

Personal Care Robots for Children: State of the Art

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Abstract

In the last decades, the application of robots in variety of industries has remarkably been increased. Self-governing robots have been employed in various fields of human life, particularly in that of old and very young people. It is assumed that in the succeeding years, personal care robots will be in an intimate relation with human beings. But, what caring responsibilities will the future robots have before children at home? This is directly related to the kinds of robots as well as those aspects of getting old that are the matter of question. Among the topics that are germane to robot carers, Child-care is the least discussed one. In this article the duties of care robots in the life of youth is investigated. It studies the benefits of the application of robots in daily life along with the negative points, perils, and anxieties that rise from the application. In this article, we examine the benefits of the usage of robots in the child life. Besides, we will discuss the disadvantages, dangers and fears that are related to child-robot connections. In the end, we will recommend some useful points.

Keywords: Robots, Care robots, Child care, Human- robot interaction

1. Introduction

Technological consideration is a collective trend and its effects on human life are noteworthy. The appearance of robots is looked at as a great technological achievement. Robotics has led to significant improvements in human life and industry. Nowadays, robots are very popular in a number of fields such as caring at home (Bilal Kartal et al, 2016; Portugal et al., 2015), accompanying guests in multi-level buildings (Velooso et al., 2012), manufacturing, medical(Feng et al., 2012; Garcia-Aracil et al., 2014), household(Matthias, 2015), military services(Halley, 2013), game(Pearson & Borenstein, 2013) and entertainment(Yampolskiy, 2013). In the following years, human beings and care robots will be closely connected

Is there any reason to feel anxious from the reliance on robots for child care? Accepting robotics and related technology is recurrently recommended as one of the ways to tackle the rising number of children in human societies. Actually, there is a growing industry which makes use of robots in child care. However, when we talk about these progresses, we have to regard some ethical concerns (Sharkey & Sharkey, 2010b). As an example, people are concerned about trusting child care to robots. They feel that such a thing can escalate social isolation and accelerate cheating and loss of dignity. Simultaneously, investigators have mentioned some evidence that prove the profits that robot care has for children (Banks et al., 2008). Also, this paper will deal with advantages, disadvantages, and worries resulted from robot care in child life.

1.1 Paper Contribution

Contribution: the previous articles mostly focus on the role of robot care for old people or in the hospitals as nurse. They do not probe the role of robots in child care. In this article, we study the roles of robots in children's life. We also would be conscious of the positive and negative aspects of these roles and the risks and concerns that they create. Finally, we will offer some recommendations which can reduce the problems between robots and children.

1.2 Paper Organisation

This paper is organised as follows: 1. An Introduction, explaining the contribution and the outline of the paper. 2. Then, description of technology and care and definition of robot care, ethics, and robot care. 3. Elaboration on child and robot care, benefits, weaknesses, and public concerns related to children and robot care. 4. Conclusion and recommendation.

1.3 Technology and Care

Assuming that due to addressing the concept of care, the technology which is applied in the child care needs investigation, presumes that the concepts of care and technology conflict with each other. On the one hand, there is a standpoint according to which care and technology struggle against each other; that the two are the manifestation of diverse realms of meaning (this is described as "gendered spheres") (Wilson, 2002). Based on this view, one domain is the embodiment of personality and emotion (care), and the other one is the origin of objectivity and standardization technology (Wilson, 2002).

Therefore, the concept of care as in healthcare, is valued as a tool to address the biological, physical, psychological and emotional needs of children in a way that is aware of individual expectations. It is in need of skill together with a compassionate nature. Explaining these details renders it possible to employ technologies that offer caring aid in a way that supports this outlook.

1.4 Definition of Care Robots

Based on the views on the entity of a care robot, recently a number of definitions are presented. Carebots are robots are planned to be used in home, hospital, or other settings. They are to contribute in, support, or arrange care for the sick, handicapped, young, old or, else, weak people (Vallor, 2011).

