2013 5th International Conference on Cyber Conflict
K. Podins, J. Stinissen, M. Maybaum (Eds.)
2013 © NATO CCD COE Publications, Tallinn

An Ethical Analysis of the Case for Robotic Weapons Arms Control

John P. Sullins
Philosophy Department
Sonoma State University
California, U.S.
707-664-2277
John.sullins@sonoma.edu

Abstract: While the use of telerobotic and semi-autonomous weapons systems has been enthusiastically embraced by politicians and militaries around the world, their deployment has not gone without criticism. Strong critics such as Asaro (2008), Sharkey (2008, 2009, 2010, 2011, and 2012) and Sparrow (2007, 2009a, 2009b, 2011) argue that these technologies have multiple moral failings and their deployment on principle must be severely limited or perhaps even eliminated. These authors and researchers along with a growing list of others have founded the *International Committee for Robot Arms Control* as a means for advancing their arguments and advocating for future talks and treaties that might limit the use of these weapons. Others such as Arkin (2010), Brooks (2012), Lin, Abney and Bekey (2008, 2012), Strawser (2010), have argued that there are some compelling reasons to believe that, at least in some cases, deployment of telerobotic and semi-autonomous weapons systems can contribute to marginal improvements to the state of ethical and just outcomes in armed combat. This presentation will trace the main arguments posed by both sides of the issue. Additionally this paper will suggest certain considerations motivated by the philosophy of technology that might be worthy of addition to future robotic arms control treaties. This position argues that these technologies through the process of reverse adaptation can change our notions of just war theory to the point that caution in their use is recommended until further analysis of these effects can be accomplished. A realistic stance towards robotic weapons arms control will be argued for without losing sight of the positive role these technologies can play in resolving armed conflict in the most just and ethical manner possible.

Keywords: *Robotic Arms Control, Autonomous Weapons Systems (AWS), Just War Theory, Robot Ethics, Machine Ethics*

1. INTRODUCTION

The use of robotic weapons systems is accelerating around the globe. While the date of the first introduction of telerobotic weapons to the battlefield is debatable, it is clear that they have grown out of the use of guided missiles and radio controlled bombs in the last century, to the "smart" missiles and unmanned weapons systems of today. These systems are constantly evolving and a vast array of telerobotic and semi-autonomous weapons systems are being deployed in all potential theaters of conflict; land, sea and air (Singer, 2009). The epochal change in conflict resolution represented by the rise of more and more capable and autonomous weapons systems has not come without criticism. This paper will describe why the rise of autonomous weapons is so seemingly unavoidable and will look at the strong arguments in favor of severely limiting the research in, and deployment of, robotic weapons systems. An argument in favor of the cautious use of these weapons systems will also be developed.

2. THE FATAL ATTRACTION OF DRONES

If you are a politician in a liberal democracy, then the technology of unmanned weapons is the answer to your dreams. While armed aggression between liberal democracies is rare, they are involved in many military conflicts driven by clashes with nondemocratic countries or interventions in unstable regions of the world. Given the norms and values espoused in liberal democracies there is a political will to spread the virtues of democracy and check the aggressions of non-democratic powers. But other values and norms such as the distribution of political power to the voting population, severely hampers the governments of these countries who try to act on their military aspirations. There are massive political costs to be paid when it comes to deploying large numbers of troops in foreign lands. Sauer and Schörnig (2012), note that the governments of democracies want to engage in military activities but the citizens of democracies demand that these adventures be low cost with no casualties from their own military and low casualties inflicted on the enemy and local population.

> [T]he need to reduce costs, the short-term satisfaction of particular 'risk-transfer rules' for avoiding casualties, and the upkeep of a specific set of normative values – constitute the special appeal of unmanned systems to democracies" (Sauer and Schörnig, 2012, p. 365).

Unmanned weapons systems would seem to allow all constituents within a liberal democracy to achieve their goals. The weapons are not expensive compared to the massive expense of building, deploying and maintaining manned systems. The

missions are secret and so small they hardly warrant mention in the daily news back home. There is almost no risk to military personnel in their use and the number of enemy casualties per strike is relatively small. Also, politicians such as President Barack Obama have made claims that these weapons are far less indiscriminate and more tightly controlled in their killing than alternative modes of attack (Landler, 2012). We should note that this claim is backed up by what appears to be questionable methods used in the official calculation of civilian casualties since every adult male in the blast of the weapon is often considered a combatant by default, a claim that is often disputable (Qazi and Jillani, 2012). So the more precise targeting available on modern drones does not necessarily correspond to less civilian casualties (ibid; Zubair Shah, 2012). These weapons also come with a moral veneer that comes from the assumption that a more ethical conduct of war is possible using these machines. Sauer and Schörnig go on to conclude that the political goals along with the normative drives of liberal democracies necessitates that unmanned systems will continue to be armed with more powerful weaponry and that they will be given more demanding missions which will require greater autonomy from the machine (Sauer and Schörnig, 2012, p. 370). In addition to this they can also help with complex political relationships such as those between Pakistan and the United States. Drone strikes have arguably benefited the Pakistani government by allowing them a tool to attack their own political enemies while simultaneously being able to criticize the United States for those killings (Zubair Shah, 2012). In some cases the residents in tribal areas of Pakistan are sometimes grudgingly in favor of the strikes:

> Many favor the drone strikes over the alternatives, such as military operations or less selective bombardments by Pakistani bombers and helicopter gunships. Better a few houses get vaporized than an entire village turned into refugees (Ibid, p. 5).

