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Algorithms of Violence: Critical Social Perspectives on Autonomous Weapons

INTRODUCTION

FOR THE PAST SIX YEARS, A TREATY BODY WITHIN THE UNITED NATIONS called the Convention on Certain Conventional Weapons (CCW) has held a series of informal Meetings of Experts, followed by an ongoing series of formal Group of Governmental Experts (GGE) meetings on the questions surrounding lethal autonomous weapons systems (LAWS): What are they, and should their development and use by militaries be prohibited or restricted in any way? These discussions have focused primarily on how existing law might, or might not, apply to such systems; where the technology is heading; and how modern militaries develop, evaluate, and deploy systems with high degrees of automation (https://unog.ch/__80256ee600585943.nsf/(httpPages)/5c00ff8e35b6466dc125839b003b62a1?OpenDocument&ExpandSection=3#_Section3). To a lesser extent, they have also explored the moral and ethical dimensions of such systems, including a presentation by myself in 2014 (Asaro 2014). Civil society has made clear its view that autonomous weapons pose numerous threats that are best addressed by prohibiting their development and use (www.stopkillerrobots.org).

There has, however, been only limited discussion of the political implications of these systems, and almost no discussion of the so-

cioeconomic implications. I have written elsewhere about the ethical and legal implications of autonomous weapons, as well as the risks they pose to global security (Asaro 2012, 687–709). In this paper, I take a more critical long-term view and investigate how the development and widespread adoption and use of autonomous weapons might transform the politics and economics of our societies. Such a discussion is urgently needed and could further inform the general public about the consequences of failing to prohibit or regulate autonomous weapons.

More broadly, there is rapidly growing public interest in the ways that algorithms shape our lives politically, socially, and economically. Small automated decisions, with a variety of built-in assumptions, and sometimes based on patterns learned from deeply biased datasets, are increasingly having more frequent, and more significant, impact on our lives. But if the cumulative effect of decisions that control access to healthcare, jobs, education, and loans has a disturbing power to shape society at large, surely automating decisions to use violent and lethal force against humans would have similar if not greater impacts on human social and political relationships.

Yet there has been little consideration of the social and political implications of automating violence, apart from considerations of how such weapons might upset military balances of power and destabilize regional and global politics through arms races. This paper aims to fill that void.

DEFINING AUTONOMOUS WEAPONS AND VIOLENT ALGORITHMS

In the ongoing discussions at the United Nations, there has been some measure of confusion over the precise meaning of lethal autonomous weapons systems, as well as various alternative terms put forth. The alternatives attempt to address different aspects of the concept, such as fully autonomous weapons, or to include less-lethal weapons by dropping the "lethal" portion of the term. Attempting to define "autonomous" has proven a particular sticking point that raises ques-

tions about the fundamental nature of agency, self-determination, and causality. Moreover, the term "autonomy" is used in different ways by philosophers, engineers, lawyers, and social scientists. Adding a modifier like "fully" further requires differentiating partial or semiautonomous systems from fully autonomous systems. Given the complex and debatable nature of autonomy, and the urgency of the concerns over autonomous weapons, it is advisable not to wait for a precise definition of autonomy and/or its degrees.

Indeed, when we look to the kinds of systems that engineers have been calling "autonomous robotics," we find something very different from what philosophers have been calling "autonomous agents." Originally, engineers and roboticists used the term "autonomous robotics" to emphasize the fact that the robots could carry their own computer control systems rather than be tethered to them by large cables (Bekey 2005). With the advance of microelectronics, this form of autonomy is now trivial, though the term is still used to describe robots capable of navigating and manipulating in open or unstructured environments (as opposed to closed and structured environments like factories).

Rather, what concerns us about the "autonomy" of weapons systems is the lack of direct and immediate human control. These are human-engineered systems that are slavishly following their programs; they do not have free will or self-determination as we would expect autonomous humans to have. Advances in microelectronics have provided the means to implement more sophisticated algorithms to automate the various functions of engineered systems, and from a greater distance in time and space than was previously possible. Rather than considering autonomy in general, it is better to focus on the automation of specific functions or processes.

