



Mastering robotics: a challenge for the future

Earth Thought Notebooks

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Published on 03/05/2018

Sciences & technologies

The current proliferation of intelligent robotic systems, with their increasing autonomy within our environment, raises essential legal, ethical, organizational and strategic issues that must be taken into account now in order to control the use of this equipment as well as possible.

For decades, our modern societies have been as fascinated as they are distrustful, even frightened by the prospects offered by the world of new technologies and more particularly autonomous robotic systems. This phenomenon has, moreover, been widely exploited by science fiction cinema, which has made it a favourite subject. In Stanley Kubrick's 1968 film, "2001, A Space Odyssey", a high-powered on-board computer refuses to be disconnected. To solve this dilemma, it decides to eliminate one by one the crew members of the ship. Without falling into the fantasy of the "Terminator" and the uncontrollable assassin robot, it is undeniable that the current multiplication of intelligent robotic systems, with increasing autonomy within our civil or military environment, raises the question of the "Terminator". essential legal, ethical, organizational and strategic questions which must be taken into account now in order to control the use of this equipment as effectively as possible.

A revolution in progress

Even if we can consider that the development of robotization is still in its infancy, we can see that integrated robots are still in the early stages of development. The robots can be found in all sectors of activity such as medicine, agriculture, education, leisure and of course the military. Moreover, these automatons are proving to be increasingly sophisticated, taking advantage of the permanent advances in the fields of embedded computing, nanotechnology, artificial intelligence and data transmission.

- Already a reality

From a military point of view, robotic systems have undergone spectacular growth in recent years, particularly from their use in the Iraqi and Afghan theatres of operation. For example, only one robot (a drone) was present in Iraq in 2003, while 12.000 remotely piloted ground and air robots were engaged five years later, like the Predators drones, Packbots robots for mine clearance and the famous Big Dog mule robot developed by the American company Boston Dynamics. Professor P. W. Singer^[1] thus predicts, based among other things on the laws of technological evolution ^[2] and the laws of economies of scale, a rapid and inevitable generalisation of robots on the battlefield. He also believes that robots will eventually be capable of working in teams and carrying out coordinated missions, including the use of force. At the same time, this prediction is reinforced by the proactive policies of certain countries such as the United States. In 2008, the US Congress voted to increase the budget dedicated to R&D and the purchase of robotic equipment from 3 to 6 billion dollars by 2018. In 2010, General Norton A. Schwartz commanding the US Air Force announced that he had trained more UAV operators than F16 pilots. With 7,500 UAVs currently in service, this equipment now represents nearly 40% of the US Air Force's aircraft ^[3].

^{3]} Civilian applications are not left out, however, and competition is fierce. The automotive world provides good examples with the unavoidable Google car, which has travelled 250,000 miles without a driver in Nevada, or the automatic parking systems already offered as standard on vehicles. Civilian "light" UAVs are also making rapid progress with numerous applications for private or professional use, such as the SNCF, which uses ocopter UAVs to check catenaries. Asian countries, mainly China, Japan and South Korea, are investing massively in means of production and are becoming leaders in the industrial robot market. They alone should account for 65% of sales in 2017 in a particularly dynamic market that is growing by 30% per year ^[4]. Given these prospects, some people no longer hesitate to talk about "robolution", suggesting that robotization could be a technological turning point and revolutionize our daily life like the invention of the steam engine in the 19th century.

- On the road to success

There are, of course, many reasons for this exceptional development. The first, and one of the most often mentioned, is the preservation of human lives, in particular through the use of these means in high-risk areas (contaminated, combat, mined or inhospitable areas). Thus, the nuclear disaster in Fukushima reminded us, in view of the helicopters carrying out norias above the power station to cool the reactors, of the need to have such "consumable" robotic means in order to be able to intervene without putting the rescuers at undue risk. For example, Airbus Helicopter recently carried out a demonstration of load slinging from a helicopter piloted either conventionally or remotely, which could have been very useful in such a situation.

