17 The Rights and Wrongs of Robot Care

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The possibility of being cared for exclusively by robots is no longer science fiction. There has been a dramatic increase in the number of companies producing robots for the care or companionship, or both, of the elderly and children. A number of robot manufacturers in South Korea and Japan are racing to fulfill the dream of affordable robot "nannies." These have video game playing, quizzes, speech recognition, face recognition, and limited conversation to capture the preschool child's interest and attention. Their mobility and semi-autonomous functions, combined with facilities for visual and auditory monitoring by the carer, are designed to keep the child from harm. These are very tempting for busy, professional parents. Most of the robots are prohibitively expensive at present. But prices are falling and some cheap versions are already becoming available. Some parents are beginning to use the cheaper ones, such as the Hello Kitty robot (Sharkey and Sharkey 2010a).

There is an even greater drive for the development of robots to help care for the elderly. Japan is facing a problem of an aging population growing out of proportion with the young population. In March 2009, Motoki Korenaga, a Japanese ministry of trade and industry official, told *Agence France-Presse*, "Japan wants to become an advanced country in the area of addressing the aging society with the use of robots" (Agence France-Press 2009). Japan is already en route to deliver robot-assisted care, with examples such as the Secom "My Spoon" automatic feeding robot; the Sanyo electric bathtub robot that automatically washes and rinses; Mitsubishi's Wakamaru robot for monitoring, delivering messages, and reminding about medicine, and Riken's RI-MAN robot that can pick up and carry people, follow simple voice commands, and even answer them. The idea is to continue this trend by developing robots that can do many of the household chores for which a visiting helper is now required. Other countries may well follow suit. Europe and the United States are facing similar aging population problems over a slightly longer time scale.[1]

As with any rapidly emerging technology, likely risks and ethical problems need to be considered. The main area of concern addressed in this chapter is the application of robots in caring for the vulnerable. Many of the applications of robots targeted at

children and the elderly could show great benefits. For the elderly, assistive care with robot technology has the potential to allow greater independence for those with dementia or other aging brain symptoms (Sharkey 2008; Sharkey and Sharkey 2010b). This could result in the elderly being able to stay out of institutional care for longer. For children, robots have been shown to be useful in applications for those with special needs (e.g., Dautenhahn 2003; Dautenhahn and Werry 2004; Liu et al. 2008). The engaging nature of robots makes them a great motivational tool for interesting children in science and engineering, or facilitating social interaction with the elderly.

We raise no objections to the use of robots for such purposes, nor with their use in experimental research or even as toys. Our concerns arise from the potential abuse of robots being developed for the care of the vulnerable. Our aim here is to throw up some of the ethical questions that need to be asked as robotics progresses sufficiently to allow near-exclusive care by robots. Our interest is in the potential infringement of the rights of the vulnerable, and so we have zoomed in on the extremes in the age range of care: the very young and the elderly. In taking a rights-based approach we are not subscribing to any general ethical theory. However, we do assume that society has a duty of care and a moral responsibility to do its best to ensure the emotional and psychological well-being of all of its citizens, regardless of their age. In looking at robots as carers, we take this duty as given and we examine the balance between it and a number of prima facie rights. We also consider how the resolution of conflicts between rights depends on the age of those cared for and their mental faculties. Elsewhere we have discussed a number of ethical issues, such as dignity and infantilization (Sharkey and Sharkey 2010b, c), the deception of the elderly (Sharkey and Sharkey 2010b), and the deception of children (Sharkey and Sharkey 2010a). Our focus in this chapter concerns the rights to privacy, personal liberty, and social contact.

17.1 Safety and the Right to Liberty and Privacy

An essential component of the duty of care is that a carer must keep their charges safe from physical harm. However, this rule is anything but simple. It does not give the carer the right to "any means" available. The rule must be traded off against the rights of the cared for, such as the right to personal liberty, the right to protection from psychological harm, and the right to privacy.

It is the health and age of the individual that determines the permissible means of safety. One robust way to keep anyone physically safe would be to put the person in a straitjacket in a padded room. Not only would this be inappropriate in most cases, it would be a violation of the rights to liberty and to protection from psychological cruelty. There are many different means for keeping people safe, and each different case will have its own path through the rights trade-offs.