This argument shows that we can expect the research into autonomous weapons systems to increase and for these systems to proliferate into every aspect of military activities across the globe. Recent history has given ample empirical evidence to back this theory up. Even though President Obama was elected largely on an anti-war vote, it has been reported that there has been an 8% increase in the use of drones during his first term and in 2011 drones were used in, "…253 strikes – one every four days…. [And] Between 2,347 and 2,956 people are reported to have died in the attacks – most of them militants" (Woods, 2011). This trend has only increased since that time. Other countries such as Israel and Italy are known to operate reconnaissance drones but recently the German government has announced plans to invest in both armed and unarmed drones (Gathmann et al, 2013; Kim, 2013; Medick, 2013). As the enthusiasm for this technology grows, a mounting opposition movement has also emerged that claims that this technology is not a

cheap, easy, casualty free means of propagating just war. Instead they claim that these technologies contribute to unjust military adventures and a indefensibly immoral push button warfare that claims the lives of thousands of innocents caught in the cross fire. In the interest of furthering the ethical use of these technologies, it is important that we give these counter arguments our full attention in this paper.

We should note that some technologies can cause what philosophers of technology call *reverse adaptation*; "…the adjustment of human ends to match the character of the available means" (Winner, 1978, p. 229). This is where the social and political milieu of a society changes to accommodate the inflexibility of a technology, rather than waiting to deploy the technology when it is more suited to the human environment. A prime example would be the way that human societies changed due to the adoption of mass production necessitating all manner of social upheaval that proved to be the fault lines of human conflict over the last two centuries. There are many other examples of this in recent history, think of the social disruption caused by the introduction of the automobile or cellular telephone, etc. It is obvious that autonomous weapons are again confronting our societies with the problems of reverse adaptation. These weapons are completing a trend in technological warfare begun in the nineteenth century that is making traditional notions of ethics in warfare largely untenable. These notions were always on shaky ground to begin with, but the tradition of just war that reaches back to the middle ages has become almost mute in its ability to influence decisions made on the modern battlefield. If this was not worrisome enough, as aging drone technologies are replaced with better equipment, the surplus will find use in civilian law enforcement duties, this will complete the circle and technologies that liberal democracies gladly used to control their enemies will now be used in ways that challenge and potentially curtail cherished civil liberties at home. Because of this, it is vital that we engage in discussion of these technologies at every opportunity. We will take up this issue again and apply it to the problem of creating a realistic robotic arms control at the end of this paper.

3. THE CALL FOR ROBOT ARMS CONTROL

Altmann (2009), Asaro (2008), Sharkey (2008, 2009, 2010, 2011, and 2012) and Sparrow (2007, 2009a, 2009b, 2011) have all challenged the perceived political expediency of robotic weapons systems as described above. They disagree with the claim that these weapons present a more limited and more just way of deploying military force and argue that their proliferation must be regulated. The most interesting and thoughtful counter arguments to the raise of the drones come from

the International Committee for Robot Arms Control (ICRAC).[1] This committee formed as an NGO in 2009 and its members represent concerned roboticists, legal scholars, philosophers, and other academics that seek to foster discussions in favor of robotic arms control. The five positions that they are in favor of supporting are listed on their website as follows.[2] Robotic weapons have the potential to lower the threshold of armed conflict. There should be a prohibition of the development, deployment and use of armed autonomous unmanned systems. No machines should be allowed to make the decision to kill people. There should be limitations on the range and types of weapons carried by "man in the loop" [telerobotic] unmanned systems and on their deployment in postures threatening to other states. There should be a complete ban on arming unmanned systems with nuclear weapons. And there should be a prohibition of the development, deployment and use of robot space weapons.

In addition to these propositions there are a number of other statements that are not agreed upon by all members of ICRAC but that there is broad agreement on such as: Limits on the endurance of unmanned weapons systems; size restrictions and or negotiated numbers of systems allowed by class and size; restrictions on operational range and size of payload; uninhabited weapons systems do not have the right to violate the sovereignty of states by incursions into their airspace or other territory.

We can distil these various claims into three main categories of proposed limitations. First, there should be limits on the authority given to decisions made solely by the machine. Second, bounds must be placed on the technological capabilities of these machines. And third, there must be restrictions placed on the deployment of autonomous weapons systems. Each one of these can be looked at from a technical, legal and/or ethical standpoint. In this paper we will deal only with the ethical justifications for and against these propositions. Let us now look at each one of these assertions in turn.

A. *LIMITS TO AUTONOMOUS DECISION MAKING*

The question of autonomous machines deciding when to use lethal force is the most ethically challenging of the three categories of proposed limitations and as such we need to pay more attention to it than the other two categories. Asaro (2008) noted that robotic weapons systems are developing along a spectrum from non-autonomous, through semi-autonomous, to fully autonomous. As we move up the scale to full autonomy there will be a critical step taken when we allow machines to

---

1 http://icrac.net

2 http://icrac.net/statements/

select and engage military targets on their own with little or no input from human operators (Asaro, 2008). His primary argument being that doing so will cloud our ability to ascribe guilt or responsibility to anyone in the event that something goes wrong. The machine might be capable of finding and attacking targets but it is unlikely to be capable of taking a moral stand to justify its own decisions (ibid, p. 2). So, in building this decision making into the machine, we are uploading our moral responsibility to the machine as well and abdicating our duties as moral agents. Furthermore, we can see that if robots are not capable of making the moral decision to kill a human being, then this situation must be avoided. In recent public talks he has begun to wonder if we ought to claim the human right not to be killed by autonomous weapon systems.[3]

Sharkey (2010), as a robotics researcher himself, argues mainly from the view that machines are never going to be able to reliably make the right choices in difficult situations on the battlefield. Robots can barely tell the difference between a human and a trash can, which begs the question of how they are going to be able to tell the difference between an innocent civilian caught on a battlefield and an irregular soldier who is posing as a civilian. This is a challenging task for a human being and well beyond the capabilities of a machine. This limitation would make an autonomous fighting machine somewhat indiscriminant and therefore unjustifiable from a moral standpoint. In an interview, Sharkey has suggested that those funding research into autonomous weapons systems have an almost mythic faith in the ability of artificial intelligence to solve these kinds of problems in a prompt manner and that this belief is far from the reality of what these systems are capable of, "[t]he main problem is that these systems do not have the discriminative power to do that," he says, "and I don't know if they ever will" (Simonite, 2008). Again, we are mistakenly placing our trust in a machine that is actually incapable of making good moral decisions, a position that is morally suspect indeed.

