# Law, life, death, responsibility, and control in an age of autonomous robotic warfare

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Abstract:

Autonomous weapon systems (AWS) can select and engage targets without human intervention. They, therefore, act as both weapons and fighters in combat. The current legal rules governing these areas are written for humans to apply and abide by, with a subsequent responsibility regime for violations. Thus, as machines, AWS pose a challenge to these legal rules. This thesis asks if international law as it currently stands is sufficient to regulate AWS, or if new law is required?

This thesis presents a novel way of understanding the relationship between AWS and those who control them that is rooted in the *lex lata*. It demonstrates that AWS exist at the centre of 'layers of control' where the influence of political decision-makers, weapons reviewers, AWS developers, and AWS users can clearly be seen. Doing so views AWS as their legal agents, meaning that the legal regimes regulating weapons, targeting, and responsibility can be applied to the actions of AWS through these controlling entities.

Ultimately, this thesis concludes that, in most cases, current international law rules are sufficient to regulate the development, use, and responsibility for AWS. In coming to this conclusion through the 'layers of control' approach, it is argued that: the weapons law regime needs to be interpreted flexibly in order that the autonomous nature of AWS can be sufficiently considered; human beings must, for the foreseeable future, play a significant rule in the use of AWS; the entities controlling AWS must be seen as acting through these systems in order for responsibility to be sufficiently attributed to them.

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Dedicated to the memory of my father, James Hughes.

Declaration:

This thesis is the sole work of the author and it has not been submitted in substantially the same form for the award of a higher degree elsewhere.

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# Chapter 1: Introduction

## 1. The argument and contribution

The main argument of this thesis is that international law, even as it currently stands, can be interpreted and applied to sufficiently regulate autonomous weapon systems (AWS) in armed conflict. This is significant because of the remote chances of international agreement upon new law in this area. The argument is rooted in the notion that, despite having 'machine autonomy', these systems are limited by their programming and the instructions they receive and so are subject to the 'control' of multiple entities.

This thesis provides an original contribution by employing a novel approach to 'control'. In this understanding, the AWS is at the centre of four 'layers of control' that are each associated with a controlling entity. These layers are: political control, concerning decisions about engaging in armed conflict using AWS; procurement control, entailing decisions about reviewing AWS and approving them for use in particular situations; technical control, involving decisions about how AWS should recognise targets and civilians; tactical control, covering decisions about how AWS can be used during attacks.

Where these entities correctly implement legal rules as part of their exercise of control, the resulting freedom for the AWS is that which is legally permissible; meaning that their use should be fully compliant with the applicable bodies of law. Owing to the qualitative deliberations required to comply with several of the applicable legal rules, and the inability of machines to ever make such decisions, this means that human beings who exert control in each layer are legally required to take key decisions about the use of AWS, particularly in relation to targeting. Consequently, human decision-making can be seen at the very centre of AWS operations, despite performance of the actual attacks being delegated to these machines.

In determining whether international law, as it currently stands, is sufficient to regulate AWS, this thesis is focussed upon the *lex lata* and how it can be best brought to bear on the novel challenges of regulating AWS without stretching its interpretation too. This thesis explains how a realistic interpretation of current law provides a framework that enables sufficient regulation to ensure lawful use of these systems and, crucially, provides an adequate responsibility regime in the event that these rules are violated. In order to provide a responsibility regime tailored to AWS, a modest *lex ferenda* suggestion is made in relation to weapons reviewers. In assessing the legal issues of AWS, several large debates in international law are touched upon, including issues of civilians directly participating in hostilities, and the difficulties of investigating and prosecuting crimes conducted during the conduct of hostilities. The central issues in these debates apply equally to AWS. Literature on these debates, and international law more widely, is drawn upon not only to take a position on these issues, but also to advance the field through placing the distinctive challenges of AWS within them.

2. Machine autonomy in AWS

In order to build this contribution, Chapter 2 outlines how AWS function with 'machine autonomy' whilst still being subject to human control, and how this can be perceived through different definitions and paradigms for understanding AWS. The way in which machines use algorithms to sense and process data is explained using computer science literature from Boden,[1] Fry,[2] and Domingos[3] in order to create a foundational understanding of how all systems with 'artificial intelligence' function. The work of Sharkey,[4] Arkin,[5] Boulanin and Verbruggen,[6] and the International Panel on the Regulation

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[1] Margaret A Boden, AI (OUP, 2016).
[2] Hannah Fry, Hello World (Doubleday, 2018).
[3] Pedro Domingos, The Master Algorithm (Perseus Books, 2015).
[4] Noel Sharkey, 'Automating Warfare: Lessons Learned From The Drones' (2011) 21 Journal of Law, Information & Science, 140.
[5] Ronald Arkin, Governing Lethal Behaviour In Autonomous Robots (CRC Press, 2009).
[6] Vincent Boulanin and Maaike Verbruggen, 'Mapping The Development Of Autonomy In Weapon Systems' (SIPRI, 2017).

of Autonomous Weapons[7] is then used to build upon this foundation and explain the specific nature of AWS. This Chapter explains that, fundamentally, AWS can be understood as encompassing sensors, processors, and actuators, and that they function according to their algorithms.

Next, philosophical,[8] physiological,[9] and critical computer science literature[10] is explored to demonstrate that the concept of 'artificial intelligence' is a misnomer and that no machine could ever really be seen as equating to a living being. The consequence of this observation is that AWS are subject to programming written by their developers and instructions provided by their users; this is fundamental to the functioning of '*autonomous'* systems, it is impossible for any machine to operate beyond these boundaries or the control of their developers and users. The work of Weizenbaum is crucial in coming to this view. He explains that even if machines are developed to their absolute technological limit and their programmer, or user, could ask them why they acted in a particular way, their ultimate answer would be, '*Because you told me to*.'[11] Winter comes to a similar conclusion with AWS, and explains that *autonomous* systems do not make decisions, but they apply the decisions of their programmers and users.[12] Whilst AWS and fighters in combat play the same role, i.e. conducting hostilities, the crucial difference is that human beings can make decisions for themselves, whereas a machine can only apply decisions within the limits of its programming and instructions.[13]

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[7] International Panel on the Regulation of Autonomous Weapons, 'Technology And Application Of Autonomous Weapons' (Stiftung Wissenschaft und Politik, 2017).

[8] Agnieszka Jaworska and Julie Tannenbaum, 'The Grounds Of Moral Status' Stanford Encyclopedia of Philosophy Archive (Stanford University, 2018) Archived:<https://web.archive.org/web/20190318070216/https://plato.stanford.edu/archives/spr2018/entries/grounds-moral-status/>.

[9] Mark Bishop, 'Why Computers Can't Feel Pain' (2009) 19 Minds and Machines, 507; Philippe Rochat, 'Five Levels Of Self-Awareness As They Unfold Early In Life' (2003) 12 Consciousness and Cognition, 717.

[10] Roger Penrose, Shadows Of The Mind (OUP, 1996), 127-208; Peter Stone et al., 'Artificial Intelligence and Life in 2030' (Stanford University, 2016) Archived:<https://web.archive.org/web/20190919211256/https://ai100.stanford.edu/sites/g/files/sbiybj9861/f/ai_100_report_0831fnl.pdf> 6.

[11] Joseph Weizenbaum, Computer Power And Human Reason (WH Freeman, 1976), 260.

[12] Elliot Winter, 'Autonomous Weapons In Humanitarian Law: Understanding The Technology, Its Compliance With The Principle Of Proportionality And The Role Of Utilitarianism' (2018) 6 Groningen Journal of International Law, 183, 193.

[13] '*contrary to what is suggested by science-fiction scenarios, the danger is not that robots begin to disobey. Quite the reverse: it is that they never disobey.*', See Gregoire Chamayou, Drone Theory (Penguin Books, 2015).

Having explained how AWS, as a matter of fact, could be said to be subject to human control, Chapter 2 then explores different definitions of AWS from the US,[14] the UK,[15] Russia,[16] the Netherlands,[17] France,[18] China,[19] Switzerland,[20] Cuba,[21] Belgium,[22] and the International Committee of the Red Cross.[23] It determines that (1) AWS should be seen as weapon systems that select and engage targets without human intervention, (2) their overall activities would be predictable even if their individual actions are not, and (3) the potential for a human being to intervene in an attack is irrelevant unless they actually do so.

Next, the Chapter critically explores the two main, competing, paradigms for understanding key aspects of AWS, namely: the 'loop' paradigm offered by Human Rights Watch[24] that enhances comprehension of the human-machine relationship; the 'levels' paradigm developed by Crootof that

[14] United States Department of Defense, 'Directive 3000.09' (2012) 13-14.
[15] Development, Concepts, and Doctrine Centre, 'The UK Approach To Unmanned Aircraft Systems' (UK Ministry of Defence, 2011) para.205.
[16] Russian UNOG Delegation, 'Russia's Approaches to the Elaboration of a Working Definition and Basic Functions of Lethal Autonomous Weapons Systems in the Context of the Purposes and Objectives of the Convention' 2018 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 4 April 2018) UN Doc. CCW/GGE.1/2018/WP.6, para.2.
[17] The Netherlands UNOG Delegation,' Examination of various dimensions of emerging technologies in the area of lethal autonomous weapons systems, in the context of the objectives and purposes of the Convention' 2017 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 9 October 2017) UN Doc. CCW/GGE.1/2017/WP.2, para.5.
[18] French UNOG Delegation, 'Characterization of a LAWS' 2016 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 15 April 2016) Archived:<https://web.archive.org/web/20190912155857/https://www.unog.ch/80256EDD006B8954/(httpAssets)/5FD844883B46FEACC1257F8F00401FF6/$file/2016_LAWSMX_CountryPaper_France+CharacterizationofaLAWS.pdf>.
[19] Chinese UNOG Delegation, 'Position Paper' 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 11 April 2018) UN Doc. CCW/GGE.1/2018/WP.7, para.3.
[20] Swiss UNOG Delegation, 'A "Compliance-Based" Approach To Autonomous Weapon Systems' 2017 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 10 November 2017) UN Doc. CCW/GGE.1/2017/WP.9, para.29.
[21] Cuban UNOG Delegation, 'Implementation and enforcement of International Law, particularly international humanitarian law, in the context of autonomous weapons' 2016 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 14 April 2016) Archived:<https://web.archive.org/web/20190912161055/https://www.unog.ch/80256EDD006B8954/(httpAssets)/2EC2FA3DC75A50FFC12580820056F458/$file/Cuba+WP.pdf> 4.
[22] Belgian UNOG Delegation, 'Towards a definition of lethal autonomous weapons systems' 2017 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 7 November 2017) UN Doc. CCW/GGE.1/2017/WP.3, para.8(c).
[23] International Committee of the Red Cross, 'Autonomous Weapon Systems: Implications Of Increasing Autonomy In The Critical Functions Of Weapons' (ICRC, 2016) 7.
[24] Human Rights Watch, 'Losing Humanity' (Human Rights Watch, 2012) 2.

provides insight into how AWS can be seen in terms of their technical sophistication from inert weapons, through automatic and *semi-autonomous*, to *autonomous* weapon systems.[25] These two paradigms are then placed within the wider ethical,[26] political,[27] and security studies literature[28] to show the major issues that AWS pose. The Chapter agrees with Leveringhaus that the use of *autonomous* attack could be morally and ethically permissible in situations where it is necessary in order to avoid defeat or the use of other systems present greater risks of undesirable consequences.[29]

3. The applicable law and layers of control

Having shown that AWS are, despite their apparent autonomy, mere machines subject to human control, Chapter 3 builds on this to explain how international law is relevant to these systems and how it can be applied to them. To do this it first explains the sources of international law and notes that there are no specific legal rules governing their use: no treaties regarding AWS have been agreed; there has not been a clear expression of customary rules relating to AWS; there have been no legal judgements where AWS could be evaluated or could have general principles applied to them; none of the 'classic' highly qualified publicists wrote about AWS, and nor are there generally agreed positions amongst modern writers that could be applied directly to AWS.

Given that there are no existing provisions that specifically regulate AWS, this Chapter goes on to explain how current international law can be applied to such systems. It does this through

[25] Rebecca Crootof, 'The Killer Robots Are Here: Legality And Policy Implications' (2015) 36 Cardozo Law Review, 1837, 1870-1872.
[26] For example, Alex Leveringhaus, Ethics And Autonomous Weapons (Palgrave Macmillan, 2016) 3; Robert Sparrow, 'Killer Robots' (2007) 24 Journal of Applied Philosophy, 62; Michael Robillard, 'No Such Thing As Killer Robots' (2017) 35 Journal of Applied Philosophy, 705.
[27] For example, Lucy Suchman, Karolina Follis and Jutta Weber, 'Tracking And Targeting' (2017) 42 Science, Technology, & Human Values, 983.
[28] For example, Paul Scharre, Army Of None (WW Norton & Company, 2018); Amitai Etzioni and Oren Etzioni, 'Pros And Cons Of Autonomous Weapons Systems' (2017) May-June Military Review, 72; Matthew Press, 'Of Robots And Rules: Autonomous Weapon Systems In The Law Of Armed Conflict' (2017) 48 Georgetown Journal of International Law, 1337; Michael W. Meier, 'The strategic implications of lethal autonomous weapons', in Jens David Ohlin (ed.), Research Handbook On Remote Warfare (Edward Elgar, 2017).
[29] Alex Leveringhaus, Ethics And Autonomous Weapons (Palgrave Macmillan, 2016) 3.

explaining the relevance of several different bodies of law and legal regimes that apply to these systems: the *Jus ad Bellum* as it is applicable to the use of force by states using AWS; the law of armed conflict and international human rights law as they are applicable through the 'weapons law' and 'targeting law'[30] regimes; the law on state responsibility and international criminal law as they are applicable through responsibility regimes for states, non-state actors, individuals and, potentially, corporations.

Next, the Chapter makes an initial assessment of the legality of AWS *per se* in order to show that they are not prohibited outright by international law, and that it is worth considering the legality of AWS in depth. Having done this, the Chapter then explains the regulatory challenge of applying legal rules normally applied to, and by, fighters to AWS. The Chapter considers three possible options for dealing with this challenge: *prohibit AWS by an international legal instrument* as suggested in works by Chengeta[31] and Human Rights Watch;[32] create a *comprehensive international legal regulation* for the development, manufacture, use, proliferation, and responsibility for AWS as preferred by Crootof,[33] Anderson, Waxman and Reisner;[34] or, *apply existing legal rules to those controlling AWS*. It is shown that the latter is the only viable option because no agreement on a prohibitive or regulatory treaty is likely to be achieved, and there are no existing legal provisions specifically regulating AWS. In evaluating options for applying current legal rules, this thesis rejects conceptualising AWS as having legal personhood as this '*would shield human actors from*

[30] It is important to note that this term is disputed. Many authors would say 'the law on the conduct of hostilities', however owing to the focus on targeting in Chapter 5, the term 'targeting law' is preferred in this thesis. See William H. Boothby, The Law Of Targeting (OUP, 2012).
[31] Thompson Chengeta, 'Measuring Autonomous Weapon Systems Against International Humanitarian Law Rules' (2016) 5 Journal of Law and Cyber Warfare.
[32] Human Rights Watch, 'Losing Humanity' (Human Rights Watch, 2012).
[33] Rebecca Crootof, 'The Killer Robots Are Here: Legality And Policy Implications' (2015) 36 Cardozo Law Review, 1837.
[34] Kenneth Anderson, Daniel Reisner and Mathew Waxman, 'Adapting The Law Of Armed Conflict To Autonomous Weapon Systems' (2014) 90 International Law Studies, 335.

*accountability*'.[35] However, following the work of Pagallo,[36] the thesis accepts that AWS can be conceptualised as the legal agents of those controlling them, who hold responsibility for the acts of these systems.

Different conceptions of control offered in existing literature on AWS are then explored. The most common notion of control regarding AWS is 'meaningful human control'. This is an approach that, if followed, would require human beings to make all key decisions about attacks at the time an attack takes place;[37] in effect, this would prohibit the use of *autonomous* targeting. This approach is rejected because, in addition to requiring compliance with legal rules, it provides additional requirements about how this should be done, and so goes beyond extant international law.[38] Implementation of these requirements would also prohibit attacks using artillery shells and some missiles that have been taking place for many years due to the inability to control such ordnance once it is launched.[39] As such, it is neither a reflection of the *lex lata* nor practical to implement and so is rejected by this thesis.

Another approach to controlling relationships over AWS is offered by Kruipy, who describes a matrix of individuals exerting control over these systems as a socio-technical system that could be

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[35] International Tin Council Case, JH Rayner (Mincing Lane) Ltd. v. Department of Trade and Industry [1989] 3 WLR 969, 986-987; Joanna J. Bryson, Mihailis E. Diamantis and Thomas D. Grant, 'Of, For, And By The People: The Legal Lacuna Of Synthetic Persons' (2017) 25 Artificial Intelligence and Law, 273, 287.