Latest developments in robotics have equipped robots with improved conditions in movement, activities that demand skill, flexibility, and the ability to adapt and learn from and communicate with human beings. So, it is clear that, nowadays, the potential range of robotic application is greatly expanded (Manyika et al., 2013). These innovations in robotic technologies have influenced the market of service robotics. In its turn, this has resulted in multiple robotic applications. The current demographic changes has led to the gradual developments in the reorganization of work, escalation of economic crisis, and increased interest in the opportunities that are introduced by Information, Communication, and Robotics Technology. The same is about the research activities and projects which aim was to develop solutions to guarantee sustainable healthcare services (Moschetti et al., 2014). The sales of robots as the assistance of old and handicapped people rose to about 6,400 units between 2013-2016 and it is expected to rapidly go up during the next 20 years (IFR, 2014).

The solutions offered by robotic service range from the simplest telepresence functions, which backs caregivers, up to the most complex ones. Some samples include the Giraff (www.giraff.org) which evolved in the ExCITE project (Coradeschi et al., 2013), AVA (www.irobot.com/ava) and Luna (Ackerman, 2011), assistance for routine activities such as the self-governing of chronic diseases (Simonov et al., 2012), well-being, and security provided by Florence (Frank et al., 2012) and Robo (van de Ven et al., 2010), along with integrity in a smart environment (Cavallo et al., 2013).

Researchers have turned their focus to the usability of robots in hospitals. Beran et al. showed that Nao, a tiny humanoid robot, could entertain children and divert their attention from the pain of flu vaccinations by applying pain-reducing cognitive-behavioral strategies (Beran et al., 2013). Jeong presented some primary behavioral evidence of the mechanism through which a socially= assistive robot could entertain patients in their beds in the oncology units of hospitals and how this form of positive communication could actually lessen patients' tension, unease, and ache (Jeong et al., 2015). It is quite a while that various robotic platforms are introduced and used in children's clinical therapy as well as interventions (Jeong et al., 2015). Pleo (Curtis et al., 2011), Keepon (Kim et al., 2013), and some other robotic platforms are instances that are used in young children's therapy.

It is probable that in future robots and other machines, preserving the human involvement, will transform child care. As is confirmed by all parents, time is an important matter in taking care of young children. As a result, economically child care is one of the largest segments, at least when it comes to nonmarket household sector. For many parents children their most valuable things. So, parents feel the happiness of having children deserve the time and costs spent on them. Some adults decide not to have biological children, and the time and costs play important roles in such a decision. (certainly the feedbacks are not that simple; a study which was done by Satoshi Kanazawa (Kanazawa, 2013) and suggested that women who have higher IQs are not that much eager to have children, made waves in the blogosphere in latest days.). On the other hand, the rate of aging in societies is higher than the number of the young people who can provide the care (Conrad, 2015; Hendrich et al., 2015; Ministry of Health, 2012; Office, 2013; Sumiya et al., 2015).

The heavy pressure of time in child care is also a factor that limits pregnancy in young mothers. It is expected that teenagers complete high school and advanced levels of education. Students' parents, educators and counsellors – not to mention teenagers themselves – are aware that teenage motherhood stops the social development of these mothers and, in this manner, makes academic success less likely (Mulligan, 2013).

If children were not in need of much time, the world would be completely different. If children did not take so much time and attention of, particularly, their mothers, more people, mostly teenagers, would have children. People who, regardless of the cost, already have children might have more of them if they were sure that each child requires less time (Mulligan, 2013).

As the growth of population is limited by children's time costs, its growth will be more fast if those costs are reduced or controlled, whether you believe that such growth is either a good thing or a bad one. If each child takes less caring time, it is expected that parents – mainly mothers – will have free time for other things like more time for working outside, completing their own schooling or enjoying leisure time activities. However, it is probable that having more children, people would spend more time for taking care of children and they will have less time for other things.

In case of rich people this is different. Because of financial capability, they can afford aides like baby sitters, nurses, and tutors. Yet, it is hoped that technological progress will finally reduce the costs of child-care for all social classes.