The use of robots is also of interest as a substitute for humans in the performance of thankless or tiring tasks, such as surveillance missions. This is because they are not subject to physiological limitations and human weaknesses such as loss of concentration, stress, fatigue or hunger. Americans talk about 3D: "Dangerous, Dull, Dirty" ^[5]. In such situations, robots are more efficient, more precise and faster to perform certain tasks. They can improve human capabilities by providing help and freedom of action. They can also provide a tactical or strategic advantage, which is of interest to industrial designers and military decision-makers. Israeli doctrine states: "You must see, understand and act faster than your enemy in order to keep him in a permanent state of shock" ^[6].

Last but not least, another reason for this technological development is the financial aspect. Robotisation is indeed an essential economic development objective for the major industrial clients. As previously mentioned, the market for service robotics is growing rapidly and is expected to increase from \$2.8 billion in 2011 to \$100 billion by 2020, according to estimates by the International Federation of Robotics. In addition, the use of robotic systems is often cheaper than the use of human resources and is seen as a competitive advantage [7]. 7] P.W. Singer points out in his book ".Wired for War"8] that an American soldier, operating for a year in the Afghan theatre, costs about \$1 million, whereas the price of a Packbot is only \$150,000 .

Although robotization is expanding in many sectors, the prospects for the technical evolution of the systems concerned nevertheless raise many ethical and legal questions.

Applications to be regulated in a legislative, structural and international framework

- Legal liability and ethical issues

The first concern is the increasing autonomy attributed to robotic systems. At present, most of this equipment is still controlled by an operator who remains responsible for the decisions taken. In this case, the operator is said to be "In the Loop" and the robot is only a remote tool. But what happens when the operator goes "On the Loop", i.e. under mission supervision or when the robot is in total autonomy? It is therefore necessary to define complex and detailed scenarios with behaviors adapted to the situations and laws. We can see that there is then the problem of the link to legal liability in case of accident or injury to others. This dilemma appears as much in the development of civilian robotic vehicles as in military applications where the possibility exists to one day see the use of autonomous lethal robots (LAR).

In such cases, what are the responsibilities of the manufacturer, the programmer, the owner, the chain of command? For example, in 2007 in South Africa, an automated air defence system in South Africa experienced a technical failure and fired horizontally, killing 9 soldiers. In 2009, Amnesty International also launched a disproportionate use of force case against the manufacturer of the Hermes drone engines used in Gaza during Operation Cast Lead in 2009. Finally, in 2010, South Korea deployed SGR-A1 robots with autonomous firepower at its borders.

On a purely military level, robotization also poses the problem of the ability of these machines to identify and categorize the stakeholders (civilian, military, friend, enemy, ...). How, therefore, to respect international humanitarian law and the principles of discrimination and proportionality that can be challenged by the use of robots? The latter raises important questions that will undoubtedly have to change the law of armed conflict. These questions overlap with ethical, legal and technical considerations, accentuated by the fact that there are still risks of technological "bugs" arising from the vulnerability of data flows between the operator and the robot. In Iraq, for example, insurgents succeeded in 2009 in intercepting images of drones transmitted to ground units by hacking into satellite data.

The various points raised underline the need for in-depth reflection on the legal status that should govern the use of military and civilian robots. This should make it possible to define in national and international legislation the limits on the use of these automated systems.