Sparrow (2007), argues that it would be immoral to give machines the responsibility of choosing their own targets even if we can somehow transcend the technical problems of complex decision making and target discrimination. He asks us to consider what we would do in the case of a machine that decided on its own to commit some sort of action that if a human had done it would constitute a war crime. In that case he argues we would find that there is no good answer when we try to decide where to affix the moral blame for the atrocity (ibid, p. 67). Asaro believes this is due to the fact that in the end, there is no way to punish a machine as they have neither life nor liberty to lose nor would it be reasonable to assume

---

[3] Asaro, P. (Forthcoming). "On Banning Autonomous Lethal Systems: Human Rights, Automation and the Dehumanizing of Lethal Decision-making," Special Issue on New Technologies and Warfare, International Review of the Red Cross.

that the responsibility for the act rested in the machine itself, or its commanding officers or even in its builders and programmers (ibid). *Jus in bello* requires that there be an ability to assign responsibility for war crimes and that the perpetrators be punished. "If it turns out that no one can properly be held responsible in the scenario described above, then AWS [autonomous weapons systems] will violate this important condition of *jus in bello*" (ibid, p. 68) Consequently, Asaro concludes that the use of this kind of weapon would be immoral and hence must be avoided.

The above arguments call into question not only the morality of having a machine decide to kill an individual human being but even their use of force to simply injure an opponent or follow opponents across political boarders as this would no doubt incite retaliation and could even lead to an escalating situation where decisions by a machine might lead to open warfare between humans. This leads ICRAC to suggest that these decisions should never be left to a machine alone.

While it is quite reasonable to seek limits on the use of autonomous weapons in situations where they could inadvertently escalate a conflict, the argument that autonomous weapons need to be banned due to the fact that they are incapable of affixing moral blame to is much harder to follow. Even if it were problematic to ascribe moral agency to the machine for metaethical reasons, there would still be legal recourse and the commanding officers that deployed the weapon as well as its builders and programmers could be held liable. Of course if these people were also shielded from culpability through various legal means, then Sparrow would be correct in making a strong claim that the lack of a responsible agent renders the use of these weapons immoral. It is not clear that that is happening yet so this argument should be tabled until there is evidence suggesting that military commanders are claiming autonomous weapons have a rogue status that absolves anyone but the machine itself of moral responsibility.

It is difficult to find arguments in favor of giving the choice to use lethal force solely to machines. Yet it has been argued that if machines truly did have the ability to accurately distinguish between targets, then we might expect a great deal of precision in these judgments and in that case it would be moral to allow them some autonomy on the battlefield (Lin, Abney, and Bekey, 2008). Given that machines would not experience the same combat related stresses that make human judgment prone to error on the battlefield, there might be good reason to take this claim seriously. Higher reasoning powers in humans are often the first casualty when violence erupts causing some to make regrettable decisions. A machine, for instance, would not have to instantly respond to enemy fire since it does not have a right to self-preservation. It could instead wait and fire only when it was sure of its target. Ostensibly, it would be able to deliver return fire accurately with less chance of harming innocent civilians which might marginally improve the ethical outcomes

of violent encounters. If the members of ICRAC are wrong in their assessment of the ability of these machines to discriminate between targets, then that somewhat weakens their case.

Arkin (2007, 2010), argues a more subtle point. He might agree that machines should only fire their weapons under human supervision but he would like to see that machines have the ability to autonomously decide not to fire their weapons even when ordered to do so by humans. He would rather design a system that independently reviewed the constraints on its operation imposed by the rules of operation, laws of war, just war theory, etc., that it was operating under. This system, called an "ethical governor," would continuously assess the situation and if the machine decided that the operation was beyond set parameters then it would disengage its ability to fire. In this way the machine's artificial ethical governor would also be able to control human decisions that might be immoral or illegal but that emotion or the heat of the battle had made the human actors unable to accurately process (ibid). In an interview Arkin said that, "[o]ne of the fundamental abilities I want to give [these systems] is to refuse an order and explain why" (Simonite, 2008). Again, since the machine has no right to self-preservation, it can legitimately disarm itself if needed. Additionally he argues that, the machine can gauge the proportionality of the fire it delivers to suit the situation it is in. Where a human might need to fire to ensure that the enemy is killed and no longer a threat to his or her person, the machine can take a calculated risk of destruction and instead only would apprehend an enemy rather than always delivering lethal force. An additional strength of this design would be that it would put a safety layer on the possibility that the human operators of the machine might be making an immoral decision to fire based on emotion, stress, or improper understanding of the situation on the ground. The robot would be able to disobey the order to fire and explain exactly why it did without any fear of dishonor of court martial that a human soldier might succumb to in a similar situation (Arkin 2007, 2010; Sullins 2010a). The system Arkin proposes would be far less likely to cause the false positive errors of excessive or indiscriminant use of force that other critics worry about, but it does leave open the possibility of a false negative, where a legitimate target may get away due to situations that cause the ethical governor to engage. What if this enemy then went on to commit his or her own war crimes? Surely this would be an immoral outcome. And is most likely why we have yet to see this system deployed.

We can see that the stance on banning autonomous targeting decisions is indeed one that requires more discussion and it is appropriate to place it on the table for potential restrictions in any robotic arms control deliberations.