Because nowadays robots and other machines perform the jobs that were previously done by people – even playing chess – and are anticipated to do other activities such as driving cars, maybe it is logical to imagine that robots will one day take care of children, too.

For some people it is heartless or immoral to trust young children to a robot or to leave them in a day care centre that is supervised by machines. But, child-rearing outlooks are affected by the recent economic and technological changes and practices. Some examples are: taking test tube babies, working mothers, screening time, public interest in fast food, or children who have their personal telephones.

There is no reason for the anxiety that machines will take the all phases of child rearing in their own hands. Compared to machines, people will always have a comparative advantage, even if machines are principally better at almost everything. Just as economically the world production will go up by employing unskilled people for some tasks and knowledgeable and skilful people for some other ones, people can do the tasks which accomplishment, compared to other tasks, are not easy or manageable for machines. Nevertheless, maybe parenting will be easier and, therefore, more acceptable in the case of robots.

2. Ethic and Robot Care

Good care (valued care) is assumed as a kind of care in correspondence with the individuals' changing needs. The literature of the ethics of care review this concept as one of the major points ; just in case of personalization, care is viewed as "good care" (Tronto, 2010; Vanlaere & Gastmans, 2011).

When they discuss ethics and robotics, the authors asses these categories, focusing on various concepts such as individuals' rights (Sharkey & Sharkey, 2012), the special requirements of a care receiving demographic (Sparrow & Sparrow, 2006), or the special impressions of the care-giver (Vallor, 2011). While these analyses, no doubt, contribute to the notions of ethics and care robots, overall, they are bereft of the establishment of standard recommendations that are based on their work and are referred to in designing future care robots. In his article "What should we want from a robot ethic?" (Asaro, 2006), Peter Asaro explains three dimensions that are as follows: "ethics of robots": (1) that considers ethical systems which robots are operating based on them; (2) the ethical systems that the designers of robots consider them, and; (3) the ethics dealing with the interaction of people with robots. Then, he argues that, considering the entity of robots as social-technical systems, an ethical framework of interaction with robots must cover all the three dimensions. For Asaro, the comprehensive notion from which the three dimensions originate, is preserving moral responsibility in the social-technical context wherein robots are operating. Asaro presents a convincing case about the necessity of a comprehensive approach to robot ethics, but does not elaborate on the approach.

3. People's Concerns about Children and Robot Care

Technological robotic care for children is a developing industry. Nevertheless, Some points should be concerned when the advances in this field are investigated (Portugal et al., 2015). It is understandable that interaction with a robot which responses follow the situation is interesting for youngsters, babies, and infants. However, based on some evidences, it is logical to be concerned about the outcome of such interactions because the powerful effects of childhood experiences, especially interactions, are not ignorable (Sharkey & Sharkey, 2011).

In the coming years, progresses in natural language processing will definitely impress the improvement of robot-child conversations (Sharkey & Sharkey, 2011). Still, the human interaction of adult-child caring would be deeper than such an exchange as. For a machine, persuasive response to a sentence or a conversational matter is completely different from offering suitable guidelines or reasonable answers to complex cultural problems. An

adult human can understand special signs and use them to respond to a child in the best way and decide on the level of the response. Since both adults and children change over time, the verbal communication between them is also subjected to change.

Children's talents and understanding determines the policy of communication between adults and children. Parents permanently assess Children's comprehension abilities, through both verbal and nonverbal signs. In this way, parents become aware of the depth of children's understanding. Both verbal and cognitive developments profit from this recognition. Finalizing a certain set of rules which helps a robot to engage in transactional communication is not that difficult. It lets a robot decide on proper guidelines that were used to be offered based on a caregiver's insights.