More specifically, what makes a weapon autonomous is that the determination to use violent or lethal force has been made by an automated process, i.e., an algorithm. The International Committee of the Red Cross (ICRC) has proposed its own working definition of autonomous weapons within the United Nations discussion (ICRC

2018). The ICRC suggests that any system that is autonomous in the critical functions of targeting and attacking should be considered an autonomous weapon. If we substitute the contested notion of autonomy with the more straightforward notion of automation, and use a broader notion of engaging violent force instead of the armed conflict concept of an "attack," we get a more generally applicable definition: an autonomous weapon system is any weapon system in which the functions of targeting and engaging violent force are automated.

In this way, we can consider the implications of automating different functions in a weapon separately. For example, we might consider whether automatic reloading systems for guns are acceptable for military purposes, and whether the same is true for civilian use, i.e., fully or semiautomatic guns. In considering the guidance systems in heat-seeking and precision-guided missiles, which allow the missiles to automatically navigate to a target, we would note that the functions of targeting them initially, and deciding to launch them and thus to use violent force, are still being carried out by humans. But if a given weapon system is automatically targeting and firing based on its algorithmic programmed responses to sensor data, and thus is automatically deploying violent force, then it is an autonomous weapon by definition. The algorithmic program that controls such an autonomous weapon effectively "decides" what constitutes a target to be subjected to violent force, and is by definition a violent algorithm.

I also choose to use the term "violent" as opposed to "lethal" here for several reasons. The first reason is that lethality is an effect rather than an intention. In physical-causal terms, many things can be lethal, including acts of nature, which lack any intention, or accidents, which lack a specific intention. Autonomous weapons are often favorably compared to self-driving cars as technologies that might reduce casualties overall, even if they still sometimes cause harm through accidents. But this is unconvincing insofar as cars are designed, as best as possible, not to cause harm, while weapons are designed specifically to cause harm. Thus, a car crash might be trau-

matic, but not violent—unless it was intended by someone to be so. Furthermore, lethality as an effect is generally probabilistic. Poisons are not strictly lethal, but can have lethal effects in certain concentrations. And even guns often miss their targets with fairly high frequency, and thus are not lethal for the majority of times they are fired. But what matters is not simply deadly effects but also the intentions and capabilities behind them. Of course, sometimes the intention behind violence is not to have a lethal effect but to cause harm and pain. And often there are higher-level intentions—the cause or aim for which violence is being deployed. Such aims may, or may not, justify violence in particular cases, but the question of the legitimacy of violence is separate from the question of what is, or is not, violence. Thus, the primary concern is acting with the intention to cause physical harm, i.e., violence.

We can include threats of violence in our definition of violence, with the caveat that threats are in some measure less severe than the actual acts of violence they threaten, but no less real or significant, given the credibility of the threat being realized. On the other hand, acts of aggression, hostility, and other political, social, and psychological expressions may or may not constitute violence or threats of violence. Very often hostility and aggression are threats or acts of violence aiming to provoke further violence or coercion. Regardless of the psychological and political motivations, however, what is essentially significant is the underlying violence constituted by the intent to cause physical harm. Additionally, there are many forms of nonphysical harm, such as economic, psychological, and social, which are both real and significant but do not constitute violence even if they motivate violent acts or amplify their effects. For example, a slap in the face is both a violent assault and a social insult. 

More complicated is the notion of destructive force, which might be aimed at property rather than persons. Merely disabling a system may not constitute violence in itself, yet insofar as destructive acts intentionally threaten or risk physical harm to persons, they could be considered a form of violent force. Bombing a building

might be claimed to have the intention of destroying only the building, not its occupants, but such a claim insults common sense. While international humanitarian law is rather permissive in allowing such acts in armed conflict, it still considers attacks on infrastructure as uses of force. I would argue that such uses of force are violent when there is an intention to threaten or risk physical harm to persons. Some cases, such as the interception of a missile, might constitute a use of force without necessarily being a violent use of force, but only if sufficient levels of precaution are used to ensure the safety of all persons. Similarly, dynamite might be used in construction projects as an intentionally destructive force, but we would not consider it violent if appropriate safety measures are taken. However, extreme forms of destruction with significant environmental impacts might constitute violence against nature or the shared human environment, such as setting fire to oil wells or causing oil and chemical spills, damaging a nuclear reactor, burning a forest, and the like. Thus, not all cases of the use of destructive force constitute violence, but many do, and the difference depends on the circumstances and nature of precautions involved.

