Legal Issues for Mobile Servant Robots

Eduard Fosch Villaronga[1,2(✉)] and Gurvinder S. Virk[3]

[1] Joint International Ph.D. Erasmus Mundus in Law,
Science and Technology Coordinated by CIRSFID,
University of Bologna, Bologna, Italy
eduard.fosch@unibo.it
[2] IDT-UAB, Universitat Autònoma de Barcelona, Barcelona, Spain
[3] Professor of Robotics, University of Gävle,
KTH Royal Institute of Technology, Stockholm, Sweden
gurvinder.virk@hig.se

Abstract. This paper identifies key legal issues which are emerging for Mobile Servant Robots (MSRs), a sub-type of Personal Care Robots (PCR) defined in ISO 13482. New cases are likely to be introduced in the market soon even though appropriate and specific binding legal regulations regarding MSRs are missing and several questions need to be carefully considered. The main issues of concern are the need for a concrete and holistic definition of MSR, clarification on the confusion among new emerging ISO/IEC robot categories (especially between boundaries and gaps in machinery with medical device regulations), unclear liability scenarios (avoiding harm, prospective liability, butterfly effect), defining and regulating human-robot collaborations and relationships, ethical issues (mass surveillance, post-monitoring personal data), autonomy (from the robot but also from the user perspective), isolation scenarios, etc. Despite the recent technical advances, there is still a long way ahead and further research is needed to overcome a variety of associated legal and ethical issues which are emerging.

Keywords: Social robots · Legal aspects · Human-Robot Interaction (HRI) · Personal care robot · Mobile servant robots · ISO 13482:2014

1 Introduction

Current industrial robot standards cannot give appropriate answers to all the questions that new service robots pose on the legal layer. However, "ignorance of the law, excuses not" is a clear and factual statement which must be addressed to ensure there is clarity in these uncertain times. Consider the following use case:

> "Duško has just bought a cloud-based personalized mobile servant robot. He calls him Dušo. Dušo reminds him to take medication at appropriate times, does online grocery shopping based on Duško's preferences and regularly checks his health status. Duško is a vegetarian and is concerned about taking pharmaceutical drugs. As he cannot sleep at night, he asks Dušo for help. The following day, and after checking with other robots and the Internet, a green box arrives home. Dušo has bought marihuana on the Internet".

© Springer International Publishing AG 2017
A. Rodić and T. Borangiu (eds.), *Advances in Robot Design and Intelligent Control,*
Advances in Intelligent Systems and Computing 540, DOI 10.1007/978-3-319-49058-8_66

This use case, which is inspired by the Random Darknet Shopper [1], a human-centred social robot for elderly care [2] and the Patent of Google on Robot Personality [3], raises the question of what is the impact that assistive technology poses to users on legal/ethical aspects: who would be liable for the acquisition of drugs illegally on the Internet? How can a robot respect the autonomy of the person? How can privacy be preserved after the insertion of a robot to the market?

Traditionally only industrial robot standards and regulations were available for ensuring human safety via ISO 10218-1, -2 and recently new service robot safety requirements have been published for personal care robots in ISO 13482. The industry robot regulations are concerned mainly with ensuring human safety by separating humans from operational robotics. The new service robot regulations focus on physical human-robot interaction (HRI) hazards by stipulating safety requirements on various design factors; these include the following: robot shape, robot motion, energy supply and storage or incorrect autonomous decisions. However, the state of the art confirms that robot capabilities go beyond the mere physical HRI, especially if the robot is used in social applications [4]. Thus, questions concerning other hazards such as cognitive HRI hazards, robot personality, understanding human commands, whether robots should be granted agenthood, what is the acceptable level of autonomy in the robot decision-making process (in legal transactions on the Internet for instance, which consequences could not physically harm a human) or simply the respect for private life are still disregarded by current standards. Some initiatives to ethically design robots and robotic system are under development [5], but at the same time that these machinery safety regulations are being developed, supra-/national and state laws are needed to provide citizens a fully legal coverage, not only in privacy matters [6].

The main objective of the paper is to highlight growing wider concerns in adopting service robots in new settings to provide some guidelines for the creation of a possible future regulatory framework for MSRs, which includes legal and ethical aspects [7]. Law is always some steps behind reality and new technology can create new scenarios not already covered in the legal framework. Although some MSRs have already entered the market, there are no specific laws addressing their use and appropriate management, no judge is specifically trained to deal with the legal consequences arising from the use of these new technologies, and end-users are not aware of what the possible consequences of adopting the new service robots could be to them. In fact, although the identification of safety principles regarding robots is a great step towards a future robotics policy [8], a specialist in robotics may still encounter a two-fold problem, namely, (1) the identification of the wider principles and impacts that their particular technology involves and brings to society; and (2) a deep understanding of the implications of adopting the new technology (e.g. does an encrypted data communication channel from the robot to the cloud offer sufficient data protection capabilities?).

First, the definition of “mobile servant robots” presented in ISO 13482 used to develop an application scenario robot at the Institut Mihajlo Pupin in the University of Belgrade is presented in Sect. 2 [2]. Second, some legal and/or ethical issues concerning, inter alia, privacy, autonomy, agenthood, final say/free will, surveillance or robotic empathy arising from the deployment of such service robots possessing a degree of autonomy is presented in Sect. 3. Section 4 introduces the conclusions and future direction of this research.

