ETHICS AND ROBOTICS. A FIRST APPROACH[1].

RAFAEL DE ASÍS ROIG[2]

Abstract: Clearly, technical and scientific progress and moral progress do not necessarily go hand in hand. Therefore, this article encourages reflection on the new ethical challenges posed by such developments and, in particular, by robotics, a field that has developed greatly in recent decades and that has led to possibilities unimaginable until recently. Thus, the author examines here the so-called roboethics, its content, the specific fields it addresses –such as social relations and moral agency of robots–, as well as the different approaches and views on these issues.

Keywords: Ethics, robotics, moral agent, human rights

Contents: I. INTRODUCTION; II. ROBOTICS; III. ROBOETHICS.

I. INTRODUCTION

In the 20th and 21st centuries there have been major advances in both the scientific and technical field. The first one has been named the science century. In this regard, it has been claimed that the first half of the 20th century focused on Physics whilst the second half on Biology, Genetics and Computer Science (Rifkin 1998: p. 20). As for the 21st century until now is characterised by the rise of Neuroscience and Nanotechnology as well as by advances in the field of Robotics (in connection with the other areas but especially to I.T).

However, despite all these advances, poverty, hunger and dissatisfaction regarding rights still persist. It is not surprising that Th. Pogge commences his book World Poverty and Human Rights examining how it is possible that extreme poverty affects half of humanity despite the enormous economic and technological progress, and how it is possible that the distribution of scientific and technological benefits is so uneven (Pogge 2002).

[1] I appreciate the comments and suggestions of F. Javier Ansuátegui, Jose Manuel Molina López, Maria del Carmen Barranco and Miguel Ángel Ramiro.

[2] Professor of Philosophy of Law. Instituto de Derechos Humanos "Bartolomé de Las Casas", Universidad Carlos III de Madrid, Spain (rarfid@inst.uc3m.es).

Moreover, in the last century, the most important advances in scientific and technical knowledge have been accompanied by atrocities to human beings, which has served to demonstrate that scientific and technological progress and moral progress do not necessarily go hand in hand. Indeed, the experiments carried out by the Nazis in concentration camps and other barbarities that have taken place in other countries, e.g. the United States (Beecher 1966: p. 1354), prompted in the years after the Second World War the idea that scientific progress of humanity requires moral progress was called into question giving rise to what some have referred to as "normative reaction" (Iacono 2006: p. 173).

Regarding this situation, it is possible to adopt two possible positions: indifference and engagement. The indifference implies allowing technology and science to progress without establishing a framework or a direction; engagement, by contrast, implies a reflection on that framework. Obviously, I shall opt to follow this second path because, among other reasons, whoever adopts the stance of indifference should be aware of the fact that there shall always be someone who sets the direction of all these developments (Sassen 1998: p. 177).

From the engagement perspective it is possible, by contrast, to suggest several ways in which this framework may be established: Ethics (through self-control or the definition of universal ethical criteria) or Law. They are not exclusive of one another but rather complementary, one needs the other.

In this sense, it is necessary to reflect on the new ethical challenges posed by such developments, especially if we take into consideration that the time period between research and the final product is being reduced. In fact, this discussion has been raised under the name of "Technoethics " or "NEST-ethics" -ethics of new and emerging science and technology- (Swierstra and Rip 2007: p. 3).

Currently, the term emerging technologies (also referred to as converging) is employed to refer to the combination of transformational technologies such as nanoscience and nanotechnology, biomedicine and genetic engineering, information technology and cognitive science. The convergence of these technologies presents undoubtedly major challenges, some of which are common to all.

I would rather use the term emerging technologies instead of "biotechnology" which is more widespread precisely because of the uniqueness that robotic represents in this reflection. As is known, there is no consensus on the meaning of the term "biotechnology". But even in its broadest sense, it is used to refer to the application of science and technology to living organisms, and in this sense, it can not be used to account for all the ethical problems that robotics may pose.

Thus, in this article, I shall focus particularly on the projection of ethics in robotics. This is a first approach aimed at introducing the debate and raising some of the issues encountered in this field.

II. ROBOTICS

Robotics is the science and technology of robots. It is a combination of many scientific disciplines and its fields of application are increasingly expanding.

Although it has often been cited that the beginning of robotics was the invention of a textile machine programmable by punched cards, the first time the term "robot" was employed was in 1920 in a Czech theatre play. The term robotics is attributed to Isaac Asimov who in the late 30s created the Laws of Robotics.

Currently, there are over one million robots in the world that serve different functions and are found in hospitals, factories and in our homes. They are increasingly intelligent machines that may be able to capture feelings and in the future, it is believed that they may be equipped with self-consciousness (Brooks 2003).

In addition to traditional industrial robots (machines designed for the manufacturing of cars, painting and handling) at present, robots are replacing human organs, prosthesis have been created that perform human functions or increase capabilities. There are robots offering services; machines that handle specific tasks, are able to move independently with a flexible behaviour and with a decision-making capability far superior to the rest. Some of them can have a conversation and perform facial movements, others are capable of complex reasoning being able to discriminate between options and be proportionate (as those used in the military for combat or surveillance).

The combination of robotics and other scientific fields, especially with neuroscience and nanotechnology has led to possibilities that until recently were only imaginable.

A brain-computer interface has been developed (BCI, brain-computer interface) based on real time electroencephalography for the classification of images presented using a visual display in series. The so-called nanorobots have been created, robots that are smaller in size than red blood cells and can be used to fight diseases -it is thought that they may be operational by 2020- (Freitas 2005: p. 55). In 2013, the company Boston Dynamics introduced an android-shaped cat that can run at a speed of 50 kilometres per hour. The company Robotic Technology announced, recently, that they have created a robot that is able to "feed itself" extracting energy from organic matter found nearby (including animal and plant tissues). Robotic pets have been created (robo-pets) used to treat sick children and for people with mental illness that have proven to be effective in the recuperation phase. Robots designed to care for the elderly, people in situations of dependency and people with diseases are being developed. Furthermore, there is the possibility that "sexbots" (sex robots) will be able to engage in a personal love relationship (Levy 2008). There are more than one hundred Android projects in the world, many of which are in Japan.

Important questions arise in the field of robotics, some of which are difficult to answer. Are there any warranties regarding their use? Are there rules governing their behaviour? Which are they? Are there any criteria regarding their destruction? Would it be possible to talk about the rights of robots? Who are the people responsible for their behaviour? Would it make sense to have human contact replaced by robots? Should robotics be used for military purposes? What is the degree of autonomy that we would like a robot to have? What are the situations in which it would be justified that a robot does not respect human will? Would there be a justification for creating slave robots? How do robots affect the environment? Should we create human-looking robots? How will robots interact with less intelligent humans around them? (Veruggio 2007).

