The Proliferation of Autonomous Weapons Systems: Effects on International Relations

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The battlefield of today has entered a new era in which the use of advanced robotics-based autonomous weapon systems is steadily growing. Given current international circumstances, the United Nations will, in all likelihood, find it difficult to effectively ban or limit their use in tandem with their technological development. Autonomous weapon systems are likely to become the mainstay of combat within the next two decades or so precisely because of the difficulty in restricting them and due to their advantages for any army that deploys them. Given this possibility, this article examines the possible effects of the widespread proliferation of autonomous weapon systems on the future battlefield and on the international arena, particularly its political, economic, and even civil aspects, while referring to fundamental concepts in international relations and security studies. The article stresses that these autonomous weapons systems will have a far greater impact on the world than has been discussed in legal and moral contexts, which, to date, have formed the core of the contemporary discourse on the subject.

Keywords: Autonomous weapons systems, robots, future battlefield, autonomous devices, arms control

Introduction

The battlefield is entering a new era. The development of technologies, their miniaturization, their dropping costs, and widespread proliferation have

transformed what just a few years ago seemed like science fiction into the prevailing reality. Among these technological trends, the proliferation of autonomous weapons systems—robots capable of applying lethal force and killing people autonomously, without the involvement of another human—in the hands of combat troops is growing. The ability to apply lethal force without human involvement raises many issues, including changes in the battlefield, warfare, and in the entire international arena.

The UN committee dealing with the 1980 Convention on Certain Conventional Weapons has discussed the development of such systems since 2013, but the discussion is still in its infancy. Furthermore, the ramifications of these systems in realms other than arms control are still unclear. Given this lacuna, this article seeks to highlight the possible effects of this technology on international relations, especially power relations and the use of power to apply force. This article also will contribute to the knowledge base being constructed on the subject, which currently relies on extensive writing about technology, especially information technology, and international relations.

Will the expanding use of autonomous weapons systems in general change the international arena, given the effect of various phenomena that were and are still common in the era of warfare with manned weapons and even ranged weapons? This article will seek to answer this question, first by defining the concept of autonomous weapons systems, describing their development, and forecasting their future use in the defense arena. Afterward, the article will present the difficulties in limiting them and the future ramifications of the extensive use of such systems on the international arena and on the use of force. The article asserts that autonomous weapons systems will affect not only the battlefield itself and phenomena usually associated with the use of force, but they will also potentially affect the broader concept of power and the international arena as a whole. Thus, we need a more broad-ranging discourse on the topic than we have at present, especially in the context of international law and arms control.

Autonomous Weapons Systems

In recent years, the discussion about autonomous weapons systems has expanded significantly in scientific, military, academic, and diplomatic circles, and at times even in certain political circles. But, despite the widespread debate, the definition of autonomous weapons systems is still complex and

depends greatly on who does the defining, what their objectives are, and what their concerns are. An autonomous weapons system can be defined as an unmanned or robotic systems, which has the ability to function with no or little human involvement by means of sensors and processors and carry out military missions, including the use of lethal force. The use of sensors and processors allows the system to operate in a previously unknown environment and to make decisions in real time based on previously written algorithms and commands provided by its operators, but the action is adapted to the conditions that prevail in the system's environment.

The use or even development of these systems has generated a great deal of opposition due to legal and moral reasons. Despite this opposition, however, it will be very challenging to limit them using the usual international treaties and committees. In fact, their use is likely to greatly expand in the coming decades, because of their inherent advantages of removing human combatants from harm's way and reducing the reliance on people in warfare; increasing the speed, accuracy, and rate of fire; being absolutely obedient to commands; lacking human needs and emotions, such as hunger, fear, fatigue, and so forth, and the fact that several systems can be operated in perfect coordination and synchronization.