For example, if an elderly person opened a drawer full of sharp kitchen knives, it would be inappropriate for the carer to suddenly spring upon them and restrain them. But if the person had been diagnosed as having severe suicidal tendencies, then such action may be deemed appropriate and even obligatory in the duty of care. With dementia sufferers who are well enough to live in their own homes, it could be inappropriate and irritating even to warn them of the danger (depending on their degree of dementia). With a young child, the appropriate action would be to remove any sharp objects from them and place them out of their reach.

Monitoring someone's activities twenty-four hours a day is another way to maintain safety. This could be done in person or with the use of security cameras. Obviously, violating the right to privacy in this way could be appropriate in some circumstances, such as those of intensive care. However, for those in partial or home care, it could be a severe intrusion on their privacy to monitor them taking a shower or using the bathroom, for example.

A Robot carer needs to understand which behavioral responses are appropriate in which contexts, as well as to be able to predict the intentions of their charges. In the remainder of this section, we examine how robots can be designed to maintain safety, and then move on to examine how this may affect the rights to privacy and liberty.

One of the primary functions of robot carers, like their human counterparts, would have to be to keep their charges safe. Robots could be used for health monitoring in a number of ways, such as taking temperatures, and monitoring respiration and pulse rate. In the high-tech retirement home run by Matsushita Electrics, robot teddy bears watch over elderly residents, monitoring their response time to spoken questions, and recording how long they take to perform certain tasks (Lytle 2002). These robots can alert staff to unexpected changes. This is an area that, once developed, could have a significant impact on elder care in the home or in care institutions. It would be easy to imagine this technology being extended to a number of other health applications, such as caring for quarantined patients.

Outside of health, the main safety method for robot care at present is through the provision of mobile monitoring using cameras and microphones. The most advanced are the childcare robots with hidden cameras to transmit images of the child to a window on the parent/carer's computer or to their mobile phone. Some childcare robots can keep track of the location of children and alert adults if they move outside of a pre-set perimeter. The children wear a transmitter that the robot can detect. For example, PaPeRo (Yoshiro et al. 2005) works by having the child wear a PaPeSack containing an ultrasonic sensor. Similarly, the Japanese company Tmsuk makes a childcare robot that uses radio-frequency tags for autonomous monitoring. The carer can also remotely control the robot to find the child and call or speak to the child through built-in speakers. Similar systems could be used for monitoring elderly patients suffering from dementia.

Such systems are labor intensive and so semi-autonomous that safety monitoring will be required to make the robots more marketable for longer daily care. Some of these advances are already well under way. For example, there are robot systems for tracking people in a range of environments and lighting conditions without the use of sensor beacons (Lopes et al. 2009). This implies that the robot will be able to follow its charge outside and alert supervisors of the charge's location.

In the near future, we are likely to see the integration of robots with other home sensing and monitoring systems. There is considerable research on the development of smart homes for the care of elderly dementia sufferers. These can monitor a range of potentially dangerous activities, such as leaving on taps or gas cookers (Orpwood et al. 2008). Camera systems are being used to determine if an elderly person has fallen over (Toronto Rehabilitation Hospital 2008, 40–41). There is no talk yet about using smart sensing for childcare, but it could get onto the agenda without stretching the imagination by much.

Further extensions to care robots could provide additional home security by employing features from security robots. For example, the Seoul authorities conducted a pilot study in which a surveillance robot, OFRO, was used with an associated security system, KT Telecop, to watch out for potential pedophiles in school playgrounds (Metro 2007). OFRO can autonomously patrol areas on preprogrammed routes. It is equipped with a microphone as well as a camera system, so that teachers can see through its lenses. Essentially, it looks for persons over a certain height and alerts teachers if it spots one. Other techniques being developed for security robots, such as fingerprint and retinal recognition, could be useful for monitoring individuals, for example, visitors or an Alzheimer's sufferer, and helping prevent petty robberies.

17.1.1 Loss of Privacy

A key issue with respect to any kind of monitoring system is whether or not it violates an individual's right to privacy. There are clear overlaps between the concerns raised about privacy in the context of childcare robots, and concerns about privacy when robots are used to monitor the elderly. Although monitoring may be conducted with the welfare and safety of the individual in mind, this may not be sufficient in all cases to justify the intrusion.