[36] Ugo Pagallo, The Laws Of Robots (Springer Netherlands, 2013) 152-170; Ugo Pagallo, 'Vital, Sophia, And Co.—The Quest For The Legal Personhood Of Robots' (2018) 9 Information, 230, 10.

[37] See, for example, Michael Horowitz and Paul Scharre, 'Meaningful Human Control In Weapon Systems: A Primer' (Center for a New American Security, 2015) Archived:<https://web.archive.org/web/20190919104630/https://s3.amazonaws.com/files.cnas.org/documents/Ethical_Autonomy_Working_Paper_031315.pdf?mtime=20160906082316>; Article 36, 'Key Elements Of Meaningful Human Control' (2016) Archived:<https://web.archive.org/web/20190720004947/http://www.article36.org/wp-content/uploads/2016/04/MHC-2016-FINAL.pdf>; Elke Schwarz, 'ICRAC Statement On The Human Control Of Weapons Systems At The August 2018 CCW GGE' 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 28 August 2018) Archived:<https://web.archive.org/web/20190919104758/https://www.icrac.net/icrac-statement-on-the-human-control-of-weapons-systems-at-the-august-2018-ccw-gge/>.

[38] Rebecca Crootof, 'A Meaningful Floor For "Meaningful Human Control"' (2016) 30 Temple International & Comparative Law Journal, 53, 61-62.

[39] Merel Ekelhof, 'Autonomous Weapons: Operationalizing Meaningful Human Control' (Humanitarian Law & Policy, 2018) Archived:<https://web.archive.org/web/20190730050511/https://blogs.icrc.org/law-and-policy/2018/08/15/autonomous-weapons-operationalizing-meaningful-human-control/>.

seen to have quasi-legal personhood for the purposes of attributing responsibility.[40] This thesis does not dispute that the relationships could be seen as a socio-technical system. But, having rejected ascribing legal personhood to AWS, due to the potential to shield individual wrongdoers, this approach is rejected for the same reason.

Chapter 3 goes on to expand upon the concept of layers of control in order to elaborate further on the original contribution to knowledge made by this thesis. It explains the nature and extent of control in this context and outlines how legal rules are applied in each layer. In order to do so, it brings together several competing concepts of control over *autonomous* systems into a coherent framework: political control draws upon UK policy documents;[41] procurement control develops from Corn's concept of procurement responsibility;[42] technical control is based upon McFarland's idea of 'autonomous control';[43]tactical control is inspired by the way in which weapons with autonomy are controlled today, as described by Scharre.[44] Each of these concepts are developed by their authors to understand control over *autonomous* systems in their entirety; however, this thesis shows that they are most relevant to distinct entities within a layer of control. The subsequent chapters show how these layers of control are exercised specifically by applying the different legal regimes mentioned above.

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[40] Tetyana Kruipy, 'Regulating a Game Changer: Using a Distributed Approach to Develop an Accountability Framework for Lethal Autonomous Weapon Systems' (2018) 50 Georgetown Journal of International Law, 45, 111.
[41] UK UNOG Delegation, 'Human Machine Touchpoints: The United Kingdom's Perspective On Human Control Over Weapon Development And Targeting Cycles' 2018 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 8 August 2018) UN Doc. CCW/GGE.2/2018/WP.1, 5-6.
[42] Geoffrey Corn, 'Autonomous Weapon Systems: Managing The Inevitability Of 'Taking The Man Out Of The Loop', in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016), 230-238.
[43] Tim McFarland, 'Autonomous Weapons And Human Control' (Humanitarian Law & Policy, 2018) Archived:<https://web.archive.org/web/20190719081210/https://blogs.icrc.org/law-and-policy/2018/07/18/autonomous-weapons-and-human-control/>.
[44] Scharre (n.28), 162-169.

4. Applying the 'weapons law' regime

In Chapter 4, the so-called 'weapons law' regime is applied to AWS in the context of weapons review criteria. This builds upon the previous chapters and explores in detail the nature and implications of procurement control, and how it influences both technical and tactical control. At the outset, a brief historical case study of autonomy being used during the Vietnam War is made to explain the importance of tailoring a legal review to weapons with autonomy to fully comprehend their impact and novelty. The importance of weapons reviews is underscored by following the work of Bolt[45] and particularly Corn,[46] who notes that weapons reviewers only provides guidance and authorise a system for use in a particular situation or in a specific manner where the unlawful use of the system is unforeseeable to them.[47] As such, this means that reviewers are gatekeepers for using AWS: they will only approve an AWS, or any weapon system, for use where they can see a lawful way of using it.

This Chapter outlines the legal basis of weapons reviews, and the applicable law, using the work of Jevglevskaja[48] and the military manuals of the UK,[49] the US,[50] Canada,[51] Australia,[52] New Zealand,[53] Denmark, [54] Germany,[55] and information from Sweden.[56] It then uses the work of Boothby,[57]

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[45] Alexander Bolt, 'The Use of Autonomous Weapons and the Role of the Legal Adviser' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013).
[46] Corn (n.42), 209.
[47] Corn (n.42), 233.
[48] Natalia Jevglevskaja, 'Weapons Review Obligation Under Customary International Law' (2018) 94 International Law Studies, 1887.
[49] UK Ministry of Defence, Manual Of The Law Of Armed Conflict (OUP, 2004) para.6.20.1; UK Ministry of Defence, 'Legal Review Of Newly Acquired Or Developed Weapons Or Associated Equipment (2009DIN04-217)' (Development, Concepts and Doctrine Centre, 2009); UK Ministry of Defence, UK Weapons Reviews (Development, Concepts and Doctrine Centre, 2016) (hereafter: UK Weapons Reviews).
[50] US Department of Defense, Law Of War Manual 2015, Updated May 2016 (Office of the General Counsel, 2016)(hereafter: US Manual).
[51] Canadian Office of the Judge Advocate General, Law Of Armed Conflict At The Operational And Tactical Levels (National Defence, 2001).
[52] Australian Defence Headquarters, Law Of Armed Conflict, ADDP 06.4 (Defence Publishing Service, 2006).
[53] New Zealand Defence Force, DM 69 (2 Ed) Manual Of Armed Forces Law, Volume 4 Law Of Armed Conflict (Directorate of Legal Services, 2017).
[54] Jes Rynkeby Knudsen, Military Manual On International Law Relevant To Danish Armed Forces In International Operations (Danish Ministry of Defence, 2016).
[55] Germany, Federal Ministry of Defence, Law Of Armed Conflict Manual (2013).
[56] Marie Jacobsson, 'Modern Weaponry And Warfare: The Application Of Article 36 Of Additional Protocol I By Governments' (2006) 82 International Law Studies, 183.
[57] William H Boothby, Weapons And The Law Of Armed Conflict (2nd edn, OUP, 2016).

McClelland,[58] and others, along with the weapons review policies of the UK,[59] the US,[60] and Australia[61] to describe the process of a weapons review. This involves examining the meaning of each applicable legal rule and how they apply to AWS: whether a weapon is specifically prohibited; whether a weapon is likely to be prohibited in the future; whether a weapon causes superfluous injury or unnecessary suffering; whether a weapon causes an unlawful level of environmental harm; whether a weapon is inherently indiscriminate; whether a weapon can be used in accordance with the Martens Clause. The Chapter outlines how procurement control has a direct influence on technical control by determining how the requirements for each legal rule can be generally met by AWS.

In doing so, the Chapter re-confirms that AWS are not fundamentally unlawful, and that they could pass a weapons review, but also that the flexibility of how weapons reviews can be performed is key to properly evaluating AWS. The legal obligation to conduct weapons reviews comes from Article 36 of Additional Protocol I to the Geneva Conventions of 1949,[62] which does not provide any instruction on how they should be carried out. As the Chapter explains, although states generally agree on what rules should be applied in reviews, there are no clear limitations on this; therefore, it is unclear how AWS should be assessed in a way that is tailored to them. This Chapter fills a gap in knowledge by explaining that, as the legal obligation is not prescriptive, weapons reviews can, and should, be used flexibly in order to comprehend the novelty of emerging systems. The best example of this is in relation to examining whether they are inherently indiscriminate. With conventional weapons a review would consider accuracy in terms of whether the weapon can hit the point it is aimed at. Whereas with AWS, the most important factor is how accurate it is in recognising targets. Taking this approach allows for the key issues of new weapons to be evaluated effectively.

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[58] Justin McClelland, 'The Review Of Weapons In Accordance With Article 36 Of Additional Protocol I' (2003) 85 International Review of the Red Cross, 397.
[59] UK Weapons Reviews.
[60] US Manual, para.6.2.
[61] Australian UNOG Delegation, 'The Australian Article 36 Review Process' 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 30 August 2018) UN Doc. CCW/GGE.2/2018/WP.6.
[62] Also note the discussion of implied duties to review weapons from customary law, Chapter 3, Section 4.

5. Applying the 'targeting law' regime

Chapter 5 builds upon the previous Chapter to demonstrate how AWS could be used lawfully within the so-called 'targeting law' regime. Taking into account the previous chapters, and the limitations on what machines can do by their very nature, this Chapter argues that many decisions about targeting require human beings to perform them lawfully and this will be the case for the foreseeable future. Authors such as Asaro[63] and Human Rights Watch[64] suggest that all targeting decisions need to be made contemporaneously by human beings. This thesis does not agree that all targeting choices must be made at the moment of attack. By following the works of Schmitt[65] and Thurnher,[66] Boothby,[67] Sassòli,[68] and Ford,[69] the Chapter explains that the nature of the legal rules relevant to targeting does not explicitly require human beings to fulfil them, meaning that what is most important is the completion of legal requirements and not how this is done. As such, there is no prohibition on these rules being satisfied by AWS. The Chapter fills a gap in knowledge between these two camps: That human traits are lawfully required for fulfilling targeting decisions, but that operationalising these choices can be done by AWS where they have the necessary technical capabilities.

The reason for taking this position is that many legally required decisions about targeting involve qualitative analysis. It is currently unforeseeable that any AWS would ever be able to perform

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[63] Peter Asaro, 'On Banning Autonomous Weapon Systems: Human Rights, Automation, And The Dehumanization Of Lethal Decision-Making' (2012) 94 International Review of the Red Cross, 687.
[64] Human Rights Watch, 'Losing Humanity' (Human Rights Watch, 2012).
[65] Michael N. Schmitt, 'Autonomous Weapon Systems And International Humanitarian Law: A Reply To The Critics' (2013) Harvard National Security Journal Features Archived:<https://web.archive.org/web/20190917164404/https://harvardnsj.org/wp-content/uploads/sites/13/2013/02/Schmitt-Autonomous-Weapon-Systems-and-IHL-Final.pdf>.
[66] Michael N. Schmitt and Jeffrey Thurnher, '"Out Of The Loop": Autonomous Weapon Systems And The Law Of Armed Conflict' (2013) 4 Harvard National Security Journal, 231.
[67] William Boothby, 'How Far Will the Law Allow Unmanned Targeting to Go?' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013).
[68] Marco Sassóli, 'Autonomous Weapons And International Humanitarian Law: Advantages, Open Technical Questions And Legal Issues To Be Clarified' (2014) 90 International Law Studies, 308.
[69] Christopher M. Ford, 'Autonomous Weapons And International Law' (2017) 69 South Carolina Law Review, 413.

qualitative decision-making,[70] and so these decisions must be taken by a human being in order to determine how an AWS should carry out an attack. Consequently, the commander is legally and morally required to always remain 'cognitively close' to the attack, even when they have delegated the execution of the attack to the AWS and it will act '*autonomously*'.

The AWS acts as a proxy for the human being and can never lawfully, nor practically, replace this human decision-making. So, for example, the method by which an AWS is to recognise targets and civilians, what factors should be considered for a comparison between military advantage and incidental harm, and how this should be done by an AWS (if it is at all possible) are all decisions that must be taken by the commander in order to be lawful.

This does not mean that a commander must determine everything about an attack, but that the commander must determine a specific mission for the AWS, within particular boundaries, prior to launching it; for example, a commander would not need to choose tank X to be attacked, but would need to determine that tanks (A) should be destroyed within B time-frame at C location and using D weapons (or causing E effects).

Another implication of legally requiring commanders to carry out qualitative assessments and be 'cognitively close' to the attack is that, unless a commander can guarantee lawfully compliant use of AWS in a *fully-autonomous* mode on the mission they have determined, then using the system in a *semi-autonomous* or remote-controlled mode becomes a legal requirement. The legal rules for an attack must be complied with: if an AWS cannot do this without additional human assistance, then that human assistance becomes lawfully required.

In relation to the previous chapters, this exercise of tactical control is most crucial in terms of how the system will actually act. It is only once the decisions about targeting take place that an AWS can be deployed according to the decisions of each controlling entity. Following on from Chapter 4, it

[70] Boothby (n.67), 56-57.

is also made clear that the instructions a commander can give, and the level of control they can exert, is subject to the limit provided by procurement control (i.e. the use of an AWS must be in compliance with a reviewer's guidance), and technical control (i.e. the use of an AWS is limited by its technological reality). Of course, this is also limited by political control (i.e. an AWS cannot be used in an armed conflict that political decision-makers do not choose to engage in). This, therefore, is the clearest example of how these different layers of control are exercised and impact upon AWS; when such a system is deployed it is always subject to these four layers of control. Other than a rogue operator deploying an AWS beyond their orders (and therefore beyond control), use of AWS does not exist beyond these layers of control. Even if non-state actors (NSAs) use AWS, they might not have a formal weapons review process, for example, but someone in their organisation chooses to purchase them, and tells their fighters how to use them; thus even the use of AWS by NSAs is still subject to multiple levels of control, even if it is not exercised in the same way.

## 6. Applying responsibility regimes

Having explained throughout the thesis that AWS are, by their nature, subject to the control of human beings, Chapter 6 demonstrates how the 'layers of control' approach facilitates determining the responsibility of states, non-state actors, and individuals for the use of AWS (it also includes an exploration of the international responsibility of corporations). The Chapter first outlines how people who are against the development of AWS have argued that there is a 'responsibility gap' meaning that, in their view, it is difficult to ascribe responsibility for the use of AWS to individuals and so their use would not be morally compliant; the works of Human Rights Watch,[71] Chengeta,[72] and Sparrow[73] are explored on this position. Overall, the Chapter shows how this position is wrong. It argues for, and

[71] Human Rights Watch, 'Mind The Gap' (Human Rights Watch, 2015).
[72] Thompson Chengeta, 'Accountability Gap, Autonomous Weapon Systems And Modes Of Responsibility In International Law' (2016) 45 Denver Journal of International Law, 1.
[73] Sparrow (n.26) 62.

evidences that, international law as is currently stands does, on the whole, have the tools to deal with responsibility for AWS by applying multiple responsibility regimes together in a new paradigm.

Some authors have considered individual legal regimes for dealing with some of the responsibility issues created by AWS,[74] and others have suggested use of multiple regimes simultaneously.[75] This Chapter fills a gap in knowledge firstly by presenting which legal responsibility regimes should be assessed, and then outlining how they can each be applied in the case of different entities controlling AWS. Thus, by presenting a new paradigm of responsibility for AWS, the Chapter demonstrates that there does not need to be a responsibility gap and that this can be closed through adopting a view that the various entities controlling AWS also have responsibilities that come from this control; the Chapter does, however, accept that there are some very specific areas where responsibility gaps could exist in international law, and that these could be closed by domestic legal systems.

The right to a remedy and concepts of moral accountability are explored in order to demonstrate the importance of determining the legal responsibility paradigm for the use of these systems, and that this paradigm needs to, and indeed can, govern each entity exercising control over AWS. In explaining the responsibility of state agents who control AWS, the state responsibility regime is outlined and it is shown that where such persons use an AWS to violate international legal obligations, the state can be held responsible for this; state responsibility for human rights violations are considered in particular owing to their application to weapons reviews discussed in Chapter 3 and to targeting in Chapter 4. The potential for violent non-state actors to use AWS is mentioned several times throughout this work and so the emerging framework regarding their responsibility as holders

[74] See, for example, Jeffrey Thurnher, 'No One At The Controls: The Legal Implications Of Fully Autonomous Targeting' (2012) 67 Joint Force Quarterly, 77; See, for example, Tim McFarland and Tim McCormack, 'Mind The Gap: Can Developers Of Autonomous Weapons Systems Be Liable For War Crimes?' (2014) 90 International Law Studies, 36; Charles James Dunlap, 'Accountability And Autonomous Weapons: Much Ado About Nothing?' (2016) 30 Temple International and Comparative Law Journal, 63.