The definition of an autonomous weapons system (AWS), also referred to as lethal autonomous weapons system (LAWS), has caused significant debate within the scientific and legal communities. The core of the argument seems to be over the level of human involvement needed (or not needed) in operating these systems and that, technologically speaking, the differences of opinion are relatively minor. Most scholars agree that an AWS is characterized by its ability to carry out a task or a series of tasks without the involvement of a human operator. Its behavior is result-oriented, based on an interaction or mutual response between the programming of the computer (part of the system) and the environment.[1] According to a more simple definition by the International Red Cross, which is one of the organizations that seeks to limit them, AWS are capable of searching, identifying, and destroying targets independently, without human intervention.[2]

Given the complexity of the issue, the different levels of autonomy already embedded in unmanned devices and robotic systems of various types should be differentiated. The US Department of Defense classifies these systems according to four categories: (1) systems are operated entirely

by a human from a distance and are therefore not autonomous at all; (2) systems are delegated and are capable of carrying out certain actions with relative independence; (3) systems are capable of carrying out a range of actions independently while under the supervision of a human operator; and (4) Fully autonomous systems that, other than being turned on and initially programmed, do not require any involvement of a human operator in carrying out their tasks (although the human operator may intervene and affect what happens if necessary, such as command that a mission be aborted).[3] Another way to define the autonomy of a system is by the type and level of human involvement needed in relation to the system's operating loop.[4]

Of all the components of the system, the factor most responsible for the autonomous operation of the system is the computerization capacity of the processor. Algorithms (that is, the computerized instructions on how to carry out a task or series of tasks) enable the system to use its various components to autonomously carry out a task. Given the fact that this comes down to software, the capacity is fundamentally computer-based, although hardware is needed so that capacity can be translated into kinetic action (with the exception of cyberwar systems, which will not be discussed in this article). Any discussion of the topic should also differentiate between autonomous and automatic tools. An autonomous system can carry out any desired task in a previously unfamiliar environment without the involvement of a human operator. By contrast, an automatic system requires the presence of computer controllers that allow something to function or occur without that occurrence being directly controlled by humans.[5]

Automatic tools have been a common feature of the battlefield for generations, such as automatic weapons that can rapidly fire without being reloaded when the trigger is held down, or landmines that automatically explode when weight is placed on them. Both automation and autonomy require human involvement, but they differ, inter alia, in their level of distinction and decision making. Despite the differentiation between these characteristics, however, systems may be simultaneously both automatic and autonomous. That is, situations are defined in the system that automatically lead to action, but the action itself is carried out autonomously and includes the ability to relate and respond to changes in the environment. The distinction between automation and autonomy can be demonstrated in the difference between a landmine operated on the basis of a single parameter—weight—automatically

and indiscriminately, and an autonomous system capable of opening fire without human involvement based on more advanced parameters, such as temperature or motion, and done selectively in relation to other parameters defined for it.

Unmanned and Autonomous Devices for Security Uses in the Early Twenty-First Century

Since the beginning of the 2010s, many countries have identified the inherent potential of unmanned systems for security purposes and have been taking various steps to acquire or independently develop them. Other than the leaders in the field—the United States, Israel, the United Kingdom, and France[6]—China, Brazil, Iran, Russia, and others have also entered the field.

At present, despite the clear trend, most systems used on the battlefield and in the security field are unmanned, but require a high level of human involvement, from planning and carrying out missions to safeguarding and maintaining. These needs leave the contemporary battlefield relatively manned and do not make it fully possible to avoid exposing humans to the dangers of combat. Furthermore, because of various constraints, such as public opinion and even technical issues (distrust of new systems that have yet to prove themselves over time), the few systems capable of simple autonomous action are not used autonomously; forces armed with such systems equip them with human operators who are required to approve the action (usually firing). However, according to research and technological forecasts, it is highly likely that this state of affairs will change.

A study published in 2016, which included extensive data-gathering on AWS, describes 256 autonomous systems already in use by military forces or in the final stages of development or testing. Based on this data, most of the AWS operate today in the air. Moreover, only 130 are capable of target acquisition without human involvement, and, of those, only 27 can autonomously make an engagement decision. The data also indicates that not even one AWS is currently capable of learning on its own or adapting to a new environment without human involvement.[7] Based on this study as well as a review of new systems that have appeared in the last few years, most of the AWS seem to run into trouble in target acquisition and autonomous engagement decision; furthermore, even systems already capable of doing so are generally aerial defense systems, such as the US Patriot and the Israeli

Iron Dome. These represent few of the active systems in today's battlefield, and most of them—despite their high level of autonomy—operate in a way that requires the approval of a human operator before opening fire, as based on guiding principles of the nations using them.[8]

In addition to the aerial defense systems, the majority of autonomous systems currently in use are neither fully autonomous nor lethal, such as land-based vehicles with autonomous travel capabilities (the weapons they carry are operated from a distance by human operators);[9] autonomous naval[10] and underwater vehicles (some with autonomous engagement capacity);[11] and aerial vehicles with autonomous capabilities for take-off, landing, and refueling, such as the X47-B.[12] There are also loitering systems, such that the Harop, capable of identifying targets, locking onto them, and attacking them without human involvement, by means of homing in on radar signals and attacking the vehicles that emit these signals on land or at sea.[13]