Children love "Make-believe" play and "let us pretend" games. Cayton (2011) believes that when children play make-believe and let's pretend games, they know that it is not a real situation. Real playing is done consciously. If you ask a child who is playing with a doll, what s/he is doing, s/he may answer that really they are going shopping or that the doll is not feeling well, but they will remind you that they are playing". On the other whole, children do not control, puppets and, in this case, it is not necessary to consider imagination and deceit. However, a child who is spending time with a puppet, quickly understands that it is not a real situation. What distinguishes a puppet from a robot is that, when the child is left alone with a robot, it is capable of operating variety of acts. This may result in physical, social, and relational anthropomorphism which can embody the situation as real and not illusion. Young children do not know technological world to that extent that distinguish between living creatures and robots. The same can be true about the old people who suffer from Alzheimer (Sharkey & Sharkey, 2011).

Furthermore, this anthropomorphism probably is not consciously controlled. Perhaps, people are conscious enough to know that the robot is a machine, yet, they may respond to it, as if it is a living creature. Therefore, attribute human features to robots in a way that liken them to humans could raise ethical arguments about deception (Sharkey & Sharkey, 2011). Accordingly, personifying inanimate things in such a case, can be deceiving. Furthermore, it is not acceptable to put an end on making or playing with dolls, puppets, and statues.

There is no evidence for the claim that a robot can function as an appropriate substitute for human care. As Sharkey and Sharkey discuss (Sharkey & Sharkey, 2010a), the sensitive response of a robot to a child in a way that establish a fixed and safe attachment is not a certain fact. Because infants' dependencies, firm attachment to a caregiver depends on good development. A child, who is provided with secure attachment, gradually learns to recognize another person's perception. When a baby observes the reflection of his/her emotions in his/her mother, s/he develops an understanding of his/her own emotions. Can a robot which is in charge for a baby, develop mutual patterns of social manners?

Epley et al. (2010) stress that children need social connection. Yet, they argue that children may not know the technological mechanism which renders interactive robots approachable f. In recent investigations, scholars have studied these factors to show how children make use of them to heighten the tendency for anthropomorphization (Epley et al., 2007).

To explain the tendency for anthropomorphizing non-human agents, Epley et al. (2007) suggest three psychological factors:

- The approachability and usability of the anthropocentric knowledge,
- The interest in reviewing and understanding other agents' behaviour, and
- The yearning for social connection

The argument is supported by numerous experimental evidences. Just few samples of these evidences are mentioned in this part. The approachability and usability of anthropocentric knowledge are affected by many factors For example, in case that the physical and behavioural resemblance between an entity and humans or animals increases, the degree that it is anthropomorphized and empathized rises too(Sharkey & Sharkey, 2012).

This description of anthropomorphism can set forth the conception that the very young people are likely to anthropomorphise robots more than any other age groups. It is partly because of the lack of necessary knowledge to know about the limited capacity of robots that deprives them of sophisticated wisdom and empathy. Very young social groups have strong yearning for social connection; babies (one reason is that instinctively they search for human social contact)

It is assumable that the very young people may easily develop intimate relations with robots and automaton pets. It is because in this age children are apt to realise the illusory understanding more than other age groups in the

population. There is a tendency among people to anthropomorphize robot companions and pets, but assuming that this will create an ethical problem to some extent is determined by the possible results of such anthropomorphism (Sharkey & Sharkey, 2012).

4. Disadvantage of Care Robots in Children's Lives

Old people's interaction with robots possibly will have some positive consequences. Nevertheless, these positive outcomes are not exactly the same about babies and infants. Because of their immaturity and young age, as well as their strong social drive despite their rudimentary technological understanding, infants naturally miscalculate the abilities of those robots that have physical features similar to that of humans or animals.

Based on infants' understanding, daily simple caring tasks such as changing diapers, changing clothes and etc. are the basis of a natural relationship. By trusting these duties to robots, the recipients of care would lose their fundamental human contacts. The worst case of this is to have robot nannies take care of children for long hours. Since it is a very weak possibility improving to have robots with cognitive human capabilities in any near future, to comfortably leave children totally in care of robots increases the probability of psychological damage in children (Sharkey & Sharkey, 2010b).