[75] See, for example, Armin Krishnan, Killer Robots: Legality And Ethicality Of Autonomous Weapons (Ashgate Publishing, 2009).

of international legal obligations in the same vein as states is also explored alongside the potential responsibility of corporations under the emergent business and human rights regime. Next, the international criminal law regime is examined and the core crimes of aggression, genocide, crimes against humanity, and war crimes are outlined to display that AWS could perform the *actus reus* elements of these crimes. This section takes particular note of the work of McFarland and McCormack,[76] who have identified an area of potential impunity regarding war crimes for AWS developers who build systems in peace time but programme them in such a way as to perform international crimes during a later armed conflict.[77]

In order to show how control of AWS relates to responsibility for their actions on the individual level, the notion of 'acting through' other entities in the 'control of crime' approach is explained using the work of Roxin,[78] Ohlin,[79] Jain,[80] and jurisprudence of the International Criminal Court.[81] This concept shows that actions of AWS should be viewed as the manifestation of technical and tactical control and so those exerting that control with *mens rea* can be seen as using these machines as instruments to carry out their criminality and thus be held responsible for what they programme or instruct the AWS to do. The Chapter explains the lack of *de jure* responsibilities of AWS manufacturers through a brief consideration of corporate liability in international law, and the potential legal responsibility for the senior managers of these companies using precedents from post-World War II trials of 'Nazi Industrialists'.[82]

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[76] McFarland and McCormack (n.74) 361.
[77] See the penultimate criteria for each crime under Art.8, International Criminal Court, Elements Of Crimes (International Criminal Court, 2011).
[78] Claus Roxin, 'Crimes As Part Of Organized Power Structures' (2011) 9 Journal of International Criminal Justice, 193; Claus Roxin, Täterschaft und Tatherrschaft (Walter de Gruyter, 2007) 127.
[79] Jens David Ohlin, 'The Combatant's Stance: Autonomous Weapons On The Battlefield' (2016) 92 International Law Studies, 1, 11-14.
[80] Neha Jain, 'Autonomous Weapon Systems: new frameworks for individual responsibility' in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016) 308-310.
[81] Situation in the Democratic Republic of the Congo in the Case of the Prosecutor v Germain Katanga and Mathieu Ngudjolo Chui (Pre-Trial Chamber) Case No: ICC-01/04-01/07 [2008] ICC.
[82] United States v. Friedrich Flick (Vol. VI), United States V. Carl Krauch (Vols. VII-VIII, and United States v. Alfried Kripp (Vol. IX) in Nuremberg Military Tribunals, Trials Of War Criminals Before The Nuremberg Military Tribunals Under Control Council Law No. 10, Nuremberg, October 1946-April 1949 (US Government Printing

Next, the Chapter explores the role of commanders through considering firstly superior orders and how the complexity of AWS might mean that seemingly innocuous orders might result in unlawful actions due to difficulties in comprehending how AWS work. Further, the applicability of command responsibility is explored both over AWS operators and the systems themselves. Again, the complexity of these systems is considered due to commanders being required to understand their subordinates in order to effectively control them.

A final mode of liability is explored in relation to procurement control; the work of Corn is used to explain the notion of 'procurement responsibility'[83] and how weapons reviewers could be held responsible for approving AWS for use where they either knew or should have known about issues with these machines that could affect their lawful use.

The responsibility paradigm that this Chapter sketches out is not, however, without issue. There are some small responsibility gaps that remain. First is that, as mentioned, not all weapons manufacturing activities are in the context of an armed conflict and so AWS developers might be immune from prosecution on the international level if they produce an unlawful system prior to the conflict starting. Further, AWS manufacturers are, for the foreseeable future, not holders of international legal personality in a way that would allow for them to be held responsible. Therefore, the international level struggles to hold these entities responsible for their control over AWS. Thus, the Chapter argues that in these situations, domestic legal regimes should be used to fill the vacuum and remove the responsibility gap. It is, however, noted that this also creates an additional issue as many modern technologies are developed and built by consortia of many different manufacturers[84]

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Office, 1950); Matthew Lippman, 'War Crimes Trials Of German Industrialists: The "Other Schindlers."' (1995) 9 Temple International and Comparative Law Journal, 173.

[83] Corn (n.42), 209.

[84] See, for example, the large number of contributing companies from different countries: BAE Systems, 'Taranis' (BAE Systems, 2016) Archived:<https://web.archive.org/web/20190812060713/https://www.baesystems.com/en-uk/product/taranis1>; Dassault, 'Neuron, The European Combat Drone Demonstrator: Introduction' (Dassault Aviation, 2018) Archived:<https://web.archive.org/web/20190727165638/https://www.dassault-aviation.com/en/defense/neuron/introduction/>.

and so it could be exceedingly difficult to attribute responsibility to those who actually cause wrongdoing. Another issue with holding individuals responsible is whether they could have, or should have, been able to understand the complexity of these machines and the implications for their usage; some technological solutions are sketched out. Despite these remaining responsibility gaps, this Chapter argues that, in opposition to the position of the anti-AWS lobby, the real responsibility gap with regard to AWS is in fact far smaller than they suggest and should not be seen as a barrier to their development or deployment.

7. Conclusion

Finally, the conclusion in Chapter 7 provides a summing up of the major issues: different entities can be seen as controlling AWS; these entities can be held responsible for the actions of AWS that they have control over; human beings should make decisions about, and remain close to, the use of AWS in attacks. However, it is also noted that the issues caused by the complexity of these systems cannot yet be solved through technological solutions, and that even if the technologies developed to the point where human beings would not need to be 'cognitively close' to an AWS attack in legal terms, the same requirement in moral terms, as established in Chapter 2, would remain.

Overall, the thesis demonstrates that international law, as it currently stands, is sufficient to regulate AWS. It is also shown that the best way for international legal rules to be applied to AWS is through the human beings and entities that control them, and that, in order to understand these control relationships, they should be seen as existing in layers which reduce the freedom of action that an AWS has to the point where the space that they can operate *autonomously* is acceptable to each controller. Where controllers correctly apply legal rules as part of their control, the *autonomous* functioning by AWS should be legally compliant according to current international legal rules.

Chapter 2: The nature of machine autonomy and how it manifests in AWS.

1. Introduction

Autonomy in weapon systems has been a concern of international lawyers since at least the 1980s, with Pictet suggesting that the use of remote-control technologies, sensors, and automation could lead to human beings playing an ever-smaller role on battlefields.[1] He ultimately warns that '*if man does not master technology, but allows it to master him, he will be destroyed by technology*.'[2] We are currently in a period of great advancement for military technologies.[3] Thus, it is very important that we fully understand the nature of, and issues created by, autonomous weapon systems (AWS). A key issue is the meaning of '*autonomous'* as it relates to AWS. This is important because, we need to understand their nature in order to determine how they should be treated by legal systems.

AWS are defined later in this Chapter as systems that target and attack adversaries without human involvement. Thus, they are a weapon that plays the role of a fighter in combat. How the legal rules apply to these machines is crucial because they are engaged in a role that no weapon has ever played before. The legal rules governing warfare have been fundamentally unchanged since 1977,[4] and were written for humans to apply, abide by, and be subject to a responsibility regime when they violate those rules. Thus, whether AWS can simply be treated as if they were human for the purposes of these legal rules deeply affects how they should be regulated and how responsibility for their actions should be ascribed.

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[1] Jean Pictet, 'Article 36', in Yves Sandoz, Christophe Swinarski and Bruno Zimmermann (eds.), Commentary On The Additional Protocols Of 8 June 1977 To The Geneva Conventions Of 12 August 1949 (Martinus Nijhoff Publishers, 1987) para.1476.

[2] The gendered language in this quote is not ideal but has been reproduced verbatim to maintain the accuracy of Pictet's meaning, Pictet (n.1) para.1476.

[3] On the 'Revolution in Military Affairs' cause by artificial intelligence and robotics, see P.W. Singer, Wired For War (Penguin Press, 2009).

[4] The last major treaty changes to the law of armed conflict were: Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 3 (API); Protocol Additional To The Geneva Conventions Of 12 August 1949, And Relating To The Protection Of Victims Of Non-International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 609 (APII).

In order to answers these questions in later chapters, the nature of AWS must first be understood. This Chapter outlines 'autonomy' as it relates to machines and how these systems work. It is determined that these machines are not '*autonomous*' in the same sense as human beings but have 'machine autonomy' subject to their programming and instructions, and so are controlled by persons who decide upon their programming and instructions. An assessment of different definitions of AWS is then undertaken. This outlines how the selection and engagement of targets are key attributes, that the actions of AWS are generally foreseeable even if specific actions are not predictable, and that the potential for human intervention is not relevant unless an intervention actually takes place. Then, the major issues generated by these systems are discussed alongside the major paradigms for understanding AWS. Finally, the Chapter notes the capabilities of weapons with autonomy that are available or in development today.

## 2. Machine autonomy

The word *autonomous* comes from 17th century Greece. It began as αὐτός (autós, "self") and νόμος (nómos, "law"). In the modern world, we think of *autonomous* entities as having '*the freedom to determine one's own actions, and behaviours*.'[5] Such an entity is, therefore, independent, and not subject to extrinsic control. However, this thesis is concerned with machines that possess autonomy.

Machine autonomy is a narrower concept than that regarding other *autonomous* entities. It comes from the field of robotics and relates more to a machine functioning *automatically* rather than to its individual freedom.[6] A machine that functions *automatically* follows a '*pre-programmed sequence of operations or moves in a structured environment.*'[7] For example, traffic lights generally

[5] Collins English Dictionary Online, 'Definition of autonomy' (2017) Archived:<https://web.archive.org/web/20161012230804/http://www.collinsdictionary.com/dictionary/english/autonomy>.
[6] Noel Sharkey, 'Automating Warfare: Lessons Learned From The Drones' (2011) 21 Journal of Law, Information & Science, 140, 141.
[7] Sharkey 2011 (n.6) 141

follow a fixed sequence for allowing vehicles at different junctions to travel. An *autonomous* machine, however, is more complicated, not only can they operate in open and unstructured environments, they also have some freedom in how these operations happen.[8] Consider that a self-driving vehicle might be instructed with a destination, but must use its conception of the world to plan a route and use its sensors to avoid pedestrians on crossings.

3. How autonomous machines work

All robotic systems whether *autonomous*, *automatic*, or somewhere in between, function in similar ways. They are all made up of sensors, processors, and actuators.[9] The *sensors* detect relevant changes to the environment and may deal with any data type which can be quantified. Various sensors could detect the shape, size, and depth of objects, along with their velocity and acoustic, electromagnetic, or engine emissions.[10] As such, machine sensors can go beyond human senses[11] and may be able to detect these data either individually or collectively (multi-phenomenon assessment can greatly increase sensing accuracy).[12]

Once data has been sensed, it must be *processed*. This is done using algorithms that compare sensor data to a pre-set condition.[13] The condition is constituted from an entry in the memory of the system (in the case of this thesis, a database of potential targets).[14] After this comparison, the algorithm will then produce an output, the result of which depends upon whether the condition is

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[8] Sharkey 2011 (n.6) 141
[9] International Panel on the Regulation of Autonomous Weapons, 'Technology And Application Of Autonomous Weapons' (Stiftung Wissenschaft und Politik, 2017) 11.
[10] Vincent Boulanin and Maaike Verbruggen, 'Mapping The Development Of Autonomy In Weapon Systems' (SIPRI, 2017) 24-25.
[11] Ian S Henderson, Patrick Keane and Josh Liddy, 'Remote and autonomous warfare systems: precautions in attack and individual accountability' in Jens David Ohlin (ed.) Research Handbook On Remote Warfare (Edward Elgar, 2017) 341-342.
[12]Alan Backstrom and Ian Henderson, 'New Capabilities In Warfare: An Overview Of Contemporary Technological Developments And The Associated Legal And Engineering Issues In Article 36 Weapons Reviews' (2012) 94 International Review of the Red Cross, 483, 489.
[13] Pedro Domingos, The Master Algorithm (Perseus Books, 2015) 1.
[14] Boulanin and Verbruggen (n.10) 24-25; Brian Handy (ed.), 'Royal Air Force: Aircraft And Weapons' (Royal Air Force, 2007) 87.

met or not (whether the sensor data matches a database entry). Some algorithms can provide multiple outputs.[15]

For example, a simplified algorithm in an AWS deployed to attack enemy tanks could be: IF object = tank, AND no civilians present, THEN attack, ELSE continue mission.[16] So, the data collected using sensors would either represent a tank, or it would not (IF/ELSE). Where a tank is detected, there is an additional condition that no civilians are present (AND). Only where these two conditions are met can an attack proceed. In computer science, the so-called 'closed world assumption' presumes that anything not known to be true is false.[17] Unless a system can recognise an entity as a target with sufficient confidence that it *is* actually a target, it will be recognised as a non-target.[18]

Where targets are recognised, an attack would be performed by the *actuators* of the system. With an AWS, these would be the munitions that it is equipped with to fire at entities which it has recognised as a target.

4. Sensing and processing of data: artificial intelligence

In order for data to be sensed and processed, it must be quantifiable. Research into using algorithms for qualitative analysis is ongoing,[19] but has not yet produced any algorithms to do this (if this is even possible).[20] As such, *autonomous* systems will only be able to comprehend their

[15] Domingos (n.13) 2.
[16] Arkin has developed some prototype algorithmic decision systems which an AWS could use. See Ronald Arkin, Governing Lethal Behaviour In Autonomous Robots (CRC Press, 2009), 132, fig.10.4.
[17] Arkin (n.16) 63.
[18] Backstrom and Henderson (n.12) 490.
[19] Tom Abate, 'Stanford Algorithm Analyzes Sentence Sentiment, Advances Machine Learning' (Stanford School of Engineering, 2013) Archived:<https://web.archive.org/web/20190612123046/https://engineering.stanford.edu/magazine/article/stanford-algorithm-analyzes-sentence-sentiment-advances-machine-learning>.
[20] Venkat Srinivasan, 'Context, Language, And Reasoning In AI: Three Key Challenges' (MIT Technology Review, 2016) Archived:<https://www.technologyreview.com/2016/10/14/156968/context-language-and-reasoning-in-ai-three-key-challenges/>.

environment through quantitative analysis for the foreseeable future.[21] Where qualitative decisions need to be taken,[22] this requires humans to work closely with the system to take those decisions and complete the mission objectives.

Still, in terms of quantitative analysis, systems with autonomy already display a significant amount of sophistication. This is only expected to increase, with more tasks being delegated to machines as they display greater capabilities in the future.[23]

The technical sophistication of systems with autonomy that are available today, and in the near future, means that the onboard computers, which coordinate the actions of *autonomous* systems, could be seen as an artificial intelligence (AI). AI is simply a characterisation of a system using computational methods that are advanced enough to perform a task normally performed by humans.[24] Although Hollywood presents us with exciting, and worrying, visions[25] of AI systems

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[21] William Boothby, 'How Far Will the Law Allow Unmanned Targeting to Go?' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013) 56-57.
[22] For example, the proportionality decision, Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; Jean-Marie Henckaerts and Louise Doswald-Beck, Customary International Humanitarian Law, Volume I: Rules (CUP, 2005) (Hereafter: ICRC Study) Rule 14.
[23] Kenneth Anderson, Daniel Reisner and Mathew Waxman, 'Adapting The Law Of Armed Conflict To Autonomous Weapon Systems' (2014) 90 International Law Studies, 335, 388-395.
[24] Some suggest that the 'artificial intelligence' is too broad to be accurate. Consider the range in complexity in AI systems in chess computers and self-driving cars. Thus, 'computational methods' is favours by some authors, see International Panel on the Regulation of Autonomous Weapons, 'Computational Methods In The Context Of LAWS' (Stiftung Wissenschaft und Politik, 2017)(iPRAW) 9-10. Also note that others suggest that machines using AI should be referred to as 'cyber-physical systems', see Kobi Lenis, 'New Technologies Symposium: How Can Lawyers Ensure Compliance With Existing Law (During Peacetime And During War) In The New Era Of Cyber-Physical Systems?' (Opinio Juris, 2019) Archived:<https://web.archive.org/web/20190508125143/https://opiniojuris.org/2019/05/06/new-technologies-symposium-how-can-lawyers-ensure-compliance-with-existing-law-during-peacetime-and-during-war-in-the-new-era-of-cyber-physical-systems/>. Still, 'AI' is the term of art that shall be used in this thesis.
[25] On the wider cultural conception of AI, see Judith A Markowitz, Robots That Kill: Deadly Machines And Their Precursors In Myth, Folklore, Literature, Popular Culture And Reality (McFarland & Company, 2019).

attempting to help,[26] or wipe out, humanity,[27] and some authors present utopian[28] or dystopian[29] visions of an AI-enabled future, these systems are often mundane systems such as chess computers.[30]

Some authors have suggested that AI systems could one day become alive.[31] This is impossible as key aspects of living such as sentience,[32] consciousness,[33] or self-awareness,[34] cannot be reduced to algorithms.[35] Thus, systems that use AI could never really be seen as living,[36] or have any attendant moral status.[37] Any perception that an AI system is 'smart' or 'intelligent' in a human-like way is illusory.[38] As the processing of these systems is just an application of mathematical models to sensor data, these systems do not *make decisions*, but they *apply decisions* already embedded in the algorithms within the processors of the system.[39] Still, by applying (probabilistic or statistical)