The Future of Autonomous Systems in the Coming Two Decades

Based on the various studies seeking, inter alia, to predict the technological feasibility of autonomous systems, all types of AWS should become technologically possible within less than twenty years and most likely will become the mainstay of weapons in modern, technologically-oriented armies.[14] This is likely to dramatically reduce human involvement in operating devices for security purposes as these devices will be capable of autonomously planning currently known tactical military missions.[15] Autonomous systems will also be able to perform these tasks at a much higher level of sophistication than is currently possible. Moreover, it seems that these systems will be able to function in groups or swarms, allowing far greater efficiency and survivability than of single systems.[16]

Experts also say that within the same time frame, these systems will generate a fundamental change in the nature of the battlefield itself. Given the autonomous capabilities of planning and performance as well as swarming capabilities, warfare in general and firing, maneuvering, and logistics in particular are expected to become much faster and more precise. In other words, the battlefield will undergo comprehensive change.[17] The emerging trend is that human deployment will become increasingly rare and will occur only when the deployment of human combatants has a clear advantage. Most tasks will be performed exclusively by systems operated from a distance, most

of them autonomous.[18] This technological development brings up many issues, in addition to the need to adapt the operational environment to the new era, which has implications for doctrines of warfare and international law. Some of these developments also cause concern and have led to resistance within certain circles in the international arena, such as human rights organizations, which are already active in limiting the use of AWS on moral, ethical, and legal grounds.[19]

International Reservations about AWS

Historically, the appearance of new technologies has often aroused antagonism and time must pass before they become an inseparable part of our daily lives. This tension, however, is exacerbated when the new technologies are lethal, especially when they are intended for military needs, as is the case of AWS. The more that technology develops, becomes more complex, and widespread, the legal and ethical concerns about it become even greater. While such debates are relevant to all fields in which robotic and autonomous systems operate, the military is a pioneer; in addition to being one of the leaders of integrated technological development, the military, more so than any other field, involves decision making that affects human lives.

In November 2012, Human Rights Watch and the Human Rights Clinic at Harvard Law School published jointly a paper entitled "Losing Humanity," which calls for banning the use of "killer robots"—in effect, to render illegal the use of AWS on the battlefield.[20] The paper was published in coordination with a well-covered international media campaign called "Stop the Killer Robots,"[21] first launched just before the first session of the UN's Convention on Certain Conventional Weapons (CCW) on the topic. The authors and others in the field claim that, within two to three decades, completely autonomous weapons will be able to select their targets without human involvement, despite assertions by senior military sources that people will always remain involved in the process.[22] According to the authors, preventing human involvement in decisions on using lethal force in an armed conflict will strip civilians of non-legal safeguards that are inherent in such conflicts and are characteristic of human nature—such as compassion and sensitivity—which prevail among human combatants but are absent from robotic devices.[23] As the UN committee was debating the topic, other reports and organizations also called for the limitation and strict

supervision of robotic weapons.[24] Despite the extensive activity, no legal restriction on the development or use of these systems currently exists, and, as of the end of 2018, these weapons are legal as long as they are used in a manner consistent with the accepted law of war.

The UN debates on this issue, which have been running since 2014, are conducted among the signatories to the CCW, but their pace lags behind the rate of technological development.[25] By virtue of its definition, the CCW is limited to weapons systems. However, limiting the use of autonomous weapons without limiting autonomy in other arenas may be not only problematic but also ineffective, because autonomy is a factor of computer abilities that can easily "leak" into other areas and/or be broken into. As it is a dual purpose field (military and civilian), the limiting of armed systems without restricting and supervising the civilian side might be pointless.[26]

The key challenge of AWS stems from the fact that these systems must make decisions about human lives without any humans involved in the process. This raises both legal and ethical questions and has many layers of complexity that may be revealed as the technology develops. A major discussion focuses on the legal difficulty in applying criminal accountability to AWS. The assertion is that combatants, commanders, and political decision makers all bear criminal liability for committing war crimes, which is meant to serve as a deterrent. However, the same accountability cannot be attributed to autonomous systems, leading to a situation in which, on the one hand, trying in court and punishing a robot is absurd, while, on the other hand, there is not one single entity that can assume accountability according to the current method: Today, no engineer or tech company that developed an autonomous system can be taken to court years later for the harming or killing of innocent civilians by that system.[27]

