

Roboethics: Ethics Applied to Robotics

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This special issue deals with the emerging debate on roboethics, the human ethics applied to robotics. Is a specific ethic applied to robotics truly necessary? Or, conversely, are not the general principles of ethics adequate to answer many of the issues raised by our field's applications? In our opinion, and according to many roboticists and human scientists, many novel issues that emerge and many more that will show up in the immediate future, arising from the upcoming marketed robotics products, demand the development of new cultural and legal tools that can provide the crucial answers to the most sensitive questions.

The unfolding and emerging scenarios made possible by robotics are fascinating and unsettling at the same time. Suffice it to think that all machines, of any form and dimension and for any type of use, will be computerized, equipped with artificial intelligence and networked, to understand that everything we have seen to date—computers, video games, cellular phones, and Internet—is really only the dawn of the technological world that awaits us. For instance, in aging societies, there is an urgent motivation for safe, autonomous, and adaptable personal (also called *social*) robots. So humans will coexist with the next-generation robots employed as domestic workers, nurses, and caregivers at home, in hospitals, and in nursing homes.

This widespread distribution of robots will raise several completely new ethical, legal, and social issues. Robots will

have the ability to learn and process our personal profiles, tastes, and habits, which will lead to privacy and safety issues, as well as those regarding individual freedom. The human-robot interactions can cause psychological and social problems, especially in vulnerable populations such as children, older persons, and patients. Then there will be issues regarding the attribution of civil and criminal liability should an autonomous robot produce damages. Finally, there will be important, critical areas bordering with bioethics, in cases of medical and biorobotics, and with humanitarian and international law, in cases of military robotics. All these cases have never been faced squarely by humanity, and this entails a need for a complex, joint approach from various disciplines to handle them.

These issues have been subject to discussion since the dawn of robotics in the works of Norbert Wiener or in the science-fiction speculations of Isaac Asimov. However, it is only in the last few years that the debate has been progressively organized within the international robotics community and that the key word *roboethics* has established itself as an emerging field of applied ethics. The complexity of the matter is enormous, as is the tableau painted by the various overlapping scientific and cultural backgrounds in the debate. This is why we believe it is worth addressing the terminology issue in this introduction to clarify the interconnecting levels between ethics and robotics.

The first level is represented by the adopted ethical theories, developed principally by the branch of philosophy

called *ethics* or *morality*, which studies human conduct, moral assessments, and the concepts of good and evil, right and wrong, justice and injustice, and so on. In our case, a generic or fundamental ethical reflection is directly related to the particular issues that are generated by the development of robotic applications and their diffusion in the society. This is the proper concept of roboethics, meaning that applied ethics, similar to bioethics, attempts to provide answers to new questions that are generated by the progress of a specific scientific and technical field. This level updates the various views

on concepts, such as dignity and integrity of the person and the fundamental rights of the individual, as well as the social, psychological, and legal aspects involved.

The second level, currently referred to as *robot ethics* or *machine ethics*, regards the code of conduct that designers implement in the artificial intelligence of robots. This means a sort of *artificial ethics* able to guarantee that autonomous robots will exhibit ethically acceptable behavior in all situations in which they interact with human beings or when their actions may have negative consequences on human beings or the environment. It is clear that the guidelines to define what is ethically acceptable and to enforce them are the product of the aforementioned field of roboethics. Robots are, in fact, machines, meaning tools that are unaware of the

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choices made by their human creators, which, therefore, bear the moral responsibility for the actions, good or bad, of robots.

Finally, there is a third level, which we could perhaps define as robot's ethics, because it is the ethic born from the subjective morality of a hypothetical robot that is equipped with a conscience and freedom to choose its own actions on the basis of a full comprehension of their implications and consequences. It is only in this case that robots may be deemed as moral agents and that one may refer to as involving the responsibilities or rights of robots. This, obviously, is currently speculative and beyond the purposes of this special issue.

It is, therefore, clear that roboethics is a work in progress, susceptible to further evolution as the events unroll in our technical and scientific future.

We are convinced that all stakeholders in the development of robotics must take part, starting with the robotics scientists and also all members of the Society. The role of the media will be crucial to this: they

will have to provide prompt and correct information on the progress of robotics and the pros and cons of its applications. An even more important role will be played by the world's school systems, which will have the task of training upcoming generations: the true players, beneficiaries or victims, of the imminent robotics invasion.

This special issue, being the first dedicated to the topic of roboethics and given the high number of submissions and the limited available space, gives priority to broader articles that provide cultural and philosophical

direction to those approaching the subject for the first time and will publish some articles analyzing the human-robot relationship from various points of view: technical, psychological, sociological, and legal. Other sensitive topics, such as military robotics or biorobotics, will require further and deeper ethical analysis in future issues of the magazine. In the following paragraphs, we briefly discuss the content of each article.

The first article, "Socially Assistive Robotics," by Feil-Seifer and Mataric, examines the ethical issues involved in using socially assistive robots, particularly in the context of health care. They describe core ethical principles for robots that provide assistance through social interaction, and they emphasize how deception (intended or unintended), autonomy, and justice can affect the ethical applications of assistive robots.

The topic is further investigated in "Children, the Elderly, and Interactive Robots" by Sharkey and Sharkey, who examine the complex psychological implications of the relationships with robots, mainly through theoretical references to cognitive psychology. They start from a survey of the present state of the art in robot caregivers and pets and discuss the risks and benefits of the relational applications with the oldest and youngest members of Society.

In "The Ethical Landscape of Robotics," Lichocki et al. survey some of the main ethical issues pertaining to robotics that have been discussed in the literature so far. They start with the notion of responsibility ascription that arises when an autonomous system malfunctions or harms people. Then, they list various ethical issues emerging in two sets of robotic applications: service robots that peacefully interact with humans and lethal robots created to fight in the battlefields. Finally, they also provide a short overview of machine ethics.

Powers broadens the ongoing debate on machine ethics, adding an

incremental strategy. In his approach, incrementalism in machine ethics becomes a practical proposal about how to simultaneously engineer and provide ethical sanction for robots. The article discusses the concrete proposals to do this and reflects in a critical manner on these matters.

A very interesting experimental approach is that described by Salvini et al. in "The Robot DustCart." The article describes DustCart, a project concerning the use of autonomous mobile robots to collect and transport rubbish bags in a small Italian town. After a report on the testing period (service provided, testing site, and so on), the authors deal with the social and legal implications of the experiment.

A further reflection on legal aspects is given in Asaro's article, "Remote-Control Crimes," which deals with the difficult international and cross-cultural aspects of roboethics. He discusses the difficulties of applying law to criminal activities that will be enabled in the future by new robotic capabilities, such as cybercrimes; *robot crimes* will be the subject of multiple governing laws, changing national rules, conflicting regulations, and disparate institutions.

Finally, in "Ethics in Advanced Robotics," Operto outlines a brief history of roboethics, whose development she has contributed to since its birth; in her article, she points out the need to uncover the philosophical assumptions underlying today's debate in ethical and social issues of robotics to facilitate the establishment of a common ground for the definition of principles and regulatory guidelines.

We hope that the readers will enjoy the articles in this special issue, are encouraged to deepen their interest in roboethics, and will actively contribute to the debate, which will become increasingly important with the growth of robotics in the society.

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