The privacy of people in general should be respected as stated in Article 12 of the Universal Declaration of Human Rights: "No one shall be subjected to arbitrary interference with his privacy, family, home, or correspondence, nor to attacks upon his honor and reputation. Everyone has the right to the protection of the law against such interference or attacks." There seems little reason to make an exception for the old or for the young. The right to privacy is also addressed in Articles 16 and 40 of the UN Convention on Child Rights.

The use of a robot carer creates a tension between the use of monitoring to ensure safety and the privacy of the target of that monitoring. As Sharkey and Sharkey (2010a) discuss, parents' use of a baby alarm is acceptable. Similarly, parents frequently video record and photograph their young children. However, there is something different between an adult being present who is recording a child and an adult covertly recording a child who thinks that she is alone while confiding in her robot friend. With the massive memory hard drives available today, it would be possible to record an entire childhood. Who will be allowed access to the recordings? Will the child, in later life, have the right to destroy the records?

Similar questions need to be asked about the situation in which an elderly person is being monitored by a robot companion, or by a remote controlled robot. A person with Alzheimer's may soon forget that a robot is present and might perform acts or say things believing he is in the privacy of his own home, or thinking that he is alone with his robot friend. While the idea of recording and preserving the memories of one's elderly parent may seem attractive, it might not be something that he would consent to, if able. Would we want our children to know everything we said about them with the belief that we were talking confidentially? Again, the important question here is, who should have access to the recordings? If the elderly person does not give consent while still in a position to do so, it would seem that all recordings should be destroyed by default after use for immediate medical purposes.

One issue that affects the elderly more than children is that of respect for the privacy of their bodies. An operator could drive a robot to peer round an elder's apartment before they were dressed or when they are taking a bath. An autonomous robot could record in the same circumstances. The elder might prefer the robot to have to do the equivalent of knocking on the door and waiting to be invited in. Furthermore, the robot could provide a clear indication (e.g., a large flashing light) when any recording or monitoring was taking place. Of course, there are individuals who are too young or whose intellectual faculties are too impaired to be able to understand recording or monitoring signals. Such individuals still have a right to privacy, but it needs to be exercised on their behalf by sensitive carers.

We have discussed how the privacy requirements of our two demographic groups differ, but we also need to take account of individuals' developmental stage and mental facility. Robot care systems should be customized individually to ensure that any intrusions on privacy are justified on the basis of the greater well-being of those concerned. They should not be based on economic or efficiency grounds.

17.1.2 Loss of Liberty

Using a robot simply as a mobile monitoring system would still be quite labor intensive for care supervisors, although more than one target could be monitored at the same time. Commercial pressures will soon lead to the development of autonomous

or semi-autonomous supervision by robots to support longer carer absence. A simple extension would be to allow home customization with maps of rooms so that the robot could recognize danger areas. As the field progresses, intelligent vision and sensor systems could be used to detect potentially dangerous activities, like a child climbing on furniture to jump or an elder heading toward basement stairs. The robot could make a first pass at warning its charge to stop engaging in a potentially dangerous activity. But would it be ethically legitimate to allow a robot to block or restrain a child or an elder from an activity that was on the robot's danger list? This is very difficult ethical territory that relates directly to one's fundamental right to autonomy.

It would be easy to construct scenarios where it would be hard to deny such robot action. For example, if a child or an elder was about to walk onto the road into heavy oncoming traffic and a robot could stop her, should it not do so? It would clearly be irresponsible for someone controlling a robot not to use it to prevent such a situation. But, what if the robot was operating autonomously? If it could predict a dangerous situation, would it not be legitimate to take action to stop it occurring, such as taking matches out of the hands of a child or an elder, getting between her and a danger area such as a gas stovetop, or even restraining (gently) to prevent her carrying out a dangerous action?

The problem here is in trusting the robot's classification and sensing systems to determine what constitutes a dangerous activity. Imagine a child having doughnuts taken from him to prevent him from becoming obese, or imagine a senior having a bottle of alcohol taken from her to prevent her becoming intoxicated and falling. Restraining a child or an elder to avoid harm could be a slippery slope toward authoritarian robotics.

