

Autonomous Weapons Systems and Deploying States. Making Designers and Programmers Accountable

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Summary

This article aims to look to the obligations of States towards International Humanitarian Law when deploying Autonomous Weapon Systems. This article aims to revise the rules of *mens rea* regarding AWS' designers and programmers.

Keywords: autonomous weapon systems; neural networks; unpredictable outcomes; State and designers and programmers' obligations; Criminal Liability.

Sumário

Sistemas Autônomos de Armas e Estados Instaladores. Responsabilização de Designers e Programadores

O artigo desenvolve a natureza das obrigações dos Estados de respeitar as normas do direito internacional humanitário em relação ao futuro emprego de sistemas autônomos de guerra no campo de batalha, seguido de uma análise dos critérios de mens rea para o programador dos sistemas autônomos.

Palavras-chave: sistemas autônomos de guerra; redes neuronais; imprevisibilidade de resultados; obrigações dos Estados e dos programadores; responsabilidade criminal.

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Introduction

The idea of Autonomous Weapons Systems (AWS) enchants everyone. Whenever the topic emerges, a speaker receives full attention and a range of fascinating questions from children to adults, from students to teachers: “Are we talking about a new type of drones?”; “Is this the era of terminator?”; “I thought that would happen only in films!”; “Wow! Will that kind of weapon ever be allowed?!”; “Is this the end of humankind?”. Maybe the reader has asked already similar questions, but, as simple as they may sound, such questions challenge ethicists, engineers, and legal scholars. It is impossible to cover all the questions that AWS raise, but due to the array of literature and differing perspectives in regard to AWS, even the best of readers is understandably puzzled. Without being too ambitious, this paper aims to organise the most relevant points concerning the future deployment of AWS on the battlefield. For that purpose, it first analyses the current state of the debate surrounding the legitimacy of AWS. It goes on to debate the obligations of the deploying States to provide military training on AWS to their forces, and the consequent liability of their designers and programmers. The article concludes that in order to avoid situations of decriminalization of International Humanitarian Law (IHL), the category of *dolus eventualis* is a necessary amendment to the International Criminal Court Statute (ICC Statute).

1. Autonomous Weapon Systems as a Modern Technology of Warfare

Artificial Intelligence (AI) is conquering every space of human lives.¹ It would be difficult to exclude any of our modern devices of communication, and even our idea of a future, from the colonizing power of AI.² Warfare technology is just another area in which AI challenges the traditional paradigm according to which humans are in control of the targeting decision-making process. In the face of the remarkable progress of machine-learning, the armed forces of almost every State have begun delegating progressively more complex tasks to computers and to robots on the battlefield. In late December 2021, the President of the ICRC Peter Maurer argued that ‘their expanded use risks falling short of the requirement of international humanitarian law as a result of the loss of human control and judgment in the use of force. Fundamentally, autonomous weapon systems raise ethical con-

1 Ashley Deeks, Noam Lubell and Daragh Murray, ‘Machine Learning, Artificial Intelligence, and the Use of Force by States’ (2019) 10 *Journal of National Security Law & Policy* 1, 1.

2 Ioannis Kalpouzos, ‘Double Elevation: Autonomous Weapons and the Search for an Irreducible Law of War’ (2020) 33 *Leiden Journal of International Law* 289, 289.

cerns for society substituting human decisions about life and death with sensor, software and machine processes.³ The question becomes more acute when we look to the recent conflict in Ukraine.

Since 2014 the Pentagon has pushed forward with projects to increase the levels of autonomy of its weaponry, and just in February of 2022 the Pentagon disclosed a memo that lays out 14 technologies considered vital to deter strategic competitors such as Russia and China.⁴ Among the categories of interest are artificial intelligence and autonomy, integrated networks of systems-of-systems, advanced computing and software and human-machine interfaces.⁵ As the US Under Secretary of Defense memo states 'trusted AI with trusted autonomous systems are imperative to dominate future conflicts. As AI, machine-learning, and autonomous operations continue to mature, the DoD will focus on evidence-based AI-assurance and enabling operational effectiveness'.⁶ Autonomous weapon systems, long considered a mere possibility, are now a reality. In 2019 Turkey began to deploy the Kargu drones in Syria⁷, in 2020 Israel deployed drone swarms in Gaza⁸, and more recently, the Russian Federation not only acknowledged the use of hypersonic missiles in Ukraine, but it was also reported that Russia deployed *Kub-Bla* drones.⁹

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- 3 Peter Maurer, 'Peter Maurer: "Autonomous Weapon Systems Raise Ethical Concerns for Society"' (*International Committee of the Red Cross*, 13 December 2021) <<https://www.icrc.org/en/document/autonomous-weapon-raise-ethical-concerns>>.
 - 4 Jason Sherman, 'Russia-Ukraine Conflict Prompted U.S. to Develop Autonomous Drone Swarms, 1,000-Mile Cannon' (*Scientific American*, 14 February 2022) <<https://www.scientificamerican.com/article/russia-ukraine-conflict-prompted-u-s-to-develop-autonomous-drone-swarms-1-000-mile-cannon/>>.
 - 5 Justin Katz, 'Pentagon Developing "National Defense Science and Technology" Strategy: Memo' (*Breaking Defense*, 2 February 2022) <<https://breakingdefense.com/2022/02/pentagon-developing-national-defense-science-and-technology-strategy-memo/>>.
 - 6 'Technology Vision for an Era of Competition' 4 <<https://www.defense.gov/News/Releases/Release/Article/2921482/department-of-defense-technology-vision-for-an-era-of-competition/>>.
 - 7 David Hambling, 'Autonomous Killer Drones Set to Be Used by Turkey in Syria' (*NewScientist*, 20 September 2019) <<https://www.newscientist.com/article/2217171-autonomous-killer-drones-set-to-be-used-by-turkey-in-syria/>>.
 - 8 David Hambling, 'AI-Guided Drone Swarm Used in Gaza Attacks' (*NewScientist*, 10 July 2021) <<https://www.newscientist.com/article/2282656-israel-used-worlds-first-ai-guided-combat-drone-swarm-in-gaza-attacks/#:~:text=During%20operations%20in%20Gaza%20in,has%20been%20used%20in%20combat.>>>.
 - 9 John Ismay, 'Russia Claims to Use a Hypersonic Missile in Attack on Arms Depot in Ukraine' (*The New York Times*, 19 March 2022) <<https://www.nytimes.com/2022/03/19/us/politics/russia-hypersonic-missile-attack-claim.html>>. Will Knight, 'Russia's Killer Drone in Ukraine Raises Fears About AI in Warfare The Maker of the Lethal Drone Claims That It Can Identify Targets Using Artificial Intelligence.' (*WIRED*, 17 March 2022) <<https://www.wired.com/story/ai-drones-russia-ukraine/>>.
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2. State of the current debate on AWS

