

# Preface

The increasing deployment of robotic technology in many domains of human life will have a substantial impact on the economic, social and cultural tissues of our societies. Though one can already anticipate some of its huge benefits, it also urges us to try to reflect on its impact on fundamental instances of everyday life and also envisage to what extent essential societal values on which we have based our cultures and legal systems may be eventually affected.

On the verge of this technological revolution, experts from academia, industry, military and civilian sectors gathered in the International Conference on Robot Ethics (ICRE 2015)<sup>1</sup> in order to reflect and discuss the main ethical problems resulting from the widespread adoption of robotics. The present book comprehends not only the shared doubts and concerns but above all the common effort to open up new pathways to a future with robots that contributes to a better world.

The book is divided into two parts: Part I presents selected contributions of the main speakers and also those of invited guests. These are organized according to relevant domains they are addressing comprising general normative and ethical issues, the ethics of some robotic applications, social and service robotics, robots in defence and war scenario and, finally, legal issues.

Part II contains the reflections and accounts of the two other events organized during ICRE 2015: a cinema cycle—The Robot Steps in; and the exhibition Nós e os Robots/Os Robots e Nós<sup>2</sup>

Part I starts with Chap. 1. Here, Malle, Scheutz and Austerweil point out that the most ethically challenging role to be played by robots is that of collaborator and social partner. Proposing that such robots must have the capacity to learn, represent, activate, and apply social and moral norms, the authors offer a theoretical analysis of two parallel questions that are: (i) What constitutes this capacity for norms in humans? (ii) How might we implement them in robots?

---

<sup>1</sup>Lisbon, 23 and 24 October 2015.

<sup>2</sup>We and the Robots/The Robots and Us, in the English translation.

In Chap. 2, Maaïke Harbers, Marieke Peeters, and Mark Neerincx analyse how a robot system's characteristics affect people's perception of its autonomy. Based on a survey aimed at identifying the rate of autonomy assigned by firefighters to a number of search and rescue robots with different shapes and in distinct situations, the authors were able to identify seven distinct aspects of perceived autonomy.

In Chap. 3, Sean Welsh argues that the critical work in deontic reasoning is better done in the knowledge representation rather than reasoning of a normative system. In this chapter, the author describes a way to formalize complex normative decisions using predicate logic and graph databases.

In Chap. 4 by Selmer Bringsjord proposes an ethical hierarchy (EH) that can be applied to both robots and humans. This hierarchy is catalysed by the question: Can robots be more moral than humans? According to Bringsjord, the light shed by EH reveals why an emphasis on legal obligation for robots is inadequate, and why at least the vast majority of today's state-of-the-art deontic logics are morally inexpressive, whether they are intended to formalize the ethical behaviour of robots or humans.

Chapter 5 by Wilhelm E.J. Klein on Robots and Free Software examines whether the arguments put forward by free software advocated in the context of computers also apply for robots. Summarizing their key arguments Klein explores whether or not they appear transferable to robot use case scenarios. Issues related to robot ethics for children–robot studies reported in contemporary peer-reviewed papers are also presented.

In Chap. 6, Jaeun Shim and Ronald C. Arkin address the particular benefits brought by robotic technology to the domain of healthcare, namely to patients with Parkinson's disease. The authors point out that since these patients cannot readily communicate their internal and external states due to their limited motor control abilities, they may experience the loss of dignity during therapy with their caregivers. Shim and Arkin postulate that a companion robot can remedy this challenge and reduce the communication gap between the patient and the caregiver smoothing and increasing the effectiveness of the interactions. To achieve this goal, they have developed a robot architecture that can help prevent the loss of dignity in patient–caregiver relationships. The primary goal of this robot mediator is to ensure patients' and caregivers' dignity during their interactions.

Chapter 7 by Harbers, de Greeff, Kruijff-Korabayova, Neerincx, and Hindriks addresses a particular field that, according to the authors, is under-examined when compared to other robotic application areas. The chapter describes the outcomes of several value assessment workshops that were conducted with rescue workers, in the context of a European research project on robot-assisted search and rescue (SAR). These outcomes are analysed, key ethical concerns and dilemmas are identified and recommendations for future ethical-related research was identified leading to responsible development and deployment of SAR robots.

M. Kyriakidou, K. Padda and L. Parry's study on Chap. 8 explore how robot ethics in children–robot interaction studies are described in contemporary peer-reviewed papers. The outcomes of a survey conducted on 27 articles indicate problematic applications of reporting robot ethics in peer-reviewed journals and

highlight the necessity for journals to consider stricter action on this aspect of publication.

In Chap. 9, Sjur Dyrkolbotn considers non-contractual liability for harm caused by artificially intelligent systems and provides a typology of different possible ways to approach the liability issue. The paper argues that the traditional robot-as-tool perspective should be maintained but warns that new techniques need to be developed, at the intersection between computer science and law, to support reasoning about the liability implications when autonomous technologies interact with their environment and cause harm.

