John Canning, Gerhard Dabringer: Ethical Challenges of Unmanned Systems

Introduction

The word “robot” has been in public use since the Czech writer Karel Čapek introduced it in his play R.U.R. (Rossum’s Universal Robots), published in 1920[1]. Karel claims that his brother, Josef Čapek , actually coined the word, stemming from the Czech word “robota” refering to work, labor or serf labor, and figuratively "drudgery" or "hard work.”[2] In the play, these were creatures that could be mistaken for humans, and seemed happy to serve. The issue in Karel’s play was whether the robots were being exploited. Thus was born, not only the term “robot,” but also the first ethical question involving them. It should come as no surprise, then, that questions involving the ethics of using robots have not gone away.

For many years the public’s frame of reference for robotic ethics were taken from Isaac Asimov’s Three Laws of Robotics, which he penned in 1942 in his science fiction short story “Runaround.[3]” (Asimov later added the less well-known Zeroth Law to this collection as well.[4]) But this was all from science fiction, since there were no real robots, and thus no real robotic ethics. Today, we stand on the threshold of the emergence of real robots, although not as Karel Čapek first envisioned them. So it is time to consider the real ethical (and legal) issues that come with them.

The Spread of Robotics

Today, we see the widespread commercial sale and use of such products as the iRobot Roomba and Scooba carpet and floor cleaners[5], with other products coming, but more importantly to our discussions in the military arena, we have such items as the HELLFIRE missile-armed Predator and

[1] An English translation of the book under the Creative Commons Licence is available: http://ebooks.adelaide.edu.au/c/capek/karel/rur/complete.html.
[2] Lidové Noviny, 24.12.1933, translation at: http://capek.misto.cz/english/robot.html.
[3] Published in: Isaac Asimov, I, Robot, New York, 1950.
[4] Isaac Asimov, Robots and Empire, New York 1985.
[5] According to iRobot, the manufacturer of Roomba, more than 2 million units have been sold worldwide until 2008 (http://www.irobot.com/sp.cfm?pageid=74).

Reaper Unmanned Air Systems (UAS). While the commercial products can make your life easier, the military ones could end your life!

Since 1994, when the U.S. Department of Defence commissioned the production of ten Predators of which the first ones were deployed in Bosnia in July 1995[6], the number of UAS has risen steadily. In total there are over seven thousand UAS in service in the U.S. Armed Forces in 2010 as opposed to 167 in 2001.[7]

The spread of robotic systems is not merely a military phenomenon but constitutes a trend of the society as a whole. According to the Statistical Department of the International Federation of Robotics, in 2007 6.5 million robots were in use worldwide with 18 million predicted for 2011[8], ranging from industrial robots to service and entertainment robots. Industrial robots, numbering approximately 1 million[9] as of today, have been growing steadily at about 100.000 per year.[10] In contrast, service robots for professional use, such as military robots, but also entertainment robots, are seen as the field where most of the growth will be located in the near future. [11]

The history of the use of UAS by the military goes back as far as the 19th century, with the Austrian Army under Franz von Uchatius using unmanned balloon bombs in 1849 in the siege of Venice. Similar concepts had also been developed in the American Civil War, though they were not deployed. [12] The development has been driven on by Nikola Tesla, Archibald Low and many others to the point that over the period of the Second World War that U.S. Forces had produced almost 1.000 units of the Radioplane OQ-2A UAV model alone.[13]

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[6] http://www.af.mil/information/transcripts/story.asp?storyID=123006556 and Statement of John F. Tierney, Chairman, Subcommittee on National Security and Foreign Affairs, Committee on Oversight and Government Reform, U.S. House of Representatives: Hearing on "Rise of the Drones: Unmanned Systems and the Future of War "http://www.oversight.house.gov/images/stories/subcommittees/NS_Subcommittee/3.23.10_Drones/3-23-10_JFT_Opening_Statement_FINAL_for_Delivery.pdf.