Despite the developments mentioned above, little consensus has been achieved among those States that agreed to discuss the topic of legitimacy of AWS. Since 2014 several meetings have been held at *The Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons which may be Deemed to be Excessively Injurious or to Have Indiscriminate Effects* (CCW) to discuss the reality and future of AWS.¹⁰ Little consensus has, however, been achieved among scholars, States' delegates and governmental experts regarding apparently simple problems such as the definition of AWS. Indeed, in spite of eight years of discussions, the 2021 final report of the *Group of Governmental Experts in the Area of Lethal Autonomous Systems* (GGE) established as an item of its agenda the 'characterization of the systems under consideration in order to promote a common understanding on concepts and characteristics relevant to the objectives and purposes of the Convention.'¹¹ To the present day, 30 countries (Algeria, Argentina, Brazil, Holy See, Iraq, New Zealand, Venezuela, among others)¹² and 165 nongovernmental organizations have called for a pre-emptive ban of AWS on account of pervasive questions about ethics of AWS, accountability for violations of IHL, as well as the likelihood that AWS will ever comply with IHL requirements.¹³ In contrast, countries such Australia, France, Germany, India, Israel, Russian Federation, South Korea, Spain, Turkey, United Kingdom and the United States are among those States that are already developing autonomous technology or otherwise oppose any pre-emptive legal regulation of AWS. There is, however, an important note of optimism that must be mentioned. In 2019 GGE at the CCW agreed to 11 guiding principles of which three are of utmost importance for this paper. First, 'international humanitarian law continues to apply fully to all weapons systems, including the potential development and use of lethal autonomous weapons systems'; Second, 'human responsibility for decisions on the use of weapons systems must be retained since accountability cannot be transferred

10 'Background on Lethal Autonomous Weapon Systems in the Convention on Conventional Weapons (CCW)' (*United Nations Office for Disarmament Office*) <<https://www.un.org/disarmament/the-convention-on-certain-conventional-weapons/background-on-laws-in-the-ccw/>>.

11 '2021 Report of the Session of the Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons Systems' Section 12 (5 b) <https://meetings.unoda.org/section/ccw-gge-2021_documents_14090/>.

12 Human Rights Watch, 'Stopping Killer Robots Country Positions on Banning Fully Autonomous Weapons and Retaining Human Control' (2020) <<https://www.hrw.org/report/2020/08/10/stopping-killer-robots/country-positions-banning-fully-autonomous-weapons-and>>.

13 USA Congressional Research Service, 'International Discussions Concerning Lethal Autonomous Weapons' <chrome-extension://efaidnbmninnibpcajpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fwww.everycrsreport.com%2Ffiles%2F2019-08-16_IF11294_b03c9e24e0fe052e50c400fd37fba2387aa9d848.pdf&clen=457295&chunk=true>.

to machines. This should be considered across the entire life cycle of the weapons system'; and lastly 'risk assessments and mitigation measures should be part of the design, development, testing and deployment cycle of emerging technologies in any weapon systems.'¹⁴. This set of principles lead to the conclusion that AWS will be required to comply to IHL parameters; humans will be present (*in or on the loop*) throughout the entire decision-making process and, finally, that the measurement of risk should be considered in every single level of development cycle of AWS, namely at the moment of deployment.

Following the above, one possible scenario raises questions about the validity of such principles: those responsible for the design, programming or deployment decide to deploy the system despite envisaging a risk of the system performing a war crime. Should those human operators, such the ones mentioned, be held accountable for the unlawful outcomes performed by AWS? If so, on what grounds does International Criminal Law demand *dolus specialis* as *mens rea*? Why are AWS so different from traditional weapons? The next section will try to address these problems in order to give an adequate legal answer and not leave AWS in a grey fog of unanswerable problems.

3. AWS, definition and the problem of Neural Networks

For the purposes of this study, an AWS is defined as a *weapon system designed and programmed for a mission, to be adaptive and to identify, select and engage military targets without human intervention*.¹⁵ The definition includes three fundamental elements which allow an AWS to be characterised as such. First, AWS should be considered a 'weapon system', rather than a new agent on the battlefield. Therefore, they should not be qualified as some kind of 'mitigated reality' which combines the best

14 '2019 Guiding Principles Affirmed by the Group of Governmental Experts on Emerging Technologies in the Area of Lethal Autonomous Weapons System' (CCW 2019) CCW/MSP/2019/9 Annex III, 10 <<chrome-extension://efaidnbmninnibpcjpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fdocuments-dds-ny.un.org%2Fdoc%2FUNDOC%2FGEN%2FG19%2FG343%2F64%2FFPDF%2FG1934364.pdf%3FOpenElement&clen=391271&chunk=true>>.