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[26] See, for example, Andrew Stanton, Wall-E (Pixar, 2008); Brad Bird, The Iron Giant (Warner Bros, 1999).
[27] See, for example James Cameron, The Terminator (Orion Pictures, 1984) and its sequels, or Joss Whedon, Avengers: Age Of Ultron (Marvel Studios, 2015)
[28] Ray Kurzweil, The singularity is near: When humans transcend biology (Gerald Duckworth & Co, 2006).
[29] Nick Bostrom, Superintelligence: Paths, dangers, strategies (OUP, 2016).
[30] See Garry Kasparov, Deep Thinking (John Murray Publishers, 2017).
[31] Max Tegmark, Life 3.0 (Penguin Books, 2018) 281-314.
[32] Sentience refers to the capacity to feel pleasure of pain, see, Agnieszka Jaworska and Julie Tannenbaum, 'The Grounds Of Moral Status' Stanford Encyclopedia of Philosophy Archive (Stanford University, 2018) Archived:<https://web.archive.org/web/20190318070216/https://plato.stanford.edu/archives/spr2018/entries/grounds-moral-status/>, paras.5.3 and 6; on the inability of machines to feel pleasure or pain, see Mark Bishop, 'Why Computers Can't Feel Pain' (2009) 19 Minds and Machines, 507.
[33] Consciousness being defined as 'subjective experience' (Tegmark, (n.31) 283); machines cannot experience this because they are an object, not a subject, see Roger Penrose, Shadows Of The Mind (OUP, 1996) 127-208.
[34] This requires an entity to recognise a 'self' in themselves, and also in others, see Philippe Rochat, 'Five Levels Of Self-Awareness As They Unfold Early In Life' (2003) 12 Consciousness and Cognition, 717, 719-722. As machines process quantitative algorithms, they cannot translate qualitative concepts such as a self, or a third person view of one's self, into quantitative programming.
[35] It is questionable whether anyone even knows where to begin with this. See, Steven Pinker, Enlightenment Now (Penguin Random House, 2018) 296-300, 425-428.
[36] '*Unlike in the movies, there is no race of superhuman robots on the horizon or probably even possible*.' See Peter Stone et al., 'Artificial Intelligence and Life in 2030' (Stanford University, 2016) Archived:<https://web.archive.org/web/20190919211256/https://ai100.stanford.edu/sites/g/files/sbiybj9861/f/ai_100_report_0831fnl.pdf> 6.
[37] See Jaworska and Tannenbaum, (n.32); see also Rebecca Crootof, 'Autonomous Weapon Systems And The Limits Of Analogy' (2018) 9 Harvard National Security Journal, 1.
[38] EPSRC, 'Principles Of Robotics' (EPSRC, 2010) Archived:<https://web.archive.org/web/20190825042317/https://epsrc.ukri.org/research/ourportfolio/themes/engineering/activities/principlesofrobotics/>.
[39] Elliot Winter, 'Autonomous Weapons In Humanitarian Law: Understanding The Technology, Its Compliance With The Principle Of Proportionality And The Role Of Utilitarianism' (2018) 6 Groningen Journal of International Law, 183, 193.

mathematical models to data, it can be argued that AI systems are capable of 'reasoning'.[40] The consequence of this is that systems with machine autonomy are fundamentally limited by their programming and, when in use, how they are instructed. Weizenbaum points out that, if it were possible for the user of an AI system to ask the machine why it acted in a certain way, the only possible answer it could give would be '*Because you told me to*.'[41]

Many believe that using AI systems for 'big data' processing means they could be highly advantageous when used to assist in strategic decision-making.[42] Yet, this thesis is focussed only upon the use of AI in weaponry. As has already been mentioned, these systems would automate quantitative data analysis about targeting. This makes them a 'narrow AI', meaning they can perform some tasks at a human level, rather than 'general AI' or 'super AI' which would, theoretically, be able to perform all tasks at a human, or above-human, level respectively.[43] As narrow AI systems cannot do everything, this raises a question of whether they can perform their tasks at legally required standards. Indeed, a general or super-AI system which was capable of all human tasks, or more, would pose fewer legal challenges as they would, by definition, already be at, or above, human standards sufficient for legal compliance.

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[40]Dustin A. Lewis, 'Legal Reviews Of Weapons, Means And Methods Of Warfare Involving Artificial Intelligence: 16 Elements To Consider' (Humanitarian Law & Policy Blog, 2018) Archived:<https://web.archive.org/web/20190912154010/https://blogs.icrc.org/law-and-policy/2019/03/21/legal-reviews-weapons-means-methods-warfare-artificial-intelligence-16-elements-consider/>; see also Judea Pearl, Causality: Models, Reasoning And Inference (CUP, 2009); Barbara J. Grosz and Peter Stone, 'A Century-Long Commitment To Assessing Artificial Intelligence And Its Impact On Society' (2018) 61 Communications of the ACM, 68.

[41] Joseph Weizenbaum, Computer Power And Human Reason (WH Freeman, 1976), 260.

[42] See, for example Kristin Houser, 'U.S. Department Of Defense Established A Center To Better Integrate AI' (Futurism, 2018) Archived:<https://web.archive.org/web/20181223070254/https://futurism.com/the-byte/jaic-militarys-ai-center>; James Vincent, 'Putin Says The Nation That Leads In AI 'Will Be The Ruler Of The World'' (The Verge, 2017) Archived:<https://web.archive.org/web/20190816212655/https://www.theverge.com/2017/9/4/16251226/russia-ai-putin-rule-the-world>; also see Ashley Deeks, Noam Lubell and Darragh Murray, 'Machine Learning, Artificial Intelligence, And The Use Of Force By States' 10 Journal of National Security Law & Policy, 1.

[43] Tannya D. Jajal, 'Distinguishing Between Narrow AI, General AI And Super AI' (Medium, 2018) Archived:<https://web.archive.org/web/20190413084933/https://medium.com/@tjajal/distinguishing-between-narrow-ai-general-ai-and-super-ai-a4bc44172e22>.

## 4.1. Machine learning

At this point, it is also important to note that some AI systems include machine learning. Whilst humans can write algorithms that can be classed as AI, (known as symbolic AI)[44] they are all rule-based.[45] Writing individual rules to perform difficult tasks, such as image recognition, becomes highly-complex as there are so many variables.[46] It is, therefore, impractical for humans to write image recognition algorithms.[47] Machine learning, however, can deal with such complex tasks by performing many rounds of trial and error and being corrected with feedback.[48]

The advantage of machine learning in *autonomous* systems is that it should continually update its comprehension of the environment, what entities it should focus on, and what characteristics those entities have as they change. This can lead to the assumption that machine learning will allow the software to 'deduce' information that it was not programmed to comprehend. For example, an image recognition algorithm trained to recognise cats could, potentially, learn that cats in real life have a greater variance than the photos it was trained on. This might lead to the algorithm recognising a lion as a type of cat due to the commonalities of paws, whiskers, and pointed ears. This is an expansion of what the algorithms focus on, rather than true deduction. This algorithm could not develop a notion of a dog without specific learning, for instance. Consequently, the use of machine learning in AWS might enable the categories of what constitutes a target to broaden slightly but would not allow a system to develop its own conception of targets.

If a system is capable of learning about its environment and the boundaries of that learning are not sufficiently restricted, the sensor data it learns from might not be known to the programmers. The consequence of this is that programmers would not be able to know what these changes are, and how they affect the system overall. As algorithms are simply mathematical models representing the

[44] Margaret A Boden, AI (OUP, 2016) 6-7.
[45] Hannah Fry, Hello World (Doubleday, 2018) 10-11.
[46] Fry (n.45) 10-11.
[47] Fry (n.45) 10-11.
[48] Fry (n.45) 10-11.

environment, they cannot incorporate context and so cannot 'know' what they are analysing or what they should (not) learn. Both of these problems are associated with so-called 'deep learning' technologies, which are programmed using neural networks.[49] As such, those machine learning methods used for programming *autonomous* systems must be chosen very carefully. This thesis is focussed upon the broader issues of targeting by these systems, rather than the specific issues of different computational methods and so these issues are only mentioned where relevant. However, even if machine learning is used, the resultant algorithms are fundamentally the same as those outlined in the previous Section.

Still, machine learning poses significant problems if systems continue to learn during service, referred to as 'on-line' or continuous learning.[50] Farrant and Ford have noted that this can cause issues where learning algorithms modify their programming: when does a programming modification mean that a system is 'new'? Does a modified AI system need to be reviewed, as with other weapon systems? How should frameworks of review deal with this issue?[51]

5. Defining autonomous weapon systems

Having understood how *autonomous* systems work, and that they automate human tasks, it is important to differentiate between *autonomous weapon systems* and *weapons with autonomy*. The later are systems which may have some automated functions, such as navigation, temperature control, de-icing,[52] take-off, and landing,[53] but not targeting functions.

[49] See Joshua G. Hughes, 'The Law Of Armed Conflict Issues Created By Programming Automatic Target Recognition System Using Deep Learning Methods' (2018) 21 Yearbook of International Humanitarian Law, 99.
[50] iPRAW (n.24) 11.
[51] James Farrant and Christopher Ford, 'Autonomous Weapons And Weapon Reviews: The UK Second International Weapon Review Forum' (2017) 93 International Law Studies, 389, 403-407; states party to API are obligated to review new weapons under Article 36. These issues are discussed more in Chapter 4.
[52] Philip Alston, 'Lethal Robotic Technologies: The Implications For Human Rights And International Humanitarian Law' (2012) 21 Journal of Law, Information and Science, 35, 43.
[53] Thales, 'A Unique Platform For Performance' (Thales, 2016) Archived:<https://web.archive.org/web/20190912154606/https://www.thalesgroup.com/en/worldwide/defence/what-we-do-air-forces-mission-and-surveillance-systems-systemes-de-drones-aeriens>.

The next logical step would be to define AWS as systems which automate targeting: An *autonomous weapon system* is that where the functions of selecting and engaging targets are performed by the machine without human intervention.[54] This is the most popular definition, having first been used by the US and then Human Rights Watch in 2012,[55] and later by then UN Special Rapporteur on Extrajudicial, Summary, and Arbitrary Executions Christof Heyns in 2013.[56] This definition seems most appropriate as it encapsulates the most novel and crucial aspects of these systems which differentiate them from others. The International Committee of the Red Cross (ICRC) also follow this definition and suggests that selecting and engaging targets are the '*critical functions*' of an AWS.[57] Due to its focus on the particular novelty which AWS present in comparison to other systems, this is the definition used in this thesis.

Consequently, where a human being is directly involved in decision-making, and either selects or engages a target, the system used would be *semi-autonomous*.[58] It is important to remember that where an operator needs to take control of a system, the machine might switch modes from *fully-autonomous*, to *semi-autonomous*.[59] Where both selection and engagement of targets are performed by a human, these systems are under direct human control.[60]

Whilst conceptualising AWS through their automated selection and engagement of targets is most commonly used, it is not ubiquitous. Discussions at the United Nations on the topic of AWS have been ongoing for six years and have not yet been able to come up with a shared definition.[61]

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[54] United States Department of Defense, 'Directive 3000.09' (2012) 13-14; Human Rights Watch, 'Losing Humanity' (Human Rights Watch, 2012) 2; Milena Costas Trascasas and Nathalie Weizmann, Academy Briefing No.8: Autonomous Weapon Systems Under International Law (Geneva Academy, 2014) 6.
[55] US DoD (n.54); HRW (n.54).
[56] Report Of The Special Rapporteur On Extrajudicial, Summary Or Arbitrary Executions, Christof Heyns (Human Rights Council, 23rd session) 2013 UN Doc. A/HRC/23/47, para.38.
[57] International Committee of the Red Cross, 'Autonomous Weapon Systems: Implications Of Increasing Autonomy In The Critical Functions Of Weapons' (ICRC, 2016) 7.
[58] US DoD (n.54) 14.
[59] US DoD (n.54) 14.
[60] Singer (n.3) 74.
[61] Michael W. Meier, 'Lethal Autonomous Weapons Systems Is It the End of the World as We Know It . . . Or Will We Be Just Fine?' in Winston S. Williams and Christopher M. Ford (eds.), Complex Battlespaces: The Law

Firstly, some states have attempted to define AWS to include systems which can be remote-controlled or overseen by humans as still being *autonomous*.[62] Obviously, during the times where a system is under remote-control, it cannot be acting *autonomously* as it would not be exhibiting any freedom in its actions. Still, if this is only a mode of operation, in addition to *semi-* and *fully-autonomous* modes, then it could still be thought of as an AWS.

Several states include an impossibility of human intervention or communication with AWS during its missions as a definitional criterion.[63] This seems overly-restrictive as two systems could perform near-identical operations but because one is within range of communication links it would not be *autonomous*. This ignores what the system itself is doing, and whether an operator is making an intervention of real consequence. As such, this thesis rejects this as a key characteristic of AWS.

Some definitions go beyond the selection and engagement of targets to include systems designed for other military and support tasks, such as surveillance.[64] This is overly-inclusive as it does not focus upon the uniqueness of AWS as being those that perform *autonomous* targeting.

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Of Armed Conflict And The Dynamics Of Modern Warfare (OUP, 2019) 290; for more on the UN discussions, see The United Nations Office at Geneva, 'Background - Lethal Autonomous Weapons Systems' (UNOG, 2018) Archived:<https://web.archive.org/web/20190912160215/https://www.unog.ch/80256EE600585943/(httpPages)/8FA3C2562A60FF81C1257CE600393DF6?OpenDocument>.

[62] Development, Concepts, and Doctrine Centre, 'The UK Approach To Unmanned Aircraft Systems' (UK Ministry of Defence, 2011)(Hereafter: UK Approach) para.205; Russian UNOG Delegation, 'Russia's Approaches to the Elaboration of a Working Definition and Basic Functions of Lethal Autonomous Weapons Systems in the Context of the Purposes and Objectives of the Convention' 2018 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 4 April 2018) UN Doc. CCW/GGE.1/2018/WP.6, para.2.

[63] The Netherlands UNOG Delegation,' Examination of various dimensions of emerging technologies in the area of lethal autonomous weapons systems, in the context of the objectives and purposes of the Convention' 2017 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 9 October 2017) UN Doc. CCW/GGE.1/2017/WP.2, para.5; French UNOG Delegation, 'Characterization of a LAWS' 2016 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 15 April 2016) Archived:<https://web.archive.org/web/20190912155857/https://www.unog.ch/80256EDD006B8954/(httpAssets)/5FD844883B46FEACC1257F8F00401FF6/$file/2016_LAWSMX_CountryPaper_France+CharacterizationofaLAWS.pdf>; Chinese UNOG Delegation, 'Position Paper' 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 11 April 2018) UN Doc. CCW/GGE.1/2018/WP.7, para.3.

[64] Swiss UNOG Delegation, 'A "Compliance-Based" Approach To Autonomous Weapon Systems' 2017 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 10 November 2017) UN Doc. CCW/GGE.1/2017/WP.9, para.29; Cuban UNOG Delegation, 'Implementation and enforcement of International Law, particularly international humanitarian law, in the context of autonomous weapons' 2016 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 14 April 2016) Archived:<https://web.archive.org/web/20190912161055/https://www.unog.ch/80256EDD006B8954/(httpAssets)/2EC2FA3DC75A50FFC12580820056F458/$file/Cuba+WP.pdf> 4.

The potential unpredictability of an AWS is suggested as a key characteristic by some.[65] However, this would exclude systems used for tasks where the end result is expected. For example, it is foreseeable that enemy battleships will be destroyed when deploying an *autonomous* system against an enemy naval convoy, even if the sequence of targeting, or number of munitions needed, are unknown. As such, it would be correct to state that the '*overall activity of an autonomous* [system] *will be predictable* [even if] *individual actions may not be*.' [66] Thus, this can be added to the definition of AWS used in this thesis.

Other definitions focus upon the expected highly-sophisticated nature of AWS. These include suggestions that an AWS would need to be '*capable of understanding higher level intent*'[67] or possess an ability to evolve its understanding of its environment.[68] Yet, as Sharkey notes, such a high technical threshold may be impossible to reach.[69] States conceptualising AWS with such lofty requirements are 'defining away'[70] issues as they can simply claim that AWS do not exist according to their definition whenever difficult questions are discussed.

Another attempt to define away issues related to AWS is to characterise them as inherently indiscriminate.[71] As will be discussed in Chapter 4, any weapon that is inherently indiscriminate would be unlawful due to being inaccurate or uncontrollable.[72] Thus, according to this characteristic, any issues raised about *autonomous* systems that are accurate and controllable could be ignored as not being relevant to AWS under this conception.

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[65] Belgian UNOG Delegation, 'Towards a definition of lethal autonomous weapons systems' 2017 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 7 November 2017) UN Doc. CCW/GGE.1/2017/WP.3, para.8(c); China UNOG Delegation (n.63) para.3.
[66] UK Approach (n.62) para.205.
[67] UK Approach (n.62) para.205.
[68] China UNOG Delegation (n.63) para.3.
[69] Sharkey 2011 (n.6) 141.
[70] See Maziar Homayounnejad 'A Note on the Sense and Scope of 'Autonomy' in Emerging Military Weapon Systems and Some Remarks on The Terminator Dilemma' in Joshua Hughes (ed.), Autonomy In Future Military And Security Technologies: Implications For Law, Peace, And Conflict (The Richardson Institute, 2018) 71.
[71] China UNOG Delegation (n.63) para.3.
[72] Art.51(4)(b)-(c), API.