These assertions from a human rights perspective are not the only criticism of AWS; other opponents claim that the possible dangers of AWS include encouraging a global arms race, which will lead to the exponential proliferation of AWS because the infrastructures needed to build them are much more accessible and available than infrastructures for building nuclear weapons, for example; their proliferation on the black market, allowing AWS to make their way to terrorist organizations; and the potential for effectively using these systems for the sake of ethnic cleansings, assassinations, destabilizations of nations and peoples, and other nefarious purposes.[28] These are only some

of the various claims—both legal and philosophical—raised by opponents to the development and use of AWS.

Limited International Ability to Prevent Proliferation

Despite the anti-AWS claims, the organizations active in the field, and the UN debates on the topic, the ability to impose and enforce an effective AWS ban (an international weapons control regime) is limited for two reasons. First, the mandate of the CCW permits it to deal only with conventional arms. The CCW is shaped by international humanitarian law and it is difficult to include other subjects. Therefore, any reference to the dangers inherent in artificial intelligence is out of bounds. The second reason nations considered leaders in the field, such as the United States, Israel, Russia, China, and others do not support the limitations. From the minutes of the debate held at the CCW in 2015, many nations do not relate to the possibility of an international regime to limit AWS, which may also be indicative on how they would vote on the issue.[29]

Moreover, despite the fact that both the superpowers and the smaller—and even weak—nations have an equal say in the decision of the CCW, it is impossible to ignore the traditional role of the large nations within the framework of international security regimes. History teaches us that in order to establish an international, long-lasting security regime, which will attain its objective, it is necessary to have the support of most, if not all, the major superpowers.[30] Thus, when examining the superpowers' stance, one quickly learns that, sweepingly, they do not unequivocally support establishing a limiting regime. Assuming that their support is needed to ensure the effectiveness of such a regime, one can safely say that the probability of establishing such a regime—and, more importantly, an effective one—is next to zero. Furthermore, to ensure that limitations within the framework of an agreement or treaty are indeed effective, parties specifically designated to supervise and mete out penalties for violations are necessary. This is problematic given the nature of the international arena and the lack of a sovereign. Sovereign nations could choose not to cooperate, as the chances that the international community would impose sanctions are low, given the state of today's international arena.

This dissonance—between the fast pace of technological development of AWS and the increasing demand for them, on the one hand, and the slow pace

of international action in limiting or banning them, on the other—suggests that AWS for military and security ends will indeed be ubiquitous in the international arena within the next two decades. We must therefore examine the possible effects that they might have on various spheres, including the nature of the international arena itself.

The Proliferation of AWS and Its Possible Effects on the Battlefield—Money, Pace, Human Involvement, and Human Life

The probability that, in the future, we will see the proliferation of AWS and their use in military and security settings around the world means that we must consider their impact beyond the legal and moral issues currently debated. AWS will not only change considerations made in life-and-death decisions but also will affect warfare and the entire international system. This section seeks to highlight several areas that could be affected and additional features associated with these systems.

At the most fundamental level, AWS will transform an aspect of warfare that has characterized it since the dawn of history: the need for human involvement, whether directly, by being present in the battlefield itself or indirectly, by operating a weapon or weapons systems from afar. Operating weapons from a distance—whether primitive ones such as traps or cannons, which has prevented face-to-face combat only to a limited degree, or more advanced weapons, such as standoff fire, used extensively since the RMA (revolution in military affairs) of the 1990s—still leaves people deeply involved in fighting, even if it has, at times, kept the danger at bay.

Even today's most advanced warfare requires people to use their cognitive capabilities as well as their decision-making skills. This involvement gradually diminishes as systems have become more autonomous; in addition to protecting soldiers' lives and preventing physical harm, these systems protect soldiers both mentally and emotionally, as the systems make decisions without requiring any human involvement. Although autonomous systems do not necessarily protect humans against lethal physical threats of all sorts—as civilians in the rear are often harmed during violent confrontations—the removal of people from the battlefield is the greatest change in military history.

