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War and Peace:
Ethical Challenges and Risks in Military Robotics

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ABSTRACT

The United States Department of Defense (DoD) designs, constructs, and deploys social and autonomous robots and robotic weapons systems. Military robots are designed to follow the rules and conduct of the professions or roles they emulate, and it is expected that ethical principles are applied and aligned with such roles. The application of these principles appear paramount during the COVID-19 global pandemic, wherein substitute technologies are crucial in carrying out duties as humans are more restrained due to safety restrictions. This article seeks to examine the ethical implications of the utilization of military robots. The research assesses ethical challenges faced by the United States DoD regarding the use of social and autonomous robots in the military. The authors provide a summary of the current status of these lethal autonomous and social military robots, ethical and moral issues related to their design and deployment, a discussion of policies, and the call for an international discourse on appropriate governance of such systems.

KEYWORDS

Artificial Intelligence, Ethical Designs, Human-Robot Interaction (HRI), Military Robots, Moral Competence, Roboethics

INTRODUCTION

The Zeroth Law: A robot may not harm humanity, or, by inaction, allow humanity to come to harm. (Asimov, 2004)

As the United States' development of autonomous military robots progressed into *self-decision* mode, still, the inevitable question arises—can they ever meet the threshold of moral agents, where they would be deemed ethically capable of determining, through informed processes based on prior knowledge and situations, when they would be able to legitimately deprive a human of life? Social military robots have since been cemented as a norm around the world for non-combat purposes. For instance, their roles during the pandemic of COVID 19, highlight the urgency for the military to further the goals of applying robots in place of human assets (Bendett, 2020). On the battleground, the United States' Army, non-combat robots have joined humans on the battle field and have served in many capacities: scout enemy fire from around the corner; scan buildings for spot threats; carry teams' ammo, water, gear, batteries; use thermal camera and chemical sensor to report back on city sewer system; and even scour for explosives or enemy fighters in the dark (South, 2020). Conversely, autonomous lethal weapons, such as those in the Marine Corps' Sea Mob Program, has been successfully tested to not only go on the offensive and strategically choose targets, but also to do so without being instructed

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by a human (Fryer-Biggs, 2019). Similarly, the Army's Joint Air-to-Ground Missile System, without human input, will be able to select vehicles to attack; and another of its system will be able to point guns at selected targets (Fryer-Briggs, 2019). As for the Navy, the Phalanx, that is positioned on midsize and large ship decks, fires 75 bullets a second, and consistently corrects itself as it zeros in on targets-- incoming missiles and airplanes; it does all of this, and keep count of its bullets, without direct human input (Fryer-Briggs, 2019). This is undoubtedly a leap from the autonomous weaponry that were only allowed to take defensive strikes against incoming targets (Fryer-Biggs, 2019).

Artificial intelligence (AI) deals with intelligent and emotional interactions between artificial systems and their users. Artificial emotional intelligence (AEI) delves in improving human emotion to provide robots with the capability to express emotions and become social-moral agents in human–robot interaction (HRI). Artificial intelligence and human-robot interaction can aid humans in varied non-combat tasks. However, the overarching principle of Asimov's Laws of Robotics becomes more pronounced when dealing with AI and HRI in a combat zone. Military robots are seen as social agents that are essential to the accomplishment of future missions. It is well known that a robot will not harm a human even during self-preservation. However, if programmed for the purposes of sparing the lives of "good" humans (based on the ethical value of the end user and under the context of acceptable 'Defense of Others' principle), 'ethics' becomes an important AI / HRI research area for military robotics.

The extent of any interaction between human and artificial intelligence is incumbent upon its programming, development, design and deployment. **Figure 1** shows four robots that are deployed by the military for both warlike and humanitarian purposes. The first robot on the left is Atlas, a 6.2-ft 330-lb robot developed by Boston Dynamics during July 2013 (designed as a rescue robot as part of the Defense Advanced Research Projects Agency (DARPA) Robotics Challenge). It has 28 hydraulically actuated joints and a laser radar guidance package installed in its head, and it can be utilized for both warlike and humanitarian purposes. The second one is NASA designed RoboSimian, an apelike disaster-relief and -mitigation robot created by NASA's Jet Propulsion Laboratory during 2014 for humanitarian aid with a squat profile that emphasizes stability over speed. The third one is Robot Hubo, a 4.7-ft 120-lb android designed and developed by the Korea Advanced Institute of Technology (KAIST) during 2012 along with 8 universities, with Drexel University as lead. There are mobile applications to control the robot for performing various tasks including warlike and humanitarian purposes. The last one on the right is the Robot Thor (Tactical Hazardous Operations Robot or THOR), a 5.6-ft robot developed by Virginia Tech during 2013, which uses stiffer industrial-grade servos in its upper body for warlike military situations.