B. *LIMITS TO THE TECHNOLOGICAL CAPABILITIES OF ROBOTIC WEAPONS*

There is a vast array of unmanned systems in use or in development in the world today. Everything from tiny surveillance drones that look like hummingbirds or spiders, to autonomous fighting vehicles and ordnance removal systems, to massive aircraft or sea vessels loaded with lethal missiles. Major world powers such as the U.S. and China are vigorously pursuing the deployment of these systems (US Department of Defense, 2007, 2011, 2012; Von Kospoth, 2009). As this arms race continues unabated, the question remains as to whether or not we could have a more just world without these systems. Altmann (2009) has argued for very strong restrictions on the proliferation of unmanned military vehicles if not a complete ban on them. Citing the success of arms control in keeping the Cold War cold, he argues that robotic arms control must be used today as a means of preventing these weapons from growing out of the ability for human control and he suggests that:

> Whereas military UAVs for surveillance already are deployed by dozens of countries, providing them with weapons has only begun recently. If unchecked by preventive arms control, this process will spread to many more countries. Later, similar developments are possible in uninhabited vehicles on land, on and under water and – to a more limited extent – in outer space. Seen from a narrow standpoint of national military strength, these developments will provide better possibilities to fight wars and to prevail in them. However, if one looks at the international system with its interactions, the judgment will be different, in particular concerning armed robots/uninhabited systems. Destabilization and proliferation could make war more probable, including between great/nuclear powers. Criminals and terrorists could get more potent tools for attacks, too (ibid).

Proliferation and escalation are the main arguments that Altmann brings to bear on this problem. If we allow the technology to continue its development without any checks to its growth, then he argues that this could lead to destabilizing events and weaponry finding its way into unsavory hands. Presumably terrorists and other ne'er-do-wells would also like cheap, reliable weapons that can cause harm to others with no risk to themselves.

ICRAC seems to agree, at least in principle, with this assessment and specifically asks for a ban on nuclear armed autonomous weapons.

There is unlikely to be anyone that would argue for uncontrolled growth in autonomous weapons, though as Singer (2009), notes in his book *Wired For War,* there was little reason for the U.S. to self-impose limits on this technology since they were the first to make extensive use of it, but the first mover advantage has

slipped. Now the interests of the U.S. would be best served by being a party to robotic arms limitation negotiations.

Another reason to place limits on robotic weapons is that there is a potential that these weapons might be successfully engaged through cyberwarfare and hijacked. An enemy could then turn the weapons systems against their owners or use them for terrorist activities. For this reason, it may be prudent to keep them unarmed and small to limit the damage they are capable of. Currently there is no known successful hijacking of a military system given that these systems utilize strong encryption on the commands and communications between the drone and its operators. There have been reports of a successfully hacked drone using the proposed civilian communications protocols now under development by the Federal Aviation Authority for the use of drones by civilian operators (Homeland1 Staff, 2012). It was found that the GPS systems could be manipulated by a third party causing the craft to veer off course and potentially crash at the bidding of the researcher from the University of Austin posing in this instance as a terrorist hacker (ibid). It is in the self-interest of parties that might be the targets of autonomous weapons systems to seek means to defeat or control these weapons through cyberwarfare, so we should expect an arms race in this sub-discipline of cyberwarfare. Paradoxically, one way to help defeat these attacks would be to build systems that do not interact that much with their operators and can do their mission stealthily and autonomously and thus avoid the notice of enemy cyberwarriors before the mission is complete. Thus it is more likely that we will see both increased encryption of military systems and more autonomous decision making by the system itself. This may also happen in the civilian sphere of operations but that is a separate topic.

C. *RESTRICTING THE DEPLOYMENT OF ROBOTIC WEAPONS*

These restrictions are concerned with where, and for what purpose, robotic weapons are deployed. ICRAC proposes a complete prohibition of deploying robotic weapons in space. Presumably this is meant to cover both autonomous and semi-autonomous machines. In addition they propose a ban on the deployment of all autonomous unmanned systems regardless of the theater of operation. Yet they do seem to tolerate some minimal use of teleoperated systems as long as they are not space based.

The ethical arguments opposing the deployment of robotic weapons in space tends to appeal to extending existing bans of the deployment of weapons of mass destruction (WMDs) in orbit or on the moon. When it comes to robotic weapons armed with WMDs, then this is a strong argument. There are grey areas however in

that many satellites have both a civilian and military use, GPS is a prime example. If we imagine a semi-autonomous satellite that provides both civilian and military functionality, then should such a machine be banned completely? Furthermore, in any future war, controlling the very high ground of space would be a vital military objective and it seems ambitious to believe that any country with advanced capabilities in space would consent to sign on to such a ban. Also, as countries and corporations begin to mine our nearby planetary and asteroid neighbors, it is very likely they will wish to protect their investments with armed planetary rovers alongside the mining bots. It is hard to see this as an immoral impulse. Of course using these machines to wantonly attack the mining operations of others is a different matter. But we have international law to appeal to in that eventuality. A better solution would be to attempt to limit the size and capabilities, or the numbers deployed, of autonomous military satellites and/or planetary rovers.

The moral support for a ban on the deployment of any autonomous robotic weapons depends entirely on whether it is decided that there is a human right not to be the target of a robotic weapon as described in the section above on limiting autonomous decision making. We were unable to come to a full conclusion on that concept. The precautionary principle would suggest that until we do, a ban is justified. But if a supra human robotic moral agent or a good moral reasoning augmentation system of the sort that Arkin proposes with his ethical governor is indeed developed, then it would actually be immoral not to deploy robotic weapons so constructed.

Even when it comes to telerobotic weapons systems, certain limits on deployment should be considered. There is wide agreement that these systems along with other high tech advances have already been used in ways that can challenge interpretations of 2(4) of the UN Charter governing the resort to force as well as the International Humanitarian Law, and the rules of armed conflict (Altmann, 2009; Arquilla, 2010, 2012; Asaro, 2011; Brooks, 2012; Caroll, 2012; IHLRI, 2013; Khan, 2002; Lin, 2010; Lin, Abney and Beekey, 2008; Marchant et al., 2011; Oudes and Zwijnenburg , 2011; Rohde, 2012; Sauer and Schörnig, 2012; Sharkey, 2008, 2009, 2010, 2011, 2012; Singer, 2009; Sparrow, 2007, 2009a, 2009b, 2011; Sullins, 2010a, 2011; Wallach and Allen, 2009).

