

## Appendix to:

### **“Robotic Visions to 2020 and beyond – The Strategic Research Agenda for robotics in Europe, 07/2009”**

#### **Ethical, Legal and Societal Issues of Robotics**

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**Ethical, Legal and Societal Issues in  
the European Strategic Research Agenda of  
the  
Coordination Action for Robotics in Europe**

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**SUMMARY**

In this presentation the authors outline the activity developed in Europe on the Ethical, Legal and Societal (ELS) issues in Robotics, from the First International Symposium on Roboethics (Italy, 2004) to the work-in-process outlined in the frame of the Strategic Research Agenda of the Coordination Action for Robotics in Europe Project (CARE) funded by the European Commission.

- Section 1: A new Applied Ethics
- Section 2: What is a Robot?
- Section 3: The Road to Roboethics
- Section 4: The European SRA on Robotics



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ELS ISSUES IN CARE SRA

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## 1. Robotics and Roboethics

**Roboethics** can be considered a new Applied Ethics.

This new lemma is composed by the words **robotics** and **ethics**.

This implies that a scientific discipline and its applications (robotics, robotics technologies) are to be evaluated (from *value*) from the point of view of the ethical values of the society “here and now”.

The authors think that Roboethics does concern

NOT ONLY

about the procedures embodied into an automatic machine to ensure that it performed correctly according to the standards,

BUT ALSO

about **values, moral decisions, human judgments**.

In this it is intimately connected to the governance of science and to the governance of the society.



## 1. What is an Applied Ethics?

According to **Brenda Almond**, the scholar who promoted the concept, “Applied ethics is marked out from ethics in general by its special focus on issues of practical concern. It therefore includes medical ethics, environmental ethics, and evaluation of the social implications of scientific and technological change, as well as matters of policy in such areas as health care, business or journalism. It is also concerned with professional codes and responsibilities in such areas (..) Although sometimes treated in isolation, these issues are best discussed in the context of some more general questions which have been perennial preoccupations of philosophers, such as: How should we see the world and our place in it? What is the good life for the individual? What is the good society? In relation to these questions, applied ethics involves discussion of fundamental ethical theory, including utilitarianism, liberal rights theory and virtue ethics”.



## 1. Roboethics and Globalisation

While robotics products are – until now - quite similar from one Nation to the other, there are in the world many idea of “ethics”: in the Anglo-Saxon, European, Chinese, Islamic, Hindu, Jewish traditions we found different conceptions of “human rights” (privacy, dignity); of “human life” (at which stage of development the human embryo/foetus is considered a human being; the so-called “right to die”; the prohibition of neuro-implants; the prohibition of augmentation by prosthesis). Different rules about experiment on non-human animals; different idea of human right for women, children; people with disabilities or diminished capacities; elders; human reproductive technologies. All these different conceptions also affect directly our applied ethics.



## 1. Different ethics, different conclusions

Here below are some of the ethical issues connected to Roboethics which can differ, in their definition and application, according to cultures, religions and societies:

- Concepts of Immanentism / Transcendentalism;
- Perception of human being / Integrity of the person;
- Diversity (Gender, Ethnicity, Minorities);
- Human enhancement;
- What is human? post-human? Cyborg?
- Human life/artificial life;
- Human intelligence/artificial intelligence;
- Freedom;
- Privacy vs. traceability of actions;
- What is science/knowledge?



## 1. The Lesson of Bioethics

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Contrary to being monolithic, bioethics is a field open to contributions from different perspectives, faiths and beliefs. We are seeing the effects of the different moral beliefs on issues like stem cells; end of life; reproductive technologies; organ and organ donation; transplantations; explants. The methodology adopted by most of the wise bioethics scholars and experts is based on cross-cultural studies, on one side; and on “reflective equilibrium” on the other side.