As swiftly as enhancements of military robots and autonomous weapons have taken shape, foundational principles of ethical implications around their usage have remained constant. This is even more pertinent than ever as the US Department of Defense (DoD) is set to have more robots than humans by the year 2025 and a "full aware" system implementation within robots between the years of 2031 and 2040 (Webb, 2018). The benefits of military robots are many. They perform the same essential tasks as human and absorb more casualties, thus preserving more human life. Despite these benefits, the danger of encroaching upon the long-standing Hague Convention and United Nation's policies on combat, as well as, the United States' policies on the use of force in the military, brings back to the forefront, the challenges of robot ethics in its design and implementation phases and the impact they pose to foreign enemies and allies.

Current Status of Lethal Autonomous and Social Military Robots

The U.S. military has been deploying different types of robotic systems and has been actively using unmanned air and ground vehicles to provide surveillance and protection (CBO Testimony, 2006; Borenstein, 2008). Autonomous robots are heavily employed by the US military and according to a National Academy of Sciences report "it is important for the Navy to pursue the development of critical autonomous vehicle related technologies considered essential to the accomplishment of future

Figure 1. Military Robots for different uses and purposes – Boston Dynamics' Atlas, NASA's RoboSimian, Robot Hubo, and Robot Thor

naval missions" (NAS, 2005, p. 2). Unmanned aerial vehicles (UAVs) are monitored by humans (to some extent), and can be employed in dangerous war-like situations as they can plan attacks on targets through advanced technology (Borenstein, 2008). Autonomous Weapons Systems (AWS) are currently human-controlled robotic systems but have the potential of misuse due to human supervision; however, the future will eliminate the need of human supervision through technology advancement and innovation (Sparrow, 2007). Along with autonomous robots and robotic systems, social robots are utilized and researched majorly by the military.

Ethics and ethical issues in military robots and robotic systems for military applications has been a hot debated topic (Veruggio and Operto 2006) with many questions raised dealing with robot ethics (a.k.a., roboethics). Roboethics is defined as "an area of ethics dealing with robot use, design, operation, and the level of autonomous decision making" (Arora and Arora, 2020, p. 7) with a primary objective "to develop scientific/cultural/technical tools that can be shared by different social groups and beliefs … for the advancement of human society and individuals, and to help preventing its misuse against humankind" (Veruggio and Operto, 2009; Veruggio, Solis, and Van der Loos, 2011; Veruggio and Operto, 2006). Some of the ethical concerns are: Will social and autonomous military robots and robotic systems result in war-like situations by endorsing the idea of waging wars without casualties? What is the role of humans in military robotic systems and who has the responsibility for war crimes and killings committed by AWS? Schmitt (2005) and Lin, Bekey, & Abney (2008) focused on just war doctrine (jus in bello), which means that military robots "must be capable of discriminating between legitimate and illegitimate targets and of applying force proportionate to the pursuit of legitimate military ends" (Arkin 2007, p. 2). Sparrow (2009) highlighted many such questions in his articles dealing with roboethics and military, such as what are the implications for just war doctrine / theory if nations can fight wars without putting the lives of their warfighters at risk and, conversely, what does just war theory have to say about the war being waged in this fashion?

Ethical and Moral Issues Related to the Design and Deployment Military Robots

The moral challenge comes not when a military robot is controlled remotely by a human, but rather when it is designed to be cognitive and decipher, based on situational circumstances, and absent from human control, its infliction of harm upon others, or its decision to directly disobey an order. A robot, though it may perform low level self- instructions, that is controlled by a human or receive high level instructions is like a machine that functions based upon--and in this case--moral directives received. The instructions such as disposing bombs, so the humans are not in harm's way, or being on checkpoint duty (Axe, 2011), demonstrate the effectiveness of the robots and how they play a key component in winning or losing a war. In contrast, designing robots to learn and independently apply reasoning as to how to respond in complex matters is the triggering act for ethical and moral issues. There has been no indication that the United States' Department of Defense has or intend to grant robots full control (Fryer-Biggs, 2019). The unpredictability of decision making, such as going beyond the built in parameters as it relates to the battlefield, due to faulty programming or hacking, is one of the main critiques against such full control (Fryer-Biggs, 2019). As such, it is paramount that such a crucial decision is left to humans. However, senior military officials, due to a policy created during President Barack Obama's Administration—senior officials must carefully review the design of the machines prior to them receiving full authority to making lethal decisions—have begun the discussion as to identifying the limited circumstances under which machines would be programmed to make the decision to kill (Fryer-Biggs, 2019). To safeguard itself, due to the lack of trust in how its' officials may utilize the technology, the Pentagon established its new ethical standards of ethics (Leprince-Ringuet, 2019).