We can consider weapons to be tools or technologies either specifically designed to inflict violence or not specifically designed to inflict violence but nonetheless used in acts of violence to cause harm. The concern here is that weapons are an identifiable class of technologies and can be regulated when they are specifically designed as weapons. The challenge to regulating weapons is so-called dual-use technologies that might have nonviolent applications or uses. Of course, nearly anything can be used as a weapon, which is not necessarily a reason to regulate it. However, when the risks of harm are significant, even non-weapons may need regulation to reduce the risk of such unintended uses.

POWER AND AUTOMATION

This paper is about the power of algorithms. In particular, it is about the political power of algorithms designed to control and target

violence. To understand the nature of this power, we must situate our thinking within a theory of how power functions in society. Because algorithms of violence have the potential to radically transform the very foundations of power, they could have profound implications for democracy and social and political stability. In 1969, Hannah Arendt published a short book, entitled *On Violence*. In it she writes:

> No government exclusively based on the means of violence has ever existed. Even the totalitarian ruler, whose chief instrument of rule is torture, needs a power basis—the secret police and its net of informers.
>
> Only the development of robot soldiers, which ... would eliminate the human factor completely and, conceivably, permit one man with a push button to destroy whomever he pleased, could change this fundamental ascendancy of power over violence. (Arendt 1969, 50)

This short passage provides a sketch of both power and the role of violence in that power, as well as the implications of the automation of violence for the establishment and exercise of power. Arendt is concerned with the nature of social control and state power—in both democratic and totalitarian regimes—and the ways in which the people participate in all kinds of political systems. The operative notion of power is the perceived power of the ruler or rulers, whether by title, office, personality, popularity, capability, or fear. Most rulers wield power through some combination of these, gaining the respect of the people and rising in rank and office. But the collective view of the public that the rulers, laws, government, institutions, and such indeed have power is fundamental to that power. To the extent that people stop believing in both the legitimacy and the potency of their rulers, the rulers' power becomes diminished. Power is, in this sense, a social fact much like the value of money. It is real, and has real effects in the world, but it is also a purely social product of our collec-

tive beliefs and actions. But power is also ephemeral, and can disappear in an instant.[1]

Perhaps the most concrete form of power is its expression in violence. Not all violence is an expression of power, but state-sanctioned violence in particular is tied to power. The state holds a monopoly on the legitimate use of violence, both internally in policing and externally through the military. Of course, the real power of a state government depends on its effective use of violence while maintaining other aspects of power. Nonviolence movements in the twentieth century won great victories over powerful states and institutions that used violence against nonviolent protestors. Civil disobedience can provide a powerful demonstration of the illegitimacy of political authority to the public, thereby leading to its transformation, diminishment, or collapse. And powerful states have deployed vast military resources to wars, only to demonstrate their inability to impose security and a political order of their choosing—most notoriously the Soviet Union in Afghanistan and the United States in Vietnam. The power to exercise violence does not simply or automatically translate into political power, and sometimes works against it. Yet the acceptance of the exercise of violence is a form of recognizing power.

Brutal and tyrannical regimes may appear to rely solely on violence and fear, but as Arendt points out, that is not really true. There is inevitably a privileged elite who benefit from and support the regime, and there are networks of secret police and soldiers who identify with the regime and are willing to enact and suffer violence on its behalf. Of course, ideology and propaganda play an important role in recruiting and sustaining such ideologues and agents, as does the use of fear and threats to keep them in line, but the secret police are not subject to control in the same way as the population. For the most part, they identify psychologically and socially with the regime and its rulers. Arendt's point is that, historically, power would not function at all without those loyal followers—the effects of their surveillance and violence are necessary, and so too are their allegiance and loyalty.