It is quite difficult to find arguments in favor of no special controls on unmanned weapons, but Strawser (2010), has argued that there is actually a moral duty to use uninhabited aerial vehicles.

> "…any new technology that better protects the just warfighter is at least a prima facie ethical improvement and is morally required to be used unless there are strong countervailing reasons to give up that protection. I have argued that if using UAVs (as a particular kind of remote weapon) does not incur a significant loss of capability particularly the operators' ability

> to engage in warfare in accordance with *jus in bello* principles then there is an ethical obligation to use them and, indeed, transition entire military inventories to UAVs anywhere it is possible to do so" (Strawser, 2010).

It is vitally important to note that Strawser makes this claim pertains only to unmanned aerial vehicles and under the condition that these systems be used only if *jus ad bellum* (lawful state of war) has been achieved, a situation he doubts has actually obtained in all of the recent uses of these weapons.

4. SUGGESTIONS FOR THE DESIGN OF FUTURE ROBOTIC ARMS TREATIES

As we have seen in this paper so far there are some developed positions on robotic arms control. One is held by countries that are prime movers in the early development of telerobotic, semi-autonomous and autonomous weapons systems who seek to let these technologies develop largely unregulated. This position is best illustrated through the promises made by leaders such as Barack Obama who assure us that these weapons are under "tight control" but controls that are not made public (Landler, 2012). Another strong position on the other end of the spectrum is that held by the members of ICARC as described in this paper which seeks to place strong publicly stated limits on the semi-autonomous versions of this technology and an outright ban on autonomous weapons systems.[4] As mentioned above, ICARC is a coalition of academic philosophers, roboticists, and other scholars. It is important to also recognize that there has been important research into the legal definitions and justifications of cyberwarfare. The Tallinn Manual represents a three year attempt to apply international law to cyberwarfare and it outlines the legal territory that justifies certain uses of these weapons as long as there use comports to international laws and treaties (Schmitt, 2013). The Tallinn Manual does not have the force of a treaty but it is a powerful tool in the construction of future treaties for the control of cyberwarfare. The document does serve as a detailed look at the legal justifications for military operations in cyberspace as implemented by the leaders of NATO nations such as the US executive branch (Ibid). Unfortunately for our purposes here, The Tallinn Manual is specifically designed for cyberwarfare (Ibid). As such, it only strictly applies to robotic weapons systems when they are either the targets of cyber-attacks or in their potential roll as attack vectors for launching acts of cyberwar. There are many points of overlap between cyberweapons and robotic weapons but it is not a one to one match. For instance, cyberweapons as of this point in time are incapable of directly launching kinetic attacks, whereas

---

[4] See: http://icrac.net/statements/

this is commonly done with robotic weapons systems. Thus one of the primary conundrums with cyberwarfare is what activities in cyberspace actually count as acts of war and would it be just to launch a kinetic attack in reaction to a successful hack of a computer system? Since robots function primarily (but not entirely) in physical space, this particular moral question does not arise with the same force as it does with cyber-attacks. Also, it is difficult to delineate the 'zone of conflict' in cyberspace, whereas a robot inhabits physical coordinates that can be precisely determined to be either inside or outside a 'zone of conflict.' In fact that is one of the current debates in robotic warfare that seems perfectly resolvable but due to reverse adaptation, has become muddled. Drones habitually fire weapons in areas that are far from known zones of conflict and thus make life very hard for civilians who can't know for sure if they are in the line of fire (Glaser, 2013). This seems to be a very immoral situation even if it is not found to be a strictly illegal situation.

This brings us to my main point in this section. One of the earlier commenters to this paper asked: Why then cannot the "old" ethics principle be similarly applied to the cyber conflict? That is a good question, why don't the standard ethical principles developed over the last three millennia along with the laws that they have inspired just settle the issue before it arises? There are two factors that challenge this very good common sense notion which we have discussed above but will go over again here.

The existing laws of armed combat are far less capable of controlling the misuse of robotic as well as cyber weapons than we might wish given the phenomenon of technological reverse adaptation and to the special problems that law encounters around the quickly information technologies it is trying to control. Certain new information technologies can rapidly alter the social milieu and given that these technologies change faster than the laws attempting to regulate them can the result is a permanent policy vacuum (Lessig, 1999). Networked web applications, cloud computing, mobile phones, autonomous robots, are all information technologies that display this behavior. Since these technologies are all used in cyberwarfare and since warfare by its very nature is about gaining advantage over an opponent, we can expect this policy vacuum to be almost insurmountable. In addition to this, technological reverse adaptation as described early in this paper causes political policy to eventually adapt to the technological change and this process can mask the policy vacuum as the changes in social norms brought about by these transformative technologies quickly become the new normal, standard of behavior or policy. As an example look at how quickly the social norms around what is public or private information has shifted over just a generation.[5]

---

[5] For a good example see (Zick, 2012).

From this we can derive two cautions for developing robotic arms control. One is to acknowledge that no set of existing laws will be sufficient and that new laws and policies will have to attempt to keep pace with developments. The second is to recognize that since the technologies push beyond the borders of legal guidance, the very design and testing process of new technologies must be guided by moral commitments in order for these values to be expressed in the resulting technologies.

This means that concepts of *jus ad bellum* and *jus in bello* must enter into the design process and not only be imposed after the technology is released on the world. This is exactly the opposite of what common sense or current industrial practice might dictate in the design of robotic weapons, but it is a necessary addition to the design process in order to assure that these weapons comport to the values in just warfare we hold as a society. What I am saying is that these weapons will only display these values if their designers and programmers personally hold these values, they cannot be effectively imposed on the technology only from outside regulation. Let us now turn to the ethical values that are germane to the project at hand.