15 Other definitions have been suggested by States. The most well-known one is the one offered by the USA according to which an AWS is a 'weapon system that once activated, can select, select and engage targets without further intervention by a human operator'. Cfr U.S. Department of Defense, 'DoD 3000.09. Autonomy in Weapon Systems' 300 <<https://www.hSDL.org/?abstract&did=726163>> accessed 20 April 2018. However, it is our understanding that this definition leaves creates more problems than solutions. For a full analysis of the definitions suggested by States cfr Afonso Seixas-Nunes, SJ, *The Legality and Accountability for Autonomous Weapon Systems. A Humanitarian Law Perspective* (Cambridge University Press (Forthcoming) 2022) Chapter 2, Section 2.4.

of machine and human capabilities.¹⁶ Second, in order to step back from idealized science-fiction scenarios, AWS must always be understood to be designed and programmed by human agents.¹⁷ In reality, the intended design, the variables and weights of the program, and the structure of a machine learning algorithm, will all be established by military personnel. Accordingly, there seems to be no place for independent action or AWS' 'self-determination'.¹⁸ Finally, an aspect that robotists have been reinforcing but which is rather frequently forgotten by scholars, is that the AWS' algorithms will not be designed for general or uncertain missions but for well-defined and specific military operations, that is, an AWS will be designed and programmed for a *mission*.¹⁹ The US DoD directive 3000.09 also establishes the software and hardware of AWS must be tested and evaluated to ensure that they 'function as anticipated in realistic operational environments against adaptative adversaries.'²⁰

16 Thompson Chengeta, 'Are Autonomous Weapon Systems the Subject of Article 36 of Additional Protocol I to the Geneva Conventions?' (2016) 23 *University of California, Davis* 66, 75-79.

17 Simon Chesterman, 'Artificial Intelligence and the Problem of Autonomy' (2020) 1 *Notre Dame Journal on Emerging Technologies* 211, 23.

18 According to the latest document on US Policy in Lethal Autonomous Weapons it can be read that those systems 'are a special class of weapon systems that use sensor suites and computer algorithms to *independently* identify a target and employ an onboard weapon system to engage and destroy the target without manual human control of the system'. What should be understood by 'independently' is not explained. Cfr. Congressional Research Service, 'Defense Primer: U.S. Policy on Lethal Autonomous Weapon Systems' <chrome-extension://efaidnbmnnnibpca-pjpcgclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fcrsreports.congress.gov%2Fproduct%2Fpdf%2FIF%2FIF11150>. Another example is the UK Definition of AWS according to which 'an autonomous system is capable of understanding higher-level intent and direction'. Cfr UK Ministry of Defence, 'Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems' <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/673940/doctrine_uk_uas_jdp_0_30_2.pdf>. Rebecca Crootof, 'Autonomous Weapon Systems and the Limits of Analogy' (2018) 9 *Harvard National Security Journal* 51, 57; Ronald C. Arkin, *Governing Lethal Behavior in Autonomous Robots* (Chapman & Hall Book 2009) 37.

19 As Tim McFarland explains 'Autonomy, in a technical sense, is simply the ability of a system to behave in a desired manner, or achieve the goals previously imparted to it by its operator, without needing to receive the necessary instructions from outside itself on an ongoing basis. For simple tasks in well-understood environments, that might be achievable with a simple, static step-by-step set of instructions. Many firewalls fit this description (...) For more complex tasks, or tasks done in less predictable environments, autonomous operation might require that more advanced capabilities be encoded: to detect changes in the environment, to select a course of action from several possibilities in response to those changes, perhaps to recognise when a goal is not achievable, and so on'. Tim McFarland, 'The Concept of Autonomy' in Rain Liivoja and Ann Valjataga (eds), *Autonomous Cyber Capabilities under International Law* (NATO Cooperative Cyber Defence Centre of Excellence 2021) <https://law.uq.edu.au/profile/14183/tim-mcfarland>.

20 U.S. Department of Defense (n 16).

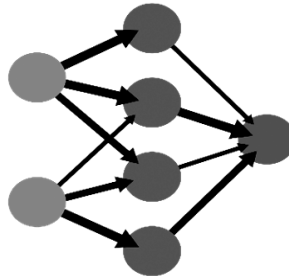
In light of the aforementioned, to be considered ‘adaptive’ a system has to be able to gather new information after it has been activated by a human operator and pursue the pre-established mission. The system collects new data from the battlefield in order to identify a target and select when and how to engage the target.²¹ These systems would not be possible without the most recent advances in AI, namely, *deep-learning* and *machine-learning algorithms*.

The highest profile breakthrough in artificial intelligence over the past two decades has come from a subfield of machine learning known as a *deep learning* (DL). Deep learning has begun to produce dramatic advances in speech recognition, visual object recognition and machine translation, so that in many regards, computers match or even exceed humans in those three areas.²² Deep learning involves the use of *artificial neural networks* that are inspired by the way neurons in the human brain are thought to interact with each other, as shown in Fig 1.²³

Figure 1

A simple neural network

input layer hidden layer output layer



Neural networks are at the foundation of current human goal-oriented algorithms which can be designed through a process of trial and error (*reinforcement learning*), producing the best *probable* result. They are able to establish not causal but *predictive*

21 Giovanni Sartor and Andrea Omicini, ‘The Autonomy of Technological Systems and Responsibilities for Their Use.’ in Nehal Bhuta and others (eds), *Autonomous Weapons Systems. Law, Ethics, Policy*. (Cambridge University Press 2016) 48-51.