We can also look to how power functions in the factory and how automation impacts that power. The factory is designed so as to maximize the production of economic value, and also to concentrate the distribution of that value into the hands of the factory owners. As Marx argues, this entails alienating the workers from the value of the goods they produce and instead valuing their labor exclusively in terms of wages. In order to further diminish the value of skilled labor, it is necessary to deskill that labor—to make work routine and workers interchangeable. To the extent that workers recognize that they are essential to the economic power of the factory, they could organize unions and demand better working conditions and higher wages; i.e., a greater share of the economic production.

Automation can be introduced into factories only to the extent that the work can be routinized and mechanical automation would be practical. Where possible, automation can offer vast increases in productivity,[2] and if it is cheaper than human labor it provides both greater economic production and fewer hands to distribute the created wealth among. With technological innovation, the range of tasks that machines and automation are capable of has continued to expand.

While capital has sought to alienate workers from the value of their products, the automation of violence seeks to alienate soldiers from the economic and political value of the violence they conduct. That is to say that robot soldiers will conduct violence without demanding wages, or the spoils of war, or a share of the political power that such violence supports. By automating the ability to silence critics and internal and external political opposition through violence, autonomous weapons promise to relieve political leaders of the burden of establishing and maintaining the legitimacy of their power, even among their soldiers and secret police. This, I believe, is what Arendt meant by the "shift in the fundamental ascendency of power over violence." Robot soldiers—the lethal algorithms controlling autonomous weapons—will provoke the ascendency of violence over power. This idea is both simple in its formulation and profound

in its implications. Just as the automation of factories was central to complex transformations in political economy in the Industrial Age, the automation of violence could reshape political economy in the postindustrial age in ways that we can only begin to imagine.

TYRANNY AND KILLER ROBOTS

One of the oft-mentioned potential threats from the development of autonomous weapons is their use by tyrants to control populations. But the idea is rarely explored in any depth. The basic idea is that democratic revolutions rely upon mass public protests. Regimes have an interest in suppressing such demonstrations in order to maintain their power. Typically, they deploy police and military forces to disrupt protests, using violence if necessary. But such situations are politically fraught. Regimes can sometimes lose power rapidly when they are seen as using violence against nonviolent protestors with legitimate grievances. This happens, on the one hand, because they lose perceived legitimacy among the public, powerful elites, and others outside the regime, but also because they may lose the support of the police and military—who may refuse to follow orders to use violence against peaceful protestors.

A frequently cited example for comparison is the Egyptian Arab Spring uprising in Tahrir Square. On January 25, 2011, an initial group of approximately 10,000 people occupied the public square in Cairo to protest the regime of Hosni Mubarak. Over several days, that crowd grew to an estimated 200,000 people engaged in peaceful protest (Stratfor 2011). During the protests, the Egyptian Army stood by. While the soldiers could have turned their weapons on the protestors, they did not.[3] And it seems likely that if Mubarak had access to a robot army he would not have needed the political support of the Egyptian Army generals, and those robot soldiers would have violently suppressed the public protest, and he would have retained control of the country.[4]

It is also important to note that democratic revolutions are not the only threat to the power of tyrants and autocrats. Many political regimes, including democratic ones, are toppled by coups led

by political rivals, and often by the military itself. Further, some regimes fall to civil wars and violent revolutions. Autonomous weapons might play a role in these too, but it is less clear what their effects might be. In the case of a military coup, it seems just as likely, or perhaps more likely, that such a coup would be successful with robot soldiers, whose allegiances may be much simpler to control than human solders. Of course, it would matter who actually controls the robot armies. Similarly, it is conceivable that rebellious forces in a civil war could acquire autonomous weapons and gain power through their use. Such events might bring forth, or destroy, democracies just as easily as they replace tyrants, however. And similarly, threats to a regime from foreign powers might be realized through autonomous weapons, but this depends little on the political structures of each country; i.e., whether it is a liberal democracy or not.