A. ETHICAL NORMS NEEDED TO GUIDE THE DESIGN OF ROBOTIC WEAPONRY AND POLICIES FOR THEIR USE

Above we covered the three major categories proposed for the regulation of robotic weapons systems; Autonomous decision making, technological capabilities, and deployment. In each case we looked at arguments both pro and con for limits on each. Here I will succinctly layout my suggestions, not as an attempt to write law but as an attempt to craft ethical justifications that could guide the design of robotic weapons systems or the design of laws that attempt to regulate them.

Autonomous decision making by robotic weapons systems—we are ethically justified in placing stringent controls onto automatic target acquisition and engagement by robotic weapons systems. Documents such as the Tallinn Manual provide detailed descriptions of legal targets in cyberwarfare (Schmitt, 2013). But it would be a mistake to assume that we are capable of designing systems that can properly discriminate these targets to the level necessary to comply with international law (Sharkey, 2010). There is also the unresolved but morally compelling argument that it might be a human right not to be killed by an autonomous system (Asaro, 2011, 2008). Although we need to protect robotic weapons systems from hijacking by increasing autonomy, we should not allow military expedience to reverse adapt our moral intuitions here.

Technological capabilities of robotic weapons systems—it is impossible to predict the exact path of growth in the future technological capabilities of robotic weapons systems so this means we are ethically justified in demanding precaution

over unbridled advance. We should assume that every advance will lead to reverse adaptation unless we consciously attend to ensuring that it does not. And demand that these weapons progress in more accuracy and less damage to people and property. Ethical values must guide this design. For instance, greater target acquisition capabilities and target discrimination algorithms can lead to both ethical and unethical designs and we have to consciously choose the ethical design. For instance these capabilities could advance a nations ability to commit extra judicial killings or they could be used to create a system that could target just the weapon, a Lone Ranger bot if you will. Funny as it sounds now, it just might be possible in the future and that machine would be a good ethical choice to add to our tools for conflict resolution.

Deployment of robotic weapons systems—assuming the above values are in effect, it is more ethical to use unmanned weapons systems than manned weapons systems. Unmanned systems can take chances that manned systems cannot and can therefor risk destruction to ensure that they have a legal and just reason for the use of lethal force. They can also risk destruction and use less lethal or even non-lethal weapons that would be a foolish risk if deployed by a human. But these deployments must not be such that they extend the zone of conflict beyond reason. For instance, weaponized drone satellites would require that entire hemispheres be considered zones of conflict with any civilian at any time potentially putting her or him at risk of being collateral damage with no chance of refuge. This would be an unjust world so robotic weapons must be deployed in regulated zones of conflict and every effort made to warn innocent noncombatants of their potential risk.

If all three of these sets of ethical norms are respected in the design of robotic weapons and or the design of treaties limiting their use, then we will better succeed in fostering jus *ad bellum* and *jus in bello.*

5. CONCLUSION -- A VALUES BASED CONTROL OF ROBOTIC WEAPONS

The first sections of this paper have shown that telerobotic drones in particular and semi-autonomous weapons systems in general have become a permanent weapon in the arsenals of the world. Simply put, modern political and military values are strong motivators for the continued development and deployment of robotic weapons. This means they are not going to go away. But given the weight of the ethical discomfort that has resulted from the recent use of telerobotic weapons systems, and the threat of technological reverse adaptation, it is reasonable to argue for placing limits on the design and use of robotic weapons systems. But only with the caveat that we take seriously the claim that these weapons could also be significant tools for complying

with *jus in bello* and that it would be immoral to limit them if that were the case. An accurate answer to that last question requires much more research. As we have seen in this paper there are many arguments both pro and con on this issue, but we also have the potential of settling this case with information gathered from an analysis of the last two decades of the use of telerobotic and semi-autonomous drones on the battlefield and in covert actions. This kind of research will have to wait for all of these reports to become declassified but over time they will and we will be able to say with much more certainty whether or not this technology has contributed to a more just and moral world.

It is vital to continue research such as that done by Arkin and other roboticists who seek to explore how much ethics and morality we can put into the design of our fighting machines. In fact, as was argued in the last section we are ethically required to do so. Since all technologies are expressions of the values of their makers, if we care about ethics and morality, it will show in the machines we build. In that way I humbly disagree with some of the members of ICRAC such as Sharkey when he argues that roboticists should avoid working on drones (see Sharkey, 2010). I agree that there are a large number of roboticists and engineers I would wish were not working on drones, but someone like Sharkey is precisely the kind of person that values centered design required to be working on these technologies as he has a very well developed sense of moral value and is also skeptical of military jingoism—and that is the kind of dissenting voice needed on design teams to create innovative and ethical machines.

Robotic arms control treaties must now be negotiated but we should not expect that a complete ban on these weapons is a realistic goal, except in the case of robots armed with WMDs and use of these weapons outside of the norms described in the last section. But we must also remember that the trend toward informational and cyberwarfare; of which robotic weapons is just a part, has already begun to challenge traditional notions of *jus ad bellum* and *jus in bello* through the effects of technological reverse adaptation to the point where even those cherished norms need to be redefined and renegotiated.

New information technologies have challenged traditional ethical norms over and over in the last fifty years and the pace of those challenges is accelerating. Theorists have argued that these challenges require a strong rethinking of our traditional moral norms and that we cannot rest on our laurels when it comes to moral theory (Bynum, 2000; Floridi and Sanders, 2003; Moor, 1985; Sullins, 2010b; Tavani, Herman, 2004). What worked in the past is not guaranteed to work in the future which requires a nimble regulatory structure that is proactive during the design stage of robotic weapons systems.

In this paper a realistic stance towards robotic weapons arms control was argued for but not at the cost of losing sight of the potentially positive role robotic weapon systems might play in resolving armed conflict in the most just and ethical manner possible. This is achieved by adhering to ethical norms of limiting certain aspects of autonomous decision making in regards to targeting humans, limits to the technological capabilities of robotic weapons systems, and limits to their deployment or use. And there limits must be consciously addressed during the design of the machines themselves in order to limit the effects of technological reverse adaptation.