22 Stuart Russell, *Human Compatible. AI and the Problem of Control* (Allen Lane The Penguin Press 2019) 4-6.

23 Stuart Russell, *Human Compatible. AI and the Problem of Control* (Allen Lane The Penguin Press 2019) 171-172; 288-295; Daniel Nelson, ‘What Is Deep Learning?’ (*UNITE.AI*, 13 October 2019) <<https://www.unite.ai/what-is-deep-learning/>>; Daniel Nelson, ‘What Is Deep Reinforcement Learning?’ (*UNITE.AI*, 17 April 2020) <<https://www.unite.ai/what-is-deep-reinforcement-learning/>> accessed 11 May 2020.

patterns between the data given to the system and, based on probabilities, to identify military targets accurately. Any modality of ‘deep learning’ can bring advantages to the battlefield: the system can ‘learn’ while performing the entrusted mission, *adapting the system to environmental uncertainties without requiring human input*.²⁴

However, according to AI experts ‘there is now overwhelming empirical evidence that systems that current DL techniques typically lead to unstable methods (...) and instability seems to be the Achilles’ heel of modern AI and DL’.²⁵ Autonomous technology open a pandora’s box with its inherent unpredictability. Unpredictability results from the impossibility of predicting how new inputs will be processed in the different layers, and also because it is highly questionable whether the *why* and *how* of a selection-making process outcome will ever be accessible to human understanding.²⁶ This explains why autonomous systems have been baptized ‘*black-box systems*’: systems whose workings are opaque to its human operators or to military commanders, i.e. the *inputs* and *outputs* are observable but the processes that take place between, that is, the structural interrelations amongst the data, are invisible.²⁷

Bearing in mind the opacity of these systems and the absence of human intervention, one might ask what the future of international criminal law will be like, as far as AWS are concerned. First, if an unlawful outcome happens on the battlefield, what kind of evidence will a Tribunal have access to? If black-box systems do not allow human operators to understand the connections the system makes, how will it be possible to attribute such an outcome to a human operator? Would the deployment of AWS imply an accountability vacuum because an outcome cannot be explained?

It is not surprising that many scholars are demanding greater transparency from opaque systems. One of the important goals of the Defense Advanced Research Projects Agency (DARPA) is to create artificial intelligence systems that are explain-

24 Kenneth Anderson and Mathew C. Waxman, ‘Debating Autonomous Weapon Systems, Their Ethics, and Their Regulation Under International Law’ in Roger Brownsword, Eloise Scotford and Karen Yeung (eds), *The Oxford Handbook of Law, Regulation, and Technology* (Oxford University Press 2017) 1100-1103 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2978359>.

25 Matthew J. Colbrook, Vegard Antun and Anders C Hansen, ‘The Difficulty of Computing Stable and Accurate Neural Networks: On the Barriers of Deep Learning and Smale’s 18th Problem’ (2022) 119 PNAS 1.

26 Shin-Shin Hua, ‘Machine Learning Weapons and International Humanitarian Law: Rethinking Meaningful Human Control’ (2019) 51 Georgetown Journal of International Law 117, 119. Tobias Vestner and Altea Rossi, ‘Legal Reviews of War Algorithms’ (2021) 97 International Law Studies 509, 535-537.

27 Gregor Noll, ‘War by Algorithm: The End of Law?’ in Max Liljefors, Gregor Noll and Daniel Steuer (eds), *War and Algorithm* (Rowman & Littlefield 2019) 83. Nathan Colaner, ‘Is Explainable Artificial Intelligence Intrinsically Valuable?’ (2022) 37 AI & Society 231, 231.

able to humans. Explainable AI (XAI), as the US agency states, 'will be essential if future warfighters are to understand, appropriately trust, and effectively manage an emerging generation of artificially intelligent machine partners.'²⁸ As Daniel Innerarity explains 'non-transparency intensifies when the systems are governed by machine learning. This opacity can be very resistant in the face of strategies of transparency especially when the mechanisms of machine learning make deductive explanations impossible. A phenomenon that is continuously changing becomes for that reason incomprehensible'.²⁹

4. AWS and Corresponding Obligations

Rain Liivoja, in a compelling article, clarifies two very important aspects. First, that IHL is 'technology neutral', that is, the laws of war do not favour one specific type of technology over another, and, second, IHL is embodied by 'technology-indifferent rules' because they focus on the behaviour of their humans on the battlefield, and not so much to the means of warfare through which they exercise their judgment.³⁰ These considerations are hugely important because, in spite of the complexity of machine learning, one feature cannot be erased from the horizon: algorithms, neural networks with which AWS will be embedded, will be designed by humans, and for the time being, States will be responsible for their deployment. It is, therefore, legitimate to ask what implications emerge for States and for individuals (designers and programmers) as far as the deployment of AWS is concerned.

4.1. States deploying AWS

One of the foundations of International Law lies firmly in the concept of State sovereignty developed throughout history.³¹ Although nineteenth positivism, the ethics of individualism and the progressive expansion of International Law have caused a radical change of approach, International Law is a State consensual-base legal system. This position was argued in the *National Decrees Case* in which

28 Matt Turek, 'Explainable Artificial Intelligence (XAI)' (*DARPA – Defense Advanced Research Projects Agency*) <<https://www.darpa.mil/program/explainable-artificial-intelligence>>.

29 Daniel Innerarity, 'Making the Black Box Society Transparent' (2021) 36 *AI & Society* 975, 978. David Gunning, 'Explainable Artificial Intelligence (XAI)' (*DARPA – Defense Advanced Research Projects Agency*) <<https://www.darpa.mil/program/explainable-artificial-intelligence>>.