Since its inception, robotics has given rise to ethical issues of undoubted relevance. According to D. Cerqui within the robotics community there are three positions regarding ethics: firstly, there are those who are not interested in this matter as they believe that it is a technology and, therefore, it is not a subject for ethics; secondly, there are those who are interested in the projection of ethics in robotics but from a conventional and uncritical ethical perspective (i.e., ethics that assume universal principles and objectives considered timeless); thirdly, there are those who adopt a comprehensive and critical approach (Veruggio and Operto 2006: p. 2).

These last two perspectives have led to a new projection of ethics which has been coined roboethics (Capurro and Nagenborg 2009).

III. ROBOETHICS

The term roboethics was officially proposed at the First International Symposium on Roboethics (San Remo, January-February 2004). At this meeting, a call was made to philosophers, jurists, sociologists, anthropologists and robotic scientists, to contribute to lay the foundations of ethics in the design, development and use of robots. That same year, at the International Robot Fair in Fukuoka (Japan), the participants (scientists and representatives of the Japanese robotics industry) signed the World Robot Declaration, the robotic version of the Hippocratic Oath which states that "the next generation robots will be partners that co-exist with human beings. They will assist human beings both physically and psychologically; they will contribute to the realisation of a safe and peaceful society. In order for society to accept and welcome robots, it is necessary to define and implement certain standards, modify living and working environments and public institutions must promote the introduction of robots".

Roboethics refers to the set of criteria or theories that purport to address all of these ethical issues posed by the development and use of robots and that are projected on the manufacturers and users and even on the robots themselves. In principle, it is the ethics of those who create and use robots although it is starting to adopt a broader view that includes the robots themselves. In this sense, it is a new thought with a clear focus but that may be developed from different perspectives (on the main opinions regarding roboethics, Veruggio and Operto 2006).

One of the features that characterises roboethics is the fact that it is a reflection focused on the future and that, on many occasions, it addresses events and situations that may arise but not necessarily and this being one of the criticism levelled at this type of study.

III.1.Singularity

The so-called emerging technologies share common ethical problems. It is worth highlighting four major issues involving each and every one of them and that we may identify as: equality and non-discrimination, autonomy, responsibility and privacy/intimacy.

The issue of equality and non-discrimination has two different but closely related perspectives. The first relates to safeguards to ensure universal access to new technologies (in this sense the reflection on the scope of patents acquires a special significance) whilst the second draws attention to the possibility that the use of new technologies may serve to increase power, capacity and welfare differences among human beings.

It is well known that autonomy is one of the main reference points in modern ethics. It is a principle that, in this context, has two projections. On the one hand one that refers to the freedom of research or science, on the other, the possibility of decision-making with the consent of moral agents. In the development and application of each of the technologies described we may find situations where this principle is involved.

As is the case with autonomy, responsibility is also another reference point for ethics and in relation to converging technologies it can be projected onto any moral person involved (scientific, technical, professional, entrepreneur, user etc.). Thus, problems in relation to responsibility are found in each of the previously mentioned technologies.

Similarly privacy/intimacy may clearly be affected by the use of Information Technology but also, clearly, by genetics.

The latter, genetics, outlines a fourth type of questions that I shall refer to with the terms of integrity/human identity and allude to the proper consideration of the human and moral aspects. Moreover, these issues are equally present in neuroscience and robotics.

However, robotics raises two other issues that are not directly on the agenda of problems of other technologies and I shall refer to them as the point of social relations and the moral agency of machines (or robots). Indeed, as we have had the opportunity to observe, some of the questions that arose in relation to robotics were linked to potential problems resulting from the relationship between human beings and machines.

Additionally, there have also been issues in regards to the treatment the robot received and the role it plays in the ethical discussion.

Robotics shares the first five main issues (equality and non-discrimination, autonomy, responsibility, privacy/intimacy, integrity/identity) with other emerging technologies, but what characterises robotics are precisely the last two (social relationships and the moral agency of robots).

III.2. Reference Framework

In 1942, in a short story entitled Runaround, Asimov devised three rules that have been considered as the first rules of robotics:

1 - A robot may not injure a human being either directly or through its intervention.
2 - A robot must obey the orders given to it by human beings, except where such orders would conflict with the First Law.
3 - A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Later, Asimov himself added a new Law: A robot may not injure humanity or, through inaction, allow humanity to come to harm.

Advances in this field together with those made in other disciplines that make up what has been called converging technologies render these rules insufficient. Thus, in 2011, in the UK, the Engineering and Physical Sciences Research Council and the Arts and Humanities Research Council have raised the following five principles (Available at http://www.epsrc.ac.uk/research/ourportfolio/themes/engineering/activities/Pages/principlesofrobotics.aspx Consulted on the 25th August 2013):

1.- Robots are multi-use tools. Robots should not be designed solely or primarily to kill or harm humans, except in the interests of national security.
2.- Humans, not robots, are responsible agents. Robots should be designed; operated as far as is practicable to comply with existing laws & fundamental rights & freedoms, including privacy.
3.- Robots are products. They should be designed using processes which assure their safety and security.
4.- Robots are manufactured artefacts. They should not be designed in a deceptive way to exploit vulnerable users; instead their machine nature should be transparent.
5.- The person with legal responsibility for a robot should be attributed.

When comparing the Asimov laws with these principles, significant differences may be established.

In any event, the need for a legal regulation of robotics is evident, albeit there is no unanimous position as to how it should be. A serious and rigorous reflection is imperative in order to provide guidelines to solve the issues associated with the development of this technology. There are issues that may be addressed conventionally but others present us with new scenarios that require a broad ethical debate.

Unquestionably, we have some policy guidelines that emerged in the field in which most progress has been made: bioethics. However, not all of these rules may be applied to robotics and, more importantly, it is necessary to ascertain if the rules framework on bioethics (which is represented by the theory of human rights) is the one we would have to use in this area.

III.2.1. Ethical framework

Thus, the first point of this debate would be to clarify what should be the ethical framework to meet the challenges posed by robotics and, in regards to this aspect, at least four possibilities become apparent. Two of them allude to human rights but differ in their attitude towards emerging technologies. For some, that I shall group under the term "bioconservative", it constitutes a real threat, as for the second group, which I shall refer to as "new humanists", they believe it is an opportunity as long as it follows a certain direction. The other two positions depart from the theory of rights to certain extent. These are the neuro-determinists and transhumanists.

III.2.1.1. Bioconservatives

Admittedly, it is not possible to refer to "bioconservatives" as a homogeneous and univocal current. This is a group of thinkers who share the idea of the need to reflect on the serious ethical, legal and political risks that biotechnology may give rise to; a reflection that must have at its core the maintenance of human identity and dignity, namely, the preservation of what makes us human (Kass 1985: p. 25).