[7] http://www.nytimes.com/2009/03/17/business/17uav.html?_r=1&hp.

[8] http://www.worldrobotics.org/downloads/2008_Pressinfo_english.pdf.

[9] http://www.ifrstat.org/downloads/2009_First_News_of_Worldrobotics.pdf.

[10] In 2007 118.000 additional units have been produced. (http://www.ifrstat.org/downloads/Pressinfo_11_Jun_2008_deutsch.pdf).

[11] Growth rate from 33% in the sector of service robots (http://www.ifrstat.org/downloads/2009_First_News_of_Worldrobotics.pdf).

[12] http://www.ctie.monash.edu.au/hargrave/rpav_home.html.

[13] http://www.nationalmuseum.af.mil/factsheets/factsheet.asp?id=486.

Unmanned Systems and the Military

Why is it, that a technology that has been used by the military for decades, should now revolutionize warfare itself? There are a number of aspects, which are to be considered.

Firstly, war spurs the development of militarily relevant technology. This has been true for centuries, and remains so today. Looking at the ongoing Operation Iraqi Freedom, and the widespread adoption of Explosive Ordnance Disposal (EOD) robots, we see them dealing with the emergence of the Improvised Explosive Device threat. At the start of the conflict, there were virtually none of these systems in use. Today, they number in the thousands, and the EOD technicians know that every mangled robot that comes into the repair facilities represents at least one life saved. [14]

If we shift our view to Operation Enduring Freedom in Afghanistan, and neighboring Pakistan, we see the same sort of thing with the increased use of surveillance, and armed Predators, and now the armed Reapers. The US administration would not have moved in these directions if there wasn't a clear benefit in doing so, and the pressure to add more systems to inventory show that the demand for this benefit hasn't been met.

What should we draw from this? First, it is obvious that these systems are saving lives. Second, it is clear that the "persistent stare" that these systems provide, coupled with weapons, is providing increased knowledge of the battlespace, and the ability to strike time-critical targets. Thirdly, there is no reason to believe that the push to develop more capable systems will drop off anytime soon, since these conflicts are continuing.

This brings us to the consideration of how future war may be conducted, and possibly in the not-too-distant future at that: Today's unmanned systems are not what most people think of as really being robots. For the most part, they operate with "man-in-the-loop remotely" control. This is particularly true for the use of weapons by one of these systems. We can expect to see a push to develop higher-level autonomy for operations by these machines to include the autonomous use of weapons.

[14] E.g. Noah Shachtman, The Baghdad Bomb Squad in: Wired Magazine (2005) (http://www.wired.com/wired/archive/13.11/bomb.html?pg=3&topic=bomb).

Secondly, the developments in engineering, sensor technology and especially computer systems and information technology, have made it possible to increasingly exploit the potential of unmanned systems. Even if the Revolution in Military Affairs (RMA) has not proven to be as effective as predicted, the concept of network-centric warfare did lay a foundation for the use of unmanned systems (and in this case especially for the use of UAS in surveillance and intelligence gathering).

Another aspect to be considered is the impact of unmanned systems on the strained budgets of the militaries throughout the world. It has been argued, that with unmanned systems, fewer soldiers will be needed to cover the growing areas of the current battlefields of counterinsurgency operations[15]. In addition, at least in the field of UAS, where unmanned systems can fulfill most of the roles of manned aircraft, they have proven to be generally cheaper in production and deployment than manned systems. On the other hand, it has also been noted, that the benefits of new possibilities like "persistent stare", result in more workload and require more personnel to maintain and operate these systems.[16]

Today's armed unmanned systems place an expensive machine between the soldier and his weapon. For small numbers of machines, this may not be much of an issue, but for large numbers of machines, this increases the cost of conducting warfare substantially.[17] The push is on to move from a "one operator, one machine" model of operations to a "one operator, many machines" model of operations in order to reduce the total cost of ownership by decreasing the cost of manpower needed,[18] as typically, the largest life-cycle cost item for a system is personnel.