30 Rain Liivoja, 'Technological Change and the Evolution of the Law of War' (2015) 97 *International Review of the Red Cross* 1157, 1167–1168.

31 Malcolm N. Shaw, *International Law* (6th edn, Cambridge University Press 2008).

the PCIJ argued that ‘the right of the State to use its discretion is nevertheless restricted by obligations which it may have undertaken towards other States’ and reiterated in the *Lotus* Case where the Court concluded that restrictions upon the independence of the States cannot therefore be presumed.³² More recently, the ICJ in the *Nicaragua* Case stated that ‘in international law there are no rules, other than such rules as may be accepted by the State concerned, by treaty or otherwise, whereby the level of armaments of sovereign state can be limited, and this principle is valid for all states without exception’.³³

The sovereignty of States does not exclude, however, obligations ensuring the compliance with IHL. Common Article 1 of the 1949 Geneva Conventions (Common Article 1) asks States to respect the obligations inherent in the laws of war ‘in all circumstances.’ Common Article 1, restated in Article 1API, stipulates that ‘[t]he High Contracting Parties undertake to respect and to ensure respect for the present Convention in all circumstances.’ It has been suggested that common Article 1 has not only a ‘quasi-constitutional’ meaning in current international law, but that it also reflects customary international law.³⁴ According to the *ICRC Study* ‘[a] State’s obligation pursuant to this rule is not limited to ensuring respect for international humanitarian law by its own armed forces but extends to ensuring respect by other persons or groups acting in fact on its instructions, or under its direction or control’.³⁵

From the reading of Common Article 1, one could conclude that a set of positive obligations for States has indeed been articulated. As some authors suggest, the term ‘ensure’ phrased in the active voice, indicates that the scope of the obligation to ‘ensure respect’ is broader than simply ‘not encouraging’, and includes a series

32 *Nationality Decrees* [1923] Permanent Court of International Justice (PCIJ) Second(extraordinary) Session, Serie B, 4lotus 24. *The Case of the SS ‘Lotus’* [1927] Permanent Court for International Justice Series A. – No. 10 18.

33 *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v United States of America)* (ICJ (Judgement)) Para 269.

34 Jean-Marie Henckaerts and Louise Doswald-Beck, *Customary International Humanitarian Law. Volume I: Rules*, vol I (ICRC – Cambridge University Press 2009) Chapter 40, Rule 138. In the *Nicaragua Case* the ICJ stated ‘there is an obligation on the United States Government, in the terms of Article 1 of the Geneva Conventions, to “respect” the Conventions and even “to ensure respect” for them “in all circumstances”, since such an obligation does not derive only from the Conventions themselves, but from the general principles of humanitarian law to which the Conventions merely give specific expression’. Cfr *Military and Paramilitary Activities in and against Nicaragua (Nicaragua v. United States of America)* (n 34) Para 220. Carlo Focarelli, ‘Common Article 1 of the 1949 Geneva Conventions: A Soap Bubble?’ (2010) 21 *European Journal of International Law* 125, 127. Henckaerts and Doswald-Beck Rule 144 (pp 510-513). Marco Longobardo, ‘The Contribution of International Humanitarian Law to the Development of the Law of International Responsibility Regarding Obligations Erga Omnes and Erga Omnes Partes’ (2018) 23 *Journal of Conflict & Security Law* 383, 390.

35 Henckaerts and Doswald-Beck (n 35) Chapter 40, Rule 139 (496).

of positive obligations.³⁶ Thus, according to the customary international norm, each deploying State ought to provide instruction on IHL to its armed forces, namely to its military commanders, independently of the technology that will be used in the hostilities. These obligations incumbent upon States must have in the horizon, first and foremost, military commanders since they are responsible ‘to plan and decide upon an attack’, taking not only ‘constant care’ but also ‘all feasible precautions in choice of means and methods of attack’, in order to protect the civilian population and civilian objects (Article 57 (2)(a)(ii) API).³⁷ On this regard, Eric Talbot Jensen provides an interpretative extension of Article 57 and explains that ‘the language of those who “plan or decide” is obviously meant to include not just the trigger puller, but also those at all levels of command and decision making. This would include, in particular, those who order autonomous systems into battle.’³⁸

This position is debatable if we look to some of the ‘travaux préparatoires’, and some of the obligations provided on Article 57, especially when the rules of individual responsibility of commanders are taken into account (Article 87 API; Article 28 Rome Statute). It becomes, however, more difficult to agree with the author when he postulates that ‘military operators must ensure that the autonomous system can exercise constant care’.³⁹ The problem of ‘misappropriation of language’ goes beyond this work, and it was already explored elsewhere, but it is never too much to call attention to such assumptions that imply autonomous agency by AWS.⁴⁰ The obligation of States to ensure that AWS will comply with IHL parameters is not identical to the obligations of ‘due care’ being delegated to autonomous systems. Moreover, if we bear in mind the positions taken by States at the CCW, it can hardly be postulated such level of capabilities delegated to AWS. Taking the DoD 3000.09 as an example, the directive expressly provides that ‘persons who authorize the use of, direct the use of, or operate autonomous (...) must do with appropriate care and in accordance with the law of war, applicable treaties, weapon system safety rules, and applicable rules of engagement (ROE)’.⁴¹

36 Knut Dormann and Jose Serralvo, ‘Common Article 1 to the Geneva Conventions and the Obligation to Prevent International Humanitarian Law Violations’ (2014) 96 *International Review of the Red Cross* 707, 727.