The removal of people from the battlefield and the capabilities of the AWS have rendered the pace of performance beyond human ability. A

contemporary example is the Iron Dome system: It can autonomously calculate the flight path of a rocket and the right location for intercepting a missile faster than is humanly possible, no matter how skilled, trained, or gifted any person is.[31] These systems are also capable of operating jointly with other systems in groups or swarms, communicating pieces of data necessary for cooperation, with inhuman speed and accuracy. These capabilities makes it possible to perform tasks effectively and efficiently, without affecting the pace of implementation. Also, given that these systems are unmanned and even autonomous, when operating in groups or swarms, they may "decide" to sacrifice some of the parts so that the mission will succeed, done without feeling and free of ramifications beyond the success of the mission itself. This greatly enhances the effectiveness of operating in groups, as compared to other solutions that cannot be implemented in the era of human warfare, or only rarely, but at the cost of human lives.

In parallel, the cost of warfare may also change drastically. On the one hand, the cost of development and acquisition of future systems could be high, not unlike the current cost of equipping armies with today's most advanced technologies, such as the F-35 stealth plane, various aerial defense systems, and advanced ground or naval systems. But, on the other hand, it is worth remembering that the cost of unmanned systems (including autonomous ones) is lower than the cost of manned systems, because they do not necessarily have to be fitted with defensive systems. When it comes to swarms, it seems that the cost of the individual parts will be relatively low as part of these systems' concept of their development and operation. Thus, generally speaking, despite the initial development and acquisition costs, in the long term, they have the potential to keep costs at present rates or even less.

The three changes presented herein are not the only ones that AWS will bring to the future. Those three changes, however, have the potential to radically affect key areas that relate to violent confrontations in the international arena as well as in other areas that have experienced minor evolutionary changes slowly over hundreds of years. Here we must ask how these changes might go beyond the battlefield and affect the international arena.

Possible Effects of AWS on the International Arena

Given the unique features of AWS and the description of the probable battlefield of the future, we must ask if—beyond the battlefield—these systems have the potential to affect the international arena as we know it today and as dictated, inter alia, by the way in which contemporary violent confrontations are conducted. While AWS have the obvious potential to dramatically affect the battlefield and warfare in general, the proliferation of AWS could also have influence aspects of the international arena as well, as discussed below.

Power relations in the international arena

Based on the realist approach in the study of international relations, power and the desire to acquire and preserve power are thought of as the central motivations in the international arena. Joseph Nye claims that realists come in all sizes and shapes, but all tend to think that global politics are power politics.[32] And, although power is a concept that is difficult to define, people experience it in their daily routines; even the fact that it cannot always be accurately measured does not detract from its importance in many aspects of life, including international relations.

One scholar who tried to break the concept into its constituent parts is Hans J. Morgenthau who considers power not only as the ability to make use of military force but in a broader sense. In his book *Politics Among Nations*, he enumerates the components of power and divides them into immutable ones, such as geography and population, and mutable ones, such as the quality of a given governance. The widespread proliferation and increased use of AWS could affect some of these components. The first is population. Without considering the effect of population size on state power, Morgenthau distinguishes between quantity and quality and claims that a nation that has a majority population in the twenty to forty age bracket will be more successful than a nation that is composed mostly of older people, even though the latter country may be larger.[33] The twenty to forty age bracket represents the majority of the workforce and also of any combat force; in a battlefield consisting mostly of AWS, however, it would be possible to amass power without the population factor or with far fewer humans than in the past.

Autonomous systems are developing in fields other than the military and that they, too, may enable a state with a small or older population to possess relatively great power. Also as the military becomes based on autonomous systems, other areas will too. Therefore, much wider changes in achieving power may occur, because of the effects that these systems will have on manufacturing, services, and more, which will be completely independent of population size.

These same aspects affect another essential component—military readiness—which Morgenthau discusses as influencing state power. According to Morgenthau, this component gives real importance to a state's geography, natural resources, and manufacturing capabilities in relation to its power. For Morgenthau, readiness is highly dependent on technological innovation, leadership, and the quality of the armed forces.[34] As for AWS, technological innovation will play a greater role than ever and will help overcome other challenges that have characterized the need to maintain military readiness. Military readiness through technological means may carry a hefty financial price tag, but the demands are less than those of a human force. In other words, technological innovation may affect the ability to amass power regardless of the population and by not relying upon humans. Both examples here indicate that the proliferation of AWS bears the potential to undermine the accepted power relations between nations, which have been based on certain principles and components for the last centuries, because of the indirect impact of AWS on those very same principles and components.