One of the main aspects of change will be constituted by the impact of autonomous potential of military unmanned systems on warfare, something

[15] A Look at the Future Combat Systems (Brigade Combat Team) Program. An Interview With MG Charles A. Cartwright in: Army AL&T Magazine 2/2008.
[16] John Canning, A Definitive Work on Factors Impacting the Arming of Unmanned Vehicles, NSWCDD/TR-0/36, 2005, p.13.
[17] John Canning, A Definitive Work on Factors Impacting the Arming of Unmanned Vehicles, NSWCDD/TR-0/36, 2005, p.14.
[18] E.g. the development of a Multi-Robot Operator Control Unit for Unmanned Systems (http://www.spawar.navy.mil/robots/pubs/DefenseTechBriefs%20-%20MOCU%202008%2008%2001.pdf.

which, in its implementation, is yet difficult to predict[19]. The same applies to the role of autonomous robots in the human society as a whole, as Bill Gates has compared the present situation of the robotics industry with the situation of the computer industry in the 1970s.[20] Although, with the political agenda as it is, it can be considered as a certainty, that these systems will have a profound impact on the future of warfare and the role of the warfighter himself.[21]

Legal Aspects

First, let us stipulate that we are not talking about either ethical or legal aspects associated with any other area than with weaponization of robots. There are others that are looking at things such as safety of flight for UAS in the US National Airspace System, and associated legal concerns. Nor will we concern ourselves with issues such as the Collision-avoidance Regulations (COLREGS), known as the "rules of the road" for international sea-based navigation. We will not comment beyond weaponization aspects.

What are the legal aspects and challenges of the development and deployment of weaponized unmanned systems by the military? What is their impact on warfare and how could the use of military unmanned systems be regulated?

The first amended Protocol relating to the Protection of Victims of International Armed Conflicts from the 8th of June 1977 to the Geneva Convention from the 12th of August 1949 relative to the Protection of Civilian Persons in Time of War states under Article 36, that "in the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party is under an obligation to determine whether its employment

[19] E.g. : „Dramatic progress in supposrting technologies suggests that unprecendented, perhaps unimagined, degrees of autonomy can be introduced into current and future military systems. This could presage dramatic changes in military capability and force composition comparable to the introduction of ‚Net-Centricity'." Task Force (29.03.2010): Role of Autonomy in Department of Defense (DOD) Systems, The Under Secretary of Defense, Acquisition, Technology and Logistics: Memorandum for Chairman, Defense Science Board, http://www.acq.osd.mil/dsb/tors/TOR-2010-03-29-Autonomy_in_DoD_Systems.pdf.

[20] Bill Gates, Scientific American, 1/2007 (http://www.scientificamerican.com/article.cfm?id=a-robot-in-every-home).

[21] In his campaign, President Obama has identified unmanned systems as one of the five important military systems. Also the budget in this area has – unlike in many other areas of military spending – not been cut but increased. Peter W. Singer, Interview vom 5.8.2009 (http://www.irf.ac.at/index.php?option=com_content&task=view&id=293&Itemid=1).

would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law".[22]

On an international level, at the present time, there are no comprehensive treaties regarding the use and development of unmanned systems[23], though on a national level the use and development is regulated by the appropriate rules of law. In the United States, for example, the Armed Forces have to ensure the accordance of a new weapon system with international treaties, national law and with the humanitarian and customary international law. To ensure this, a new weapon system has to be approved in an evaluation process by the Judge Advocate General's Corps, the legal branch of the U.S. Armed Forces.[24]

In addition all branches of the Armed Forces have separate regulations, which specify the details of the evaluation process. A typical evaluation process would include the military necessity for the weapon; the ability of the weapon to distinguish lawful targets from protected persons and objects (i.e. discrimination); whether the damage caused by the weapon causes unnecessary suffering; treaties that may prohibit the acquisition and employment of the weapon, and domestic law. In addition the deployment and use of the weapon system would be governed by the current Rules of Engagement.[25]