37 Henckaerts and Doswald-Beck (n 35) Chapter 40, Rule 142 (501-505). Noam Neuman, ‘A Precautionary Tale: The Theory and Practice of Precaution in Attack’ (2018) 48 *Israel Yearbook on Human Rights* 19, 28. International Law Association Study Group on the Conduct of Hostilities in the 21st Century, ‘The Conduct of Hostilities and International Humanitarian Law: Challenges of 21st Century Warfare’ (2017) 93 *International Law Studies* 322, 375.

38 Eric Talbot Jensen, ‘Autonomy and Precautions in the Law of Armed Conflict’ (2020) 96 *International Law Studies* 577, 589–590.

39 Jensen (n 39) 587.

40 Seixas-Nunes, SJ (n 16) Chapter 3.

41 U.S. Department of Defense (n 16) Section 2 (b).

Following the above, it is legitimate to accept that ‘the behaviour of an autonomous software entity is ultimately dependent upon actions of people in relevant positions, notably its designer and operator, due to the nature of computers and software. Autonomous software entities are essentially sets of human-written instructions executed by human-constructed computing devices.’⁴² As Tim McFarland argues, ‘unlike manually operated weapons, much of the behaviour of an AWS would be determined by parties other than the individual who employs it on the battlefield. Care must be taken to ensure that the elements of crimes involving the weapon system accurately reflect the involvement of the person who is the perpetrator of the offence’.⁴³ This is clear in Ronald Arkin’s preface, where he argues that ‘the reality of these systems moving out from their ivy tower laboratories into the real-world military-industrial complex prior to their actual deployment [...] forced upon me a further responsibility to inform my colleagues of the consequences of their and our research’.⁴⁴ This increased responsibility will be accompanied by a more stringent requirement for accuracy at the crucial moments of manufacturing, designing, programming and maintaining an AWS. These considerations are aligned with the set of principles drafted at the CCW. Not only in what concerns the presence of human operators during the entire decision-making process but also in what concerns risk assessments. Therefore, Jensen is correct to extend the obligations enshrined in Article 57 API to every operator involved with the design and programming of an AWS for a specific mission. Due to the high level of sophistication and complexity inherent to AWS, it is understandable that the chain of command can indeed be expanded in the sense that it is difficult to envisage that a commander will not need designers and programmers to understand the true capabilities of the systems, since designers and programmers will be required to be familiar with the Humanitarian Law constraints, without accepting some dilution of commanders’ responsibility.

States are the primary subjects of International Law in general, and IHL in particular. As the ICJ argued in the *Nuclear Weapons Advisory Opinion* ‘all States are bound by those rules in Additional Protocol 1(API) which, when adopted, were merely the expression of the pre-existing customary law, such as the Martens Clause, reaffirmed in the first article of Additional Protocol 1’⁴⁵, and that ‘the intrinsically humanitarian character of the legal principles in question which permeate the entire law of armed conflict (...) applies to *all forms of warfare and to all kinds of weapons, those of the past and*

42 McFarland (n 20).

43 Tim McFarland, *Autonomous Weapon Systems and the Law of Armed Conflict: Compatibility with International Humanitarian Law* (Cambridge University Press 2020) 150.

44 Arkin (n 19) Preface.

45 ICJ, *Advisory Opinion on the Legality of the Threat and Use of Nuclear Weapons*, Judgment 84. (Our emphasis)

*those of the future.*⁴⁶ Thus, the obligations of States to provide military training and formation for the use of AWS will be of paramount importance. Marco Longobardo precisely argues that ‘military programmers of autonomous weapon systems must be experts in the employment of such technologies in order to reduce errors that could result in civilian casualties and damages to civilian objects’, and ‘that military training may be evaluated in the assessment of the State’s compliance with the principle of precaution in the attack’.⁴⁷ This is certainly the path taken by the DoD 3000.09 establishing responsibility for the Under Secretary of Defense to ‘oversee and provide policy for individual and functional military training for the Total Force relating autonomous and semi-autonomous weapons systems’.⁴⁸

4.2. Obligations for designers and programmers

Despite all the care that States may demonstrate towards the deployment of AWS, it is impossible to exclude from the horizon situations in which the system might fail to operate properly, resulting in outcomes that breach IHL regulations. The first question that must be addressed is the problem of the liability of all those, aside from the military commander, participating in the process of designing and programming AWS. In attending to the individual responsibility framework, it is vitally important to consider that the Nuremberg IMT forcefully affirmed the central role of individual responsibility by stating that ‘crimes against international law are committed by men, not by abstract entities, and only by punishing individuals who commit such crimes can the provisions of international law be enforced’.⁴⁹ More recently, the ad hoc Tribunals and the ICC have all demonstrated the continuing importance of establishing individual criminal responsibility as the ‘cornerstone of international criminal law’.⁵⁰ More specifically, Article 25(1) of the ICC Statute introduced a novel concept when it stated that ‘the Court shall have jurisdiction over natural persons pursuant to this Statute’, thus restricting the jurisdiction to ‘natural persons’.

46 ICJ, *Advisory Opinion on the Legality of the Threat and Use of Nuclear Weapons, Judgment* (n 46) Para 86. (Our emphasis)

47 Marco Longobardo, ‘Training and Education of Armed Forces in the Age of High-Tech Hostilities’ in Elena Carpanelli and Nicole Lazzerini (eds), *Use and Misuse of New Technologies: Contemporary Challenges in International and European Law* (Springer 2019) 80-81.

48 U.S. Department of Defense (n 16) Enclosure 4.

49 The United Nations War Crimes Commission, *Law Reports of Trials of War Criminals. The I.E. Farben and Krupp Trials*, vol Vol X (The United Nations War Crimes Commission by His Majesty’s Stationary Office 1949) 223.