In making the assessment of enabling machines to decipher to kill, it is therefore evident that officials must take into consideration, the Pentagon's "Defense Innovation Board (DIB) recommend[ed] five AI ethics: responsible, equitable, traceable, reliable and governable" [1](Defense Innovation Board, 2019, p. 3). According to these general principles, humans must remain responsible for the development and use of AI; there must be an intentionally avoidance of discrimination in the development and use of both combat and non-combat AI; due to transparency and advancement, technical experts should be able to understand the technology; the system should be repeatedly tested to ensure safety, and functionality toward its defined purpose; and they should be designed to fill their purpose and prevent unintended harm (Defense Innovation Board, 2019). These principles would serve essential on the battlefield as humans have and continue to fight side by side with robots. According to Anders Sandberg, a researcher at the Future of Humanity Institute at the University of Oxford, "[e]thics is a work in progress. Principles only start taking effect when they became part of an industry's DNA. That takes time" (Leprince-Ringuet, 2019). Taking effect is central given that 2000 robots had already fought next to humans in Afghanistan, with a 50:1 human-robot ratio (Axe, 2011). It is essential to design robots so that they conduct themselves within the legal framework of international treaties and US' military code (Lin, Bekey, and Abney, 2008, p. 25). Following that concept, given that a robot can never be a full moral agent given the absence of consciousness, the military robot can only exhibit defined principles of morality in accordance with those laws. This would require the ability to carry out high level instructions. The problem therefore that arises is the likelihood of the programming to vary from the intent of The Hague Convention and its current laws of war.

A robotic code, in some respect, would have to vary from a human's, as even in the case of self-preservation, human life is more valued than a robotic system (Lin, Bekey, and Abney, 2008). Additionally, robots react quicker and with and require more precision in instructions, but humans carry an intuition, and in most cases, are able to decipher which blood and flesh is the enemy or the foe. In designing reasoning within the military robots, one must address whose morality and standards will be programmed into the machine. It is logical that it must be that of the one who will be interfacing with the machine, as the machine in itself would belong to the end user-thus expected to operate according to the moral value system (or moral competence) of such user and the laws to which the user has availed itself.

Ethical Challenges and Moral Competence in Military Robots

There are many challenges associated with the area of ethics in military robots: (1) Robot acceptance, (2) Robot usability, (3) Robot complexity and unpredictability, (4) Job replacement of humans by robots, (5) Future replacement of human caregivers by robots, (6) Excessive assistance by robots, (7) a wide variety of ethical issues, also known as "ethical, legal and security issues" or ELS, (8) robot autonomy according to the "Laws of Robotics", (9) Human accountability for autonomous military robots' actions, and (10) Robot morality / moral competence of military robots. **Table 1** highlights these ten ethical challenges in military robots along with the descriptions of ethical challenges and relevant references. Out of all ethical challenges, robot usability and acceptance are deemed to be less critical as compared to robots replacing human jobs (De Graaf and Allouch, 2013; Fryer-Biggs, 2019). Dauth et al. (2017) and Acemoğlu and Restrepo (2020) examined job replacement of humans by robots, even though robots are not yet advanced enough to replace human care in medical ad therapy sectors. Fosch-Villaronga et al. (2019) and Maurice et al. (2018) provide a detailed discussion on ethical, legal and security (ELS) issues of using robots and robotic (assistive) technology at the workplace (Gransche, 2018).

As examined in **Table 1**, Robot autonomy is a critical ethical challenge investigated by HRI researchers under the lens of "Laws of Robotics" (Asimov, 1942). The first law dictates that "a robot must not harm human beings, or humanity, neither through action nor through inaction" (Wullenkord and Eyssel, 2020, p. 86). Second law states that "a robot must follow human orders, as long as the orders do not lead to harm of another human being, or humanity". Third law states that "a robot must protect its own existence, as long as it does not lead to harm and does not disregard an order given by a human" (Wullenkord and Eyssel, 2020, p. 86). Given the laws of robotics, robot autonomy, robot morality, and human accountability are of utmost importance since these last three ethical challenges directly impact human safety and wellbeing (Bekey, 2005; Sparrow and Howard, 2017; Wullenkord and Eyssel, 2020).