It is the ability to discriminate between a lawful and unlawful target that drives most of the ethics concerns for armed robots, although the consideration for causing unnecessary suffering is not far behind. The latter is referred-to as a "collateral damage" issue, while the former is a "targeting" issue.[26]

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[22] http://www.icrc.org/ihl.nsf/FULL/470?OpenDocument; It has to be noted, that this article refers to the use and development of weapons, but not their possession, as the protocol solely regulates international armed conflict. See: International Committee of the Red Cross, Commentary on the Additional Protocols of 8 June 1977 to the Geneva Conventions of 12 August 1949, Geneva 1987, 1471. (http://www.icrc.org/ihl.nsf/COM/470-750046?OpenDocument); regarding peacekeeping and International Humanitarian Law see e.g.: Ray Murphy, United Nations Military Operations and International Humanitarian Law: What Rules Apply to Peacekeepers? In: Criminal Law Forum, Volume 14, Number 2 / Juni 2003, p. 153-194.

[23] Except for the the Missile Technology Control Regime (originated 1987), an informal and voluntary association of countries (34 in 2009)which share the goals of non-proliferation of unmanned delivery systems capable of delivering weapons of mass destruction.

[24] The necessity for this evaluation process is laid down in the Department of Defence Instruction 5000.1, E.1.15. (http://www.dtic.mil/whs/directives/corres/pdf/500001p.pdf).

[25] John S. Canning, Legal vs. Policy Issues for Armed Unmanned Systems, 2008: http://www.unsysinst.org/forum/download.php?id=51).

[26] Concerning the issue of „targeted killing" see Armin Krishnan, Killer Robots. Legailty and Ethicality of Autonomous Weapons, Farnham/Burlington 2009, p. 100-103.

These issues are considered separately during the “legal weapons review,” prior to full-scale production and use, and for its actual use on the battlefield. It is noted though that any “legal weapon” could be used in an illegal manner. The use of weapons on the battlefield is therefore addressed by the “Rules Of Engagement”.

The complexity and various dimensions of legal regulations concerning the use of weapon systems can be observed in the discussion of the use of weaponized UAVs by the United States in Pakistan. This topic, discussed intensely by the international community[27], has also been addressed by the Subcommittee on National Security and Foreign Affairs of the House of Representatives in two prominent hearings[28].

Robots and Humans – Changes in Warfare

Robots have no life to lose. There, in a nutshell, is the primary change in conducting warfare by using robots. Humans, however, are still mortal, and can be killed. Robots also know no suffering. This, too, is a primary change in conducting warfare by using robots. Robots can be damaged or destroyed, however. If damaged, they can be fixed. If destroyed, they can be replaced. If a human is killed, he (or she) is gone forever. If they are injured, it could be with irreparable damage such as losing a limb, and the quality of their remaining lives reduced as a result.

One of the less expected effects of the use of unmanned ground vehicles (UGVs) was the emotional link that human operators began to establish to the systems they teleoperated. This emotional bond between robots and humans has also shown the potential to endanger soldiers on the battlefield. There have been reports, that soldiers are taking excessive risks to retrieve unmanned systems under enemy fire to save them from

[27] See e.g.: Nils Melzer, Targetted Killing in International Law, Oxford/ New York 2008. and the Report of the Report of the Special Rapporteur on extrajudicial, summary or arbitrary executions, Philip Alston,
http://www2.ohchr.org/english/bodies/hrcouncil/docs/14session/A.HRC.14.24.pdf.
[28] „Rise of the Drones: Unmanned Systems and the Future of War“:
http://www.oversight.house.gov/index.php?option=com_jcalpro&Itemid=19&extmode=view&extid=136 and „The Rise of the Drones II: Examining the Legality of Unmanned Targeting“:
http://www.oversight.house.gov/index.php?option=com_content&view=article&id=4903:hearing-on-the-rise-of-the-drones-ii-examining-the-legality-of-unmanned-targeting&catid=72:hearings&Itemid=30.