REFERENCES

Altmann, J. (2009). Preventive Arms Control for Uninhabited Military Vehicles, in *Ethics and Robotics*, R. Capurro and M. Nagenborg (eds.) AKA Verlag Heidelberg. Accessed Jan 25 2013 at: http://e3.physik.tu-dortmund.de/P&D/Pubs/0909_Ethics_and_Robotics_Altmann.pdf

Arkin Ronald C. (2010). The case for ethical autonomy in unmanned systems. *Journal of Military Ethics* 9(4): 332–341.

Arkin, Ronald C. (November, 2007): Governing Lethal Behavior: Embedding Ethics in a Hybrid Deliberative/Reactive Robot Architecture, Technical Report GIT-GVU-07-11, Mobile Robot Laboratory College of Computing, Georgia Institute of Technology. (http://www.cc.gatech.edu/ai/robot-lab/online-publications/formalizationv35.pdf)

Arquilla, John. (2012). Cyberwar is Already Upon Us: But can it be controlled? *Foreign Affairs*, March/April, Accessed Jan 25, 2013 at: http://www.foreignpolicy.com/articles/2012/02/27/cyberwar_is_already_upon_us

Arquilla, John. (2010). The New Rules of War, Foreign Policy, March/April, Accessed Jan 25, 2013 at: http://www.foreignpolicy.com/articles/2010/02/22/the_new_rules_of_war

Asaro, P. (2011). Military robots and just war theory. In: Dabringer, G. (ed.) *Ethical and Legal Aspects of Unmanned Systems*. Vienna: Institut für Religion und Frieden, 103–119.

Asaro, Peter M. (2008). How Just Could a Robot War Be? In P. Brey, A. Briggle, & K. Waelbers (eds.), Current Issues in Computing and Philosophy (pp. 50-64). Amsterdam: Ios Press.

Brooks, Rory. (2012). What's Not Wrong With Drones? Forign Policy. Accessed Jan 25, 2013 at: http://www.foreignpolicy.com/articles/2012/09/05/whats_not_wrong_with_drones

Bynum, Terrell W. (2000). Ethics and the Information Revolution. *Ethics in the Age of Information Technology,* Linkoping University, Sweeden, pp. 32-55.

Caroll, R. 2012: Drone Warfare: A New Generation of Deadly Unmanned Weapons. The Guardian. Accessed Jan 25, 2013 at: http://www.guardian.co.uk/world/2012/aug/02/drone-warfare-unmanned-weapons

Dabringer G (ed.) (2011). *Ethical and Legal Aspects of Unmanned Systems*, Vienna: Institut für Religion und Frieden.

Floridi, Luciano and Sanders, J.W. (2003). The Foundationalist Debate in Computer Ethics. *Readings in CyberEthics (2nd ed),* Jones and Bartlett Publishers, Inc. Canada.

Gathmann, F., Gebauer, M., Medick, V., and Weiland, S. (2013). Deutschlands Drohnenpläne: Merkel rüstet auf, Spiegel Online, January 25. Accessed February 6, 2013 at: http://www.

spiegel.de/politik/deutschland/kampfdrohnen-plaene-der-regierung-stossen-auf-heftigen-widerstand-a-879701.html

Glaser, John (2013). Terrorized by Drones, Afghan Civilians Increasingly Flee Homes. *Anti War.com March 28. Accessed March 29 at: http://news.antiwar.com/2013/03/28/terrorized-by-drones-afghan-civilians-increasingly-flee-homes/*

Homeland 1 Staff, (2012). Researchers: Drones vulnerable to terrorist hijacking. *Homeland1,* July 2. Accessed on March 29, 2013 at: http://www.homeland1.com/Security-Technology/articles/1309966-Researchers-Drones-vulnerable-to-terrorist-hijacking/

International Humanitarian Law Research Initiative (IHLRI), Harvard University. Accessed on February 2, 2013 at: http://ihl.ihlresearch.org/index.cfm?fuseaction=page.viewpage&pageid=2083

Kahn Paul W. (2002). The paradox of riskless warfare. *Philosophy & Public Policy Quarterly* 22(3): 2–8.

Kim, Lucia (2013). Germany and Drones. *International Herald Tribune,* February 5. Accessed Feb 5, 2013 at: http://latitude.blogs.nytimes.com/2013/02/05/germany-and-drones/?nl=opinion&emc=edit_ty_20130205

Landler, Mark (2012). Civilian Deaths Due to Drones Are Not Many, Obama Says, *The New York Times,* January 30. Accessed March 28, 2013 at: http://www.nytimes.com/2012/01/31/world/middleeast/civilian-deaths-due-to-drones-are-few-obama-says.html?_r=0

Lessig, Larry (1999). The Code is the Law. *Industry Standard, April 19-26, 1999.*

Lin, Patrick (2010). Ethical blowback from emerging technologies. *Journal of Military Ethics* 9(4): 313–331.

Lin Patrick, Abney, Keith,, and Bekey George. (2008). Autonomous Military Robotics: Risk, Ethics, and Design. San Luis Obispo, CA: California Polytechnic State University.

Lin P, Bekey G and Abney K (eds) (2012). Robot Ethics: The Ethical and Social Implications of Robotics. Cambridge, MA: MIT Press.

Marchant, G.E. et al. (2011). International governance of autonomous military robots. The Columbia Science and Technology Law Review 12: 272–315.

Medick, V. (2013). 'Credible Deterrence': Germany Plans to Deploy Armed Drones, *Spiegel Online*, January 25, 2013. Accessed February 6, 2013 at: http://www.spiegel.de/international/germany/germany-plans-to-deploy-armed-drones-in-combat-abroad-a-879633.html

Moor, James H. (1985). What is Computer Ethics? *Metaphilosophy,* 16 (4), pp. 266-275.