The position of bioconservatives is based on the possible damage that technological progress and, above all, some proposals regarding its implementation, could cause to humanity and the environment. From their perspective, what is considered good may not be defined in terms of the manipulation of life as this is always negative (Rifkin 1983: p. 230). They oppose the use of technology to modify human nature as they feel that this shall undermine our dignity (Fukuyama 2002: p. 149). They seek to preserve the individual attributes that define human beings, conserve the human species and respect what would be its natural evolution.

Conducting unnatural scientific achievements designed to optimise people (such as the creation of persons with extraordinary abilities) shall lead to catastrophic consequences according to bioconservatives. Human nature represented by a series of traits that make us members of a species is what provides us with a moral sense and

should not be altered. That alleged optimisation involves the loss of these ethical traits and irreparably damages some of the basic moral notions such as responsibility and freedom.

Therefore, to expect a world in which human limitations do not exist leads to a loss of sense of life. Moreover, these objectives shall result in a widening gap between rich and poor (see in this regard and referring to genetics, Silver 1997).

Additionally, bioconservatives believe that it is reasonable to reject the creation of post-human entities as there is no evidence that they are able to share our values and our cultures (Agar 2010).

Therefore, it is necessary to give up certain technologies (McKibben 2003) and, in any case, to adopt the precautionary principle. As J. Rifkin pointed out, it is not necessary to pretend to dominate or manipulate nature but rather become part of it with other living beings (Rifkin 1983: p. 252). Humans today have no right to change the future or predetermine how people of tomorrow shall be. We have no right to play God (Ramsey 1970: p. 138).

III.2.1.2. Neurodeterminists

Meanwhile, the neurodeterminism is an approach that equates morality to biology. Thus, it is argued that our ethical structure has a biological component that makes us unique compared to other living beings. Unquestionably, this is not a new approach. Since Darwin, many philosophers and scientists have sought to justify the ethics in the evolution process. What currently distinguishes these positions is their support for neuroscience.

In any event, within neurodeterminism we find different opinions. Some of them defend the idea that humans are the product of evolution as are other animals or plants, being the "self" an accumulation of neural internal resources (Harris 2011).

Some neuroethics reject free will and autonomy and consider the “self” as a state of the brain. Accordingly, they have come to propose a new ethic, a new philosophy of life based on brain data; a morality that originates from brain biology (Churchland 2011)[3].

However, other neuroethics consider that social behaviour is not solely a biological issue. Thus, M. Gazzaniga argues that we are not completely determined by physical processes. Free will and the sense of responsibility do not arise only from a cerebral hemisphere but also from social interaction and community life. According to this author, the sense of responsibility does not rely on the brain as we own our actions.

[3] According to Churchland, consciousness is the result of different phenomena, many of which are neurobiological.

Values are built on cultural contexts. Hence, we are very different to other animals even though we share chemical components, physiological reactions and, in some cases, similar mental structures (Gazzaniga 2012 and 2008).

III.2.1.3. Transhumanism

Transhumanism is a philosophy that aims to use technology to improve people's lives, increase intelligence and make human beings happier and more virtuous. The potential improvement of humans is based on technology.

For transhumanism the end of mankind is inevitable if the developments of science and technology are not embraced, obtaining instruments and apparatus that allow fighting against this outcome. This development shall create unlimited unique machines that could merge with humans.

It is a movement that covers different currents (Bostrom 2011: p. 157) and has been considered by some as dangerous for violating the human essence. Some transhumanists positions are opposed to humanist ethics, although it may be advisable to consider them as part of post-humanism. But many advocates of this trend apply modern re-interpretations of principles or values and are presented as a logical step in humanism before scientific and technological changes (Jotterand 2010: p. 617).

For example, the so-called democratic transhumanism attempts to combine the values of the Enlightenment. It is an approach that advocates that humans will be happier when they take rational control of the natural and social forces that control their lives (Hughes 2002).

Other transhumanist approaches are presented as an evolution of humanism and their main purpose is to prolong to a maximum a healthy living (Bostrom 2003). Thus, they refer to human dignity whilst understanding that it is an idea that evolves and progresses. Therefore, it is necessary to identify a concept of human dignity that could be applicable to post-human beings. Transhumanists argue that we may reform ourselves and our nature legitimately in accordance with human values and personal aspirations.

Transhumanism, representing the progress of robotics without limits, has been accused of being a source of serious ethical conflicts: (i) assisting in the construction of a society composed of first-class individuals (who can access the new technology) and second-class (who do not have access to new technology and shall, logically, be dominated by first-class individuals) and in which social competitiveness and diversity have been eliminated (as efforts and diversity have been replaced by machines), (ii) altering the identity of people and violating their privacy, (iii) provoking from a global perspective the extermination of other races and cultures and the subjugation of other peoples (iv) taking over an alleged right to make decisions that may compromise the

future, (v) turning a blind eye to the problems in relation to the political, military or economic use of science.

These are allegations that have been answered by transhumanism. For example, the accusation of leading to first and second-class individuals has been contested by stating that this would not necessarily happen and, moreover, is not new (human society has always lived with this danger as there are groups seeking to enslave others). Regarding the criticism that this way of applying technology causes inequality is rejected by stating that it is not necessarily so and that on occasions it might be the opposite (sex change, an example which is equally used to account for how today's society does not accept diversity). In relation to the statement of possible harm to our descendants, they defend themselves by stating that it is based on a very questionable assumption –that our descendants will be technologically helpless or unsophisticated (Bostrom 2005: pp. 202-214).

In conclusion, transhumanism rejects the view of nature as something constant and unchanging and argues that the moral value of human beings does not exist because they belong to a species but because of what humans do. Therefore, technological advances should be used for the moral improvement of humankind (Persson y Savulescu 2010: p. 656). This is an improvement that will not produce negative effects since it aims to improve the moral behaviour of people so it could hardly be thought that it is a moral evil (Persson 2012: pp. 692-693).

III.2.1.4. An open humanism from the human rights perspective

Although transhumanism presents aspects to be considered, I do not find it convincing in general terms as it ignores very relevant issues resulting from the application of enhancement techniques (according to T. Peters, Peters 2011, transhumanists are naive about human nature and are overestimating what can be achieved through technological innovation).

Nor am I convinced by neurodeterminism as I do not believe that the mind is solely a physical-chemical issue or that it possible to equate morality to biological, chemical or physical conditions (Cortina 2011: p. 72). From a phenomenological point of view, free will is not attributable to a single state of mind but rather to the person as a whole. Our brain is modified with the decisions we make. The self is not something that is found in an isolated place but is rather the continuous movement that transcends into the world and others. As pointed out by A. Cortina, "in the same way that there are psychological and social foundations of morality, there are also brain foundations and this does not imply that they form the basis of the moral life" (Cortina 2011: p. 46).