50 *Prosecutor v Duško Tadić, Judgment* [1999] ICTY – Appeals Chamber IT-94-1-A Para 664-666; Elies van Sliedregt, *Individual Criminal Responsibility in International Law* (Oxford University Press 2012) 17.

Suresh Venkatasubramanian writes a provocative piece where the author believes that autonomous technology of warfare brings about 'an epistemic disconnect between technology (and machine learning based modeling in particular) and the law'.⁵¹ Indeed, the author asks 'how is a system supposed to learn what targets satisfy principles of proportionality, distinction and precaution when to do so it must rely on a precise labeling that almost cannot exist by design? Models may be imprecise in a strict probabilistic sense, but they need precision in order to function correctly. And this precision is at odds with the vagueness baked into legal language'.⁵² This comment can raise a set of important questions such as the importance of human judgment or the codification of the rules of war into algorithms of neural networks. The former has been already a source of numerous debates.⁵³ The latter, however, is somehow unexplored in relation to AWS, and the articulation of IHL and the Rules of Engagement (ROE). ROE are lawful commands issued by competent authorities, namely military commanders, to circumscribe the 'circumstances and limitations within which military forces may be employed to achieve their objectives'.⁵⁴ What happens then if ROE are poorly designed, causing violations of IHL on the battlefield? This question is answered if situations such the *Horizon* scandal in the UK and the *Robodebt* crisis in Australia are taken into account. In both situations, IT programs were poorly and deficiently designed and caused enormous public outrage because of the false or inaccurate outcomes.⁵⁵

51 Suresh Venkatasubramanian, 'Structural Disconnects between Algorithmic Decision-Making and the Law' (*Humanitarian Law & Policy*, 25 April 2019) <<https://blogs.icrc.org/law-and-policy/2019/04/25/structural-disconnects-algorithmic-decision-making-law/>>.

52 Venkatasubramanian (n 52).

53 Just as an example, cfr Jeff Malpas, 'The Necessity of Judgment' (2020) 35 *AI & Society* 1073. Eric Talbot Jensen, 'The (Erroneous) Requirement of Human Judgment (and Error) in the Law of Armed Conflict' (2020) 96 *International Law Studies* 26.

54 International Institute of Humanitarian Law, *Sanremo Handbook on Rules of Engagement* (U.S. Naval War College ed, 2009) Para 3 <<http://www.iihl.org/wp-content/uploads/2017/11/ROE-HANDBOOK-ENGLISH.pdf>>. To different notions and understandings of ROE cfr JFR Boddens Hosang, *Ruyles of Engagement and the International Law of Military Operations* (Oxford University Press 2020), 29-31.

55 'Post Office and Horizon IT Scandal – Government and Post Office Must Take Urgent Action on Compensation for Sub-Postmasters' (17 February 2022) <<https://committees.parliament.uk/committee/365/business-energy-and-industrial-strategy-committee/news/161072/post-office-and-horizon-it-scandal-government-and-post-office-must-take-urgent-action-on-compensation-for-subpostmasters/>>. Kevin Peachey, 'Post Office Scandal: What the Horizon Saga Is All About' (*BBC News Business*, 22 March 2022) <<https://www.bbc.com/news/business-56718036>>. David Mariuz, 'Robodebt Was a Fiasco with a Cost We Have yet to Fully Appreciate' (*The Conversation-Academic Rigour Journalistic Flair*, 16 November 2020) <<https://theconversation.com/robodebt-was-a-fiasco-with-a-cost-we-have-yet-to-fully-appreciate-150169>>.

AWS involves highly complex systems that will certainly require a higher level of technical knowledge and more human operators in the pre-deployment phase than in automatic or semi-autonomous systems. According to the previous section, States are required, and also interested in, putting all efforts possible into training their military forces on the complexities of AWS. Designers and programmers must be not only knowledgeable about the capabilities of the system as to the complexities of the battlefield, but also be capable and responsible for the encodement of ROE. The question is, what must the level of responsibility of designers and programmers be? As McFarland argues ‘care must be taken to ensure that the elements of crimes involving the weapon system accurately reflect the involvement of the person who is the perpetrator of the offence’, and thus, a problem emerges at the level of the mental element for international crimes (*mens rea*).⁵⁶

For the first time in the history of International Criminal Law, provides a general definition of the mental element in Article 30.⁵⁷ Article 30 (1) stipulates that:

1. Unless otherwise provided, a person shall be criminally responsible and liable for punishment for a crime within the jurisdiction of the Court only *if the material elements are committed with intent and knowledge*.⁵⁸
2. For the purposes of this article, a person has intent where:
 - (a) In relation to conduct, that person means to engage in the conduct;
 - (b) In relation to a consequence, that person means to cause that consequence or is aware that it will occur in the ordinary course of events.
3. For the purposes of this article, “knowledge” means awareness that a circumstance exists or a consequence will occur in the ordinary course of events. “Know” and “knowingly” shall be construed accordingly.

Thus, in order for an individual to be held accountable for international crimes involving AWS, according to the ICC Statute, they would have had to have both participated and shown culpable behaviour, in the commission of a crime. The difficulty of interpreting Article 30 ICC Statute goes beyond the scope of this work and has, in any case, already been extensively discussed by scholars.⁵⁹ What is important to retain here is that the ‘material element’ germane to an assumption of guilt comprises ‘intent’ to cause and ‘knowledge’ of the circumstances or consequences.⁶⁰

56 McFarland (n 44) 150.

57 Mohamed Elewa and Sara Porro, ‘Article 30. Mental Element’ in Mark Klamburg (ed), *Commentary on the Law of the International Criminal Court* (Torkel Opsahl Academic EPublisher 2017) 314.

58 Our emphasis.

59 Antonio Cassese (ed), *The Oxford Companion to International Criminal Justice* (Oxford University Press 2009) 159-160.