destruction.[29] This coincides with naming repair-shops for unmanned systems "robot hospitals"[30], the practice of operators to name and relate to their equipment similar as they would do with pets. [31] Recent studies suggest that with advanced artificial intelligence and robotics this phenomenon will be something that the human society will have to reckon with in all aspects of human-robot interaction.[32]

Another aspect normally not associated with ethical challenges of unmanned systems, is the change of the self-image of the warfighter and the role of the soldier operating unmanned vehicles through long distances. While living in the U.S., UAS operators fly their missions in Iraq and Afghanistan and return to their homes afterwards just as with a normal day at office. It has been argued, that this can be psychologically problematic for the UAS operators not only because of the dual experience of being at home and being at war at the same time but also because due to the kind of deployment they also experience a change in camaraderie. UAS Operators are said to experience combat stress on similar levels as soldiers deployed in Iraq but lack the possibility to share these experiences with other members of their unit and therefore do not as a unit have a rest and recovery period to cope with these experiences.[33] However, recent reports from the USAF indicate, that though it is yet not fully clear how these factors will influence the psyche and also the relationships of soldiers experiencing this in a way paradox variant of warfare, the impact might be a lot less substantial than generally assumed.[34]

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[29] Peter W. Singer, Interview vom 5.8.2009 (http://www.irf.ac.at/index.php?option=com_content&task=view&id=293&Itemid=1).

[30] http://www.army-guide.com/eng/article/article_1050.html.

[31] E.g. the packbot named "Scooby-Doo" (http://news.cnet.com/2300-11386_3-10000731-6.html?tag=mncol). There have also been accounts that soldiers did not want a damaged robot to be merely replaced but they wanted this individual robot repaired. Peter W. Singer, Interview vom 5.8.2009 (http://www.irf.ac.at/index.php?option=com_content&task=view&id=293&Itemid=1). Peter W. Singer also reports an incident, where a Commander, after a UGVs was destroyed, writes a condolence letter to the manufacturer. Peter W. Singer, Wired for War. The Robotics Revolution and Conflict in the Twenty-first Century, New York 2009, 20-21.

[32] Fumihide Tanaka, Aaron Cicourel, Javier R. Movellan, Socialization between toddlers and robots at an early childhood education center, 2007, http://www.pnas.org/content/104/46/17954.full.

[33] Peter W. Singer, Interview vom 5.8.2009 (http://www.irf.ac.at/index.php?option=com_content&task=view&id=293&Itemid=1).

[34] AUVSI Unmanned Systems North America 2009, Panel: Ethics in Armed Unmanned Systems in Combat, Washington DC, 12.8.2009.

Two Ways of approaching the Ethical Challenge

The Ethical Governor

Dr. Ronald C. Arkin, from the Georgia Institute of Technology, has proposed the concept of what amounts to an ethical governor for armed unmanned systems.[35] Basically, this is an AI "ethics module" that would dispassionately process the existing Rules Of Engagement and make more ethical decisions regarding engagements than a human soldier could. An autonomous, armed machine so-equipped would then proceed to use lethal force against an enemy target, including the possible direct targeting of human enemy combatants, while at the same time avoiding the targeting and killing of non-combatants, or the engaging of other illegal targets. While potentially a more ethical approach to warfare than what exists today, there are two issues with this approach: (1) the bug-free development of the ethics module itself; and (2) the fact that this would have a machine autonomously targeting and killing people.