2 Mobile Servant Robots: The Serbian Case Study

Sometimes called companion robots, sometimes called care robots, ISO 13482:2014 safety standard for personal care robots included Mobile Servant Robots (MSR) together with Person Carrier (PCaR, for example intelligent wheelchairs) and Physical Assistant Robots (PAR, inter alia wearable exoskeletons) [9]. This is the first ISO standardization project aimed at addressing the shift from industrial to service robotics for Activities of the Daily Living (ADL) and how the new safety requirements for close human-robot interaction shall be accommodated. The terminology is still developing and currently is not consistent across research and regulatory stakeholders [11]; various definitions of service robot, personal care robot and MSR can be found in different ISO or Institute of Federal Robotics (IFR) corpuses:

- IFR and ISO 8373:2012 define the *service robot* as "a robot that performs useful tasks for humans or equipment excluding industrial automation applications".
- *Personal care robots* (PCR) are a sub-type of service robots and are defined by ISO 13482:2014 as "service robots that perform actions contributing directly towards improvement in the quality of life of humans, excluding medical applications".
- ISO 13482:2014 defines the *mobile servant robot* (MSR) as "personal care robot that is capable of travelling to perform serving tasks in interaction with humans, such as handling objects or exchanging information".

The robot from the Institut Mihajlo Pupin is a "human-centric, social, care-robot for elderly people and persons with reduced ability to improve their quality of their life and to create conditions for more independent living at their homes […] by providing companionship" [2]. To work, this robot complements its features with ambient assisted living technologies (AAL) and wearable body devices for the humans that can measure, among others, their blood pressure, heart pulse and motion accelerations. Within its capabilities, this robot has communication capabilities (for tele-visits by medical staff or for making emergency calls), ability to collect and fuse all data into a cloud system accessible by authorized people such as family members or the medical team, and performs several caregiver tasks such as assisting, nursing, monitoring, amusing or communicating with the elderly and disabled people. According to the above-mentioned definitions, the Serbian robot is a mobile servant robot.

Three very important aspects can easily be derived from this use case:

(1) Although service robots are intended to allow close human-robot interactions as well as human-robot contact for performing ADL, there are fundamental differences in their human-robot interaction (HRI) capabilities even if they are in the same corpus [12]. PCaR and PAR, although differing largely on their technical functions, are non-social assistive technologies. As a matter of fact, either sporadically (PCaR) or in a symbiotic manner (PAR), both interact physically with their users. MSRs on the other hand do not interact physically with their users, but cognitively. In Rodić et al. words, it is important to establish a "mental communication [and] emotional contact" with elderly people, something that goes beyond the physical HRI. Indeed, there is no "contact" understood as the "zero distance between the robot and an object in its external environment" between

humans and MSRs. And in spite of the fact that "mental stress" is mentioned in section 5.9.3 or "non-contact sensing" in section 6.5.2.1 in ISO 13482:2014, the standard disregards the cognitive aspects related to the above-mentioned caregiver tasks. The article 3 of the European Charter of Fundamental Rights (EU CFR) on the contrary protects both the physical and the mental integrity of the persons, something that should be addressed by machinery-type service robot standards, especially because care robots "will not only communicate but play important roles in their user's emotional life" [13].

(2) The standard is concerned with HRIs, while actually these interactions are going to turn into a "life-long relationship" once MSRs will end up in personal environments [14]. This challenges the current categorization of these robots provided by the ISO robot standardization process, which focuses only on the safety issues. The "sophisticated presence" that social assistive technologies as MSRs offer in companionship contexts goes far beyond single sporadic HRIs [15]. Indeed, MSRs aim at creating affective meaningful relationships with their users [13, 16]. As relationships are "long-term built up over time through many interactions" as well as "social, emotional, persistent and personalized" [17], the shift from interaction to relationship will require reciprocity, trustworthiness, empathy, social awareness and tones of personal sensitive data from the user [18–20]. In this respect, Google has already patented some of these characteristics such as the use of cloud robotics to support robot personality [3]. This may hinder further research on this domain.

(3) Although the definition of PCR excludes expressly medical applications, the Serbian carebot "monitors" the patient and uses wearable technology to measure the user's vital signs. Here there are two issues to note. First, it is true that the first main goal of the carebot is not to perform medical tasks such as "diagnosis, prevention, monitoring, treatment or alleviation of disease" [21]; however it is "keeping the human under surveillance" as if he/she is a patient and is able to call medical services or relatives in case of emergency. If the robot monitors/keeps-under-surveillance a person in this way with any particular and well-known disease (which is likely to happen if used in elderly care), the robot should be considered a medical device under the Council Directive 93/42/EEC of 14 June 1993 concerning medical devices. In any case, the "intention of use" is what will prime before the Court [22, 23]. The issue is regarding whether the medical device category of the wearable technology used to complement the robot functionalities could be extended to the robot itself. The Serbian carebot happens to work within a robotic system that includes a cloud platform, an AAL environment and a range of wearable devices that monitor the vital signs of the human in a patient-like manner (making it a medical device). If the robot works accordingly to the vital medical signs collected by the wearable sensors (e.g. to call to an ambulance) and if this information is processed together in the cloud platform, then it is not clear whether the robot is by extension a medical device. In fact, this pictures an Internet-of-Things (IoT) scenario where the robot will be just one of the devices connected to the system. Of course, privacy and security issues but also other concerns regarding this new phenomenon are still not clear from the legal perspective (see *infra*).