- Organizational consequences

The attention of designers and decision-makers must also focus on the human-machine relationship and the implications of the presence of these robotic systems in our environment. The appearance of this equipment is certainly changing our organizations and the way we work. Referring to the industrial environment, C.É. Bouée, President of Roland Berger Strategy, states in his book "... the emergence of robotic systems is certainly changing our organizations and ways of working. Confucius and the automatons"» [10]: "The dazzling robotization and automation that we will experience in the coming decades, where the combination of the machine and the automation will become generalized.10]: "The dazzling robotization and automation that we will experience in the coming decades, when the combination of machine and intelligence will become widespread, brutally and almost systematically call into question not only the role, but also the added value and reliability of man in the production process, and even in decision-making" [11]. 11] This phenomenon will naturally have to be considered and integrated within our units where man holds the central place. What will be the implications of the mass arrival of these robots on collective behavior, esprit de corps or command style? From a tactical point of view, how can these resources be integrated into the conduct of combined operations? In response to these questions, a specific study will have to be conducted on the influence of the dehumanisation of military action: first of all at the level of operators [12] but also among the populations with whom the maintenance of a social link remains indispensable for intelligence gathering and the engagement of the armed forces.

- A strategic challenge

Finally, it should be noted that these prospects for the development of robotization are likely to modify the relations of influence between the major world powers. First of all, in economic terms, the expected growth of the robotics market may redistribute the cards of industrial dynamics and change the hierarchy of the States concerned, with a significant advance of Asian countries that would position themselves on "low-cost" robots. Japan, with its aging population but leader in the field of humanoid robots, could thus regain its development potential. In terms of strategy, we also note that the United States has clearly chosen to invest in the military robotics applications sector. In terms of deterrence, the possession of a robotic army will indeed provide the countries in question with an undeniable advantage, likely to change the balance of power on the world geopolitical chessboard. This last point thus suggests an ethical paradox between the need, on the one hand, to regulate the proliferation of military robotic systems and, on the other hand, the need to protect the civilian population, rate to avoid possible abuses and violations of human rights and, on the other hand, the need to own such systems in order to ensure one's own national security.

Conclusion

Robotisation, a very real phenomenon today, is progressing in a dazzling way throughout the world and is disrupting our daily lives. Some see this evolution as the solution to all ills, while others draw a parallel with Greek mythology and Prometheus' opening of Pandora's box. For example, Noel Sharkey, founder of the International Committee for Robot Arms Control, is actively campaigning to ban the manufacture and use of robotic weapon systems. All in all, this technological change, which has been enhanced by the development of more autonomous robots, raises many questions that will require in-

depth reflection at the international level in order to establish a clear legal and ethical framework aimed at controlling future applications as best as possible.

1] P.W. Singer, "[1] P.W. Singer, "The Dehumanization of Military ActionWired for War: the robotics revolution and conflict in the twenty-first century"New York, Penguin Press, 2009.

2] Moore's Law is an empirical law that takes for granted the doubling of computer power every two years. The theoretical limit of this law would be the miniaturization limit at the size of the atom.

3] Scott Gourley and Tony Skinner, "Robot Wars: unmanned ground vehicles", Jane's Defence Weekly, 3 June 2008; Ronan Doaré, Jean-Paul Hanon and Gérard de Boisboissel, "Robots on the battlefield: contemporary issues and implications for the future", January 2014

4] Patrick Arnoux, "La prochaine déferlante: la robolution métamorphose violemently l'industrie mondiale", Le Nouvel Économiste, December 18, 2014.

[5] "Dangerousness, hardship, dirt"

[6] Joseph Henrotin, "Robotics, an actor in counter-insurgency?", Defence and International Security N°10, 2010

7] Patrick Arnoux, "La prochaine déferlante: la robolution métamorphose violemently l'industrie mondiale", Le Nouvel Économiste, December 18, 2014.

8] P.W. Singer, "...Wired for War: the robotics revolution and conflict in the twenty-first century"New York, Penguin Press, 2009.

[9] "South Korea deploys robot capable of killing intruders along border with North", The Telegraph, 13 July 2010

[10] Charles Edouard Bouée and François Roche, "Confucius and automata: the future of man in the civilization of machines", Grasset, October 15, 2014

11] Patrick Arnoux, "La prochaine déferlante: la robolution métamorphose violemently l'industrie mondiale", Le Nouvel Économiste, December 18, 2014.

12] "Interview with a drone pilot: It is not a video game", Spiegel Online International, March 12, 2010.

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Release date 19/02/2018
