

SERVICE ROBOT ETHICS

SANJA DOGRAMADZI

*Bristol Robotics Laboratory, University of the West of England, Coldharbour Lane
Bristol, BS16 1QY, United Kingdom*

GURVINDER S VIRK

*CLAWAR Association Ltd, UK & School of Engineering and Advanced Technology,
Massey University, Wellington, New Zealand*

OSMAN TOKHI

*Dept. of Automatic Control and Systems Engineering, University of Sheffield, Mappin
Street, Sheffield, S1 3JD, UK*

CHRISTOPHER HARPER

*Bristol Robotics Laboratory, University of the West of England, Coldharbour Lane
Bristol, BS16 1QY, United Kingdom*

The area of robotics is moving from its traditional roots in the industrial sector as the entire robotic community is keen to develop new types of robots for new environments. This change in emphasis is being driven by many factors and it is now widely accepted that robots must become mass market products in order that they may fulfil their full potential in providing assistive capabilities to humans in a wide range of applications. This shift has been noticed and ISO has set up new standardization groups to investigate the robot standardization activities that need to be encouraged to facilitate the commercialisation of new types of robots throughout the world. The robotic community has been developing prototype robotic systems for a variety of new applications and many new sectors are causing concern and if they should be encouraged or not. This has started an ethical debate on what should be encouraged and if there are robot applications that should be discouraged. It is accepted that robot applications that generically improve the quality of life for humans should be encouraged but areas which promote unethical areas of human activities should be looked at more closely to determine if robots should be allowed to enter these sectors or not; this includes applications such as military applications, sex robots, fully autonomous robots, etc. In view of these developments, discussions have commenced within ISO so that internationally accepted views can be formulated and accepted. This paper presents the start of these deliberations and raises some of the important issues that need to be debated so that internationally accepted views can be agreed at the ISO level so that commercialisation of only the accepted systems is permitted across international boundaries.

1. Introduction

1.1. *Technology and ethics*

Each major advance in technology brings with it a new set of challenges. Responsible and ethical applications of technologies are major issues often raised in the press and scientific publications over cutting edge new developments in the research community. For major new robotics developments that are bringing robots closer to people in many ways, not only industrial robots standards and rules are becoming inapplicable but new acceptance and understanding of these machines have become major challenges. This paper discusses the ethical issues arising from the new and emerging service robot applications and poses questions on adopting new guidelines for steering responsible robotics research and the subsequent commercial designs in a direction consistent with the safety, welfare and full acceptance of the general public. It is widely accepted that discussions and recommendations are especially required in robotics applications which are less understood but introduce more subtle problems in the integration of robots in established social and religious doctrines. Asaro [1] states that there are currently three concepts in robotics ethics, namely, the ethics built into the robots themselves, the ethics of the robots' designers and users, and the ethics of people interacting with robots. This paper focuses on the human ethics of robots' designers, manufacturers and users of robots intended for societies with different cultural and religious values. Examples of robotics applications that can potentially pose significant ethical concerns will be discussed.

1.2. *Background*

Industrial robotics ethics has mainly been challenged by working classes who 'lost their jobs to the machines'. It has been frequently suggested that automation and robots cause major unemployment, but this is an age-old argument which by now should have lost all credibility as almost *every* advance in technology is likely to attract objections of this sort. As industrial robots moves towards more widespread use towards service provision, and the new service robotics are becoming more and more sophisticated than their fixed predecessors with their level of autonomy and cognition being significantly increased, and human-robot boundaries being slowly removed, a number of different ethical issues are becoming obvious.

The robot-ethics term has already been coined by a group of researchers as a new area concerned with the social effects that the current trends in robot

development should be aware of in the decades to follow due to the possible impact if these systems are widely accepted [2]. A number of robotics researchers have already brought up ethical concerns in several areas of robotics applications, including military robots [3], brain-robot interfaces [4], advanced sexual toys [5], childcare robots [6]. In rehabilitation or minimally invasive surgery applications, in which arguably the user experiences a very close physical relationship with robots, much progress and useful developments (MIT-MANUS, Lokomat treadmill, Da Vinci robot) have been made with a remarkable lack of reported accidents or ethical issues. However, in recent years, research trends in rehabilitation robotics have moved towards direct brain-machine interfaces for wheelchair or orthoses controlled devices. This has already posed ethical questions [4] among researchers whose concerns lie in the fact that once these systems become more intelligent, the “brain control” of artificial agents can lead quickly to non-ethical applications used for enhancement of “normal persons” instead of helping “people with disabilities”; this change of emphasis causes concern with the general public if enhancing human functionalities in this way is a good idea or not.