## 1. The Reflective Equilibrium

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A "reflective equilibrium" is the end-point of a deliberative process in which we reflect on and revise our beliefs about an area of inquiry, moral or non-moral. The inquiry might be as specific as the moral question, "What is the right thing to do in this case?" or the logical question, "Is this the correct inference to make?" Alternatively, the inquiry might be much more general, asking which theory or account of justice or right action we should accept, or which principles of inductive reasoning we should use. We can also refer to the process or method itself as the "method of reflective equilibrium." (Stanford Philosophical Encyclopedia).

The “ method of the reflective equilibrium” is that the authors suggest to apply also in the case of the development of Roboethics.



## 1. The fallacy of reducing Values to technical issues

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When debating the issues of the risk of techno-science, there is a known syndrome affecting the world policy makers for which the political and institutional differences are downsized to technical issues (surrogate).

In this way, the underlying “real” factors which are working in the decision-making process are hidden.

Among these real factors we can list the economic interest, political choices, and all the interest which are driving the tecnoscience policy.

One example are the political and ethical decisions about the OMG's, in which we are seeing the effort to reduce, to the mere perspective of risk evaluation, more global prescriptive, and societal differences.



## 1. The potential Day After...

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In dealing with socio-ethical issues in techno-science the authors are aware that the feeling of the public opinion can go through a non-linear phase change from the *before* to the *after* if some dramatic cases related to the technological applications should occur.

It was the case with nuclear energy before and after Chernobyl; and of genetic engineering before and after the Dolly case.

Until now, no deadly cases have occurred in the field of robotics applications. However, experts and stakeholder should be aware of the rapidly changing social attitude in respect to the accepted dimension of the risk in scientific innovation.



## 1. The Public Concerns

The questions lies also in the fact that “public concerns tend to focus not only on the narrow prediction of probabilities, but also on neglected or unknown (thus unpredicted) effects on society, and the **institutional incapacity to deal with such effects**. Indeed, the tendency to collapse these normative dimensions into technical assessments of ‘risk perception’, and to dismiss public concerns as irrational, is itself a major source of concern. Only when these problems are recognised, does it become possible to address more effectively the sources of public concerns, namely inadequacies in the governance of innovation itself” (Wynne and al, 2008).



## 1. Ethical Issues in an ICT Society

Roboethics shares many “sensitive areas” with Computer Ethics and Information Ethics. But, before that, we have to take into account the global ethical problems derived from the Second and Third Industrial Revolutions, in the field of the relationship between Humans and Machines:

- Dual-use technology;
- Anthropomorphization of the Machines;
- Humanisation of the Human/Machine relationship;
- Technology Addiction;
- Digital Divide, socio-technological Gap;
- Fair access to technological resources;
- Effects of technology on the global distribution of wealth;
- Environmental impact of technology.



## 1. Computer and Information Ethics

From the Computer and Information Ethics we borrow the known Codes of Ethics called PAPA, acronym of: privacy, accuracy, intellectual property and access.

**Privacy:** What information about one's self or one's associations must a person reveal to others, under what conditions and with what safeguards? What things can people keep to themselves and not be forced to reveal to others?

**Accuracy:** Who is responsible for the authenticity, fidelity and accuracy of information? Similarly, who is to be held accountable for errors in information and how is the injured party to be made whole?

**Property:** Who owns information? What are the just and fair prices for its exchange? Who owns the channels, especially the airways, through which information is transmitted? How should access to this scarce resource be allocated?

**Accessibility:** What information does a person or an organization have a right or a privilege to obtain, under what conditions and with what safeguards?



## 1. Engineering Ethics

By Engineering Ethics are meant the Codes of Ethics bearing on the professional responsibilities of engineers, guiding to a responsible conduct in research and practice. In this context, Security and Reliability are the most important ethical codes of conduct.

Furthermore:

- Hold paramount the safety, health and welfare of the public.
- Perform services only in areas of their competence.
- Issue public statements only in an objective and truthful manner.
- Act in professional matters for each client as faithful agents/trustees.
- Avoid improper solicitation of professional assignments.