The automation of violence may not be as easily realized or extreme as a pure "pushbutton" power to reliably target anyone anywhere at any time. The practical realization of such a system is complex and challenging, and complex systems are prone to failure and breakdown. But the trend towards that goal is clear, as are the political implications of the trend itself. Insofar as democratic revolutions or peaceful political protests are seen as among the few remedies to political tyranny, the automation of violence would serve to greatly undermine or eliminate that remedy. Just as the fear of the police and military—without actual use of violent force—is often enough to keep the masses from protesting, so too could the threatened automated violence serve to keep tyrants in power, without having to actually deploy violence, or by using it only sparingly to demonstrate its potency. They would certainly desire the technological promise of being able to remove enemies and threats at the push of a button and the automation of violence.

And while such tyrants may not be able to completely eliminate the need for human soldiers and police officers, the automation of their work would lead inevitably to their greater productivity and efficiency—achieving more control through violence with fewer hands. This, in turn, would lead to fewer military and police, and an

even narrower distribution of political power, resulting in the concentration of ever greater power in fewer hands, more easily and more efficiently than before. Moreover, by concentrating military power in fewer hands, it seems likely that over time the few individuals who wield the power of lethal force would tend to use it to acquire and preserve their own political power, and only others with similar access to automated violence would have the means to challenge those who hold power. Democracy as a political formation could be less stable in the context of autonomous weapons controlled by the few, and it seems unlikely, and probably undesirable, to try to democratize such weapons.

DESTABILIZING DEMOCRATIC SOCIETIES

Beyond the possibilities of tyrants precluding democratic reform, we should also consider how such systems might harm already existing liberal democracies. There are several ways in which a democratic society might be threatened by autonomous weapons. Most obviously, external threats from foreign states could deploy autonomous weapons with strategic advantages and thereby invade, occupy, and conquer a democratic society. While recent history holds few examples of democracies going to war against each other, it is a possibility, but more likely we would see undemocratic states behaving in this way. It is also quite possible that, without a legally binding treaty to prohibit them, all types of states would acquire autonomous weapons. So it is likely that democratic societies that are taken over by the use of autonomous weapons would become, or be subject to, autocratic, despotic, or tyrannical regimes.

The other significant threat to democratic societies is internal: the possibility of autocratic, tyrannical, or totalitarian factions rising up and gaining political control. Here is where the threats to democracy are most concerning. If such groups are willing to use violence to achieve political gains—through political assassination, intimidation, terrorism, or violent revolution—autonomous weapons could give them a significant and powerful advantage.

Some have argued that autonomous weapons are a new form of weapon of mass destruction (WMD). While the common understanding of WMDs is that they include chemical, biological, and nuclear weapons, we can consider a broader definition. More precisely, a WMD is any weapon that allows an individual or small group of people to unleash mass violence and destruction resulting in mass casualties. From a military perspective, WMDs are challenging because they are difficult to control; they are imprecise and can have unintended and undesired consequences. From a strategic perspective, they offer a threat that is useful for deterrence but provides little military advantage in actual use.

But autonomous weapons could be developed to be very precise. Indeed, they could target specific individuals, or groups of individuals, and eliminate only those targets.[5] As such, they could be far more politically potent. They could allow small extremist groups to eliminate and terrorize their critics more effectively. They could also be used in acts of terror to undermine faith and confidence in democratic states and institutions. In short, small groups and individuals could deploy violence at scale and in ways never before seen. If done strategically, that violence could empower such groups politically, or at least create enough chaos and uncertainty for them to seize power. We have already seen how rightwing extremist groups have leveraged social media as a tool to amplify their propaganda and reach vast new audiences with greater efficiency and potency. So too could their acts of violence be conducted more efficiently with autonomous weapons at their command.

Of course, it may be unlikely that the groups that acquire autonomous weapons are able to develop an effective strategy for them. As we have seen with terrorism, it is much easier to engage in acts of violence than to actually establish political power and authority. But the ability of extremist groups to conduct violence at larger scales, with fewer resources and greater effects, is likely to have an overall destabilizing effect on societies where that occurs, and perhaps globally.