Robots are able to follow well-specified rules, but they are not good at understanding the surrounding social context and predicting likely intentions (Castellano and Peters 2010). Although a robot can be programmed with rules about the dangerous situations that programmers anticipate, it is never going to be possible to anticipate enough of them. Humans, on the other hand, are very skilled at such understanding and prediction from as young as twelve months (Woodward and Sommerville 2000). A human carer is likely to be able to predict the intention behind a child building the pile of blocks to reach an otherwise inaccessible window handle in a way that the robot is not.

There are many discussions to be had over the extremes of robot interventions and where to draw the line. There are some differences in the issues raised in caring for children and for the elderly. It is sometimes necessary to constrain the action of an infant to prevent harm. However, children need to be free to explore and satisfy their curiosity for normal healthy development. This requires a balancing act between their safety and their freedom of which robots are incapable. The problem for the elderly is that if a robot restrains their actions or prevents their movements to certain places,

it could be equivalent to imprisonment in the home without trial. There are already circumstances in which carers can restrict the liberty of individuals in order to protect them. However, there are legal procedures available for making such decisions. We must ensure that we do not let the use of technology covertly erode the right to liberty without due process.

17.2 Human Contact and Socialization

It is the natural right of all individuals to have contact with other humans and socialize freely. If robots begin to be trusted to monitor and supervise vulnerable members of society, and to perform tasks such as feeding, bathing, and toileting, a probable consequence is that some young and old humans could be left in the near-exclusive company of robots.

In discussing the effect of new therapies for people with aging brains, Boas (1998) points out, "What stimulates them, gives a lift to their spirits, is the human interaction, the companionship of fellow human beings." And having a good social network helps to protect against declining cognitive functions and incidence of dementia (Crooks, Lubben, and Petitti 2008; Bennett et al. 2006). For children, very serious defects both in brain development and psychological development can occur if they are deprived of human care and attention (Sharkey and Sharkey 2010a). The effects, and risks, of reduced human contact are likely to be quite different for the elderly and for infants. Infants need nurturing and parenting to enable their normal development, while the elderly require companionship to avoid loneliness and to maintain their mental health for longer. We will deal with each of these populations separately.

17.2.1 First Contact with the Robots: Infants in Care

The impairments caused by extreme lack of human contact with infants are well known and documented. Nelson and colleagues (Nelson et al. 2007) compared the cognitive development of young children reared in Romanian institutions to those moved to foster care with families. Children reared in institutions manifested greatly diminished intellectual performance (borderline mental retardation) compared to children reared in their original families. Chugani and colleagues (Chugani et al. 2001) found that Romanian orphans, who had experienced virtually no mothering, differed from children of comparable ages in their brain development—and had less active orbitofrontal cortex, hippocampus, amygdala, and temporal areas.

Perhaps little or no harm would result from a child being left in the care of a robot for very short periods. But what would happen if those periods of time became increasingly frequent and longer? The outcome would clearly depend on the age of the child in question. It is well known that infants under the age of two need a person with whom they can form an attachment if they are to develop well. In an earlier paper (Sharkey and Sharkey 2010a), we considered whether an infant might be able to form

an attachment to a robot caregiver, perhaps in the same way that Harry Harlow's monkeys became attached to a static cloth surrogate mother.

What research there is suggests that very young children can form bonds with robots. Tanaka, Cicourel, and Movellan (2007) placed a "state-of-the-art" social robot (QRIO, made by Sony), in a daycare center for five months. They found that the toddlers (aged between ten and twenty-four months) bonded and formed attachments to the QRIO robot in a way that was significantly greater than their bonding with a teddy bear. They touched the robot more than they hugged or touched a static toy robot, or a teddy bear. The researchers concluded, "Long-term bonding and socialization occurred between toddlers and the social robot."

Turkle and colleagues (Turkle et al. 2006a) report a number of individual case studies that attest to children's willingness to become attached to robots. For example, ten-year-old Melanie describes her relationship with the robotic doll "My Real Baby" that she took home for several weeks:

Researcher: Do you think the doll is different now than when you first started playing with it?