(American Council of Engineering Companies Ethical Guidelines)



## 1. Ethics in Science and Technology

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“What is science? Not the collection of facts but the establishment, through open debate, of new principles that command wide acceptance. The process of incorporating ethical concerns and recommendations in daily application.” (John Polanyi, Nobel Laureate)

How can the ethical principles discussed in transdisciplinary assemblies; expressed by warnings or the public’s concern; suggested by religious personalities, theologians, and moral leaders; and/or forwarded by a community of concerned scientists be incorporated in the current application of research and development?



## 1. Codes of Conducts

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Here below the main social and institutionalized forms of codes of conducts:

- Oath & pledge
- Code & guideline
- Appeal
- Recommendation
- Manifesto
- Statement & declaration
- Resolution
- Convention
- Charter
- Law



## 1. Universally Adopted Ethical Principles

In roadmapping Roboethics, we refer to the General Ethical Principles adopted by most Nations, Cultures and People of the World.

Among them:

- United Nations Universal Declaration of Human Rights (1948)
- Unesco: Declaration on Science and the use of scientific knowledge (1999)
- Charter Of Fundamental Rights of the European Union (2000)



## 2. Robotics New Science?

*Is Robotics a new science, or it is a branch or a field of application of Engineering?*

Actually Robotics is a discipline born from:

- Mechanics
- Physics/Mathematics
- Automation and Control
- Electronics
- Computer Science
- Cybernetics
- Artificial Intelligence

This shows that Robotics is a unique combination of many scientific disciplines, whose fields of applications are broadening more and more, according to the scientific and technological achievements.



## 2. Specificity of Robotics

It is the first time in history that humanity is approaching the threshold of replicating an intelligent and autonomous entity. This compels the scientific community to examine closely the very concept of intelligence – in humans, animals, and of the machines – from a cybernetic standpoint.

In fact, complex concepts like autonomy, learning, consciousness, evaluation, free will, decision making, freedom, emotions, and many others shall be analysed, taking into account that the same concept shall not have, in humans, animals, and machines, the same semantic meaning.



## 2. Robotics and the Two Cultures

From this standpoint, it can be seen as natural and necessary that Robotics draws on several other disciplines:

- Logic/Linguistics
- Neuroscience/Psychology
- Biology/Physiology
- Philosophy/Literature
- Natural History/Anthropology
- Art/Design

Robotics de facto unifies the so called two cultures, *Science* and *Humanities*. The effort to design Roboethics should make the unity of these two cultures a primary assumption. This means that experts shall view Robotics as a whole - in spite of the current early stage which recalls a melting pot – so they can achieve the vision of the Robotics' future.



## 2. Robot as Slave

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The theme of the relationship between humankind and autonomous machines – or, automata - appeared early in world literature, developed firstly through legends and myths, more recently by scientific and moral essays.

The topic of the rebellions of automata recurs in the classic European literature, as well as the misuse or the evil use of the product of ingenuity. It is not so in all the world cultures: for instance, the mythology of the Japanese cultures does not include such paradigm. On the contrary, machines (and, in general, human products) are always beneficial and friendly to humanity.

These cultural differences in attitudes towards machines are a subject the Roboethics Roadmap should take into account and analyse.



## 2. Common Questions

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Some examples of common questions:

- Although farsighted and forewarning, could Asimov's three Laws become really the Ethics of Robots?
- How far can we go in embodying ethics in a robot? And, which kind of "ethics" is the correct one for Robotics?
- How contradictory is, on one hand, the need to implement Roboethics in robots, and, on the other, the development of robot autonomy?
- Is it right that robots can exhibit a "personality"?
- Is it right that robots can express "emotion"?



## 2. What is a Robot?

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Robotics scientists, researchers, and the general public have about robots different evaluations, which should be taken into account in the Roboethics Roadmap:

- a) Robots are nothing but machines
- b) Robots have ethical dimensions
- c) Robots as moral agents
- d) Robots, evolution of a new species



### 2.a) Robots Are Nothing but Machines

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Many consider robots as mere machines - very sophisticated and helpful ones - but always machines. According to this view, robots do not have any hierarchically higher characteristics, nor will they be provided with consciousness, free will, or with the level of autonomy superior to that embodied by the designer. In this frame, Roboethics can be compared to an Engineering Applied Ethics.