The growing gap between developed and underdeveloped nations in the ability to go to war

Historically, a nation's economy and technological development have affected its ability to go to war and to be victorious, but now it seems that the gap between economically and technologically developed and underdeveloped nations is only growing. If, in the past, advantages in certain areas (such as quantity and courage) may have compensated, to some extent, for economic and technological disadvantages, this has radically changed since the industrial revolution and certainly since the RMA in the 1990s. In fact, some claim, for example, that the same gap between the United States and Iraq was among the factors that led to the wave of global terrorism and expressed

the inability of certain nations to confront others on the battlefield because of the enormous gap in their respective conventional capabilities.[35]

The transition to an era of AWS—in which the pace of warfare will outstrip human capacity and basic warfare concepts, such as decisive victory, will change—could radically widen this gap even more than it is today. The gap is expected to grow in two ways. The new era could make it even more difficult for sub-state organizations to operate in the international arena, thus sending them to seek out even more desperate measures than they have used to date. Some states, which in the past were capable of confronting their enemies, may also find themselves in an inferior position, thus forcing them to take desperate measures, such as terrorism or other means, even more so than in the past.

Similar challenges are also liable to serve as an incentive—although hardly the only one—for the appearance of an AWS black market where, presumably, those who fail to develop or acquire higher quality systems, out of desperation, could purchase inferior ones, in terms of safety, reliability, differentiation capacities, and more. An AWS black market could have extremely negative ramifications for the international arena and undermine its stability as a whole. This phenomena could even pose more risks to peace and international stability than the general arms race, which will undoubtedly occur.

Shifting considerations regarding violent conflicts, apathy to politics, and trigger-happy warfare

In the long term, two additional changes may affect economic and political aspects of warfare and violent conflicts. First, reduced human involvement in the battlefield most likely will significantly lower the cost of war. This could have far-reaching consequences, especially for nations that have had to call up reserves or divert large parts of the workforce to fighting. This could also dramatically reduce the cost of treating wounded combatants and supporting the survivors of combatants killed in battle.

Second, in the nations that will extensively use AWS, civilians may express apathy to politics, which will allow leaders to act without considering public opinion. If conflicts cease to pose a risk to human life, then the major interest in pursuing war will become financial. However, if conflicts continue to threaten civilians in the rear and on the other side of the conflict (as is the

case in current asymmetrical warfare), both civilian involvement and public opinion will still be important. For the same reasons, upon deciding to get involved in a conflict, leaders may reach the point of becoming trigger-happy. But, here too, if conflicts continue to affect human life, whether they are civilians in the state that operates the AWS or on the opposing side, this phenomenon will be limited, despite the changes that AWS will generate.

Conclusion

Within two decades, autonomous weapon systems could become widespread and could constitute a key factor in the future battlefield, given developments in technology and the difficulty in creating an effective international security regime to limit their proliferation. Based on this assumption, this article sought to engage in a theoretical analysis of the possible effects the proliferation of AWS could have in the future battlefield and in the international arena.

The article argued that the AWS will lead to changes in the various parameters currently applied to warfare. Three key parameters were described here: the financial and economic factors consequent to extensive AWS proliferation; the pace of fighting; and human involvement and human lives. In the last parameter, we can expect far-reaching changes. Based on these changes, it has been argued that the possible effects on the international arena could include the ability to amass power even in the absence of factors, such as population, which were indispensable in the past; a growing gap between developed and underdeveloped states/non-state organizations in the ability to participate in armed conflicts and defend themselves; and the set of considerations likely to guide leaders and states as they decide upon getting involved in a violent confrontation or going to war. Based on the above, it has been claimed that, theoretically, AWS have the ability to influence the international arena at a level beyond which the battlefield and warfare themselves currently do. Given these claims, it seems these systems will have much greater potential to influence the legal and moral context than the contemporary discourse on the subject has suggested.

The possible changes outlined herein and the future impact of AWS indicate an increase in the importance of technology over other factors that used to be more significant in relation to warfare and the international arena. Furthermore, as in the past—in the case of the technological revolution on whose edge we currently stand—nations that fail to bridge the technological

gap and consequently suffer from inferiority in the international arena might turn to different directions with possibly catastrophic results. As long as effective limitation on the development and use of AWS seems unlikely in the near future, it is imperative that we be prepared to deal with them while it is still feasible to do so.

Notes

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