On the military side, news that the US government requires one third of their air and ground war vehicles unmanned by 2010 and 2015, respectively, has certainly concerned many. The ethical and justice viewpoints in warfare are usually difficult to find but having an army equipped with robots against a human army is likely to cause ethical issues as to whether the robot soldiers should be allowed to kill humans even in war. Arkin, a roboticist contracted by US Department of Defence but also one of cofounders of the IEEE Roboethics Roadmap [2], has designed and formalized the autonomous agents’ architectures for military robots that arguably behave more ethically than some human soldiers whose judgment can be sometimes impaired by uncontrolled feelings of anger, vengeance or despair [3]. It is clear that we need to ask the question “Is it possible to make robot soldiers so robust that they cannot malfunction on a battlefield and cause unforeseeable damages?” “Could all possible complexities of battlefields and warfare situations be embedded in the robots that then have to come up with an ‘ethical solution’?” This is an autonomous robot application that can be challenged with more ethical questions yet it seems that, like many other weaponry developments, nobody is able to provide any sensible or acceptable answers.

Until recently most of the issues to be addressed for developing the new service robot systems have been of a technical nature as the work is still confined to laboratories. Industrial robotics has for the last forty years been subject to regulations and standards by the International Standards Organisation (ISO) [7].

The standards instruct clearly that robots and humans are to be kept separate as long as the robots are operational. The latest ISO 10218-1:2006 standard on Robots for industrial environments specify safety requirements and guidelines for the inherent safe design, protective measures, and information for use of industrial robots allows a degree of collaboration between humans and robots. The same standard does not apply to the new emerging service robot sector where much closer human-robot interactions are foreseen. A recent ISO initiative that started in 2007 is revising the current robotics standards to include terms, guidelines and regulations applicable to this new generation of robots. The same group has already produced a new vocabulary for personal care robots, a robotics application that has recently grown in research and commercial domains. A personal care robot is provisionally defined as a “service robot with the intended purpose of either aiding or performing actions that contribute directly towards improvement of the quality of life of an individual or group of individuals”.

Such personal care robots could potentially be used as domestic carers, personal companions, entertainment toys, systems to provide sex and even love. Some examples include care assistants that can ‘watch over grandma or the kids’ as Carebot from GeckoSystem International, and the Wakamaru robot for ‘independent living’. Personal care robots have recently been a popular topic in the press and other scientific articles. A number of robotics scientists have repeatedly expressed their concerns over the potential consequence of introducing some of these new types of personal care robots into our society. An advisory team of UK group of robotics experts AMT 00/2, working under the BSI (British Standards Institution) umbrella, has recently taken into consideration the need for including robot ethics within the international standardization framework. The requirements for the new ethical guidelines will be discussed in selected applications of personal care robots.

2. Ethical issues in personal care robots

A recent survey has shown that healthy subjects have a limited trust in assistive robots for personal care [8]. There is still a genuine defiance of the general public, especially adults, for robots operating on their own which can directly interact with or have contact with humans. What may seem acceptable in one culture, like the Japanese, where robotics is well regarded can look completely unacceptable to other countries, like in Europe. The two countries (Japan/Korea), leaders in personal care robots design, are creating not only new ‘gadgets’ but also a philosophy of living and loving that may be much different

from the existing one. With more personal care robots becoming commercial products or being becoming topics of extensive research projects funded in Europe and US, there is a feeling that new paradigms of human-robot relationships, living styles and growing up are emerging within society that does not seem to be involved in decision making in any way.

Ethical issues are of particular concern in personal care robot application domains, in which there may be particularly strong emotional interactions between robots and humans. As an example of the potential problems, the area of personal companionship robots need to be considered; this is further discussed in Section 3.

3. Personal companionship robots

Studies so far have not proved that there is a high level of enthusiasm for personal care robots. Scopelliti et al. [9] investigated people's representation of domestic robots across three different generations, taking into account gender and educational levels. His results demonstrate that young people tend to have positive feelings towards domestic robots, whereas elderly people are more frightened of the prospect of having a robot in their homes. Further studies have been done to explore what a domestic, personal care robot should look like, how it should communicate or what tasks it should do [10], [11] in order to be more acceptable. Although initial studies have shown that the elderly population does not like the idea of having a robot in their households, there still seems to be considerable further investments in this direction. Could there be a non-robotic solution around the corner? Does the problem of aging society have to be solved using personal robot companions?