## 2.b) Robots Have Ethical Dimensions

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In this view, an ethical dimension is intrinsic within robots. This derives from a conception according to which technology is not an addition to man but is, in fact, one of the ways in which mankind distinguishes itself from animals. So that, like language and computers, but even more, humanoid robots are symbolic devices designed by humanity to extend, enhance, and improve our innate powers, and to act with charity and god intentions. (J. M. Galvan)



## 2.c) Robots as Moral Agents

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Artificial agents, particularly but not only those in Cyberspace, extend the class of entities that can be involved in moral situations. For they can be conceived as moral patients (as entities that can be acted upon for good or evil) and also as moral agents (not necessarily exhibiting free will, mental states or responsibility, but as entities that can perform actions, again for good or evil). This complements the more traditional approach, common at least since Montaigne and Descartes, which considers whether or not (artificial) agents have mental states, feelings, emotions and so on. By focusing directly on 'mind-less morality' we are able to avoid that question and also many of the concerns of Artificial Intelligence. (L. Floridi)



## 2.d) Robots, evolution of a new specie

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According to this point of view, not only will our robotics machines have autonomy and consciences, but humanity will create machines that exceed us in the moral as well as the intellectual dimensions. Robots, with their rational mind and unshaken morality, will be the new species: Our machines will be better than us, and we will be better for having created them. (J. Storrs Hall)



## 3. The European Approach

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- 2004: First International Symposium on Roboethics
- 2005: The EURON Roboethics Atelier Project
  - The EURON Roboethics Roadmap
  - Review by international experts (ECAP; CEPE)
- 2005-2008: ETHICBOTS - **E**merging **T**echno-ethics of **H**uman **I**nteraction with **C**ommunication, **B**ionic and **R**obotic **S**ystems
- 2007: CARE SRA



### 3. The EURON Roboethics Atelier Project

EURON (European Robotics Research Network) aims to promote excellence in robotics by creating resources and exchanging the knowledge we already have, and by looking to the future (<http://www.euron.org>).

In 2005, EURON funded the Research Atelier on Roboethics, with the aim of drawing the first Roboethics Roadmap.

The ultimate purpose of the project was to provide a systematic assessment of the ethical issues involved in the Robotics R&D; to increase the understanding of the problems at stake, and to promote further study and transdisciplinary research.

The Roboethics Roadmap outlines the multiple pathways for research and exploration in the field and indicates how they might be developed.



### 3. The EURON Roboethics Roadmap

The roadmap embodies the contributions of more than 50 scientists and technologists, in many fields of investigations from sciences and humanities. This study will hopefully be a useful aid in view of cultural, religious and ethical differences.

Roboethics Roadmap was not:

- an exhaustive picture of the State-of-the-Art in Robotics, nor a guideline of ethics in science and technology. The reason is that Robotics is a new science still in the defining stage.
- a list of Questions & Answers. Actually, there are no easy answers, and the complex fields require careful consideration.
- a Declaration of Principles. The Euron Roboethics Atelier cannot be regarded as the institutional committee of scientists and experts entitled to draw a Declaration of Principles on Roboethics



### 3. Scope: Near Future Urgency

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In terms of scope, the authors decided to take into consideration – from the point of view of the ethical issues connected to Robotics – a temporal range of few decades, in whose frame we could reasonably locate and infer – on the basis of the current State-of-the-Art in Robotics – certain foreseeable developments in the field. For this reason, we considered premature – and have only hinted at – problems inherent in the possible emergence of human functions in the robot: like consciousness, free will, self-consciousness, sense of dignity, emotions, and so on. Consequently, this is why we have not examined problems –debated in literature – like the need not to consider robot as our slaves, or the need to guarantee them the same respect, rights and dignity we owe to human workers.