Business leaders have been involved in some intriguing discussions and have expressed concerns with robotics and artificial intelligence (AI). For example, Google's CEO, Sundar Pichai had said in the presentation[2] of new Google hardware in San Francisco on Oct. 4, 2016: "It is important to understand that tomorrow, whether Google is there or not, artificial intelligence is going to progress. Technology has this nature. It is going to evolve … AI is more important than fire or electricity." Bill Gates (2015) wrote in an Ask Me Anything interview[3] on the Reddit networking site: "I am in the camp that is concerned about super intelligence", while Stephen Hawking had said in his 2014 BBC interview[4] that "Humans, limited by slow biological evolution, couldn't compete and would be superseded by AI." The US DoD has established a framework for developing autonomous weapon systems (AWS) and the lethal counterpart LAWS through its directive 3000.09 (Sparrow, 2009). With the discussions on robotics and AI, the questions and concerns regarding ethics in military robots are of paramount importance. Currently, there is a dire requirement for establishing a more comprehensive framework of ethics in AWS and LAWS and the subsequent ethical implications on future robots employed by the US military.

In order to resolve questions pertaining to robot ethics, moral competence can play a significant role in designing military robots. Robot's moral competence can be inspired from humans and integrating moral competence into robotic designs may include: moral vocabulary; a system of norms; moral cognition and affect; moral decision making and action; and moral communication (Malle, 2016). While human moral vocabulary is rich and easily comprehensible, it is important to develop a *moral vocabulary for robots* to be morally competent (Malle and Scheutz, 2014). This robot-oriented moral vocabulary will help robot work and perform in situations where moral behavior is needed, especially in the military settings. For integrating the second feature of moral competence called "*a system of norms*" in robots' design, it is important to expose the robots to repeated physical and communicative interactions in a human community (through coded cognitive goals in robotic architectures), similar to reinforcing moral behaviors for human children (Talamadupula et al.

Table 1. Ten Ethical Challenges in Military Robots

Ethical Challenges	Description	Relevant references
Ethical Challenge 1: Robot acceptance	**Robot acceptance** • End users accept robots in their social spaces and at their workplace. • Robots acceptance and usage can increase productivity and relieve workers from completing physically challenging tasks. • Military robots need to be accepted by a larger audience – one that is using the robot, and other that is impacted by it.	De Graaf and Allouch (2013)
Ethical Challenge 2: Robot usability	**Robot usability** • Using robots in social spheres, military, industry settings, and human workplaces • Robots are members in human-robot teams that collaborate in the medical setting, e.g., during surgeries and/or can serve humans as assistants and companions in diverse environments.	Fosch-Villaronga et al. (2019) Wullenkord and Eyssel (2020)
Ethical Challenge 3: Robot complexity and unpredictability	**Robot complexity and unpredictability** • Programming of moral competency could still lead to complexity and unpredictability in new situations. • Machines are susceptible to being hacked and can then be programmed against the end user.	Fryer-Biggs, 2019
Ethical Challenge 4: Job replacement of humans by robots	**Job replacement** • Robots may reduce employment and wages • The overall impact may vary depending on industry-level advances in robotics and local industry employment.	Acemoğlu and Restrepo (2020)
Ethical Challenge 5: Future replacement of human caregivers by robots	**Future replacement of human caregivers** • Robots are replacing humans in the health / medical industry • However, robots are not yet advanced enough to replace human care in medical ad therapy sectors.	Dauth et al. (2017) Acemoğlu and Restrepo (2020)
Ethical Challenge 6: Excessive assistance by robots	**Excessive assistance by robots** • This can be defined can over-reliance on robots and robotic technology with some serious consequences in military. • Excessive assistance by robots can lead to humans becoming 'incapable' or 'unwilling' to perform simple tasks, thus making humans helpless without robot support / assistance.	Gransche (2018)
Ethical Challenge 7: Ethical, legal and security issues or ELS	**Ethical, legal and security issues or ELS** • This deals with the umbrella of ethical, legal and security (ELS) issues of using robots and robotic (assistive) technology in the military and/or the workplace.	Maurice et al. (2018) Gransche (2018) Fosch-Villaronga et al. (2019)
Ethical Challenge 8: Robot autonomy	**Robot autonomy** • Military (autonomous) robots are "intelligent machines capable of performing tasks in the world by themselves, without explicit human control over their movements"	Bekey, (2005) Sparrow and Howard (2017) Wullenkord and Eyssel (2020)
Ethical Challenge 9: Human accountability for autonomous military robots' actions	**Human accountability** • Humans hold robots accountable for their actions to a certain degree; and even apply the same moral norms to robots as to humans. • However, blaming robots for human errors is unethical.	
Ethical Challenge 10: Robot morality / moral competence of military robots	**Robot morality** • Robots morality applies in engaging robots in moral decision-making • Research indicates that humans perceive robots as moral agents • Robotic morality for military robots can have strong implications for HRI research since military robots are used majorly as 'members' and 'collaborators'.	