Melanie: Yeah. I think we really got to know each other a whole lot better. Our relationship, it grows bigger. Maybe when I first started playing with her, she didn't really know me so she wasn't making as much [sic] of these noises, but now that she's played with me a lot more, she really knows me and is a lot more outgoing. (Turkle et al. 2006a, 352)

In another paper, Turkle and colleagues (Turkle et al. 2006b) chart the first encounters of sixty children between the ages of five and thirteen with the MIT robots Cog and Kismet. The children anthropomorphized the robots, made up "back stories" about their behavior, and developed "a range of novel strategies for seeing the robots not only as 'sort of alive' but as capable of being friends and companions." Their view of the robots did not seem to change when the researchers spent some time showing them how they worked, and emphasizing their underlying machinery. Melson and colleagues (Melson et al. 2009) directly compared children's views of and interactions with a living dog and a robot dog (AIBO). Although there were differences, the majority of the children interacted with the AIBO in ways that were like interacting with a real dog: they were as likely to give commands to the AIBO as to the living dog, and over 60 percent affirmed that AIBO had "mental states, sociality, and moral standards."

Overall, the pattern of evidence indicates that children saw robots that they had spent time with as friends and felt that they had formed relationships with them. They even believed that a relatively simple robot was getting to know them better as they played with it more. So, extrapolating from the evidence, it seems that there is a good possibility that children left in the care of robots for extended periods could form attachments to them. However, it is unlikely that the attachment would adequately replace the necessary support provided by human attachment.

To become well adjusted and socially attuned, an infant needs to develop a secure attachment to a carer (Ainsworth, Bell, and Stayton 1974). A securely attached infant will explore their environment confidently, and be guided in their exploration by cues from the carer. The development of secure attachment between a human carer and an infant depends on the carer's maternal sensitivity, and ability to perceive and understand the infant's cues and to respond to them promptly and appropriately. Detailed interactions between a mother and baby help the infant to understand their own emotions, and those of others.

In Sharkey and Sharkey (2010a), we argued from a review of the technology that robot carers into the foreseeable future would be unable to provide the detailed interaction necessary to replace human sensitivity and promote healthy mental development. Many aspects of human communication are beyond the capabilities of robots. There has been progress in developing robots and software that can identify emotional expressions (e.g., Littlewort, Bartlett, and Lee 2009) and there are robots that can make emotional expressions (Breazeal 2002; Cañamero and Fredslund 2001). However, recognizing what emotion is being expressed is only a tiny step toward understanding the causes of the emotion—is the child crying because she dropped her toy, because she is in pain, or because her parents are fighting?

There are many challenges to be overcome to develop a robot that could respond appropriately and sensitively to a young child that currently seem insurmountable. This is further complicated because responses that may be appropriate at one age would not be appropriate at another. An important function of a caregiver is to promote a child's development, for instance, by using progressively more complex utterances in tune with the child's comprehension.

When a human carer is insufficiently sensitive, insecure attachment patterns can result: *anxious-avoidant* attachment when the child frequently experiences rejection from the carer; *anxious ambivalent* attachment when the carer is aloof and distant; *disorganized attachment* when there is no consistency of care and parents are hostile and frightening to the children. Babies with withdrawn or depressed mothers are more likely to suffer aberrant forms of attachment: avoidant or disorganized attachment (Martins and Gaffan 2000).

Perhaps a child with a secure attachment to their parent would not suffer much as a result of being left with a robot for short periods. But the fact is we just don't know: no one has yet researched the possible negative consequences of children being left with robots for varying time periods, and it would be too risky to do so. We do know that young children do best when they spend time with a caregiver with whom they have a secure attachment. Thus, it is highly likely that leaving children in the care of a robot is not going to benefit them as much as leaving them in the care of an attentive and focused human carer. Robot nannies should not be used just because we cannot demonstrate that they are harmful. Rather, they should "qualify for (part-time)

care only when it is proven that their use serves the child's best interests" (Zoll and Spielhagen 2010, 298).