### 3. Methodology: Open Work

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The development of Roboethics is an Open Work susceptible to further development and improvement which will be defined by events in our techno-scientific-ethical future. We are convinced that the different components of society working in Robotics, and the stakeholders in Robotics should intervene in the process of building a Roboethics Roadmap, in a grassroots science experimental case:

- The Parliaments
- Academic institutions and Research Labs
- Public ethics committees
- Professional Orders
- Industry
- Educational systems
- The mass-media



### 3. Principles inspiring Roboethics

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- Human Dignity and Human Rights
- Equality, Justice and Equity
- Benefit and Harm
- Respect for Cultural Diversity and Pluralism
- Non-Discrimination and Non-Stigmatization
- Autonomy and Individual Responsibility
- Informed Consent
- Privacy
- Confidentiality
- Solidarity and Cooperation
- Social Responsibility
- Sharing of Benefits
- Responsibility towards the Biosphere.
- The Geneva Conventions and Additional Protocols.



### 3. EU Charter Of Fundamental Rights

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Articles of interest:

- Human dignity
- Right to life
- Right to the integrity of the person
- Respect for private and family life
- Protection of personal data
- Freedom of the arts and sciences
- Freedom to choose an occupation and right to engage in work
- The rights of the child
- The rights of the elderly
- Integration of persons with disabilities
- Environmental protection
- Consumer protection



### 3. Roboethics Taxonomy

- Humanoids  
*Artificial Mind, Artificial Body*
- Advanced production systems  
*Industrial robotics*
- Adaptive robot servants and intelligent homes  
*Indoor Service Robots, Ubiquitous Robotics*
- Network Robotics  
*Internet Robotics, Robot ecology*
- Outdoor Robotics  
*Land, Sea, Air, Space*
- Health Care and Life Quality  
*Surgical Robotics, Bio-Robotics, Assistive Technology*
- Military Robotics  
*Intelligent Weapons, Robot Soldiers, Superhumans*
- Edutainment  
*Educational Robots, Robot Toys, Entertainment, Robotic Art*



### 3. Taxonomy Methodology

Aware of the classifications produced by the main Robotics organizations, which differ from one another on the basis of the approach – technological/applicational -, we have preferred, in the case of the Roboethics Roadmap, to collect the many Robotics fields from a typological standpoint, according to shared homogeneity of the problems of interface towards the society.

Instead of an encyclopaedic approach, we have followed - with few modifications - the classification of **EURON Robotics Research Roadmap**.

For every field, we have tried to analyse the current situation rather than the imaginable. Thus, we have decided to give priority to issues in applied ethics rather than to theoretical generality.



### 3. A Human Centred Ethics

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Likewise, and for the same reasons, the authors suggest to select as the subject of the roboethical investigation not the robot and its artificial ethics, but the human ethics of the robots' designers, manufacturers and users.

Problems like those connected to the application of robotics within the military and the possible use of military robots against some populations not provided with this sophisticated technology, as well as problems of terrorism in robotics and problems connected with biorobotics, implantations and augmentation, are urging and serious enough to deserve a deep and sharp investigation.



### 3. Triage methodology

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In line with other European projects, the authors suggest the adoption of a triaging methodology, “in order to distinguish issues of rights protection and promotion that concern society now from issues that may possibly concern society in a distant future only” (Ethicboths, Deliverable 6). The triage is based on the selection criteria of *imminence*, *novelty*, and *potential social pervasiveness*. Another temporal refinement proposed concerns “the distinction between long-term visions driving research in robotics and the near-term perspectives of robotics research and technology transfer”. Long-term visions are taken into account by the authors chiefly by means of ethical monitoring recommendations, which mostly point to the need for further ethical inquiry and bear no direct regulatory implications.



### 3. Recommendations to European Institutions

The just concluded ETHICBOTS project has produced some recommendations about the Emerging Technoethics of Human Interaction with Communication, Bionic and Robotic Systems which are based on the promotion and the protection of fundamental rights as expressed in the European Chart for the Human Rights (Lisbon 2000).

Distinctive ethical issues arise from sharing action control with or delegating it to machines possessing some of the above sensori-motor and cognitive capabilities. The ETHICBOTS consortium has pursued the prior goal of identifying and analysing novel ethical issues arising in this special human-machine interaction context.