ENFORCING INEQUALITY

We have seen how autonomous weapons could be used to protect the political authority of a regime; i.e., its authority to make and adjudicate the rules of society. But while in many cases there is a large overlap between the economic and political elites in a society, they are often different even if closely aligned, and sometimes in conflict with each other. Here we consider the use of autonomous weapons in maintaining economic inequality, and preserving or establishing an economic order.

The role of a police force in society is twofold: to protect the rights of individuals from being infringed on by other individuals, and to protect the socio-political-economic order itself. The two are tied together insofar as the economic system—the rules of exchange governing the distribution of goods and resources, as well as state-imposed duties and taxes—establishes property rights that are then enforced through state-sanctioned violence. To the extent that the distribution of economic goods is unequal and perceived as unjust or illegitimate, there is a risk of protests, rebellion, and revolution either by powerful individuals and organized groups, or by popular masses.

Autonomous weapons could, through the use of violent force, support greater levels of economic inequality and injustice than would otherwise be possible—greater even than what could be supported with human slaves and soldiers—and for many of the same reasons that they could entrench despotic and tyrannical regimes. And since even soldiers and police need to eat, such an order could also require spending fewer economic resources on the police and military needed to maintain it.

More generally, increasing automation across all sectors of the economy could result in larger percentages of the population becoming outsiders to the economy, such as the landless, the jobless, the disenfranchised, and the economically irrelevant. This is a central fear among those warning of mass technological unemployment due to automation and artificial intelligence, but rarely do they explicitly

consider how technological unemployment might transform security forces. Clearly automation has served to disempower workers, though perhaps not as much as have the politics and laws undermining the power of workers and unions. But we have not really thought through the implications of disempowering police and military forces.[6]

It is also important to consider that the use of automated violence in imposing economic arrangements need not be conducted only by states and governments. Private organizations and individuals could also acquire such systems. One of the early applications for autonomous weapons is likely to be sentry guards—autonomous robots that patrol and protect private property such as factories, warehouses, and homes from intruders. A central question will be whether these will be simply fancy alarm systems, or systems authorized to use violent force against intruders or to arrest and detain them until human authorities arrive. Similarly, wealthy individuals might obtain autonomous weapons to protect their gated communities and homes, or even as personal bodyguards. Such systems would allow the elite to enjoy their wealth even when there are vast numbers of disenfranchised people willing to act violently towards these beneficiaries of an egregiously unjust economic order.

Indeed, we have already seen the deployment of weaponized remote-operated systems for private security. The Skunk drone was developed by Desert Wolf, a South African company, for the specific purpose of crowd control. Its first sales were to the private security forces of mining companies, for use in managing violent encounters with the protesting union workers (Kelion 2014). The system is a small drone that is armed with paintball guns and also capable of deploying tear gas pellets. The fact that one of the first acquisitions of private armed drones was specifically to deal with organized labor protests is a good indication that such systems would also be at the forefront of the development of autonomous weapons for private applications.

Some police forces have also obtained the Skunk drone, and Israeli Border Police have used their own tear gas–deploying drones against protestors on the Palestinian border (*Times of Israel* 2018). This

raises further questions about how autonomous weapons might be deployed along borders in the future to stop refugees seeking safety and migrants seeking economic opportunity. As climate change and environmental degradation drive more and more people from their homes and countries, autonomous weapons could be deployed at scale to prevent them from crossing certain borders, thereby reinforcing economic and environmental inequalities, even though it is a human rights violation to refuse entry to refugees.

CONCLUSIONS

Autonomous weapons will raise a host of practical problems, from causing costly and geopolitically destabilizing arms races, to their susceptibility to hacking and spoofing, to empowering small groups of people—even individuals—to unleash massive levels of destruction and kill in great numbers, constituting a new kind of weapon of mass destruction. States are currently discussing these issues from the perspective of state sovereignty and national and global security. I believe it is also incumbent on us to consider the implications for human rights, as well as the prospects for democracy and open and free societies in an age of algorithms of violence and autonomous weapons. What will it mean to be human? What kind of society will these systems be defending?