Chapter 10 provides fundamental insights into the difficulties of autonomous and mixed vehicle control Endre E. Kadar, Anna Köszeghy and Gurvinder Singh Virk address this problem based on the evidence provided by three case studies.

Chapter 11 by L. Beton, P. Hughes, S. Barker, M. Pilling, L. Fuente and N.T. Crook refers that due largely to the introduction of new technologies such as force sensing, it is now possible to have humans present within the workspace of a robot in an industrial setting. However, the authors emphasize that physical safety is not the only consideration when attempting to develop robots that are truly able to collaborate with humans. The establishment of trust lies at the heart of any such collaboration. The authors argue that trust in a robot depends, at least in part, on perceived safety and perceived intelligence, and that these, in turn, depend on the collaborative strategies that the robot adopts. A significant number of studies have been performed on human–robot collaboration strategies. One of the key areas of interest is in the adoption of leader/follower roles in the collaboration.

Also addressing industrial robotics, S.R. Fletcher and P. Webb, in Chap. 12, claim that technological advances will cause a change in the way industrial robots are viewed and traditionally operated. This means they will leave their usually highly secluded environments being deployed to work more closely and collaboratively with people in monitored manufacturing systems with the widespread introduction of small-scale robots and assistive robotic devices. According to the authors, this will not only transform the way people are expected to work and interact with automation, but will also involve much more data provision and capture for performance monitoring. The chapter discusses the background of these developments and the anticipated ethical issues that are likely to be faced.

In Chap. 13, Sean Welsh claims that lethal decision-making is complex and requires detailed analysis to define what is to be banned or regulated. The chapter proposes an extension of the current “single-loop” analysis to two loops: a policy loop and a firing loop. The aim is to clarify what exactly is meant by meaningful human control of a law and to facilitate wording such as might occur in a Protocol VI to be added to the Convention on Certain Conventional Weapons (CCW).

Chapter 14 by Dores Delfim, Ana Baltazar, Teresa Cabral, Isabel Machado and Paula Gonçalves provides an overview of the safety issues of the Portuguese Military Remotely Piloted Aircraft Systems (RPAS), namely the human error,

integration into regulated common national airspace (considering the rules of air) and the airworthiness certification aspects. The chapter also brings out the safety assessment methodology by addressing its application to Antex-X02 RPAS, a platform under development by the Portuguese Air Force Academy.

Chapter 15, by invited guest, Major-General João Vieira Borges regards the theme of robotics in the military domain from a strategic perspective. Considering the trilogy that strategy comprehends—goals, means and threats—three fundamental topics are approached: (i) the need to work at political, strategic, operational and tactical levels (ii) the role of robots in the new security and defence environment and (iii) the importance of incorporating robots in military education.

Chapter 16, a keynote by R. Gélin, highlights the importance for the social/service robotics designer of being aware of the potential ethical and safety issues that may arise from the development of humanoid robots functioning as companions. After a short description of a possible use case, dedicated to the assistance of an elderly person, the author identifies the main concerns from safety and ethical points of view and proposes ways on how to prevent risks.

In Chap. 17, Isabel Ferreira and João Sequeira highlight that demographic trends reveal a significant world-changing age distribution resulting from increased average longevity and the deep decline in fertility rates. In this framework, the use of robotic technology to guarantee prolonged autonomy of senior citizens and their active ageing is an imperative. The authors point out, however, that the use of robotic technology can never replace fundamental bonds, as those that link parents to their children.

Two papers constitute the second part of this book: Chap. 18, and Chap. 19.

In Chap. 18, Rodrigo Ventura and Isabel Ferreira report their effort to bring robotic technology closer to the lay persons in the general public—an educational effort that, in their opinion, should precede the massive deployment of all information and communication technologies and that becomes particularly needed at the verge of a widespread use of robotic technology. This chapter gives a brief account of the content and organization of the exhibition and of how the public reacted to it.

In his paper Chap. 19, José Manuel Martins addresses the role of fiction, namely the role of the cinema in the construction of prototypical mental representations and changing mentalities.

Lisbon  
July 2016

Maria Isabel Aldinhas Ferreira  
Joao Silva Sequeira  
Mohammad Osman Tokhi  
Endre E. Kadar  
Gurvinder Singh Virk

A World with Robots

International Conference on Robot Ethics: ICRE 2015

Aldinhas Ferreira, M.I.; Silva Sequeira, J.; Tokhi, M.O.;

Kadar, E.; Virk, G.S. (Eds.)

2017, XV, 240 p. 54 illus., 36 illus. in color., Hardcover

ISBN: 978-3-319-46665-1