3 Legal Aspects Concerning Mobile Servant Robots

Besides their compliance with the technical safety requirements, MSR need to be compliant with the current existing legal framework. In 2014, the RoboLaw project claimed the respect for the fundamental rights as well as for the safety, responsibility, autonomy, independence, enablement, privacy, social connectedness and justice when developing care robots [8].

Concerning safety, there is a difference between the certified safety, gained by the obtaining of certifications (which forces specialists in robotics to correctly categorize their creations); and the perceived safety in the planned intended use scenarios, i.e. the reliance that a person has over the robot which normally relates to the robot's physical safety and the trust of not only the robot's behaviour but also the robot's intention [19]. This is important because "robotics combines […] the promiscuity of information with the capacity to do physical harm" [24] but also they can be involved in psychological risk scenarios if "mental communication" [2] is the only channel of communication, e.g. depression due to decrease on human-human interaction, overreliance on the robot, frustration when the robot does not understand human commands, or increasing feeling of presence (FoP) [25].

Responsibility refers to who should be held responsible if harm occurs. Clause 7 e) Directive 85/374/EEC in theory prevents manufacturers from being held responsible for defective products if "the state of scientific and technical knowledge at the time when they put the product into circulation was not such as to enable the existence of the defect to be discovered" [26]. The problem is that nowadays we are within a butterfly-effect moment: we do not know which are the consequences of these machines on long-term. The degree of autonomy of the robot will play a major role in the allocation of responsibility: in teleoperated robots, the American Federal Trade Commission (FTC) is already working on "unfair and deceptive" robots so as to protect the expectations of citizens when robots work in WoZ [27]; and in autonomous robots, the National Highway Traffic Safety Administration (NHTSA) recently identified the artificial intelligent system of the Google's driverless car as the driver of the vehicle [28]. This is the first time in history that some sort of agenthood has been given to a robot, the consequences of which are still unknown for the relationship between an autonomous robot and its responsibility.

The use of social robots in elderly care also poses questions concerning privacy, freedom as well as the deception and the infantilization of the elderly [29]. Privacy refers to the respect for the private and family life (Art. 7 EU CFR) but also to the protection of personal data (Art. 8 EU CFR). The robotic system needs to ensure that privacy is protected in balance with other competing interests such as the wellness of elderly people at their own homes. With regard to data protection, the use of cloud computing capabilities for sensor fusion challenges the current data protection framework. Similar to what happens with applications on smart devices, the Serbian carebot would be subject to the data protection laws of the country where the user would be, including non-European countries [30]. In the European Union there are strict rules concerning the explicit consent of the involved subject, something difficult to obtain in dementia patients and in long-standing relationships; also on the relationships between data

controllers and data processors, something aggravated by the IoT structure. The upcoming General Data Protection Regulation will toughen all these requirements and will introduce new principles and rights such as the privacy-by-design principle, the right to be forgotten and data portability right which will oblige the data controllers to collect the information in a "structured and commonly used and machine-readable format" so as to "transmit those data to another controller without hindrance from the controller to which the data have been provided" [31].

The autonomy, independence as well as the free will of the elderly and disabled people are recognized in [32]. The RoboLaw project states that this autonomy "is no longer a lack of dependence from others […] rather it should mean the relational capability of a person to take care of his/her own forms of dependence". This independence and free will need to be carefully addressed in companionship contexts, especially when the robot will have a role in the decision-making process (autonomously or tele-operated). The Serbian carebot includes an embedded personality on the system that could help ease the relationship between the human and the robot. Until now, there has been research on proxemics and social awareness (and the swift from one to the other one [33]), as well as from the recognition/exposure of emotions from the robot perspective [34]. Yet, there are some researchers that think more social and emotional behaviour could lead to a poorer perception of the social robot [35].

In any case, the robot should avoid any discrimination contexts, e.g. when interacting with elderly people with impaired hearing/speaking. In addition, it should be made accessible and affordable to the general public according to the Article 35 EU CFR and the principle of justice.

4 Conclusions

This article has highlighted that current machinery-type standards governing service robots focus on the physical HRI are inadequate when social robots are used in elderly care where they work more on the cognitive layer. This challenges the current legal regulatory system which is supposed to protect the physical and mental integrity of the persons; both these aspects are not often taken sufficiently into account. In addition, other legal aspects such as privacy, data protection or autonomy are also not adequately addressed. Although there are no current specific laws governing them, users of these robots are a part of the society vulnerable that need special protection. Because of that, future robot technology will have to pay attention to all the cognitive aspects involved in human-robot relationships as well as to promote the human-human interaction as it is found of vital importance.

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