**Recommendations in general concern:** learning robots, stability and uncertainty issues in robotics, position of humans in the control hierarchy, robotic action legibility, privacy, race and class issues, gender issues, and misleading uses of intentional language to describe robot behaviour.

**Recommendations about domain-specific human-robot interactions** concern care robots, edutainment robots, robotic surgery, robot in the workplace, and military uses of robots.



### 4. From Risk-Governance to Innovation-Governance

A very inspiring report of the same title (Report of the Expert Group on Science and Governance to the Science, Economy and Society Directorate) funded by the EC has been recently released. The assumption was that the public is thought to fear science because scientific innovations entail risk. However, the report's authors concluded that "there is no general, indiscriminate public disaffection with nor fear of 'science'. Instead, there is selective disaffection in particular fields of science, amidst wider areas of acceptance – even enthusiasm". The disaffection is often correlated to the lack of European institutional capacity to deliberate and resolve normative questions concerning the **prior shaping** of science and innovation.



## 4. Taking European Knowledge Society Seriously

An important conclusion of this report is that “steps should be taken away from the present narrow and exclusive understanding of innovation towards recognising more socially distributed, autonomous and diverse collective forms of enterprise. This promotion of diverse civic ‘knowledge-abilities’ would perhaps be the most effective single commitment in helping address legitimate public concerns about Europe as a democratic knowledge-society, able to hold its own distinctive place in a properly-grounded global knowledge-economy”.



## 4. CARE Coordination Action for Robotics in Europe

The Coordination Action for Robotics in Europe (CARE) is a project funded by the European Commission (Directorate Information Society and Media) under the 6<sup>th</sup> Framework Programme. Its objective is to identify research priorities and to define a Strategic Research Agenda (SRA) for robotics in Europe based on the SRA developed by EUROP (European Robotics Platform) in 2006.



## 4. SRA's Application Domains vs. Scenarios

Five dedicated working groups have been formed to cover five major application domains: industrial, professional service, domestic service, security and space robotics. For each application scenario the project's working plan has scheduled an ELS issues roadmapping activity.

		Application Domains				
		Industrial	Professional Service	Domestic Service	Security	Space
Application Scenarios	Manipulation Robots	•	•			•
	Robotic co-workers	•	•	•	•	•
	Logistic Robots	•	•	•		
	Security Robots			•	•	
	Exploration/ Inspection		•		•	•
	Edutainment Robots		•	•		



## 4. ELS Issues in CARE SRA

One specific CARE WP is devoted to the Ethical, Legal and Societal Issues of Advanced Robotics in Europe. The authors share the responsibility to carry out this task. To this purpose they have produced a Questionnaire about the forecasted ELS issues in robotics from 2010 to 2020 in the six identified application scenarios. The ELS issues have been listed on the basis of the protection of the principles stated and approved in the European Chart for the Human Rights and according to the risk to which humans and their environment could be exposed in working and co-working with robots; in employing robots in professional and/or domestic services; in employing robots in the security and space exploration fields. This Questionnaire is going to be distributed to robotics and non robotics international experts in Science&Technology Studies. The Questionnaire results will be processed, and then submitted to the European Commission in the frame of the CARE Coordination Action.



## 4. From the Principles to Real Life

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Roboethics, as an Applied Ethics, shall deal with the practical cases which are arising from daily life. The process involves the preservation of the stated principles in any particular occasions in which robotics applications are to be evaluated in respect to their techno-ethical sensitiveness. The process suggested is a deliberative adjustment between general principles and particular judgments. When the particular cases should involve only robots' improper performance or malfunctioning, it is likely that these cases will be discussed by experts, in courts or in the proper quarters.



## 4. A tool for prevention

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When, on the other side, the cases should involve directly issues of human rights, and especially in respect to the novelty of those cases, then society as a whole might be called to judge the case, to reconfirm the principles, or to appropriately reform them. Until now, no dramatic case occurred yet, at least to our knowledge, in the field of robotics. Authors's wish and commitment are that Roboethics could be a the tool of prevention for our society.