The arguments employed by those that I have named bioconservatives I believe may serve as areas of concern when setting criteria and standards regarding the use and scope of these technologies as we cannot restrict technological progress.

Consequently, there are aspects of the three positions discussed that must be taken into consideration. In regards to bioconservatism I believe that it is necessary to refer to arguments focused on humanistic ethics and therefore, it is based on the value of human beings and the importance of a dignified human life. It is a public ethic that assumes among its first principles the categorical imperative that H. Jonas considered as characteristic of the 21st century: "Act in such a manner that the effects of your actions are compatible with the permanence of genuine human life on Earth" (Jonas 1984: p. 38).

In light of the above, in order to assess what is right or wrong regarding this issue, I find it necessary to refer to the theory of human rights as it is the main ethical and legal reference of the contemporary world.

It is important to note that focusing on human rights does not imply stating that the ethical problems have already been solved. Given that there are different ways of conceiving rights, different theories of rights, having rights as a basis allows us, on the one hand, to adopt a critical and non-conformist stance, on the other, to put themselves in someone else's position and adopt the viewpoint of the weak (the one who has no strength or power) and, finally, a set of criteria that define what may be justified and what may not. There are, in any case, criteria which become more precise in relation to specific problems, and are governed by the relevance of the human being and dignity. Adopting the rights perspective provides us with a starting point but also imposes limits regarding the possible conclusions; limits that are linked to the protection of the autonomy and satisfaction of human needs.

However, the point of view of the rights that I consider appropriate requires the openness of up to five dimensions which I shall refer to as: openness towards progress, openness towards society, openness towards future generations, openness towards possibilities and diversity and openness towards disability.

The debate dominated by a theory of human rights must be open to technological and scientific progress which means that the neurodeterminists or transhumanists thesis should be totally rejected.

The theory of rights should not reject the advances in technology and its use for the improvement of human life, although this requires us to clarify anthropocentrism and replace it with an egocentric and biocentric view that encompasses respect for life and the human being as a whole. In this sense, Riechmann calls for a deepening of the Enlightenment thought, and an Enlightenment of the Enlightenment that seeks to find peace between humans and the non-human nature (Mosterín and Riechmann 1995: pp. 131-132). It must also examine the relevance and ethical role of what has been built and manufactured by human beings and their impact on society and other people.

This ethical framework should, moreover, focus on our social dimension, be aware of the importance of interpersonal relationships for the achievement of a dignified human life, thus establishing an ethics that takes into consideration others. The human

being is linked to the activity of others and therefore the latter plays an essential role. We are part of a culture and a society that transforms us. The brain itself is capable of absorbing and applying the lessons to be drawn from what is around us (mostly other human beings).

It is equally necessary that this theory of rights focuses on future generations placing emphasis on responsibility and foresight, within a responsibility directed towards the future that allows us to progress with caution.

The ethical framework which governs the rights theory in this field must also be critical regarding the idea of human dignity in the manner it has been created and specified from modernity and Enlightenment. An idea of human dignity based on a conception of human beings and society that, in a sense, are at the origin of the search for machines and devices that achieve perfection. The human model of the Enlightenment was supported by some patterns based on perfection and a social model that, at times, imposed an exclusive lifestyle. Human dignity has been built highlighting what we might conceive as an abstract dimension of the person, leaving aside the contextual or location dimension. It has been built based on patterns of "normality" that historically have coincided with those of the powerful (Barranco 2011: pp. 94-95). Thus, we must eliminate certain ideal models we project on the concept of human dignity that make the situation in which some people are found unworthy and different. Equally, we must value human diversity and consider it as one of the great wealth of our societies.

Finally, this ethical framework should be open and address the issue of disability. This is a question that presents itself as one of the main areas of concern when we face the challenges of emerging technologies. Therefore, it is important to remain vigilant to the evolution of this reflection and the role that disability plays (Romañach 2009).

Many of the technological advances that are occurring in the field of robotics (and generally, in the emerging technologies) are using as a reference a human being model that may be perceived as exclusive and a source of discrimination. This is an image that aims to be associated with perfection and that conveys, or may potentially convey, the idea that as we move away from this image, life has less meaning or happiness is more elusive. From this viewpoint, disability appears as an example of imperfection, as a situation of suffering, and at best, as a natural disadvantage that must be eliminated.

This idea is particularly evident when the question of improvement interventions is addressed and even also in therapeutic interventions. It should not come as a surprise the statement of the Disabled Peoples' International (“Disabled people talk about the new genetics”) which states: “We want to make clear that people with disabilities are not opposed to a medical research whose purpose is a genuine treatment or pain relief. We are against the genetic cleansing driven by profit reasons and social efficiency based

on prejudice against persons with disabilities and carried out in the name of cure or treatment."

The acceptance of improvement interventions (or even therapeutic) applied to a disabled person may be viewed as an underestimation of these people with disabilities. However, impairment is often the result of a situation and not a feature of individuals (De Asís 2013). This is also a manifestation of human diversity and like other manifestations it may be perceived by the individual as something unsatisfactory or satisfactory.

Additionally, beyond the disability, we must be aware of the fact that, in many cases, we seek the best for our children and we do so intervening dramatically in what could be described as environmental factors (measures designed to help children develop skills in relation to nutrition, training and physical exercise) but yet we question interventions on other factors (such as genetic factors for example).

Therefore, in order to eliminate the concern regarding the world of disability, a change in society is necessary, eradicating discrimination emanating from it in relation to persons with disabilities. And from there, the question of the improvements shall not be part of a special debate in regards to people with disabilities but rather the general discourse in which the freedom of the improvements is justified as they are available to everyone and when there is no impact on the rights of human beings.

III.2.2. The legal framework

The various questions that have raised highlight the need to consider a controversial principle in the field of scientific research: the precautionary principle. This is a principle that supports the adoption of protective measures for certain products or technologies that are believed to create a serious risk but there is no scientific proof (on the precautionary principle Sunstein 2005)[4]. However, with this principle, it is necessary to include another one to complement and clarify it, as is the freedom of research (which functions as a right). Under this principle humans must decide how far they wish to go with their research, but it must respect certain principles and serve a purpose that is consistent with the ethical framework referred to above.