My Spoon [12] and a robot bathtub [13] are Japanese robots that feed and wash elderly and disabled persons while Paro, the robotic seal soothes human feelings. There is less need for a human around elderly people who are supported by robots which may prone responsible adults to increasingly rely on robots to look after their children or parents. There have been no studies as yet about the potential psychological consequences of long term exposure of fragile people to artificial agents.

If the implementation of personal robots is imminent then the responsibility for studying the long term effects of their use lies with the scientific community – robots engineers, sociologists, psychologists but ultimately with scientists and engineers of the robots. There is a need for ethical guidelines, control utilization of robots in caring for children and the elderly, as has been already propagated by some of UK roboticists [6].

4. Ethics guidelines

Making ethical decisions nearly always involves facing a series of dilemmas but often there is no straightforward answer so decisions have to be based on balancing basic ethical principles and such ethical guidelines are just recommendations and they can offer no definitive solutions; a good example of some ethical issues can be found in the EU Respect project report [14].

Service Robotics ethics guidelines – what should they involve?

- Users benefits included/concerned
- Long term and short term psychological effects of using service robots in particular applications
- Possible misuses of the given technology and how to prevent it. This is a subset of safety standards that is related to ethical issues in service robots misuse.
- Ethical issues related to animal welfare (example of the sheep shearing robot [15])
- Legal issues related to using technology in socially and economically deprived areas.

Furthermore, it is clear that all the stakeholders need to be involved in investigating the issues. In this respect we need to consider who should contribute to writing the ethical guidelines? Some of the stakeholders are the following:

- From technical/engineering standpoint – Robotics engineers
- From ethical viewpoints – psychologists, philosophers, medical officers, etc
- From legal point of view – lawyers, NGO representatives, ISO experts
- Etc,

5. Conclusions

The paper has formally started the international debate that is needed for formulating an ISO view on the ethical aspects of new robot applications. ISO is formally responsible for producing the standards for robot systems and so an ISO view on these ethical issues that are emerging is important so that the sector can be developed in a structured manner.

References

1. P M. Assaro, *International Review of Information Ethics*. What Should We Want From a Robot Ethic? , 9-16, 6(2006).
2. G. Veruggio (ed.), *Proceedings EURON Roboethics Atelier, EURON Roboethics Roadmap*, 2/27-3/3, 2006.
3. R Arkin, *Technical Report GIT-GVU-07-11*, Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/Reactive Robot Architecture, (2006)
4. JJ Wagner, DM Cannon, HF Machiel Van der Loos, *Proc. ICORR'2005 Cross-Cultural Considerations in Establishing Roboethics for Neuro-Robot Applications*, 1, 2005.
5. D Levy, *Harper Collins Love and Sex with Robots: The Evolution of Human-Robot Relationships*, (2007)
6. <http://www.infoniac.com/hi-tech/robotics-expert-calls-for-robot-ethics-guidelines.html>
7. ISO Robot Safety Standard 10218-1:2006, International Organization for Standardization, June, (2006).
8. Virk GS, Sjöström C, Engström M and Trinius W, *Proceedings of the Workshop on Ethics of human interaction with robotic, bionic, and AI systems: Concepts and policies*, Standards and/or ethics for service robots? p69-75, (2006).
9. M. Scopelliti, M. V. Giuliani, A. M. D'Amico, and F. Fornara, *Designing a more inclusive world*. If I had a robot at home. Peoples' representation of domestic robots, in, S. Keates, J. Clarkson, P. Langdon, and P. Robinson, Eds. Springer, pp. 257-266, (2004)
10. K. Dautenhahn, *Proc. IEEE Ro-man Design spaces and niche spaces of believable social robots*, , 192-197, (2002).
11. S. Woods, K. Dautenhahn, and J. Schulz, *Proc. IEEE Ro-man*. The design space of robots: Investigating children's views, pp. 47-52, (2004).
12. R Soyama, S Ishii and A Fukase, *Proceedings of the ICORR*, The Development of Meal -Assistance Robot "My Spoon", (2003)
13. www.popularmechanics.com/technology/industry/1288241.html
14. <http://www.respectproject.org/ethics/principles.php>
15. JP Trevelyan, *Service Robot, Automatic Sheep Shearing*, Vol2, No 3, (1996)