17.2.2 Human Contact and the Elderly

A major concern that we have about home robot care for the elderly is that it may replace human contact. With very advanced smart sensing systems and robots that can lift and carry, bathe and feed, as well as keep their charges safe, there will be less need for care visits—the whole point of using the robots is because there will be fewer carers available as the population ages. This is bad news for many elderly people for whom visiting carers are the only human companionship they have on a daily basis. According to a report from the charity Help the Aged in 2008, 17 percent of older people in the UK have less than weekly contact with family, friends, and neighbors, and 11 percent have less than monthly contact.

Using robots for care of the elderly seems likely to reduce the number of opportunities they have for interaction with other human beings, and the benefits that come from such interaction. Sparrow and Sparrow (2006) argue that robots should not be used in elder care because of the likely consequential reduction in social contact. They make the point that even using robots to clean floors removes a valuable opportunity for interaction between an elderly resident and a human cleaner.

Research strongly suggests human companionship is essential for the well-being of the elderly, and yet there are no specific rights to companionship. There is a right to participation in the culture in Article 27 of Universal Declaration of Human Rights.[2] Deprivation of human contact may also be considered as cruelty, which is covered by Article 5. However, it is not clear that someone living independently in their own home with the help of robots would be being *subjected* to lack of companionship. Home helpers are not employed specifically as companions; it is just one of their beneficial side effects. Before introducing mass robot care, this side effect needs to be recognized as a function. Substantial evidence suggests that human contact should be seen as part of the right to welfare and medical treatment.

It is clear that an extensive social network offers protection against some of the effects of aging: being single and living alone is a risk factor for dementia (Fratiglioni et al. 2000; Saczynski et al. 2006; Wilson et al. 2007). Holtzman et al. (2004) found that frequent interaction in larger social networks was positively related to the maintenance of global cognitive function. Wang et al. (2002) similarly found evidence that a rich social network may decrease the risk of developing dementia, and concluded that both social interaction and intellectual stimulation play an important role in reducing such risks.

There is evidence that stress exacerbates the effects of aging (Smith 2003), and that social contact can reduce the level of stress a person experiences. Kikusui, Winslow, and Mori (2006) provide a wide-ranging review of the phenomena of *social buffering*,

whereby highly social mammals show better recovery from distress when in the company of conspecifics. A recent review (Heinrichs, von Dawans, and Domes 2009) concludes that the stress-protective effects of social support may be the result of the neurotransmitter oxytocin that is released in response to positive social interactions, and that oxytocin can have the effect of reducing stress.

One take on the problem of social exclusion of the elderly in Japan is to move toward the development of robot companions and robot pets. These are being touted as a solution to the contact problem—devices that can offer companionship, entertainment, and human-like support. Examples include Paro, a fur-covered robotic seal developed by AIST that responds to petting; Sony's AIBO robotic dog; NeCoRo (OMRON), a robotic cat covered in synthetic fur, and My Real Baby (iRobot), described as an "interactive emotionally responsive doll."

There are, to our knowledge, no studies that directly compare the effect on the elderly of robot versus human companionship. Obviously, as is the case with children, robots are not going to be able to be as responsive to the needs of the elderly as are humans. However, they might be useful to supplement rather than replace human carers. There is, for example, evidence that giving the elderly robot pets to look after can be beneficial. Positive effects, such as reduction in loneliness and improved communication, have been found in studies where elders were allowed to interact with a simple Sony AIBO robot dog (Kanamori, Suzuki, and Tanaka 2002; Banks, Willoughby, and Banks 2008; Tamura et al. 2004).

These outcomes need to be interpreted with caution, as they depend on the alternatives on offer. If the alternative is being left in near-complete social isolation, it is unsurprising that interacting with a robot pet offers advantages. Better comparisons could be made such as with a session of foot massage, or sitting with a sympathetic human listener.

On the upside, a robot pet does not have to be a replacement for social interaction. It could be provided in addition to other opportunities, and might further improve the well-being of an elderly person. As discussed in Sharkey and Sharkey (2010b), robot pets and toys could act as facilitators for social interaction by providing conversational opportunities (Kanamori, Suzuki, and Tanaka 2002). Having a robot pet may also give elders an increased feeling of control and autonomy. There is strong evidence that these factors can improve their well-being, and even result in longer life expectancy (Langer and Rodin 1976).