In order to determine these principles and purposes we may build on existing standards on bioethics, namely, the International Declarations and Agreements on Bioethic and Biodiversity. It is a regulatory framework that is developed in line with the theory of human rights and is considered a reference point in regards to the treatment of robotics. However, there are two aspects that make the discourse unique and are

[4] The precautionary principle appears in the International arena in the United Nations Conference on Environment held in Stockholm in 1972. In the Rio Declaration on Environment and Development in 1992 it is defined as: "Where there are threats of serious or irreversible damage, the lack of full scientific certainty shall not be used as a reason for post-poning cost-effective measures to prevent environmental degradation".

associated to (i) the relationship that may be established between humans and machines and (ii) the moral agency of these humans and machines. This calls for a re-reading some of these rules that must also take into consideration the different types of robots.

III.3. The roboethics content

The inclusion of robotics in the ethical discourse entails taking into consideration the existence of different types of robots and establishing their role within this line of thought.

There are different classifications of robots and machines[5]. If the focus were to analyse its projection on ethics, a good classification would be to distinguish between dependent and independent machines. The first are those that require a human being in order to perform its functions; the latter are those that do not need one (at least on a general basis). Indeed, the existence of fully autonomous robots is still an illusion. However, this distinction allows us to identify problems by highlighting two of the main principles of ethics: autonomy and responsibility.

Another interesting perspective involves the use of classification criteria based on the robot's interaction with humans and their rights, that is, criteria that takes into consideration the possible ethical issues raised by the type of robot. In this line of thought we may differentiate three types of robots (all of which are closely related): (i) Robots that carry out a task or provide a service that may pose an ethical problem due to the type of service or relationship with humans; (ii) Robots that provide a service that poses an ethical problem either because they cause harm to third parties, the possible harm to the individual or the possible harm to society, (iv) Robots that have moral agency problems.

Among the first classification it is possible to distinguish three groups. On the one hand, there are the industrial manipulator robots and their main ethical problem lies in its effect on the labour market. On the other, there are those robots that provide a service that raises ethical issues in society such as the so-called sexbots (sex robots). Finally, there are those that perform a function that has an impact on human care (caregivers or assistance robots).

Among the second classification it is also possible to establish three groups. Firstly, those whose ethical questioning occurs because they cause harm to third parties (military drones). Secondly, those whose ethical questioning arises because it is stated that it may result in an injury to the individual, either to their physical or moral integrity or their identity (prosthesis robots or robots that stimulate the brain). Finally, there would be the robots whose ethical problem lies in the possible damage they could inflict in the present or future society (this group could include some of the types of robots that

[5] John P. Sullins (Sullins 2006: pp. 25-26) makes a distinction between telerobots (operator dependent) and autonomous robots (not dependent). On robot generations and future possibilities (Moravec 1993 and 2003).

I have mentioned in previous groups, although we could also allude to the so-called nanorobots).

The robots I have referred to as those that pose moral agency are the ones for which it may not be clear who is responsible for their actions and their moral status. These robots are considered by some as moral agents or persons, similar to humans.[6]. Within this group, there are the robots that learn, reason in a relatively independent manner, are self-powered and are able to externalise feelings (*Learning*, *reasoning*, *eating*, o *sentimental robots*).

Regarding the role of robots in the ethical debate, very briefly, this role may be the moral object or the moral agent (on the robot's moral status, Bostrom y Yudkowsky 2011).

Within the scope of the rights theory, the features that a being should possess have been discussed (and are still subject to debate). The moral role (subject or object) of children, the disabled, etc. is under discussion. In relation to robotics, the aim is to investigate and decide the ethical role of machines and robots. Obviously, if they are considered as an agent this may require the possession of a number of features (defining human beings) or, quite simply, a decision of humans themselves. I shall leave this issue for the section regarding the treatment of robots.

Although the above classifications may be further specified, they provide an early glimpse regarding the main ethical problems that arise within the roboethics context. It is possible to highlight the following ten issues: (i) The impact on the labour market with the consequent loss of jobs, (ii) The physical and moral integrity of people (particularly the intervention in the rights of others), (iii) The physical human identity (the issue of prosthesis), psychological (possible dependence on the robot) or social (social isolation and neglect of social duties), (iv) Cultural and biological diversity (social uniformity and contamination), (v) Privacy/intimacy (treatment and modification of personal data), (vi) Equality and non-discrimination (equal opportunity of access to knowledge and discrimination, focusing particularly on vulnerable groups, (vii) Property (patents regulation), (viii) Liability and security regarding deception, defect or manipulation, (ix) Identification and registry of robots, (x) Agency or moral role of the robot.

This catalogue may be structured in different manners. Thus, P.M. Asaro has addressed three major issues regarding roboethics: embedded systems in robots, the people who design and use robots, and how persons treat robots (Asaro 2006: p. 9). Additionally, Bostrom and Yudkowsky refer to two major issues: (i) the role of robots in the ethics of human beings, (ii) the moral status of the robots (Bostrom y Yudkowsky 2011). I shall adopt this distinction in general terms distinguishing between the uses and limits of robotics and the manner in which robots are treated.

[6] Reflections on the issue of whether computers are able to think and their similarity to humans started very soon (inter alia Mays 1951: p. 249; Von Neuman 1951; Bunge 1956: p. 139).

Practically, the first nine problems mentioned above belong to the first of the areas of concern, whilst the latter would correspond to what I refer to as treatment towards robots. In principle, as previously noted, the singular field of roboethics would be the second one, since the first one alludes to concerns that are present in other technological fields. However, in the first case, the roboethics also presents a singularity arising from the relationship between humans and machines (even though it is difficult to conceive that there may be relationships between humans and robots similar to those that occur between humans, this is something that may not be ruled out completely).

III.3.1. The purposes of robotics

The examination of these issues is influenced by the purpose we attribute to robotics. As I noted above, in order to do so we may build on the standards on bioethics and biodiversity. Three general and programmatic statements would be derived from these:

1 - . Scientific and technological progress should serve the welfare of humanity, the sustainable development of all countries, world peace and the protection and preservation of nature.

2 - Human welfare and its interests prevail over the sole interest of society or science, it involves the promotion of respect for human dignity and the protection of human rights (among which are life and moral integrity, privacy, free consent, the choice of a way of life, work, etc.).

3 - Respect for human dignity implies respect for human diversity, the environment, the biosphere and biodiversity (forcing the sustainable use of its components and the fair and equitable sharing of benefits arising from the use of resources).

But there is an issue that affects our entire discussion that governs roboethics and that may be expressed through the following two questions: why do we want robots? What types of robots do we want? The answer to these two questions determines the content of this reflection. Two complex questions that lead us to major ethical problems.

In any event, even if only minimally, it is possible to make some progress in regards to finding an answer. I think we may all agree that we want robots to help humans and their environment. Therefore, we look for robots that provide services to us and may correct unintended diversities or diseases. Achieving this type of machine may have a clear justification as long as human diversity and biodiversity are respected and if they mainly have a therapeutic reasoning. Another justification would be if they are improvement techniques[7], being mindful of the fact that the concept of improvement is in itself problematic.