A common definitional feature is lethality.[73] But, this ignores the potential of using an AWS with less-than-lethal munitions. One can forgive the inclusion of this characteristic, however, as the international discussions at the UN are specifically orientated toward 'lethal autonomous weapon systems.'[74]

Despite the varying views,[75] we can see that defining AWS as systems that select and engage targets without human intervention is the most appropriate. The understanding of AWS in this thesis can also incorporate that these systems are, on the whole, predictable in terms of what they will do because they simply follow the instructions they are given and the algorithms they are programmed with. Additionally, we can note that the potential for intervention by an operator is irrelevant unless they actually intervene.

6. The development of AWS

The development of AWS can be seen through two main analytical lenses. One is for advanced militaries to be seemingly evermore distant and remote from the exercise of military violence and the other is for technology to ostensibly never stop progressing.

6.1. Increasing remoteness and distance

In terms of remoteness, or distance, this lens suggests that ever since people threw rocks to avoid hand-to-hand combat with adversaries, humans have been attempting to exert force onto

[73] China UNOG Delegation (n.63) para.3; Belgium UNOG Delegation (n.65) para 8(c); French UNOG Delegation (n.63).
[74] See UNOG (n.61).
[75] For other perspectives on defining AWS, see Amandeep Singh Gill, 'Chart-1 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' (Geneva, 29 August 2018) Archived:<https://web.archive.org/web/20190913104519/https://www.unog.ch/80256EDD006B8954/(httpAssets)/C43B731506CE4D35C1258272003399DB/$file/Chart.1+Updated.pdf>.

others whilst reducing risks to themselves.[76] This concept has gained significant traction in relation to the use of UAVs (uninhabited aircraft vehicles, or 'drones')[77] where pilots remotely-control these platforms from the other side of the world[78] through socio-technical systems.[79] This has led to discussions on whether such systems enable 'riskless'[80] and 'gamified'[81] remote warfare,[82] for the side using these technologies, and if this means that their use is unethical.[83] Such criticisms appear pre-mature, as they belie the experiences of the users of these systems who, although not suffering physically, report significant psychological repercussions of this work,[84] and an ongoing deep moral connection to it.[85] Indeed, Williams notes that drone operators have an 'intimate' connection to their targets, despite the physical distance between them.[86] However, with the use of AWS, this connection would be lost through technological proxies. A loss of moral engagement would, in terms of Just War Theory,[87] be a negative development. So, if remote-controlled drones already provide the benefit of

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[76] Generally, see Jens David Ohlin (ed), Research Handbook On Remote Warfare (Edward Elgar, 2017).

[77] This term is used rather than the more common 'unmanned aircraft vehicle' firstly to remove any gendered association, and also to prevent any confusion that 'unmanned' also means no 'man' is involved in the decision-making process. This second point is made by Alex Leveringhaus, Ethics And Autonomous Weapons (Palgrave Macmillan, 2016) 3.

[78] Derek Gregory, 'Drone Geographies' (2014) 183 Radical Philosophy Archived:<https://web.archive.org/web/20190912162118/https://www.radicalphilosophyarchive.com/article/drone-geographies>.; Dan Gettinger, 'Drone Geography: Mapping A System Of Intelligence' (Center for the Study of the Drone, 2015) Archived:<https://web.archive.org/web/20190912162257/https://dronecenter.bard.edu/drone-geography/>.

[79] See, for example, Lucy Suchman, Karolina Follis and Jutta Weber, 'Tracking And Targeting' (2017) 42 Science, Technology, & Human Values, 983.

[80] See, for example, Shane M Riza, Killing Without Heart: Limits On Robotic Warfare In An Age Of Persistent Conflict (Potomac Books, 2013).

[81] See, for example, Lambèr Royakkers and Rinie van Est, 'The Cubicle Warrior: The Marionette Of Digitalized Warfare' (2010) 12 Ethics and Information Technology, 289.

[82] Note that 'remote warfare' is sometimes conceptualised to include the use of proxy, surrogate, or deniable forces physically removed from those in command. See Oxford Research Group, 'Conceptual Series: Defining Remote Warfare' (Oxford Research Group, 2019) Archived:<https://web.archive.org/save/https://www.oxfordresearchgroup.org.uk/pages/category/conceptual-series-defining-remote-warfare>.

[83] See, for example, Gregoire Chamayou, Drone Theory (Penguin Books, 2015).

[84] Eyal Press, 'The Wounds Of The Drone Warrior' (New York Times, 2018) Archived:<https://web.archive.org/web/20190904114515/https://www.nytimes.com/2018/06/13/magazine/veterans-ptsd-drone-warrior-wounds.html>.

[85] Peter Lee, 'Drone Crews And Moral Engagement' (The Psychologist, 2017) Archived:<https://web.archive.org/web/20190912162913/https://thepsychologist.bps.org.uk/volume-30/june-2017/drone-crews-and-moral-engagement>.

[86] John Williams, 'Distant Intimacy: Space, Drones, And Just War' (2015) 29 Ethics & International Affairs, 93.

[87] See Michael Walzer, Just and Unjust Wars: A Moral Argument with Historical Illustrations (4th edn., Basic Books, 2006).

reducing physical risks for the side using them, but maintain a level of moral and psychological engagement, why develop AWS?

### 6.2. The (dis)advantages of AWS

AWS provide two clear benefits over other combat systems. Firstly, AWS offer the ability to go further than the limits of human-controlled systems and to operate beyond the speed of human reactions.[88] Automation of human actions allows for them to be performed much faster.[89] Where, for example, an AWS engages an equally matched adversary (human or machine), the entity which can act quicker will ultimately triumph because more attacks can take place in a shorter time. On a larger scale, the side with the faster 'operational tempo' often wins wars.[90] Thus, AWS are ideal for situations of combat at super-human intensity.

Second, remote-control technologies, such as UAVs, are reliant upon communication signals from their operator.[91] If UAVs lose this link, all they can do is fly around in circles or return to base.[92] When this happens, the UAV is militarily useless. Thus, remote-control UAVs cannot be used where: stealth is essential to a successful mission and the communication-link would alert the enemy; communication is impossible, or degraded, such as missions underwater, underground, in buildings,

[88] Mark Wolverton, 'The General Is A Robot: Artificial Intelligence Goes To War' (Undark, 2018) Archived:<https://web.archive.org/web/20190403034402/https://undark.org/article/book-review-scharre-army-of-none/>.
[89] Paul Scharre, Army Of None (WW Norton & Company, 2018) 352-326; Amitai Etzioni and Oren Etzioni, 'Pros And Cons Of Autonomous Weapons Systems' (2017) May-June Military Review, 72; Matthew Press, 'Of Robots And Rules: Autonomous Weapon Systems In The Law Of Armed Conflict' (2017) 48 Georgetown Journal of International Law, 1337, 1361.
[90] Frans P. B. Osinga, Science, Strategy And War (Routledge, 2007) 1; also see generally, Paul Virilio, Desert Screen: War At The Speed Of Light (Continuum, 2002).
[91] The use of the term 'operator' has expanded since 9/11 and has been used to refer to special forces soldiers in various services. See, for example Jack Murphy, 'What Is An Operator?' (NEWSREP, 2013) Archived:<https://web.archive.org/web/20190912163549/https://thenewsrep.com/29133/operator/>; Michael Hastings, The Operators (Phoenix, 2013); James Rennie, The Operators: On The Streets With Britain's Most Secret Service (Pen & Sword Military, 2007). However, in this thesis it is used to describe those who operate weapon systems.
[92] Alberto Cuadra and Craig Whitlock, 'How Drones Are Controlled' (The Washington Post, 2014) Archived:<https://web.archive.org/web/20181015172518/https://www.washingtonpost.com/wp-srv/special/national/drone-crashes/how-drones-work/?noredirect=on>.

or caves; an adversary is jamming communication signals; a technical fault impairs communication.[93] Thus, AWS which could operate in the absence of data links offers clear benefits over remote-controlled systems.

However, it is important not to oversell AWS. Whilst they offer potential tactical advantages over some human-controlled weapons, due to the strict logical rules they must follow, they can only bring those advantages to bear in situations they are programmed for. Thus, AWS are likely to be favoured over drones, inhabited systems, or 'boots on the ground' when the particular situation matches up to the intended use of the AWS. As such, they are unlikely to be used in situations they are not specifically programmed for, or for tasks requiring human judgement.

Such fragility offers both advantages and disadvantages. By automating tasks, this should remove human errors where people misunderstand the data they are receiving. Such mistakes have resulted in many incidents where the wrong targets have been attacked.[94] Yet, where incorrect data is processed by machines, this can also result in undesired outcomes. For example, during the Cold War, a Soviet missile early-warning system indicated a US attack was imminent. Soviet protocol suggested that a massive nuclear response should take place. But, the machines were processing incorrect data caused by sunlight reflecting off cloud tops.[95] If these machines were *autonomous*, they would have followed protocol and the nuclear response would have started World War III. A human being recognised the unusual data pattern and chose not to enact protocol, thereby averting conflict.[96] Thus, there is a role for human beings to engage with alongside and in control of AWS.

Some argue that a human presence in targeting decisions is required to enable moral and ethical compliance. As an AWS would simply recognise targets and non-targets, human adversaries would be treated as objects rather than individuals. This is seen as an affront to human dignity

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[93] Scharre (n.89) 327-328; Henderson et al. (n.11) 337; Etzioni and Etzioni (n.89) 72.
[94] Scharre (n.89) 141, 167-168, on 'friendly fire' incidents from the 2003 Iraq war see 137-143, on the shooting down or Iranian Air Flight 655 see 169-170.
[95] Scharre (n.89) 1-2.
[96] Scharre (n.89) 1-2.

according to Kantian ethics.[97] Unfortunately, human beings have been treated as mere targets for decades, for example, when they are added to both counterterrorism[98] and strategic military target lists.[99] Further, early definitions of '*military objective*' include combatants.[100] As such, whilst deaths in conflicts are already somewhat undignified,[101] AWS do not seem to create more indignity than other practices of modern warfare.

Another important moral and ethical aspect of the permissible use of AWS is accountability for their actions.[102] This moral accountability should, logically, reside with the entity that made targeting decisions. If one is of the opinion that AWS make decisions, then this means that it would be immoral and unethical to use these systems as no human decision-maker could be sufficiently tied to the actions of the AWS.[103] However, this view misunderstands how these systems actually work. As we have already seen, AWS are only capable of following their programming.[104] As such, AWS cannot be moral agents because they cannot decide upon their own actions.[105] Consequently, moral and ethical accountability for AWS rests with '*the set of humans responsible for its creation, programming, and deployment.*'[106] Legal responsibility is discussed in detail in Chapter 6.

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[97] Aaron M. Johnson and Sidney Axinn, 'The Morality Of Autonomous Robots' (2013) 12 Journal of Military Ethics, 129, 134; Ozlem Ulgen, 'Human Dignity In An Age Of Autonomous Weapons: Are We In Danger Of Losing An 'Elementary Consideration Of Humanity'?' (2016) 8 ESIL Conference Paper Series 1-19 European Society of International Law 2016 Annual Conference.
[98] Aurel Sari, 'Missing The Mark: Reprieve, 'Kill Lists' And Human Rights Advocacy' (EJIL Talk, 2016) Archived:<https://web.archive.org/web/20161114070952/http://www.ejiltalk.org/missing-the-mark-reprieve-kill-lists-and-human-rights-advocacy/>.
[99] See Derek Gregory, 'Bombing Encyclopedia Of The World' (Geographical Imaginations, 2012) Archived:<https://web.archive.org/web/20190621173403/https://geographicalimaginations.com/2012/08/03/bombing-encyclopedia-of-the-world/>.
[100] For multiple definitions, see Horace B. Robertson, Jr., 'The Principal Of The Military Objective In The Law Of Armed Conflict' (1998) 72 International Law Studies, 197.
[101] Scharre (n.89) 288.
[102] Robert Sparrow, 'Killer Robots' (2007) 24 Journal of Applied Philosophy, 62, 67.
[103] Sparrow (n.102) 66-75.
[104] Elliot Winter, 'Autonomous Weapons In Humanitarian Law: Understanding The Technology, Its Compliance With The Principle Of Proportionality And The Role Of Utilitarianism' (2018) 6 Groningen Journal of International Law, 183, 193.
[105] Michael Robillard, 'No Such Thing As Killer Robots' (2017) 35 Journal of Applied Philosophy, 705.
[106] Robillard (n.105) 716.

### 6.3. The loop paradigm

The distance within human-machine relationships is exemplified in AWS discourse in the 'loop' paradigm. This enables us to formalise an understanding of the distance between the decision-making of the person using/controlling a system and the manifestation of that decision:

> '*Human-in-the-Loop Weapons: Robots that can select targets and deliver force only with a human command;*
>
> *Human-on-the-Loop Weapons: Robots that can select targets and deliver force under the oversight of a human operator who can override the robots' actions; and*
>
> *Human-out-of-the-Loop Weapons: Robots that are capable of selecting targets and delivering force without any human input or interaction.*'[107]

The Campaign to Stop Killer Robots seeks to have the use of *out-of-the-loop* targeting banned.[108] Yet, by focussing upon the distance in a human-machine relationship, this ignores the quality of that relationship: would an '*on-the-loop*' operator be fully focussed on observing the system during operations?[109] Further, the loop paradigm does not allow us to understand the sophistication of the system. The *out-of-the-loop* category could seemingly include everything from a landmine to Arnold Schwarzenegger's Terminator character.[110] As such, this paradigm does not allow us to really understand the uniqueness that AWS present.

Still, this thesis is primarily concerned with the use of '*out-of-the-loop*' systems, or those using an '*out-of-the-loop*' mode, during targeting, as this aligns with the definition adopted by this thesis.

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[107] HRW (n.52) 2.

[108] Campaign to Stop Killer Robots, 'The threat of fully autonomous weapon systems' (Stopkillerrobots.org, 2019) Archived:<https://web.archive.org/web/20190929102338/https://www.stopkillerrobots.org/learn/>; HRW (n.52) 2-5.

[109] For more on meaningful human control of AWS, see Chapter 3, Section 5.7.

[110] Cameron (n.27).

Another popular paradigm that can help us understand the advancement of *autonomous* systems in terms of their sophistication is now considered, before both paradigms are brought together.

6.4. Increasing technological progress

Perhaps the first weapon with autonomy is the Gatling gun. Invented in 1861, it automated the process of loading, firing, and ejecting bullets which is regularly seen in modern firearms.[111] However, the first 'smart' weapon, meaning that which is capable of directing itself at the target, was the German 'Falcon' introduced in 1943. This was a torpedo incorporating an acoustic sensor used to target allied and merchant ships.[112] The Falcon is a type of what are now known as precision guided munitions (PGMs). Some of these missiles use onboard sensors such as radar, heat, or electromagnetic sensors, to locate and lock onto their targets.[113] PGMs with the highest levels of autonomy available today are 'fire-and-forget' missiles.[114] These require a human to designate a type of target to be attacked, and a location where the system can *autonomously* search for the target. However, due to a very small search area, the human essentially chooses the target and the system *autonomously* guides itself toward it.[115] This is referred to as '*autonomous end-game engagement*'.[116]

However, the 'Harop', a missile-cum-drone, is a much more advanced form of PGM called a loitering munition.[117] This system has a range over 500km and can stay in flight for over 2 and a half hours.[118] Such freedom means that the Harop is no longer a weapon with autonomy, but, according

[111] Scharre (n.89) 35.
[112] Scharre (n.89) 39.
[113] Other types of precision guided munition may have their target determine by a human being using GPS coordinates, or 'painting' a target using a laser, for example. See Scharre (n.89) 40-41.
[114] For example, the UK Brimstone missile or the US LRASM missile.
[115] Handy (n.14) 87.
[116] Scharre (n.89) 97.
[117] Israel Aerospace Industries, 'Harop' (IAI, 2018) Accessed 24 June 2020. Available at:<https://www.iai.co.il/p/harop>. Note that the vast majority of internet resources in this thesis have been archived so that these resources are available in the same state that they were researched. However, some websites prevent archiving and so references for these websites have been provided in the standard way.
[118] Scharre (n.89) 47-48.

to the definition used in this thesis, it is actually the first AWS.[119] This system has been employed in combat during the Nagorno-Karabakh conflict. But, it is unclear whether it was used in an *autonomous* mode.[120]

It is important to note that the development of autonomy in weapons has not been linear. There are at least 183 weapons with some form of autonomy available today[121] (albeit not necessarily lawfully)[122] which include: obvious examples such as landmines and submarine-mines; defensive systems which shoot incoming ordnance out of the sky faster than a human could react at military bases[123] and on military equipment;[124] an automatic machine gun that can recognise invading forces along the South Korean border;[125] encapsulated torpedo mines which use sensors to recognise underwater targets and then fire a homing missile to engage adversarial ships;[126] the Sensor Fuzed Weapon which, after being air-delivered, follows several complicated steps and releases 40 sub-munitions that, for a few seconds, can search for and attack tanks.[127]

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119 Rebecca Crootof, 'The Killer Robots Are Here: Legality And Policy Implications' (2015) 36 Cardozo Law Review, 1837, 1870-1872; Scharre (n.89) 46-50.