60 William A. Schabas, *The International Criminal Court – A Commentary on the Rome Statute* (2nd edn, Oxford University Press 2012) 627-630.

Accordingly, to hold an individual responsible for ordering the commission of a crime under the ICC Statute, he must have acted with an intent to commit the crime and with the knowledge that such a crime would be committed in the ordinary course of events, following the execution of his order. In other words, for a crime to be committed, the agent must act with *dolus directus*.⁶¹

In light of this, a lower 'guilty state of mind' in relation to *possible but not certain* outcomes resulting from the deployment of an AWS cannot be attributed to any of the human operators involved with its design, programming and/or maintenance. This implies risks perceived by human operators that some sort of unlawful consequence would occur at the time he or she acted in the ordinary course of events would not carry any criminal consequence because of the operator's uncertainty that a crime would occur.⁶² A question, however, may be asked. Considering the obligations of States to provide military training on AWS capabilities, and the higher risk of such systems on the battlefield (unpredictability; opacity), should a lower threshold of guilty not be considered? Let us imagine the situation in which the human operator realized the eventuality of criminal outcomes but made the decision to deploy the system despite a possible violation of IHL, thus acting with *dolus eventualis*.

According to some experts, Article 30 does not cover *dolus eventualis*, and there is no help to be found in jurisprudence either.⁶³ In the *Lubanga Case*, for example, the Pre-trial Chamber accepted the category of *dolus eventualis*, stating that 'the above-mentioned volitional element also encompasses other forms of the concept of *dolus* which have already been resorted to by the jurisprudence of the ad hoc tribunals, that is [...] *dolus eventualis*' while the category of recklessness is not accepted'.⁶⁴ This understanding was then later embraced by both the Trial Chamber and the Appeals Chamber in the *Lubanga Case*.⁶⁵ In the *Bemba Case*, in 2009, the Pre-trial Chamber argued that the language of Article 30 ICC Statute '[did] not accommodate a lower standard than the one required by *dolus directus* in the second degree (oblique intention)', and that '[t]his standard is undoubtedly higher than the

61 Badar, Mohamed Elewa and Sara Porro, 'Rethinking the Mental Elements in the Jurisprudence of the ICC' in Carsten Stahn (ed), *The Law and the Practice of the International Criminal Court* (Oxford University Press 2015) 652-653.

62 Alejandro Kiss, 'Command Responsibility under Article 28 of the Rome Statute' in Carsten Stahn (ed), *The Law and Practice of the International Criminal Court* (Oxford University Press 2015) 642.

63 Schabas, William A., *An Introduction to the International Criminal Law* (Cambridge University Press) 237-239. Badar, Mohamed Elewa and Porro (n 62) 654-655.

64 *Prosecutor v Thomas Lubanga Dyilo* [2009] ICC – Pre-Trial Chamber I ICC-01/04-01/06-803, Decision on the Confirmation of Charges 438.

65 *Situation in the Democratic Republic of the Congo in the Case of the Prosecutor v Thomas Lubanga Dyilo* [2004] ICC-01/04-01/06 A 5 (ICC – Appeals Chamber Judgment on the appeal of Mr Thomas Lubanga Dyilo against his conviction) Para 447-448.

principal standard commonly agreed upon for *dolus eventualis* – namely foreseeing the occurrence of the undesired consequences as a mere likelihood or possibility'.⁶⁶ This reasoning was then later embraced by both the Trial Chamber and the Appeals Chamber in the *Lubanga Case*.⁶⁷

In light of the above, it is fair to say that every mission on the battlefield has always involved risk of some sort, but until today the use of a weapon and/or the decision to release a munition has always been a matter for human judgement, even under the most severe conditions on the battlefield. Thus, the use of AWS will certainly demand more care and attention to the levels of substantial risk attendant upon a mission, especially at the level of programming the system. That level of care cannot be only entrusted to military commanders. It would be unrealistic to demand from military commanders the knowledge AI inherent to neural networks. Therefore, designers and programmers should be held accountable for unlawful outcomes caused by lack of due care in the assessment of the risks involving the mission entrusted to AWS.⁶⁸ If the category of *dolus eventualis* were to be excluded, it would simply mean a well-covered process of disregard for international values and, eventually, a decriminalisation of IHL.

5. Conclusion

Roboticians and engineers believe they have a mission to 'engineer ideas into reality'. Thus, the long-expected days of machine supremacy may be arriving, and subsequently, AWS will replace humans in the context of hostilities. In technical terms, the difference between a weapon system that can identify, select and engaging military targets without human supervision would be just a matter of programming, but that programming should fall into some kind of non-existent area of law. States are indeed called to put all efforts in the training of their armed forces to ensure respect for the laws of war 'in all circumstances'. However, it is not realistic to demand such high level of commitment from States without demanding parallel responsibility from designers and programmers involved in the deployment of AWS. It is therefore suggested that an amendment to the ICC Statute to include the category of *dolus eventualis* would be the way to proceed. A final question, however, dooms the horizon: will the international community ever be willing to introduce such an amendment to the ICC Statute?

66 *Situation in the Central African Republic in the Case of the Prosecutor v Jean-Pierre Bemba Gombo* [2009] ICC ICC-01/05-01/08 362-363.

67 *Situation in the Democratic Republic of the Congo in the Case of the Prosecutor v Thomas Lubango Dyilo* [2012] ICC-Trial Chamber I ICC-01/04-01/06-2842 Para 1011; *Situation in the Democratic Republic of the Congo in the Case of the Prosecutor v Thomas Lubango Dyilo* (n 66) Para 447-448.

68 Seixas-Nunes, SJ (n 15) 219-222.

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