[7] For example, it has been argued that supporting human efforts may weaken our sense of responsibility and undermine our will to solve problems in life (Fuchs 2006: p. 600)

Nevertheless, we are not looking for robots to replace us nor, in that sense, to behave and become human-like. Indeed, the latter may even be discussed[8], albeit it requires us to consider what we believe to be human. This is an issue that may be resolved from different angles, all of which are problematic and may even be modified in line with technological advances.

In the field of human sciences it is normally addressed in accordance with a conception of human beings constructed from ethical and aesthetic references. The first would be the ethical based on four main principles: the ability, autonomy, independence and responsibility. The second, aesthetic, based on a defining form or shape of humans (which has its most grotesque manifestations in the references found in some legal orders alluding to the requirement of having a "human figure" to be considered a person[9]). Determining the idea of human being based on a pattern of capacity that differs from diversity and allegedly universal and abstract, may lead to explicitly set aside the consideration of a person to certain humans, or to adopt a vision of a person which is exclusively biological. Thus, for some people, the concept of a person is based on the possibility of being aware of the future and to have desires in relation to it. Equally, it may be stated "we are human to the extent that we descended from humans." In a sense, the consideration of the human, as a category, is a concept humans must determine and must be done so within the ethical framework to which I referred to earlier, thus adopting an open and plural view that respects diversity and focuses on nature.

In any event, the concept of what is considered as human also involves a number of circumstances, traits and characters that are part of our identity such as death, dependency, pain, suffering, efforts, imperfections, limitations, etc. traits that most probably we do not wish to see replicated in a robot, but that are, in many cases, the most obvious expression of human diversity and freedom. Therefore, we would not be producing something human but superhuman, whereupon the question of "what for?" becomes increasingly relevant.

Furthermore, the construction of a machine identical to a human being is not only unjustified for certain types of robots[10], and in addition to the fact that their purpose and their consequences are not clear, it may be argued that it is something that is against the current bioethical rules as, for example, the prohibition on human cloning. This argument may be applied to prosthetics and neuroprosthetics that might be related to the prohibition of organ trade, a prohibition that is under discussion today (as it is considered as common in certain fields). Certainly, regarding this point, the reflection on the human integrity and identity becomes increasingly important.

[8] The issue has been addressed in the field of bioethics (Rifkin, J. and Howard, T. 1977).
[9] Vid. for example article 30 of the Spanish Civil Code that considered born the fetus in human form able to live detached from the mother for 24 hours. Article amended by Final Provision Three of Law 20/2011 of 21 July.
[10] For example, many service robots would lose some of their benefits if they had emotions.

III.3.2. Use and limits of robotics

The issue regarding the use and the limits of robotics may be considered traditional in the field of ethics as it relates to the limits of scientific research and the responsibility of the agents and users of technology. These are problems related to the autonomy and responsibility and for which, as mentioned previously, there are positive parameters: the normative texts on bioethics. However, as was also noted earlier, there is a new dimension in this field that is represented by the social and relational projection of the robot.

Traditionally, a series of principles that should guide the theoretical and applied research are highlighted: proportionality and weighting (risk and benefit assessment), rigour and prudence, equality in access to information and transparency, plural and wide debate and the demand for scientific training and qualification of scientists and technologists.

Beyond these principles, the analysis of the issues regarding roboethics is mainly casuistic and depends on the type of robots. In accordance with the types described above, it is possible to highlight the following four major problems:

Firstly, the issue regarding responsibility. In relation to this point it is possible to distinguish three possible agents of responsibility: the creator (the scientist or technologist), the merchant and the user. All of them, in some cases clearly and in others in not such a distinct manner, are either directly or indirectly liable. There are four aspects on which responsibility is projected: purpose, deceit, defect or manipulation. Such responsibility must have both a current and future projection, must be assessed and adapted according to the type of robot.

Secondly, the possible alteration of the human identity, either in physical, psychological or social terms. The first two cases may occur in connection with machines or robots that function as prosthesis but it is also possible to include herein assistant or caregiver robots with which situations of dependency may occur (in addition to the implications of having machines intervening in a typically human relationship) or sexbots. The substitution of people in the care of children or the elderly results not only in security issues and responsibility for the behaviour of the robot but, more importantly, it may mean a possible social isolation or a change in the understanding of social relations along with the questionable abandonment of behaviours and obligations that have traditionally identified us (Sharkey 2008: pp. 1800-1801)[11].

Thirdly, the possible alteration of cultural and biological diversity and, thus, also the environment. Situations that may arise with nanobots or as result of the deposit of waste or machines that no longer work. Additionally, it is worth highlighting the

[11]The need for the robot to look human as much as possible has been defended so that the human-robot relationship is similar to that of human-human (Arkin, Ulam y Wagner 2012).

uniformity of the robots and the disappearance of traits that have characterised some people.

Fourthly, the possible performance of acts contrary to rights. The typical example would be that of military drones that demonstrate the possibility that these machines may be manufactured to kill humans (on the importance of the robots used in war to act respecting ethical rules, Arkin 2009). Sexbots may be included in this group and their use for prostitution, although in reality, the possibility that this is carried out by robots, eliminates the questioning of this practice in terms of rights[12]. Equally, the possible intervention in the labour market which mainly affects industrial robots must be highlighted in relation to this point (Brynjolsson and Mcfee 2011)[13]. Problems in regards to the creation of robots that increase the differences in opportunities between humans and the possible breach of privacy or the intimacy of individuals are matters that also belong to this group (e.g. as seen with assistance robots that need accurate information about the person they are assisting).

III.3.3. The treatment of robots

As previously mentioned, progress in robotics by creating humanoids able to learn, reason and feel has given rise to the line of thought regarding the possibility of considering them as true moral agents and even as rights holders.

Until now, robots have always been treated as objects rather than subjects. This would be the case regardless of their role and in the event of moral relevance, at best it is possible to allude to machines as moral objects and the existence of duties regarding their care. Nevertheless, what these opinions claim is the consideration of the machines as subjects.

If we do not allude to a religious reasoning, the consideration of robots as moral subjects requires that they should have the traits we demand from them. I have previously pointed out that the definition of moral subject associated with human beings is difficult to pin down. Moreover, at present we are still far from achieving a machine that could be considered identical to a human. In addition, I have also questioned that we are directing our research towards this goal that we could even consider as forbidden by current bioethical standards.