120 Thomas Gibbons-Neff, 'Israeli-Made Kamikaze Drone Spotted In Nagorno-Karabakh Conflict' (Washington Post, 2016) Archived:<https://web.archive.org/web/20190407234150/https://www.washingtonpost.com/news/checkpoint/wp/2016/04/05/israeli-made-kamikaze-drone-spotted-in-nagorno-karabakh-conflict/?noredirect=on>.

121 Heather Roff and Richard Moyes, 'Robotics & Autonomy' (Global Security Initiative, 2016) Archived:<https://web.archive.org/web/20170616235808/https://globalsecurity.asu.edu/robotics-autonomy>.

122 See, for example, Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (adopted 18 September 1997, entered into force 1 March 1999) 2056 UNTS 211.

123 Raytheon Corporation, 'Phalanx Close-In Weapon System' (Raytheon, 2016) Archived:<https://web.archive.org/web/20190726165802/https://www.raytheon.com/capabilities/products/phalanx/>; Rafael, 'Iron Dome' (2019) Accessed 24 June 2020. Available at:<https://www.rafael.co.il/worlds/air-missile-defense/short-range-air-missile-defense/>.

124 Michael Kurt Riepl, 'War Crimes Without Criminal Accountability? The Case Of Active Protection Systems' (Humanitarian Law & Policy, 2016) Archived:<https://web.archive.org/web/20170831090044/http://blogs.icrc.org/law-and-policy/2016/06/01/war-crimes-without-criminal-accountability-case-active-protection-systems/>.

125 John Pike, 'Samsung Techwin SGR-A1 Sentry Guard Robot' (Global Security, 2011) Archived:<https://web.archive.org/web/20190827141904/https://www.globalsecurity.org/military/world/rok/sgr-a1.htm>.

126 Scharre (n.89) 51; Derick S. Hartshorn, 'U.S. Naval Mines - Captor Program' (Hartshorn, 2009) Archived:<https://web.archive.org/web/20190216151932/http://www.hartshorn.us/Navy/navy-mines-10.htm>.

127 Scharre (n.89) 51-52.

There are several moral and ethical issues which AWS raise in relation to their technological sophistication (or lack thereof), rather than their distance from human decision-makers.[128] Leveringhaus suggests that the difference between targeting by humans and machines is that the human has a choice *not* to attack, whereas a machine can only follow its programming.[129] Indeed, Purves et al. contend that as machines would just be applying human inputted instructions, AWS could not apply their algorithms '*for the right reasons*.'[130] Yet, Leveringhaus argues that the deployment of an AWS can be morally and ethically permissible where the use of other remote-controlled or inhabited systems present a greater risk of undesirable consequences, or of military defeat.[131] Such situations are in-line with the missions that this thesis predicts AWS will be used for: those in communication-denied environments, or in combat at super-human intensity. These are both situations where AWS would be advantageous and required to prevent defeat on a tactical level, and therefore could be morally and ethically compliant.

Another common argument put forward for AWS being immoral is that these systems would lack the human qualities of mercy or compassion needed to avoid morally and ethically problematic killings, and it is currently unforeseeable that humans will ever be able to programme these traits.[132] For example, if an AWS could recognise the targetability of children acting for the enemy,[133] or enemy soldiers who are not in a position to defend themselves,[134] the machine could not identify the moral quandaries of such attacks and exercise restraint. It would simply attack. Conversely, Arkin notes that AWS would not have their judgement clouded by anger, hate, or psychiatric issues, could act quicker

[128] For an overview, see Anzhelika Solovyeva and Nik Hynek, 'Going Beyond the "Killer Robots" Debate: Six Dilemmas Autonomous Weapon Systems Raise' 12 Central European Journal of International and Security Studies 12, 166.
[129] Leveringhaus (n.77) 89-117.
[130] Duncan Purves, Ryan Jenkins and Bradley J. Strawser, 'Autonomous Machines, Moral Judgment, And Acting For The Right Reasons' (2015) 18 Ethical Theory and Moral Practice, 851.
[131] Leveringhaus (n.77) 82-86.
[132] HRW 2012 (n.54) 4.
[133] Scharre (n.89) 290-294.
[134] Leveringhaus (n.77) 92-93; For the example of the 'sleeping soldier' see Chamayou (n.83) 199, although this example is specific to killings using UAVs, it could also apply to AWS.

than humans, and could take greater physical risks to eliminate targets.[135] Arkin also suggests that AWS could monitor the behaviour of human beings to ensure their ethical compliance.[136]

Some follow Arkin's logic to suggest that an AWS would be incapable of carrying out an atrocity.[137] However, the actions an AWS will take are ultimately dependent upon its programming and instruction. As a feminist analysis of international crimes shows, atrocities in warfare, those of sexual violence in particular, are often the result of a specific plan by high-ranking authority figures.[138] They could order AWS to be (re-)programmed to commit atrocities just as easily as they could order humans to carry them out. Thus, the moral and ethical permissibility of using an AWS is massively influenced by the underlying programming of the system, and the instructions they are given on each mission.

In terms of strategic concerns, some have suggested that if an AWS were to act in an unpredictable way, whether through poor programming, or malfunction, this could create significant risks of an AWS initiating unintended conflicts,[139] or engaging in unlawful conduct.[140] But, as Meier points out, AWS that present a chance of unpredictable actions are unlikely to be developed or deployed.[141] As we saw above, the precise actions of an AWS might not be predictable, but what the

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[135]Ronald Arkin, 'The Case For Banning Killer Robots' (2015) 58 Communications of the ACM, 46. See also, Arkin (n.16) 29-30.

[136] Arkin (n.16) 127-133.

[137] Ryan Khurana, 'In Defense Of Autonomous Weapons' (The National Interest, 2018) Archived:<https://web.archive.org/web/20181103014212/https://nationalinterest.org/feature/defense-autonomous-weapons-33201>.

[138] Charli Carpenter, '"Robot Soldiers Would Never Rape": Un-Packing The Myth Of The Humanitarian War-Bot' (Duckofminerva.com, 2014) Archived:<https://web.archive.org/web/20190912145010/https://duckofminerva.com/2014/05/robot-soldiers-would-never-rape-un-packing-the-myth-of-the-humanitarian-war-bot.html>.

[139] Paul Scharre, 'Autonomous Weapons And Operational Risk' (Center for a New American Security, 2016) 18-23.

[140] Sharkey 2017 (n.145) 182-183; Philip Feldman, Aaron Dant and Aaron Massey, 'Integrating Artificial Intelligence Into Weapon Systems' [2019] arXiv Archived:<https://web.archive.org/web/20190527202432/https://arxiv.org/pdf/1905.03899.pdf>.

[141] Michael W. Meier, 'The strategic implications of lethal autonomous weapons', in Jens David Ohlin (ed.), Research Handbook On Remote Warfare (Edward Elgar, 2017) 456-460; US DoD (n.53) para.4(1)(1)(a).

system is capable of *autonomously* performing will be foreseeable in accordance with the programming and instructions of the system.

Further, many have noted that AWS could provide immense benefit to the deploying side, such that the asymmetry between technologically advanced and less-advanced groups in warfare would widen.[142] This is a trend that has been ongoing for centuries.[143] Yet, the potentially enormous disparity between a belligerent party using AWS and one without them asks whether the side using AWS are no longer engage in fighting, but are actually 'manhunting' the other.[144] Added to the reduced physiological and psychological harms mentioned earlier, several authors have recognised that this would change the calculous for political decision-makers who would have one less reason to avoid conflict.[145] For technologically advanced forces, these aspects are strategically beneficial as they are more likely to be able to achieve their strategic and military aims. However, for their opponents, resistance may be near-impossible.[146] This, therefore, could lead to worries of technologically enabled global imperialism. However, precision-guided munitions,[147] high-altitude bombing,[148] and UAVs have also generated similar concerns that did not lead to such consequences.[149]

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[142] Pakistan Delegation, 'Statement By Ambassador Tehmina Janjua To Informal Meeting Of Experts' 2016 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 12 April 2016) Archived:<https://web.archive.org/web/20190913072735/https://www.unog.ch/80256EDD006B8954/(httpAssets)/D6F11030CC982C11C1257F93005933A0/$file/2016_LAWS+MX_GeneralExchange_Statements_Pakistan.pdf>, 2; Noel Sharkey, 'Why Robots Should Not Be Delegated With The Decision To Kill' (2017) 29 Connection Science, 177, 182-183. Sharkey also notes to potential for AWS to be used by authoritarian regimes against their own people.
[143] See, for example, Neil C. Renic, 'Justified Killing In An Age Of Radically Asymmetric Warfare' [2018] 17 European Journal of International Relations, 543; Riza (n.80).
[144] Chamayou (n.83) 33-34.
[145] Sharkey 2017 (n.142) 182; HRW 2012 (n.54) 39-40.
[146] Peter Asaro, 'Algorithms of Violence: Critical Social Perspectives on Autonomous Weapons' (2019) 86 Social Research, 537.
[147] Scott F. Murray, 'The Moral and Ethical Implications of Precision-Guided Munitions' (School of Advanced Air and Space Studies, 2007) Archived:<https://web.archive.org/web/20190913073308/https://apps.dtic.mil/dtic/tr/fulltext/u2/a488535.pdf>.
[148] Tom Engelhardt, 'Top Guns No More' (Tomdispatch.com, 2011) Archived:<https://web.archive.org/web/20190901010524/http://www.tomdispatch.com/post/175368/tomgram%3A_engelhardt,_top_guns_no_more>.
[149] See, for example, Ian G R Shaw, Predator Empire: Drone Warfare And Full Spectrum Dominance (University of Minnesota Press, 2016); Meier 2017 (n.141) 452-456.

On the other side of this argument are worries about proliferation of AWS to terrorist groups.[150] Yet, the technological capabilities needed for a terrorist-AWS already exist.[151] UAVs can be bought online, and AI software can be downloaded from the internet.[152] To terrorists, it would not matter if their versions of AWS are not very sophisticated. A terrorist group only needs one success in order to terrorise the public, whereas a military needs their AWS to work reliably all the time. Still, as Pinker points out, the number of people with terrorist-desires, and the know-how to produce such a machine whilst evading law enforcement is incredibly small and so it would be very unlikely for a terrorist group to be capable of building AWS in the near-future.[153]

Still, the more AWS proliferate, the more incentive groups will have to acquire them as there is no advantage to be had by being the only entity without AWS. This could lead to a multi-polar political landscape which can be unstable, potentially leading to greater levels of conflict.[154] The mass adoption of AWS could subsequently lead to future armed conflicts being primarily machine-on-machine combat, thus potentially alleviating much of the human suffering associated with war.[155] As such, AWS as an advanced technology presents a complex ethical, moral, and strategic picture.

### 6.5. The levels paradigm

In terms of technological advancement, it is possible to consider autonomy along a continuum of increasingly sophisticated machines: *inert* systems require direct human control to do anything,

[150] See, Future of Life Institute, 'Slaughterbots' (YouTube, 2017) Accessed 24 June 2020. Available at:<https://www.youtube.com/watch?v=HipTO_7mUOw>.
[151] Andrew Furman, 'Private Sector Perspectives On The Development Of Lethal Autonomous Weapon Systems' 2016 Group of Governmental Experts on Lethal Autonomous Weapons Systems Side Event (Geneva, 15 April 2016).
[152] There are thousands of algorithms available, to be used for good or ill, for free at TensorFlow, 'Libraries & Extensions' (TensorFlow2019) Accessed 24 June 2020. Available at:<https://www.tensorflow.org/resources/libraries-extensions>.
[153] Pinker (n.35) 191-198, 301-307.
[154] John J. Mearsheimer, 'Structural Realism' in Timothy Dunne, Milja Kurki and Steve Smith (eds), International Relations Theories (3rd edn, OUP, 2013) 84-86.
[155] Note John Canning, '"You've Just Been Disarmed. Have A Nice Day!"' (2009) 28 IEEE Technology and Society Magazine, 13.

such as swords; *automatic* systems are programmed to act in a specific and responsive way, such as landmines; *semi-autonomous* systems may be programmed to perform some critically relevant tasks but require human guidance for others, such as heatseeking missiles that are aimed and fired by humans but lock onto targets themselves; *autonomous* systems that can carry out all relevant tasks without human involvement.[156] This is the so-called 'levels of autonomy' paradigm.

In developing this paradigm, Crootof focusses her discussion on weapon systems.[157] However, due to the focus of each category on technological capability, rather than the use of the systems, these categories could be read to be very wide and include systems which are used for military support tasks, such as *autonomous* surveillance platforms. The inclusion of systems that do not perform targeting were rejected from the definition of AWS in this thesis. Whilst this paradigm enables understanding of the differences in technology, and how it can progress and manifest in different ways, the categories are far too wide such that the essence of targeting by AWS becomes lost. Further, multi-stage weapons with autonomy such as torpedo encapsulated mines, and the Sensor Fuzed Weapon are difficult to categorise. They are inert when initially emplaced/deployed by humans, but the sub-munitions have greater autonomy when finding targets and so each weapon as a whole defies categorisation. Whilst this paradigm allows us to understand increasing autonomy, it is difficult to characterise actual weapon systems within its taxonomy.

### 6.6. Bringing both paradigms together

Both the 'levels' and 'loop' paradigms are useful lenses for understanding different aspects of AWS. But both lack the focus of the other and struggle to deal with real world systems. For example, the Brimstone air-launched fire-and-forget missile is fired at a target by a pilot, but the missile itself

[156] Crootof (n.119) 1864-1865 (note that Crootof suggests her levels as inert, automated, semi-autonomous, and autonomous. 'automated' has been changed to 'automatic' for consistency in this thesis).
[157] Crootof (n.119) 1864.

performs the final actions of the attack *autonomously* ('*endgame engagement*').[158] Prior to release, the missile is *inert* and the pilot is '*in-the-loop*'. At the point of release, the missile is *semi-autonomous* with the pilot '*on-the-loop*'. During the attack, it is *autonomous* and the pilot is '*out-of-the-loop*'. As such, classification of actual weapons is difficult for these paradigms. Thus, whilst it can be illuminating to consider the technological capability of a system under the 'levels' paradigm and the distance between the weapon and human under the 'loop' paradigm, neither are satisfactory.

So, as Scharre suggests,[159] both paradigms should be considered simultaneously, whilst also considering what the weapon is doing. He proposes looking at autonomy in three dimensions: the task(s) a machine performs; the relationship between the human and the machine when the task(s) is performed; the sophistication of the machine when performing the task(s). These dimensions are independent and increasing any of these parameters can make a system '*more autonomous*'.[160]

Due to the independence of each dimension, and lack of clear thresholds, this paradigm cannot specifically define an AWS. But, it can be used to better understand differences in each definition offered by states.

With an AWS as defined by this thesis and others (a system that selects and engages targets without human intervention), the tasks performed by the system can be characterised as *critical*, in keeping with the ICRC understanding,[161] the human-machine relationship as *distant but potentially contactable*, and sophistication as *high*. The potentially contactable nature of this system would mean that an operator could be *in*, *on*, or *out-of-the-loop*, with the system being *autonomous* or *semi-autonomous* in accordance with the acts which the human is performing. Consequently, this can be used as a baseline to compare other definitions.

[158] Handy (n.14) 87.
[159] Scharre (n.89) 27-28.
[160] Scharre (n.89) 27-28.
[161] ICRC (n.57) 7.

In terms of tasks, very wide definitions could include systems performing highly-complex or simple tasks,[162] and so the amount of autonomy displayed by such an AWS would vary depending upon how it is employed. Those definitions requiring lethality[163] would be focussed upon *critical* targeting functions and so be at a similar level of autonomy along this dimension as the AWS definition adopted by this thesis.

Regarding the human-machine relationship, those definitions requiring an absence of human supervision[164] would always require an operator to be *out-of-the-loop*. Such systems would always present the greatest distance and autonomy possible in the definition of AWS used in this thesis. Beyond this are those definitions which require an impossibility of recalling or controlling the system.[165] Whilst they may be functionally as distant as simply having no operator oversight, the total absence of possible communications means that they are conceptually even more distant. As such, systems where communication is impossible present the greatest distance, and therefore most autonomy in terms of the human-machine relationship.