17.3 Conclusion

We began with an appraisal of how well care robots could keep their charges physically safe. It turns out that this may be one of their most significant features. However, physical safety comes with potential costs to the rights of the individuals being cared

for. We have discussed here how it could violate rights to privacy and personal liberty. It seems almost paradoxical that the more safety the robots provide, the more their use may breach human rights.

Both old and young have a right to privacy, although privacy may have a different character for the two age ranges. It would hardly be an intrusion on an infant's privacy if their carer watched them sitting on the toilet and cleaned their bottom. Would it be so different to have a robot with the infant that broadcasts the images to the parent's computer? Admittedly, it feels less comfortable, but as long as it was only the parent watching and the images were not recorded, it would be unlikely to be considered a violation of the child's privacy. An elderly person might feel quite differently about similar treatment and not wish to have a robot camera with them in such a delicate situation. Our proposal was that a robot should always have an indicator when it is recording or transmitting images and that it warn of its presence and ask permission before entering a room.

There is also a tricky balance between physical safety and the right to liberty. We pointed out that in some circumstances, such as when a person is about to walk onto a busy road, it might be a good idea for a robot to intervene to prevent harm. However, we suggested that it would be unwise to allow a robot to make autonomous decisions about what is dangerous outside of obvious cases—such as leaving a gas stovetop on—where it could issue a warning. A robot would not have the subtlety or sensitivity to human intention to predict potential danger. What is dangerous for one person may be harmless for another. There are a lot of differences in this regard between infants and the elderly. Restraining or blocking the path of someone could represent a slippery slope to an authoritarian robotics that could result in keeping people as virtual prisoners in their own homes.

Looking into the future of care robotics, we examined the possibility that automated care could dramatically reduce the amount of human contact needed for safety and physical welfare. However, such a reduction could be a violation of the fundamental right to psychological well-being and could be considered to be a form of cruelty or torture or both under Article 5 of the Human Rights Convention (1949). Again, there are differences between the young and the elderly.

We argued from current evidence that young children can be fooled into believing that quite simple robots have mental states and can form friendship bonds with them. It seems likely that if children spent most of their time with a robot carer, they would form attachments. This means loving an artifact that cannot love them back. We cannot unequivocally demonstrate what the potential long-term harm of such relationships might be. However, we reviewed evidence from child development studies showing the types of psychological damage that could occur with insufficient human care.

We believe that there is an unacceptably high risk of abnormal attachment for children exposed to too much robot care. This could manifest later in all sorts of adult

psychological malfunctions, including the inability to parent properly. Thus, we need to ensure intense scrutiny of any robotics products where it is implied that they could be used for childcare. With strong built-in physical safety features, we would have to find a way to ensure that robots marketed for short-term companionship for children would only be used for that purpose.

The impact on the elderly would be quite different. Leaving an elderly person in the near-exclusive care of robots in virtual home imprisonment would be a serious violation of their right to liberty and their right to participation in society, and would be a form of cruelty. We discussed some of the detailed evidence that social interactions and human companionship can retard the progress of dementia. Nonetheless, we concluded that there are a number of ways in which robots could greatly benefit the elderly. Assistive robots, if used sensitively, could empower the elderly and give them greater independence. We also suggested that companion robots could act as facilitators and conversational aids to improve the social life of the elderly.

Before we go adopting robots in the large-scale care industry, we must be sure about which rights we may be violating. We must minimize these violations in a way that is customized for each individual, and we must ensure that the accrued benefits for an individual are proportionally greater than any losses due to the infringement of their rights. Having considered the field of robot assistance and care, our view is that robotics could be of benefit to the welfare of the elderly, particularly if it maintains their independence at home for longer. However, for children, although there may be benefits interacting with robots in a social, educational, or therapeutic setting, robot childcare comes with too many risks to be considered viable.

Notes

1. Gecko Systems is a U.S. company that is conducting trials for its CareBot with elderly people. Gecko Systems leaders suggest that the CareBot will provide cost effective monitoring of an elderly parent, and permit working parents to check up on their children and "watch their children routinely in a window on their computer monitors while at work."

2. General Assembly res. 217A (III), December 10, 1948.

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