Regarding the bug-free development of the ethics module:

There is an entire industry today built around the concept of "software maintenance." Basically, this is the fixing of software problems that become apparent after an item has been delivered to the field for use. Most professional software developers would state that the probability of delivering a completely bug-free product, in something as complex as an ethics module, the first time around would have to be near zero – even with extensive testing beforehand. The unanswered question is "How long would it be before all the bugs are worked-out?" There may be no way of answering this question since how would you know if you had actually eliminated the last bug?

Regarding having a machine that can autonomously target and kill people:

Based on conversations with lawyers from the U.S. Navy's JAG Office in the Pentagon, and with the U.S. Office of the Secretary of Defense's Office of General Counsel[36], it is unlikely that such a system would be allowed to pass a legal weapons review, simply because of the fact that it would be

[35] http://www.cc.gatech.edu/ai/robot-lab/online-publications/formalizationv35.pdf.
[36] John Canning, „You've Just Been Disarmed. Have a Nice Day!" in: IEEE p.15.

targeting a human. The issue is, particularly on today's battlefield, how do you tell an insurgent from an innocent civilian ("target discrimination")? They are both dressed the same and look alike. This is a tough problem for our human troops to handle today. It won't be any easier for a machine.

The Moral User

Peter Asaro recently has proposed an approach for tele-operated systems which centers on the ethical decision-making of the human operators. Asaro argues that Arkin's, and similar approaches, do not sufficiently take into account that the basis for ethical decision-making in warfare, Law of Armed Combat, Rules of Engagement and Just War Theory, are not always a set of clearcut rules but do include a hodgepodge of laws, rules, heuristics and principles subject to interpretation and value judgments.[37]

Therefore, drawing upon User-Centered Design, he brings forward his idea of "modeling the moral user", which would involve three elements. First, using the methods of cognitive psychology, the representations, decision rules and perceptual and emotional requirements for effective ethical decision-making should be sought to be understood. Second, drawing upon recent work in experimental philosophy, we should explore the nature of moral intuition, value comparisons and judgments and using experimental economics, we should also engage the nature of risk assessment and probability estimation. He also points out, that it might be necessary to evaluate the significance of rational thought in ethical decision making. Third, it would be necessary for the society to decide which ethical standards it wants to promote and to which extent it will be able to enforce these standards on the soldiers through the technology.[38]

Contrary to arguments, which see psychological stress mainly as a cause for unethical behavior, Asaro points out, that it might be necessary for operators of unmanned systems to experience these factors in order to make effective ethical decisions and to feel empathetic and sympathetic emotions.[39] Without prejudging any questions about the nature of morality – can an artificial intelligence or unmanned system gain a level of moral agency or not – the question if we decide to imagine unmanned systems as rule-based entities or if

[37] Peter Asaro, Modeling the Moral User: Designing Ethical Interfaces for Tele-Operation, in: IEEE Technology and Society 28/Spring 2009, p. 22.
[38] Asaro, IEEE p.23.
[39] Asaro, IEEE, p.24.

we strive to implement an emotional component, might very well become a crucial point for future developments in this field.

Another one of the key questions Asaro identifies is, that in the aim to effectively capture the range of moral reasoning, it might be necessary to consider that there can very well be a range of individual and cultural variations in ethical reasoning as well as different values and standards of moral reasoning.[40] Following the idea that warfare is a cultural practice and that of cultural and individual morals, Asaro continues to ask which ethical standards we should chose to implement in the design of unmanned systems and if the implementation of an ethical software system would in fact make the person operating it more ethical.[41]

Though Asaro mainly concentrates on systems at hand, which are teleoperated systems, there seems no inconsistency to widen the scope on to autonomous unmanned systems. However this may be, if we decide to accept, that it is a widely shared current ethical standard of warfare to expose other people to as little negative influence as possible but necessary to achieve a task, then averting the needless loss of life during warfare seems not only a sensible goal but leads us to an approach where we might find that removing the lethal component from armed conflict might be a way to solve – at least for the moment – the most prominent question concerning autonomous armed unmanned systems, that is, shall it be possible for a machine to act with the potential consequence of humans losing their life?