Turning finally to sophistication, the definitions which allow for remote-control or human oversight can also vary in terms of their sophistication as the level of autonomy present in this dimension is dependent upon what humans actually delegate to the AWS. These concepts are, therefore, two-sides of the same coin. Consequently, depending upon how it is used, an AWS could be *inert*, *automatic*, *semi-autonomous*, or *fully-autonomous*. However, one would expect AWS defined by their highly-technical functioning to display a greater level of sophistication and autonomy along this dimension.[166]

[162] Cuban UNOG Delegation (n.64); Russian UNOG Delegation (n.62) para.2; French UNOG Delegation (n.63); UK Approach (n.62) para.205.
[163] China UNOG Delegation (n.63) para.3; Belgian UNOG Delegation (n.65) para 8(c); French UNOG Delegation (n.63).
[164] Cuban UNOG Delegation (n.64); Swiss UNOG Delegation (n.64) para.29; French UNOG Delegation (n.63).
[165] Netherlands UNOG Delegation (n.63) para.5; China UNOG Delegation (n.63) para.3; Belgian UNOG Delegation (n.65) para 8(c).
[166] UK Approach (n.62) para.205; China UNOG Delegation (n.63) para.3.

By looking across these different characteristics for conceptualising AWS, we can see that there are vastly different understandings of what an AWS is. Further, whilst human-machine relationships and the sophistication of a machine are, essentially, two-sides of the same coin, it is the tasks that the AWS is performing that provide context for the other two dimensions. This not only underlines the superiority of Scharre's approach, but also that it is key to consider how *autonomous* a system is at the time of its usage.

Thus, in terms of their use, this thesis is focussed on the '*critical functions*'[167] of selecting and engaging targets by AWS. Indeed, it is the performance of these tasks in the context of distance and sophistication that determines their compliance with legal rules and the attendant need for regulation. Consequently, the precise definition of an *autonomous* system is largely immaterial. in the following chapters, this thesis focuses on the ability of international law to regulate critical functions in particular.

7. The state of AWS technology on the horizon

We have already mentioned the Harop system, but weapon systems in development today and the near future could allow for a much greater search area than with fire-and-forget missiles or loitering munitions, merged with the autonomy in targeting that other systems have. *Semi-autonomous* systems such as the Taranis UAV built by BAE Systems and the nEUROn UAV built by Dassault Aviation can search wide areas for targets and *autonomously* select them, however the decision to engage a target is currently performed by a human.[168] Their ability to recognise targets would suggest a *high* level of sophistication. But they have a *close* relationship with their human

[167] ICRC (n.57) 7.

[168]Berenice Baker, 'Taranis Vs. Neuron - Europe's Combat Drone Revolution - Airforce Technology' (Airforce Technology, 2014) Archived:<https://web.archive.org/web/20190306141311/https://www.airforce-technology.com/features/featuretaranis-neuron-europe-combat-drone-revolution-4220502/>; Jason Ford, 'Taranis test flights to inform design of future combat aircraft' (The Engineer, 2014) Archived:<https://web.archive.org/web/20190421175521/https://www.theengineer.co.uk/taranis-test-flights-to-inform-design-of-future-combat-aircraft/>.

operator who is required to be *in-the-loop* for *critical* decisions. Both systems are 'technology demonstrators', meaning that, rather than full production models, they are, fundamentally, an experiment to see what innovations can be developed for them, and which of these will be useful for future systems.[169]

However, there are several research programmes which indicate that humans might be pushed out of the targeting loop. The US military is looking at *autonomous* target selection and engagement using multiple systems.[170] The UK military has also initiated several exercises and studies geared toward greater integration of *autonomous* systems into its military functions.[171] Further, Russia is developing weapons with autonomy for targeting.[172] It is important to note that these research programmes might not be fruitful, nor might the developed technologies end up being used as part of a single system. However, they indicate that military research is heading towards greater autonomy

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[169] Baker (n.168).
[170]SBIR, 'Automatic Target Recognition Of Personnel And Vehicles From An Unmanned Aerial System Using Learning Algorithms' (SBIR, 2018) Archived:<https://web.archive.org/web/20190701145740/https://www.sbir.gov/sbirsearch/detail/1413823>; Federal Business Opportunities, 'Military Imaging And Surveillance Technology - Long Range (MIST-LR) Program' (Fbo.gov, 2013) Archived:<https://web.archive.org/web/20190913074810/https://www.fbo.gov/index?s=opportunity&mode=form&id=78b0ddbf382678fa9ace985380108f89&tab=core&_cview=0>; Philip Root, 'Fast Lightweight Autonomy (FLA)' (Darpa.mil, 2018) Archived:<https://web.archive.org/web/20190727150621/https://www.darpa.mil/program/fast-lightweight-autonomy>; Scott Wierzbanowski, 'Collaborative Operations In Denied Environment (CODE)' (DARPA, 2018) Archived:<https://web.archive.org/web/20190430115949/https://www.darpa.mil/program/collaborative-operations-in-denied-environment>; Shepard News, 'DARPA Seeks Proposals For Third Swarm Sprint' (Shephard Media, 2018) Archived:<https://web.archive.org/web/20181018192021/https://www.shephardmedia.com/news/uv-online/darpa-seeks-proposals-third-offset-swarm-sprint/>; Patrick Tucker, 'US Military Changing 'Killing Machine' Robo-Tank Program After Controversy' (Defense One, 2019) Archived:<https://web.archive.org/web/20190318180141/https://www.defenseone.com/technology/2019/03/us-military-changing-killing-machine-robo-tank-program-after-controversy/155256/>.
[171] UK Government, 'Streets Ahead: British AI Eyes Scan Future Frontline In Multinational Urban Experiment' (UK Government, 2018) Archived:<https://web.archive.org/web/20190724050902/https://www.gov.uk/government/news/streets-ahead-british-ai-eyes-scan-future-frontline-in-multinational-urban-experiment>; British Army, 'Ex Autonomous Warrior 2018' (British Army, 2018) Archived:<https://web.archive.org/web/20181123051919/https://www.army.mod.uk/news-and-events/awe-2018/>; Development, Concepts and Doctrine Centre, 'Human-Machine Teaming (JCN 1/18)' (UK Ministry of Defence, 2018); Development, Concepts and Doctrine Centre, 'Future Force Concept (JCN1/17)' (UK Ministry of Defence, 2017).
[172] TASS News, 'Kalashnikov Gunmaker Develops Combat Module Based On Artificial Intelligence' (TASS, 2017) Archived:<https://web.archive.org/web/20190704194054/https://tass.com/defense/954894>.

in weapon systems, which suggests that AWS could become more common. Still, this thesis expects that as cutting-edge AWS are developing in the same vein as UAVs, there will be similarities between their positions in military hierarchies and they will be instructed by operators who will themselves be overseen by commanders.[173]

At this point, it makes sense to briefly mention that manufacturers of *autonomous* systems are generally following the example of the aerospace industry which is seen as the 'gold standard' in terms of safety.[174] For instance, manufacturers of *autonomous* vehicles are pursuing a better-than-human failure rate.[175] This goal is also present in the development of weapons with autonomy. For example, BAE Systems are working toward 100% accuracy in target identification within a $10m^2$ space at a distance of 10km with their Taranis system.[176] Thus, although there are many issues associated with AWS, some engineers are working towards reducing the technical problems as much as possible. However, some of the moral and ethical issues mentioned above have led other engineers to oppose building AWS.[177]

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[173] Gregory (n.78).

[174] Alan Winfield, 'The Ethical Roboticist' (Centre for Autonomous Systems, Liverpool, UK, 27 June 2016). An earlier version of this presentation is available online: Alan Winfield, 'The Ethical Roboticist' (YouTube, 2011) Accessed 24 June 2020. Available at:<https://www.youtube.com/watch?v=OmuXhb6pA5s>.

[175] Lee Bell, 'Humans Vs Robots: Driverless Cars Are Safer Than Human Driven Vehicles' (The Inquirer, 2015) Archived:<https://web.archive.org/web/20190708112444/https://www.theinquirer.net/inquirer/feature/2426988/humans-vs-robots-driverless-cars-are-safer-than-human-driven-vehicles>; however, note that the calculation of a crash rate is difficult, see Peter Hancock, 'Are Autonomous Cars Really Safer Than Human Drivers?' (The Conversation, 2018) Archived:<https://web.archive.org/web/20190824172322/https://theconversation.com/are-autonomous-cars-really-safer-than-human-drivers-90202>.

[176] Keith Rigby, 'Future Design Drivers For Autonomous Systems Technology' (Royal Aeronautical Society, London, 19 July 2017).

[177] Future of Life Institute, 'Lethal Autonomous Weapons Pledge' (Future of Life Institute, 2017) Archived:<https://web.archive.org/web/20190728063149/https://futureoflife.org/lethal-autonomous-weapons-pledge/>; Future of Life Institute, 'An Open Letter To The United Nations Convention On Certain Conventional Weapons' (Future of Life Institute, 2017) Archived:<https://web.archive.org/web/20190728062950/https://futureoflife.org/autonomous-weapons-open-letter-2017>; Future of Life Institute, 'Open Letter On Autonomous Weapons' (Future of Life Institute, 2016) Archived:<https://web.archive.org/web/20190828231158/https://futureoflife.org/open-letter-autonomous-weapons/>.

8. Summing up major issues

AWS are clearly a technology that create many moral, ethical, strategic, and legal issues. Some are positive, and some are negative. Like all technologies, AWS are not wholly good, nor wholly bad, nor wholly neutral[178] – they have an effect not only upon warfare,[179] but also upon the societies who engage in, and are subject to, their use.[180] Further, the underlying algorithms reflect both the programmers,[181] and the approaches to programming that they took.[182] Despite AWS being instruments, or tools, of human beings, and subject to their instructions, we cannot view them in isolation from their effects on society, nor from the effects of society on them.[183] As the development of new tools enables the creation of new uses for those tools,[184] it is difficult to fully appreciate how AWS will be used in the future beyond the situations of combat at super-human intensity and in communication-denied environments, which this thesis has already outlined. Indeed, as Virilio notably said, '*When you invent the ship, you also invent the shipwreck ... Every technology carries its own negativity, which is invented at the same time as technical progress*.'[185] A question for international law then is how it can minimise the potential negativities of AWS.

[178] Melvin Kranzberg, 'Technology and History: "Kranzberg's Laws"' (1986) 27 Technology and Culture, 544, 545-548.
[179] Alexandra Sweny, 'The Third Revolution In Warfare: AI Weapons' (Vanguard Magazine, 2018) Archived:<https://web.archive.org/web/20150918094050/http://www.vanguardcanada.com/2015/08/18/the-third-revolution/>.
[180] In relation to the effects of deploying UAVs, see Leila Hudson, Colin S. Owens and Matt Flannes, 'Drone Warfare: Blowback From The New American Way Of War' (2011) 18 Middle East Policy, 122.
[181] On the biases of programmers making it into their code, see, for example, Hannah Devlin, 'AI Programs Exhibit Racial And Gender Biases, Research Reveals' (The Guardian, 2017) Archived:<https://web.archive.org/web/20190913085159/https://www.theguardian.com/technology/2017/apr/13/ai-programs-exhibit-racist-and-sexist-biases-research-reveals?CMP=twt_gu>.
[182] See Helmut Aust, '"The System Only Dreams in Total Darkness": The Future of Human Rights Law in the Light of Algorithmic Authority' in Andreas von Arnauld, Kerstin von der Decken and Nele Matz-Lück, German Yearbook Of International Law (Volume 60) (Duncker & Humblot, 2018).
[183] Mireille Hildebrandt, Smart Technologies And The End(S) Of Law (Edward Elgar 2015) 162-163.
[184] Weizenbaum, (n.41) 19.
[185] Paul Virilio, Politics Of The Very Worst (Semiotext(e), 1999) 89.

## 9. Conclusion

Overall, this Chapter has demonstrated how AWS should be defined and understood. AWS, by their nature, are not '*autonomous*' in the same sense as human beings but their machine autonomy is limited to what they can be programmed to do and instructed to do. This is fundamental; it is not possible for a machine to disobey its programming and instructions.

By conceptualizing AWS as systems that select and engage targets without human intervention, whether or not that intervention is materially possible, and noting that their actions are generally foreseeable enables the thesis to focus on the actions of AWS, and their users in the following chapters (particularly in Chapter 5). Having noted the different paradigms used for understanding AWS, this provides a basis for the subsequent analysis to also consider the human-machine relationship and technological sophistication in addition to the tasks that the system is instructed to perform. Having determined that AWS can only operate subject to control, the next Chapter explains how legal rules can apply in this context and how control relationships should be conceptualised as existing in different layers for each controlling entity.

# Chapter 3: The law applicable to autonomous weapon systems in layers of control

## 1. Introduction

The previous Chapter noted that autonomous weapon systems (AWS) are a type of weapon that is qualitatively different from any which has gone before. Through delegating the application of targeting choices to AWS, the operators and commanders of such systems are treating them in a similar way to human fighters. Consequently, this means that AWS must be considered not just in terms of being weapons, but also in terms of their behaviours in combat.

In order for international law to sufficiently regulate AWS, the applicability of law to these systems in terms of both weapons and 'fighters' in combat must be addressed. Indeed, there are '*no doubt*[s]'[1] that the law of armed conflict (LoAC) applies to new technologies such as AWS. This is a position of '*universal consensus*.'[2] But, it is unclear exactly how legal rules apply to them,[3] and so this presents a regulatory challenge. This Chapter provides a clear account of how the legal regimes relevant to weapons, and to targeting, can apply to such system by showing clear links between the humans who legal rules are addressed to, and the use of AWS as their legal agents in an exercise of control. It is also explained which entities exert control over AWS and how their relationships with AWS are based on control that affects how they are employed. Prior to those discussions taking place, however, this thesis first outlines the sources and bodies of international law that are relevant to AWS.

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[1] International Committee of the Red Cross, 'International Humanitarian Law And The Challenges Of Contemporary Armed Conflicts (31IC/11/5.1.2)' (ICRC 2011) Archived:<https://web.archive.org/web/20181123164311/http://e-brief.icrc.org/wp-content/uploads/2016/08/4-international-humanitarian-law-and-the-challenges-of-contemporary-armed-conflicts.pdf>, 36.
[2] Michael N. Schmitt and Jeffrey Thurnher, '"Out Of The Loop": Autonomous Weapon Systems And The Law Of Armed Conflict' (2013) 4 Harvard National Security Journal, 231, 243.
[3] Schmitt and Thurnher (n.2) 243.

## 2. Sources of international law relevant to AWS

Before outlining the bodies of international law relevant to AWS, the applicability of the domestic law of each state who use these systems must be addressed. Most notable would be the criminal and service law regimes relating to responsibility for AWS operations. The potential to use these regimes to assist a responsibility paradigm is discussed in Chapter 6. However, on the whole, domestic law is not relevant to these *international* law discussions, except insofar as some international obligations requires the enaction of domestic laws.

As stated in the statute of the International Court of Justice (ICJ), international law comes from: international agreements, such as treaties or conventions;[4] international customs, of general state practice accepted as law;[5] general principles of law, as recognised in domestic systems;[6] judicial decisions from other courts, and the teachings of '*highly qualified publicists*'.[7]

### 2.1. Treaty law

Treaties are international agreements between states[8] (or international organisations)[9] that delineate arrangements for obligations to be carried out.[10] Treaties may be 'law-making', meaning they are intended to have general applicability or a 'treaty-contract' between a small number of entities.[11] Sometimes, treaty rules reflect customary rules, but they are still separate obligations even if they are identical.[12] As such, this thesis shall separately refer to both customary and treaty

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[4] Art.38(a), Statute of the International Court of Justice (adopted 24 October 1945, entered into force 24 October 1945) (Hereafter: ICJ Statute).
[5] Art.38(b), ICJ Statute.
[6] Art.38(c), ICJ Statute.
[7] Art.38(d), ICJ Statute.
[8] Art.2(1), Vienna Convention on the Law of Treaties (adopted 23 May 1969, entered into force 27 January 1980) 1155 UNTC 331 (Hereafter: VCLT).
[9] Art.1, Vienna Convention on the Law of Treaties between States and International Organizations or between International Organizations (adopted 21 March 1986, not in force).
[10] Art.26, VCLT.
[11] Malcolm N Shaw, International Law (8th edn, CUP, 2017) 70.
[12] Case Concerning Military And Paramilitary Activities in and Against Nicaragua (Nicaragua v United States of America) Merits [1986] ICJ Reports, p.14, para.177.

obligations where relevant. With regard to interpretation, treaty terms should be understood with their '*ordinary meaning*'.[13] Where this is still uncertain, supplementary means of interpretation can be used.[14] It is important to note that violation of treaty obligations can be grounds for terminating that treaty,[15] unless it is of humanitarian character.[16]

Certain treaties create, or contribute to, a particular 'regime'. Those treaty-regimes relevant to AWS include: the maintenance of international peace and security;[17] the conduct of hostilities;[18] human rights law;[19] international criminal law.[20]

### 2.2. Customary international law

Customary international law (CIL) is generated from state practice and *opinio juris*. As the ICJ has stated, for a rule of CIL to form:

> '[n]*ot only must the acts concerned amount to a settled practice, but they must also be such, or be carried out in such a way, as to be evidence of a belief that this practice is rendered obligatory by the existence of a rule of law requiring it.*'[21]

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[13] Art.31, VCLT.
[14] Arts.31-33, VCLT.
[15] Art.60(1) to (4), VCLT.
[16] Art.60(5), VCLT.
[17] Art.2, Charter of the United Nations (adopted 26 June 1945, entered into force 24 October 1945) (Hereafter: UN Charter).
[18] There are many treaties which contribute to the law of armed conflict, see Adam Roberts and Richard Guelff, Documents On The Laws Of War (3rd edn, OUP, 2004).
[19] See, for example, International Covenant on Civil and Political Rights (adopted 16 December 1966, entered into force 23 March 1976) 999 UNTS 171 (Hereafter: ICCPR); International Covenant on Economic, Social and Cultural Rights (adopted 16 December 1966, entered into force 3 January 1976) 993 UNTS 3 (Hereafter: ICESCR); Convention for the Protection of Human Rights and Fundamental Freedoms (adopted 4 November 1950, entered into force 3 September 1953) 213 UNTS 221 (Hereafter: ECHR); American Convention on Human Rights (adopted 22 November 1969, entered into force 18 July 1978) 1144 UNTS 123 (Hereafter: IACHR); African Charter on Human and Peoples' Rights (adopted 27 June 1981, entered into force 21 October 1986) 1520 UNTS 217 (Hereafter: ACHPR).
[20] See, for example, Rome Statue Of The International Criminal Court 1998 (adopted 17 July 1998, entered into force 1 July 2002) 2187 UNTS 3.
[21] North Sea Continental Shelf Cases (Germany v Denmark; Germany v Netherlands) Judgement [1969] ICJ Reports, p.3, para.77.