The most alarming case happens when robot nannies are left responsible with children for a complete day. Since today knowledge still is not developed to that extent to let apply cognitive human abilities on robots in near or far future, leaving children in the care of robots for long hours would multiply the possibility of pernicious psychological harm in them (Sharkey & Sharkey, 2011).

Impeded sociocultural, emotional, and linguistic developments are not the only negative effects of permanent connection of a young child to a robot are not. In Bryson's (2010) words, a child can predict the reactions of robots much easier than that of humans and, owing to this quality, child may favour connection to robots to that of human. In line with this view, Kubinyi (2010) argued that like cross-fostered animals and birds that are brought up by surrogate species and have developed other manners and responses, the human beings who have grown up beside robots, in comparison to other humans, probably will behave differently. For example, they may develop an interest in systems of personal entertaining and get used to the norms of non-human behaviours. The final result of this is the arrival of new forms of humans or homo-techniques (Kubinyi et al., 2010).

Melson (2010) has investigated the negative consequences when human interactions are replaced with technology. He cautions that if children get involved in personifying robots as living creatures, they are susceptible to develop a robotic understanding of human and animal entity, bereft of moral standing. Trusting the responsibility of babies and infants to robots is a risky action with severe and harmful costs.

5. Conclusion and Recommendations

Nowadays, robots are widely used in different industrial fields. Independent robots are set to perform particular tasks in human societies, chiefly in the lives of old and very young people. The population of old people is rapidly multiplying worldwide. Therefore, to enlarge the chance of mobility and facilitate independence, it would be helpful to refer to personal care robots. A sub-branch of robotic care, that is still less discussed, is Child-care. In the near future, the personal care robots will be closely connected to human beings.

This article investigated the functions of robots in children's regular life. This article tried to not only discuss the advantages of the robotic application in enhancing children's life condition, but also regarded the disadvantages and anxieties raised from this application.

As we elaborated on in the previous section, old people's collaboration with robots could result in positive points. Such promising consequences are not repeated in the case of babies and young infants. Because they constitute the youngest social group and, unlike their little technological knowledge, have a strong passion for social connectivity, babies naturally exaggerate the physical capacities of those robots which physically are identical to humans or animals.

Such an identification can jeopardize the life of infants and even those around them by exposing them to long time connection to robots. This, undeniably, diminishes the time of human connection and, in this way, blocks children's mature social understanding. Such children will not learn to develop perfect communication with their fellow human beings. For infants, having a careful caregiver is a crucial necessity. Leaving children with robots for long hours is not something to be approved. The most important reason is that it will problematize the process of internalizing natural human relationships in infants. Likewise, a robot could not be of help for an infant in developing linguistic ability exactly the same does a parent.

Nowadays it is well known that, to have a balanced and normal social life, an infant is in need of a caregiver

who simulates proper maternal sensitivity through which the caregiver can observe and understand baby's all movements and deal with them in the most perfect way (Ainsworth et al., 1991). Usually robot nanny cannot teach infants to develop the skills to understand the nuances of mutual and perfect human relations. May be it is pleasant to hire a robot for looking after your baby and letting you focus on your work as much as possible, but the risks are also considerable. Essentially, in older children it is different. For the children who have enjoyed the attendance of human caregivers and, therefore, have developed secure attachments, through precious and basic human-social contact, exposure to robots could even be useful. Robots certainly will acquire a vital role in the future society. Thus, it would be very useful if children be familiar with the automatic jobs and the technology used in robots. In Milson's view (2010), obtaining robotic literacy is a must for both parents and children. "Such 'literacy' will provide them with the chance to be familiar with these realities:

- the systematic process of manufacturing, preserving and putting robots in to action, highlighting the fact that they are the result of human contemplation;
- knowing the restrictions and capacities of different robotic technologies; and
- distinguishing between living and 'pretend' living—damaged creatures, puppets, and robots."

Moreover, giving children and adults the chance to realize the details of anthropomorphism and the methods that are applied to enlarge the mental illusory states in lifeless machines, could function as an influential tactic to protect both children and adults from the unwanted consequences of the apparent magnification of the capabilities of robots.

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