly in the future.

7   Conclusion

Age is not a condition, but there is a tendency in society and research to group people by age and to define users from specific age groups. The paper has discussed aging as a process and not a stage. Moreover, elderly and old people are concepts that are often used without any further problematization, but they are ambiguous. For example, they may be based on peoples' self-images or other people's perceptions of them. However, both self-images and other people's perceptions of elderly and old people are colored by culture and media.

However, increases in age of Western populations and advances in healthcare are leading to increasing expectations of lifelong health, rather than increasing afflictions by illness and weakness with age. Indeed, much of the loss of sensory capacities is already compensated by technological devices such as hearing aids and speech synthesizers.

When robots are introduced as alternatives for human caregivers, people are generally resistant. This is probably at least partly due to robots' portrayals, especially in popular culture. Thus, by applying an information design perspective we can gain deeper insights into the influences of historical and current culture and media on both the perceptions and experiences of aging, and relations of these perceptions and experiences to the acceptance (or lack of acceptance) of robots as aids for nursing old people. Robots could provide additional support for people who need help in their daily life. More relevant and important issues regarding robotic aids for elderly people may be the socio-economic differences, particularly the gaps between those who can and cannot afford such aids.

A change in expectations regarding the requirements of elderly and old people is needed. Notably, to enable lifelong learning and help them to maintain independence it will be essential to develop educational practices that enable people who lack digital

literacy to participate in and benefit from the digitalized society. Moreover, in order to develop well-designed robots that people of *all* ages can use, it will be essential to include users in the design process

Attitudes regarding robots and how they can support elderly and old people are changing, but there is still a fear that robots will replace humans. However, elderly people could potentially find that living with a robot was more secure and comfortable than encountering new human faces every day or week.

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