However, two questions still remain unanswered with different meanings. The first would entail to question ourselves what would happen in the event that machines identical to humans were actually created? Indeed, it is plausible to believe that this is science fiction and it shall never happen (on the differences between machines and people, Duffy 2006: p. 31). So, regardless of how much progress is made in aesthetic

[12] The "sexbots" can improve the objective of prostitution (no commitments, no affections, better security, better hygiene, no marginalisation). Therefore, the problems in relation to this type of robots are whether they should exist, the human-machine relationship and the proper use of the robot.
[13] This is a problem that has been aggravated with the introduction of "independent" robots.

patterns, feelings, gestures and movements, it is difficult to think that emotions, feelings, hormonal reactions, intelligence or consciousness may be incorporated. However, advances in neuroscience and computer science oblige us not to exclude completely this possibility. Throughout history, much has been written about what robots will never do (for example Dreyfus 1972) and subsequently, many of such things have been developed successfully (Brooks 2003).

As is well known, the rapprochement of robots to humans made a spectacular progress with the birth of artificial intelligence in the middle of the last century. Artificial intelligence is employed to refer to a non-living agent's reasoning ability. At first, artificial intelligence sought to include as much knowledge as possible in the machine but the ambition of making the machine achieve consciousness persisted. It was then that advances in neuroscience and the study of emotions took place deriving from the assumption that the study of emotions as well as reason is within the realms of possibility. The human mind expresses not only the ability to think but also to feel. Thus, in 1994, A. Damasio published his book Descartes' Error (Damasio 1994) in which he argues that if an individual does not have capacity to feel emotions he has lost much of his ability to reason. From this time on the aim is not solely the accumulation of knowledge but also to establish a closer connection with the real world. Therefore, the possibility of making robots that recognise, understand and express emotions is already considered. However, these emotions shall be different to those of humans. Accordingly, the real aim is not to produce "human beings" but rather to improve the robots' relationship with people.

In any event, it is important to note that as pointed out by A.F. Beavers, to consider the robot as a moral agent the possibility of creating robots that could consciously perform immoral behaviour should be considered and this is something that is not being done and it is not clear that it should be done (Beavers 2009). It has been argued that considering robots as moral agents would imply that these are aware of the consequences of their actions and they are able to not comply with the rules (Johansson 2011). But then a question that we had already raised arises once again: Why do we wish to create machines that violate our rules?

Additionally, if machines identical to humans were actually created, we could hardly reject the idea of considering them as moral agents. For this reason, it has been proposed to use the so-called Turing Test (Turing 1950: p. 433) to establish the moral agency of the robot, stating that if the robot became equivalent to a human being and humans are moral agents, then robots should be so too[14]. No machine has fully satisfied this test.

The different arguments that may be employed to deny the moral agency can be disputed. In 1950 Turing already referred to a series of objections directed towards the possibility that robots were intelligent and they could all be overcome: (i) The

[14] The Turing test is a test used in the field of artificial intelligence to determine whether a machine behaves in all respects as intelligent, then it must be intelligent.

theological objection: The soul has been given by God to men but may also be given to machines, (ii) the objection of those who "hide their heads in the sand"; it would be horrible if this happened but it does not seem to be a strong argument, (iii) The mathematical objection: machines have their limitations but as do humans, (iv) The argument of consciousness: machines can not be conscious of what they do or have feelings (I have already referred to this issue), (v) The argument of the different capabilities: there are things that machines are incapable of doing but this is also applicable to human beings, (vi) The argument of the informal behaviour: there are no rules that determine human behaviour entirely but it would be possible to program a machine this way.

Additionally, we must be aware that denying moral status to robots due to the way in which they have achieved their capacity to feel pain and suffering is not acceptable as it may also be applied to humans (Bostrom and Yudkowsky 2011: p. 8)[15]. Moreover, this viewpoint may be defended appealing to human diversity and dignity (Bostrom 2005: pp. 202-214).

However, as I have already reiterated, our aim is not to create robots that are identical to humans and this entails that we cannot extend the moral agency of humans to robots nor integrate them in human ethics. We seek perfection in robots and humans are not perfect, and equally, human ethics takes on a meaning in regards to the possibility of what is considered immoral and our intention is not to create unethical robots.

The other issue is whether there is only one type of moral agent or if it is possible to adopt a pluralistic view thereof. This point of view would entail not considering machines as human but grants them a moral value which is higher than the one objects possess. Thus, for example, J.P. Sullins has stated that, in certain circumstances, robots can be seen as moral agents suggesting three conditions that need to be fulfilled: (i) autonomy from programmers or operators, (ii) their behaviour is analysed or justified in terms of intention to do good or evil (iii) behaves as though it is responsible for another moral agent (Sullins 2006). Nevertheless, there is another possible argument: the one followed by those who claim the rights of animals.

Indeed, in recent years various authors and schools advocate to broaden moral agency to include animals based on empathy, the existing relationships or the ability to feel pleasure and pain. To consider animals as moral subjects and the subsequent recognition of rights is not incompatible with a differentiation based on their different characteristics.

Consequently, this same argument may be applied to robots and it would not mean that we would need to consider them as humans or animals.

[15] On the technical possibility of creating robots that are able to feel, Evans 2003.

REFERENCES

Agar, N. (2010), *Humanity's End: Why We Should Reject Radical Enhancement*, MIT Press, Cambridge.

Arkin, R.C. (2009), "Ethical Robots in Warfare", available at: http://www.cc.gatech.edu/ai/robot-lab/online-publications/arkin-rev.pdf Consulted on 4th August 2013.

Arkin, R.C., Ulam, P., y Wagner, A.R. (2012), "Moral Decision-making in Autonomous Systems: Enforcement, Moral Emotions, Dignity, Trust and Deception", *Proceedings of the IEE, vol. 100*.

Asaro, P.M. (2006), "What Should We Want From a Robot Ethic?", *IRIE, International Review of Information Ethics, vol. 6*.

Barranco, M.C. (2011), *Diversidad de situaciones y universalidad de los derechos*, Dykinson, Madrid.

Beavers, A.F. (2009), "Between Angels and Animals: The Question of Robot Ethics, or Is Kantian Moral Agency Desirable?", available at http://faculty.evansville.edu/tb2/PDFs/Robot%20Ethics%20-%20APPE.pdf Consulted on 15th September de 2013.

Beecher, H.K. (1966), "Ethics and Clinica Research", en *New England Journal of Medicine, n. 274*.

Bostrom, N. (2003), "The Transhumanist FAQ. Versión 2.1", *World Transhumanist Association*, Available at www.transhumanism.org, Consulted on the 12th August 2013.

Bostrom, N. (2005), "In Defense of Posthuman Dignity", *Bioethics, vol. 19, n. 3*.