Decades after building the infrastructure of the Internet, and developing its applications and adjusting our social behavior, we are just now beginning to understand how it threatens core elements of democratic societies in unanticipated ways. And while we have not really considered all the ways in which autonomous weapons could be used, we are still racing to build infrastructures that will support the automated identification and tracking of individuals en masse, including face tracking and other biometric technologies, and the networks of cameras and databases they will need to be effective. Taken together, these technologies are providing powerful new tools of surveillance and propaganda to tyrannical governments and violent extremists. As such, they pose critical threats to existing democ-

racies, as well as to the growth and ascendency of new democracies.

The ability to couple those tools of surveillance and propaganda directly to automated violent attacks, which would be enabled by autonomous weapons and algorithms of violence, would take those threats to terrifying new levels. Tyrannical governments would be able to target their critics with little effort, cost, or risk. Violent extremists could sow fear and terror at far greater scales, and with less effort and less risk of being held to account. A sociotechnical system that makes real physical violence as cheap and streamlined as today's online vitriol would be a grim world in which civil discourse, liberal values, and the fundamental institutions of democracy could face relentless attacks.

If we are to have any hope of reining in the power exerted by algorithms over our political, economic, and social lives, and of shaping a future technology that supports democratic values and human rights, it is essential that algorithms of violence are rightly seen as unacceptable. We must work to put in place treaties, laws, and practices that ensure that the development and use of autonomous weapons is prohibited and stigmatized.

NOTES

1. The Berlin Wall was a real physical barrier, guarded by soldiers ready to kill anyone trying to cross it. When an East German official, Günter Schabowski, mistakenly announced the borders would be opened immediately, including those in Berlin, it led to a series of events that resulted in the gates being opened and parts of the Wall falling in a matter of hours. This is an example in which political power can be seen to collapse suddenly and dramatically (https://en.wikipedia.org/wiki/Berlin_Wall#Fall_of_the_Berlin_Wall).
2. Productivity can be broken down in a variety of ways, but automation generally aims to increase throughput as well as the efficient use of resources, and often is able to increase precision, accuracy, and quality. Of course, when machines are first introduced to factories, the reality is that they do none of these things, and it is only with further

investments, time, and refinements—often the result of human troubleshooting—that productivity gains are actually realized (see Giedion 1948; Noble 1986; Brooks 1988; Zuboff 1988).

3. The politics behind this are likely complicated, with military leaders deciding to side with the democratic protestors over Mubarak, who would have liked them to violently suppress the demonstration. Indeed, Mubarak's supporters did send loyal militias to attack protestors. And following the collapse of Mubarak's regime, the Army did use violence against further protests and sit-ins (https://en.wikipedia.org/wiki/Egyptian_revolution_of_2011#Role_of_the_military).
4. Of course, human soldiers also turn their weapons against peaceful protestors in many cases. In Tiananmen Square in Beijing in 1989, the soldiers did follow orders and attacked the protestors there, killing hundreds and possibly thousands (*https://en.wikipedia.org/wiki/People%27s_Liberation_Army_at_the_1989_Tiananmen_Square_protests*, *https://en.wikipedia.org/wiki/1989_Tiananmen_Square_protests#Death_toll*). https://en.wikipedia.org/wiki/1989_Tiananmen_Square_protests).
5. In its Slaughterbots video, the Future of Life Institute offers a shocking example of how autonomous weapons might be deployed en masse to target specific individuals who have watched a human rights video online, while no one is really sure who is behind the attacks (https://www.youtube.com/watch?v=9CO6M2HsoIA).
6. One possible analogy here could be the de-Ba'athification effort of the Coalition Provisional Authority in Iraq following the US-led invasion and occupation in 2003. That effort greatly destabilized the security situation in the country (*https://en.wikipedia.org/wiki/De-Ba%27athification*).

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