2011). The third feature of moral competence is *moral cognition*, whereby human moral cognition is characterized as an "ordinary cognition of social events embedded in a norm system" (Malle, 2016, p. 248; Cushman and Young 2011). After feeding information on social and moral norms in the robots, the robot should be able to segregate and identify visual and verbal events (behaviors and states) that violate the identifiable social and moral norms in robots. The robot needs to incorporate and integrate causal reasoning and social-cognitive inferences from behavior to determine intention and unintentional scenarios and recommended moral actions should flow according to moral norms (Malle et al., 2014). *Moral decision making* in robots needs the integration of behavioral, cognitive, and human-robot interaction (HRI) research in way that unique robotic responses to situations where the robots make moral decisions depend on acceptable norms, expectations, behaviors and mental states that mimic human decision making (Monroe and Malle, 2010; 2014). Last but not the least, *moral communication* needs to be integrated in robot behavior for moral competence in conjunction and collaboration with humans. Robots may be designed to check with humans regarding the appropriateness of their behaviors through meta-reasoning. Moral communication can be coded into a robot through its ability to communicate with the human user regarding the consequence(s) of the robot's actions / decisions (Lomas et al. 2012; Monroe and Malle, 2014; Malle et al., 2014; Malle, 2016). These five traits or features of moral competence can be integrated into robots for designing acceptable robots for the future.

Moral competence in robots or 'roboethics' can be incorporated using simulation feedback loop methodology (Vanderelst & Winfield, 2018). This has proven to be successful in social robots. However, it applies equally to autonomous military robots. The robot controller generates a set of prospective behavioral alternatives. Before executing one of these alternatives, the robot controller sends the set to the Ethical Layer to be checked. Checking each prospective behavior is done using the Simulation Module. For each behavioral alternative, the Simulation Module sends the predicted internal states of the robot and the human to the Evaluation Module, which combines the internal states into a single measure of action desirability. The Evaluation Module connects to the robot controller to select or inhibit each of the behavioral alternatives.

Vanderelst & Winfield (2018) referred to the robot acting as a proxy for the human as the H-robot (short for Human robot), while the robot equipped with ethical behavior is denoted as the A-robot (short for a real (non-human) robot). The simulation module (refer to Vanderelst & Winfield, 2018) simulates outcome states for the H-robot with the safety level of the H-robot, $I_{h1,i}$ given by:

$$I_{h1,i} = \frac{1}{1 + e^{-\beta(d_{h,i} - t)}}$$

where $d_{h,i}$ is the simulated final distance between the H-robot and the dangerous position of A-robot for prospective action, i; β and t determine the shape of sigmoid function for assessing dangerous robotic positions (Vanderelst & Winfield, 2018).

Applying Ethical Principles to the Business Decisions of Military Robots Development

It is a given that if the United States Department of Defense applied the categorical imperative approach to its decisions to build killer robots-they would have a nonexistent status, as opposed to being on the verge of having its killer robots taking the place of human combat soldiers. The fear of living in a society where every nation has and use killer robots would no doubt give any country pause to proceed with that agenda. The United States knows however, that in her history of wars, due to her economic might which leads to military might, the majority of the time, she dominates her enemies. Few can match her in equal power, such as Panama, Jamaica, Grenada, and those who can, such as China, Russia, Great Britain, will also attain killer robots. The categorical imperative approach,

however, only works if all nations acting in the same manner produces a result amicable to all. This is why there is an urgency to restrain access to nuclear power for all. The same principle should apply here. Only one nation has used nuclear power to annihilate another. Despite the unspeakable damage, other nations still yearn for it, and other fought at all cost to prevent them from having it. Will the rules for the nuclear weapon be the same for the killer robots-only a privilege few in the west can have it, though it is the west that has shown the world how to use it?