Qazi, Shehzad H. and Jillani, Shoaib (2012). Four Myths about Drone Strikes. *The Diplomat,* June 9. Accessed March 28, 2013 at: http://thediplomat.com/2012/06/09/four-myths-about-drone-strikes/

Oudes C and Zwijnenburg W. (2011). Does Unmanned Make Unacceptable? Exploring the Debate on Using Drones and Robots in Warfare. Utrecht: IKV Pax Christi.

Rohde, David. (2012). The Obama Doctrine: How the President's War is Backfiring. *Foreign Policy,* March/April. Accessed on Feb 1, 2013 at: http://www.foreignpolicy.com/articles/2012/02/27/the_obama_doctrine

Sauer, Frank and Schörnig, Niklas. (2012). Killer Drones – The Silver Bullet of Democratic Warfare? Security Dialogue 43:4, 363-380.

Schmitt, Michael N. (2012). International Law in Cyberspace: The Koh Speech and Tallinn

Manual Juxtaposed, 54 *Harv. Int'l L.J.* Online 13. Accessed March 29, 2013 at: http://www.harvardilj.org/2012/12/online-articles-online_54_schmitt/

Schmitt, Michael N. (Gen. Ed.) (2013). Tallinn Manual on the International Law Applicable to Cyber Warfare. Cambridge University Press. Accessed on March 3, 2013 at: http://www.ccdcoe.org/249.html

Sharkey, N. (2008). Grounds for Discrimination: Autonomous Robot Weapons. RUSI Defence Systems, 11 (2), 86-89.

Sharkey Noel. (2009). Death strikes from the sky. IEEE Technology and Society Magazine 28(1): 16–19.

Sharkey Noel. (2010). Saying 'no!' to lethal autonomous targeting. Journal of Military Ethics 9(4): 369–383.

Sharkey Noel. (2011). Moral and legal aspects of military robots. In: Dabringer G (ed.) Ethical and Legal Aspects of Unmanned Systems. Vienna: Institut für Religion und Frieden, 43–51.

Sharkey, Noel. (2012). Killing Made Easy: From Joysticks to Politics. In Lin, P., Abney, K., and Bekey, G.A., Robot Ethics: The Ethical and Social Implications of Robotics (pp. 111-128). Cambridge, MA: MIT Press.

Simonite, Tom. (2008). ‚Robot Arms Race' Underway, Expert Warns. *New Scientist,* February 27. Accessed on Feb 1 2013 at: http://www.newscientist.com/article/dn13382-robot-arms-race-underway-expert-warns.html

Singer, Peter, W. (2009). *Wired For War*, New York: Penguin Press.

Sparrow, Robert, W. (2007). Killer Robots. Journal of Applied Philosophy, Vol 24, No. 1.

Sparrow Robert, W. (2009a). Predators or plowshares? Arms control of robotic weapons. IEEE Technology and Society Magazine 28(1): 25–29.

Sparrow, Robert, W. (2009b). Building a Better WarBot: Ethical Issues in the Design of Unmanned Systems for Military Applications. Science and Engineering Ethics 15: pp. 169-187.

Sparrow Robert W. (2011). The ethical challenges of military robots. In: Dabringer G (ed.) Ethical and Legal Aspects of Unmanned Systems. Vienna: Institut für Religion und Frieden, 87–102.

Strawser BJ. (2010). Moral predators: The duty to employ uninhabited aerial vehicles. Journal of Military Ethics 9(4): 342–368.

Sullins, John. P. (2010a). RoboWarfare: Can Robots be More Ethical Than Humans on the Battlefield? Ethics and Information technology 12(3): pp. 263-275.

Sullins, John P. (2010b). Rights and Computer Ethics. *The Cambridge Handbook of Information and Computer Ethics, Floridi, L. (ed), pp. 116-133,* Cambridge University Press, UK.

Sullins, John P. (2011). Aspects of telerobotic systems. In: Dabringer G (ed.) Ethical and Legal Aspects of Unmanned Systems. Vienna: Institut für Religion und Frieden, 157–167.

Tavani, Herman (2004). Ethics and Technology: Ethical Issues in an Age of Information and Communication Technology. *Wiley,* New York USA.

US Department of Defense (2007). Unmanned Systems Roadmap 2007–2032. Washington, DC: US Department of Defense.

US Department of Defense (2011). Aircraft Procurement Plan: Fiscal Years (FY) 2012–2041. Washington, DC: US Department of Defense.

US Department of Defense, November 12, (2012). Autonomy in Weapons Systems. Directive

Number 3000.09. Accessed Jan 25 2013 at: http://www.dtic.mil/whs/directives/corres/pdf/300009p.pdf

Von Kospoth, N. (2009). China's leap in unmanned aircraft development. Available at: http://www.defpro.com/daily/details/424/ (accessed 20 October 2011).

Wallach, W. & Allen, C. (2009). Moral Machines: Teaching Robots Right from Wrong (New York: Oxford University Press).

Winner, Langdon (1978). Autonomous Technology: Technics-out-of-control As a Theme in Political Thought. *MIT Press*.

Woods C (2011). Drone war exposed. Accessed Jan 25 2013 at: http://www.thebureauinvestigates.com/2011/08/10/most-complete-picture-yet-of-cia-drone-strikes/

Zick, Colin J. (2012). Survey Reveals Generation Gap in Employee Attitudes Toward Confidential Information. *Security, Privacy and the Law,* Blog published by Foley Hoag LLP. Accessed March 29 2013 at: http://www.securityprivacyandthelaw.com/2012/06/survey-reveals-generation-gap-in-employee-attitudes-toward-confidential-information/

Zubair Shah, Pir. (2012). My Drone War. *Forign Policy,* March/April. Accessed Feb 1, 2013 at: http://www.foreignpolicy.com/articles/2012/02/27/my_drone_war?page=0,4