Managing the Ethical Challenge of Autonomous Use of Lethal Force – "You have been Disarmed"

Another approach to the autonomous use of force has been put forward by John Canning, following extensive discussions with representatives of the US Navy's JAG Office. It was noted that this JAG Office was going to require that weapons-bearing unmanned systems would be required to maintain a "man-in-the-loop" for target discrimination and weapons control, if they were designed to target people. It was noted, however, that if they were designed to target either the "bow" or the "arrow," but not the human

[40] Asaro, IEEE, p.23.
[41] Interview with Peter Asaro, 8.9.2009 (http://www.irf.ac.at/index.php?option=com_content&task=view&id=295&Itemid=22).

"archer," then there was the possibility for the autonomous use of weapons[42]. Pulling this thread, Canning discovered many weapon systems that had already been designed and fielded, based on this concept. Several examples: AEGIS weapon systems on US Navy ships when set to the AUTO-SPECIAL mode of operation; CAPTOR mine systems that would target enemy submarines, but not surface ships; the US Army's PATRIOT missile system in a mode similar to AEGIS' AUTO-SPECIAL mode.

In contrast, it was shown that anti-personnel landmines have been outlawed because they can't discriminate between a soldier and a child, but anti-tank landmines are still legal to use because they target "things" – not "people."[43]

Canning has taken this one step further by pointing-out that the weapon used by a robot does not have to be a traditional gun or missile, where there may be a substantial likelihood of collateral damage, but something else might be used instead. He is fond of saying that his "dream machine" is one that marches up to an enemy combatant on the battlefield; physically takes the rifle out of his hands; saws the rifle in half with a diamond-tipped saw; hands the two halves back to the enemy combatant; and then tells him to "Have a nice day!"[44]

The question is then one of "Is the enemy carrying his bow, such as a rifle or pistol, or is he riding it, such as a tank or warship?" Non-lethal weapons, such as Active Denial, might be used to separate an enemy combatant from his "bow" if he is carrying it, but if he is riding his bow, it is not necessary to achieve a "platform kill" in which a ship is totally sunk (drowning the crew), or a tank is obliterated (killing the crew). It may be enough to achieve either a "mobility kill," where you disable either the motor or the steering mechanism on a ship, or a "mission kill," where you might poke a hole through a tank's main gun barrel, thereby rendering it useless. However, even if a crew is killed or injured, they still do constitute a legitimate target under international humanitarian law, so in this case, certain, limited, amount of human collateral damage may be acceptable.

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[42] John Canning, „You've Just Been Disarmed. Have a Nice Day!" in: IEEE Technology and Society 28/Spring 2009, p.12-15.

[43] Also see Patrick Hew, Autonomous Situation Awareness. Implications for Future Warfighting in: Australian Defence Force Journal, Issue 174, 2007, pp77-78 and pp 83-84.
The Western Militaries' Blind Spot in Robot-Enabled Warfare, in print.

[44] John Canning, „You've Just Been Disarmed. Have a Nice Day!" in: IEEE Technology and Society 28/Spring 2009, p.12-15.

Conclusion

As we have just shown, ethical considerations for robots have been around from the inception of the term “robot.” For most of the intervening time, “popular” ethics for robots were defined by Isaac Asimov’s science fictional works, but the near-at-hand development of real armed, autonomous military robots is forcing us to seriously consider the ethics of these machines in more pragmatic terms. Driven heavily by legal concerns for target discrimination, we are channeled into autonomously targeting either the “bow,” or the “arrow,” but not the human “archer,” thereby bringing up the possibility of disarming a foe, as opposed to killing him. This is a fundamental paradigm shift from the way mankind conducts warfare today. We would argue that this also marks a fundamental improvement to the ethics of conducting war. While this is an ethical challenge, we would argue it is one we cannot afford to ignore.

Disclaimer

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