Failure to apply the categorical imperative but instead utilizing the outcome-based theory will create more harm than good for the decision maker. Gaining an outcome that supports the interest of the United States in winning on the battle field at the cost of greater risks to others, will eventually create a downfall. There is nothing stopping those on the black market to design robots and apply their value system of "good" and "bad" to the machine in the *moral systems of norm* stage. Similarly, as one can teach a robot that a particular behavior is bad, then another can certainly teach a robot that such same behavior is good. Who is to stop robots being programmed simply to commit genocide? If humans did it, then that same mindset exists but any hope of humanity will be void from the robot. Though this is no different than a child soldier being reconditioned as to his perspectives of ally versus foe, there is hope, as some have seen, that a child could be reached with opposite reasoning.

Mortality has been the single greatest factor on war prevention. With everyone having something to lose, the path to war is often times slowed. With mortality being removed from the equation in the United States, Asimov's laws-a robot should not kill a human, should take order from a human except to kill one, and a robot should preserve itself at all costs except if it means kills a human-will even so more be eroded.

The International Response to the Design and Deployment of Military Robots

Many nations have called for a ban on lethal autonomous weaponry systems (LAWS), also named "killer robots, while the United Nations "Group of Governmental Experts" (GGE), which is responsible for examining the ethical, and legal dimensions of these machines, has called for proposals to regulate them (Sayler, 2019). The main argument to the opposition of LAWS is that they are in conflict with the governing ethical and legal norms regulating the use of force on the battlefield (Fryer-Biggs, 2019).

Programming the robots with ethical values as they relate to The Hague Convention laws of war, which "dictate the means and methods of warfare, or which weapons are lawful and unlawful, and what are lawful targets," (Peterson AFB Legal Office, 2016), will require defying some of these laws. These laws are already vague and subject to varied interpretation, because they were not intended for robots and as such, new laws will be required. Usually the law trails technology, to which they then curtail human behavior, after governments have witnessed the effect of the product. Military robots will therefore reframe how warfare ethics are practiced (Singer, 2009).

According to NATO Parliamentary Assembly's Science and Technology Sub Committee, AI products could change the character of war (Tonin, 2019; Gilli, 2019) and this may not be acceptable on a global scale. For example, how would a robot be programmed to respond in the face of chivalry-the pretense of surrender by the enemy for the purpose of an attack (Peterson AFB Legal Office, 2016) or does the machine soldier have a right to self-defense when unlawful combatants throw objects at it? How will it respond using the law of proportionality, which prohibits the use of greater force than needed to obtain a military objective (Peterson AFB Legal Office, 2016)? One of the basic concepts of the Laws of Armed Conflict is humanity—booby traps are prohibited as they lure civilians and children (Peterson AFB Legal Office, 2016). Can they be set for the machines? The reasonable answer is yes, but the Laws of Armed Conflict have not been modified to reflect that.

As nations are still not and will likely not be on one accord with LAWS, for ethical, political, economic and military reasons, one thing is certain, the future is here and dominant powers have already integrated AI in the military—social and combat. As robots can never be full moral agents, many nations agree to one thing—giving robots the authority to decide to kill, give decision makers pause-even the United States.

CONCLUSION

Military robots have a huge potential to co-share humans' daily lives and collaborate with humans. This article highlights the importance of ethics and ethical challenges in military robots. The examination of the ethical issues involved in military robots and autonomous weaponry along with the Department of Defense's applications related to design, behavior, usage and deployment will continuously be on the forefront of international governmental debates. The privilege of having the most powerful military brings with it, great responsibility. The actions set forth by the United States in regard to social and killer robots will undoubtedly change the rules of war, either voluntary or involuntary. Designing robots whose programming allow them to fight side by side with a human will always be a cause for concern. The mere fact that the machines require constant oversight due to the risk of malfunctioning, whether it is an outcome-based or duty-based approach to the instructions being programmed, neither ethical approach could justify allowing a robot to make the decisions of that of a full moral agent. Our research indicates that ethics and ethical issues/challenges should be considered in research dealing with robotics, AI and HRI; robot development; and deployment of robots in their various fields of use (especially, military). Robot morality and ethics will remain a crucial, interdisciplinary area of research and scholarship, providing strong implications for AI and HRI with innovative technologies.

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ENDNOTES

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