Bostrom, N. (2011), "Una historia del pensamiento transhumanista", *Argumentos de razón técnica: Revista española de ciencia, tecnología y sociedad, y filosofía de la tecnología, n. 14*

Bostrom, N. and Yudkowsky, E. (2011), "The Ethics of Artificial Intelligence", Available at http://www.nickbostrom.com/ethics/artificial-intelligence.pdf (Consulted on the 10th July 2013)

Brooks, R. (2003), *Flesh and Machines: How Robots Will Change Us*, Vintage.

Brynjolsson, E. y Mcfee, A. (2011), *Race Against the Machine*, Digital Frontier Press.

Bunge, M. (1956), "Do computers think?", *British Journal for the Philosophy of Science, 7*.

Capurro, R. and Nagenborg, M. (2009), *Ethics and Robotics*, IOS Press.

Churchland, P.S. (2011), *Braintrust*, Princeton University Press.

Cortina, A. (2011), *Neuroética y neuropolítica. Sugerencias para la educación moral*, Tecnos, Madrid.

Damasio, A. (1994), *Descarte's Error*, Putnam, New York.

De Asís, R. (2013), *Sobre discapacidad y derechos*, Dykinson, Madrid.

Dreyfus, H. L. (1972), *What Computers Can't Do*, Harper & Row, New York.

Duffy, B.R. (2006), "Fundamental Issues in Social Robotics", en *IRIE, International Review of Information Ethics, vol. 6*.

Evans, D. (2003), "Can Robots have Emotions?", http://www.inf.ed.ac.uk/events/hotseat/dylan_position.pdf Consulted on 12th August 2013.

Freitas, R. (2005), "Microbivores: Artificial Mechanical Phagocytes using Digest and Discharge Protocol", en *Journal of Evolution and Technology, vol. 14,* 2005.

Fuchs, Th. (2006), "Ethical issues in neuroscience", *Curr. Opin. Psychiatry 19*.

Fukuyama, F. (2002), *Our Posthuman Future: Consequences of the Biotechnology Revolution*, Strauss and Giroux, New York

Gazzaniga, M. (2008), *Human: The Science Behind What Makes Us Unique*, Ecco.

Gazzaniga, M. (2012), *Who's in Charge?: Free Will and the Science of the Brain*, Ecco.

Harris, S. (2011), *The Moral Landscape: How Science Can Determine Human Values*, Free Press.

Hughes, J. (2002), "Democratic Transhumanism 2.0", http://www.changesurfer.com/Acad/DemocraticTranshumanism.htm. Consulted on the 26th July 2013.

Iacono, T. (2006), "Ethical challenges and complexities of including people with intelectual disabilities as participants in research", en *Journal of Intellectual & Developmental Disability,* 31:3.

Johansson, L. (2011), *Robots and Moral Agency,* Theses in Philosophy from the Royal Institute of Technology 37.

Jonas, H. (1984), *The Imperative of Responsibility: In Search of an Ethics for the Technological Age*, The University of Chicago Press.

Jotterand, F. (2010), "At the Roots of Transhumanism: From the Enlightenment to a Post-Human Future", en *The Journal of Medicine & Philosophy, vol. 35*.

Kass, L (1985), *Toward a more natural science. Biology and human affairs*. The Free Press, New York.

Levy, D. (2008), *Love and Sex with Robots: The Evolution of Human-Robot Relationships*, Harper Perennial, Nueva York.

Mays, W. (1951), "The hypothesis of cybernetics", *British Journal for the Philosophy of Science, 2*.

McKibben, B. (2003), *Enough: Staying Human in an Engineered Age,* Henry Holt and Company.

Moravec, H. (1993), "The age of robots", Available at http://www.frc.ri.cmu.edu/users/hpm/project.archive/general.articles/1993/Robot93.html. Consulted on the 22nd July 2013.

Moravec, H. (2003), "Robots, After All", Available at http://www.frc.ri.cmu.edu/~hpm/project.archive/robot.papers/2003/CACM.2003.html.

Mosterín, J. and Riechmann, J. (1995), *Animales y ciudadanos. Indagación sobre el lugar de los animales en la moral y el derecho de las sociedades industrializadas,* Talasa, Madrid.

Persson, I. (2012), "Could it be permissible to prevent the existence of morally enhanced people?", en *The Journal of Medicine & Philosophy, vol. 38*.

Persson, I., y Savulescu, J. (2010), "Moral Transhumanism", en *The Journal of Medicine & Philosophy, vol. 35*.

Peters, T. (2011), "H-: Transhumanism and the Posthuman Future: Will Technological Progress Get Us There?", Available at http://www.metanexus.net/essay/h-transhumanism-and-posthuman-future-will-technological-progress-get-us-there Consulted on 1st August 2013.

Pogge, Th. (2002), *World Poverty and Human Rights*, Blackwell, Oxford.

Ramsey, P. (1970), *Fabricated Man: The Ethics of Genetic Control*, Yale University Press, New Haven.

Rifkin (1983), *Algeny: A New Word—A New World*, Penguin, New York

Rifkin, J. (1998), *The Biotech Century*, Penguin Putnam, New York.

Rifkin, J. and Howard, T. (1977), *Who should play God? The artificial creation of life and what it means for the future of the human race*, Dell Publishing Company, New York.

Romañach, J. (2009), *Bioética al otro lado del espejo*, Diversitas, A Coruña.

Sassen, S. (1998), *Globalization and its discontents*, The New Press.

Sharkey, N. (2008), "The Ethical Frontiers of Robotics", *Science 19*.

Silver, L. M. (1997), *Remaking Eden: Cloning and Beyond in a Brave New World*, Avon Books, New York.

Sullins, J.P. (2006), "When Is a Robot a Moral Agent?", en *International Review of Information Ethics, vol. 6*.

Sullins, J.P. (2006), "When Is a Robot a Moral Agent?", en *IRIE, International Review of Information Ethics, vol. 6*.

Sunstein, C. (2005), *Laws of Fear*, Cambridge University Press.

Swierstra, T. and Rip, A. (2007), "Nano-ethics as NEST-ethics: Patterns of Moral Argumentation About New and Emerging Science and Technology", en *NanoEthics, vol. 1*.

Turing, A.M. (1950), "Computing Machinery and Intelligence", en *Mind 49*.

Veruggio, G. (2007), "La nascita della Roboetica", en *Leadership medica, n. 10*.

Veruggio, G. y Operto, F. (2006), "Roboethics: a Bottom-up Interdisciplinary Discourse in the Field of Applied Ethics in Robotics", en *IRIE, International Review of Information Ethics, vol. 6*.

Von Neuman, J. (1951), "The general and logical theory of automata", Jeffress, L.A. (comp.), *Cerebral Mechanisms in Behavior*, Wiley, New York.