Thus, where both of these elements exist, a rule of CIL may form. Appreciation of these elements must be done separately and give regard to the '*overall context, the nature of the rule and the particular circumstance*'.[22] Primarily, acts of state organs in their executive, legislative, judicial or other functions constitute state practice[23] (international organisations may contribute to the formation or expression of CIL rules,[24] but non-state actors, multinational corporations, and individuals may not).[25]

Forms of practice can be varied.[26] The following discussion of AWS will focus primarily on rules developed from '*operational conduct "on the ground"*' which can include '*battlefield or other military activity.*'[27] The formation of CIL rules must be representative of the practice as a whole,[28] it must be sufficiently widespread, representative, and consistent as to be a general practice.[29] Still, contradictory or inconsistent practice does not necessarily preclude the recognition of practice as settled.[30]

In terms of the *opinio juris* element, the practice must be '*undertaken with a sense of legal right or obligation, that is, it must be accompanied by a conviction that it is permitted, required or prohibited by customary international law*.'[31] Thus, where '*comity, political expedience*[,]

[22] North Sea Continental Shelf Cases (Germany v Denmark; Germany v Netherlands) Dissenting Opinion of Judge Tanaka [1969] ICJ Reports, p.175; Case Concerning Rights of Nationals of the United States of America in Morocco (France v United States of America) Judgement (1952) ICJ Reports, p.176, p.200; International Law Commission, ' Report of The International Law Commission on the Work of its Seventieth session' (2018) UN Doc. A/73/10, para.66 (Hereafter: ILC 2018), Conclusion 3 and accompanying commentary.
[23] Case Concerning the Continental Shelf (Libyan Arab Jamahiriya v Malta) Judgement [1985] ICJ Reports, p.13, para.27; ILC 2018, Conclusion 5 and accompanying commentary; Nicaragua case (n.12) para.183.
[24] 'The subjects of law in any legal system are not necessarily identical in their nature or in the extent of their rights' in Reparation for Injuries Suffered in the Service of the United Nations (Advisory Opinion) [1949] ICJ Reports, p.174, p.178; ILC 2018, Conclusion 4, commentary paras.4-7.
[25] ILC 2018, Conclusion 4, commentary paras.8-9.
[26] ILC 2018, Conclusion 6(2).
[27] ILC 2018, Conclusion 6, commentary para.5.
[28] Jurisdictional Immunities of the State (Germany v Italy: Greece intervening) Judgement [2012] ICJ Reports, p.99, paras.76 and 83; ILC 2018, Conclusion 7 and accompanying commentary.
[29] North Sea Continental Shelf case (n.21) para.74 and 77; ILC 2018, Conclusion 8 and accompanying commentary.
[30] Nicaragua case (n.12) para.186; ILC 2018, Conclusion 8, commentary para.2.
[31] ILC 2018, Conclusion 9, commentary para.2, note that 'right or obligation' is used to reflect the rights and obligations of states, see fm.723; North Sea Continental Shelf case (n.21) paras.76-77; Jean-Marie Henckaerts

*convenience*', or seeking to abide by treaty or domestic law, are unaccompanied by a separate sense of right or obligation accepted as law, no *opinio juris* can form.[32] Evidence of *opinio juris* can be found across a range of different statements, decisions, or actions of states.[33] Due to AWS being recent developments, there is no evidence of relevant state practice combined with *opinio juris* which could be used to create specific CIL rules related to AWS.

Some customary rules are thought of as being of greater importance than others. These are known as *peremptory* or *jus cogens norms*. These obligations are not owed to other states but are of such importance that they are owed to the international community as a whole (*erga omnes*).[34] The responsibility for such rules in relation to 'aggravated' state responsibility is considered in Chapter 6.

Where a state has clearly and persistently expressed opposition to a rule of CIL to other states during its formation, and continues to oppose it, the customary rule cannot be applied to that state unless it is a *jus cogens* norm.[35] As such, if a particular state clearly and openly objected to the formation of rules related to autonomy in warfare, such rules would not apply to them for so long as they maintain their objection.

### 2.3. General principles of law

Due to international law being under-developed in comparison to domestic legal systems, gaps sometimes appear which can be solved through applying principles of law that are recognised in

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and Louise Doswald-Beck, Customary International Humanitarian Law, Volume I: Rules (CUP, 2005) (Hereafter: ICRC Study) p.xxxii.

[32] Asylum Case (Colombia v Peru) Judgement [1950] ICJ Reports, p.266, pgs.277 and 286; North Sea Continental Shelf case (n.21) para.76; ILC 2018, Conclusion 9, commentary paras.3 and 4; John B. Bellinger III and William J. Haynes II, 'A US Government Response To The International Committee Of The Red Cross Study Customary International Humanitarian Law' (2007) 89 International Review of the Red Cross, 443, 445 and 446-447.

[33] ILC 2018, Conclusion 10(2).

[34] Case Concerning Barcelona Traction, Light and Power Company, Limited (Belgium v Spain) New Application: 1962, Second Phase [1970] ICJ Reports, p.3., paras.33-34.

[35] Fisheries (United Kingdom v Norway) Judgement [1951] ICJ Reports, p.116, p.131; ILC 2018, Conclusion 15 and accompanying commentary; James A. Green, The Persistent Objector Rule In International Law (OUP, 2016).

domestic systems. This source of international law is rarely used, but it has created some important rules.[36] This thesis applies these principles where relevant. For example, the violation of an international obligation generating a subsequent obligation to make reparation is discussed in Chapter 6.[37]

### 2.4. Highly qualified publicists

Academic writing as a source of international law is generally restricted to writers of classic works. Such compositions mostly come from writers during the period when the natural law approach dominated, and so analysis rather than juridical opinion was of crucial importance.[38] Yet, some later writers of great standing, such as Oppenheim or Rousseau, are often referred to in similar terms as the 'classic' writers and their opinions are sometimes treated as law.[39]

### 2.5. Judicial decisions

Under Article 59 of the ICJ statute, the decisions of the Court have binding effect only on the parties in dispute, and in respect of that dispute. In practice, however, international courts will often consider their previous decisions, and those from other judicial bodies in both the international and domestic arenas.[40] As such, relevant aspects of judicial decisions are applied where applicable, both where they determine particular rules of international law or enhance the interpretation of obligations.

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[36] For a discussion on various principles which have been brought into international law through cases at the PCIJ and ICJ, see Shaw (n.11) 74-78.
[37] Case Concerning the Factory at Chorzów (Claim for indemnity) (Germany v Poland) Merits (1928) PCIJ Rep Series A No 17, p.10, 29.
[38] Shaw (n.11) 84.
[39] Shaw (n.11) 84.
[40] Shaw (n.11) 82-83.

## 2.6. Other possible sources

Whilst the ICJ statute lists only five sources of international law across four paragraphs, some other documents and decisions are occasionally treated as law. Resolutions of the UN Security Council are binding upon all states,[41] and so are treated as equivalent to international law. In contrast, resolutions of the UN General Assembly have no binding effect.[42] But, General Assembly resolutions that have received substantial support from states have, on occasion, been treated as law. The 'De-Colonisation Declaration'[43] and the 'Declaration on Friendly Relations'[44] appear to have been elevated to the level of being treated as law even though they are not in *de jure* terms.[45]

Other documents that are non-binding can form 'soft law'. This means that whilst the documents are not law, particular attention should be given to them.[46] The International Law Commission is tasked with developing international law[47] by creating draft treaties and reports. These have no independent legal standing. But they are sometimes treated as if they were law, or at least as the preeminent determination of what the law is.[48]

In other cases of soft law formation, groups of experts have made pronouncements upon how international law should apply to certain situations. For example, 'International Expert Manuals' claim to rearticulate LoAC for particular situations. They have covered topics such as naval warfare,[49] non-

[41] Art.25, UN Charter.
[42] Art.10 UN Charter. However, note the administrative competency of the General Assembly under Arts.15-17
[43] Declaration on the Granting of Independence to Colonial Countries and Peoples (15th session, 14 December 1960) UN Doc. A/RES/1514.
[44] Declaration on Principles of International Law concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations (25th session, 24 October 1970) UN Doc. A/RES/25/2625.
[45] Shaw (n.11) 86.
[46] Shaw (n.11) 87.
[47] Art.1, Establishment of an International Law Commission (2nd session, 21 November 1947) UN Doc. A/RES/174.
[48] Note several references to the ILC's work in Gabčíkovo-Nagymaros Project (Hungary/Slovakia) Judgement [1997] ICJ Reports, p.7, paras.50-54.
[49] Louise Doswald-Beck, San Remo Manual On International Law Applicable To Armed Conflicts At Sea (CUP 2005).

international armed conflicts,[50] air and missile warfare,[51] and cyber-warfare.[52] International expert manuals provide additional illumination in interpreting relevant treaty and customary rules for situations that they focus on. This has led to the adoption of some of these rules into domestic policy.[53] The policies which articulate international LoAC obligations for each domestic armed force are national military manuals. They are often thoroughly researched for practical application, and so they can also be used as a guide to the applicable LoAC rules. The manuals referred to in this thesis come from the UK,[54] the US,[55] Canada,[56] Australia,[57] New Zealand,[58] Germany,[59] and Denmark.[60]

The authors of some of soft law instruments have claimed to be authoritative re-statements of the *lex lata*.[61] But, the authority of such documents actually comes from the original rules within them. Therefore, this thesis uses such instruments as a guide to what the law is in some circumstances, but endeavours to refer to *de jure* legal rules from an actual source of international law where available.

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[50] Michael N Schmitt, Charles H.B Garraway and Yoram Dinstein, The Manual On The Law Of Non-International Armed Conflict With Commentary (International Institute of Humanitarian Law, 2006).
[51] Humanitarian Policy and Conflict Research, Manual On International Law Applicable To Air And Missile Warfare (Harvard University, 2009) (Hereafter: AMW Manual).
[52] Michael N. Schmitt and Liis Vihul (eds), Tallinn Manual 2.0 On The International Law Applicable To Cyber Warfare (CUP, 2017)(Hereafter: Tallinn Manual).
[53] For example, see the application of rules from Doswald-Beck (n.49) in the chapters on air and naval warfare in UK Ministry of Defence, Manual Of The Law Of Armed Conflict (OUP, 2004).
[54] UK MoD (n.53).
[55] US Department of Defense, Law Of War Manual 2015, Updated May 2016 (Office of the General Counsel, 2016)(Hereafter: US Manual).
[56] Canadian Office of the Judge Advocate General, Law Of Armed Conflict At The Operational And Tactical Levels (National Defence, 2001).
[57] Australian Defence Headquarters, Law Of Armed Conflict, ADDP 06.4 (Defence Publishing Service, 2006).
[58] New Zealand Defence Force, DM 69 (2 Ed) Manual Of Armed Forces Law, Volume 4 Law Of Armed Conflict (Directorate of Legal Services, 2017).
[59] German Federal Ministry of Defence, Law Of Armed Conflict Manual (Federal Ministry of Defence, 2013).
[60] Jes Rynkeby Knudsen, Military Manual On International Law Relevant To Danish Armed Forces In International Operations (Danish Ministry of Defence, 2016).
[61] See, for example, Basic Principles and Guidelines on the Right to a Remedy and Reparation for Victims of Gross Violations of International Human Rights Law and Serious Violations of International Humanitarian Law (60th session, 21 March 2006) UN Doc. A/RES/60/147.

## 3. Bodies of law relevant to AWS

Having outlined the sources of international law and hinted at the rules and regimes of international law which are germane to AWS, this Chapter now turns to explore the bodies of law that are most relevant to such systems. These are the *Jus ad Bellum*, the law of armed conflict, international human rights law, state responsibility, and international criminal law.

### 3.1. Jus ad Bellum

Where a state uses force extraterritorially, the *Jus ad Bellum* legal regime applies to the recourse to that force. There is a substantial customary history of this regime.[62] However, it has been overtaken by the scheme laid out in the UN Charter. The Charter prohibits the use of force under Article 2(4). But, the use of force by states can be lawful if: force is being used with the consent, invitation, or acquiescence of the territorial state;[63] the use of force has been approved by the UN Security Council under Chapter VII of the UN Charter;[64] the state using force is acting in self-defence.[65] Artificial intelligence systems may be used for data analysis by states to assist them in determining whether to initiate an armed conflict.[66] But, such systems are not expected to be delegated the decision to initiate conflicts and so are not of concern here. Still, the use of AWS may create some *Jus ad Bellum* issues.[67]

Firstly, there is a risk that an AWS could malfunction, cross an international border and conduct hostilities. This could *prima facie* create an international armed conflict (IAC) due to the

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[62] See, Stephen C. Neff, War and the Law of Nations: A General History (CUP, 2005).

[63] David Wippman, 'Pro-Democratic Intervention' in Marc Weller (ed.), The Oxford Handbook Of The Use Of Force In International Law (OUP, 2015) 805.

[64] Art.39, UN Charter.

[65] Art.51, UN Charter.

[66] For more on AI in strategic decision-making and the use of force, see Ashley Deeks, Noam Lubell and Darragh Murray, 'Machine Learning, Artificial Intelligence, And The Use Of Force By States' 10 Journal of National Security Law & Policy, 1.

[67] Here the focus is on legal issues, but there are other issues related to moral conceptions of Jus ad Bellum, see Heather Roff, 'Lethal Autonomous Weapons And Jus Ad Bellum Proportionality' (2015) 47 Case Western Reserve Journal of International Law, 37.

execution of non-consensual extraterritorial violence. However, where uses of force are accidental or erroneous, this would not create an armed conflict.[68]

Secondly, some cyber-weapons could have *autonomous* functions that create *Jus ad Bellum* issues. For example, if such a weapon is programmed to automatically respond to any cyber-incursion by launching a counter-attack, this would likely engage the computer system that launched the initial attack. If the initial attack were perpetrated by a non-state actor (NSA), or routed through computer systems in a third state, an automatic-return cyber-strike could become an armed attack if it were to create the required level of physical destruction.[69] This could create an IAC with the state the NSA is residing in, and/or the third state that a cyber-attack has been routed through.

Third, if military personnel from one state are subject to an armed attack, they may engage in national self-defence.[70] However, if only an uninhabited system is attacked, should this also lead to grounds for national self-defence and the beginning of an armed conflict?[71] This situation is unclear. Whilst surveillance uninhabited aircraft vehicles (UAVs, or 'drones') have been shot down over foreign countries without hostiles breaking out,[72] the case may be different if it is a large *autonomous* ship,[73] for example. Such issues are obviously problematic and need further exploration, but they are beyond the scope of this thesis.

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[68] UK MoD (n.53) 3.3.1.

[69] Marco Roscini, Cyber Operations And The Use Of Force In International Law (OUP, 2014) 14, 42,237,285; Michael N. Schmitt, '"Attack" As A Term Of Art In International Law: The Cyber Operations Context', CYCON 2012 (NATO CCD COE 2012) 4-7; See also Deeks, Lubell, and Murray (n.66) 7-11.

[70] Art.51, UN Charter.

[71] Alan Backstrom and Ian Henderson, 'New Capabilities In Warfare: An Overview Of Contemporary Technological Developments And The Associated Legal And Engineering Issues In Article 36 Weapons Reviews' (2012) 94 International Review of the Red Cross, 483, 497-498.

[72] Jamie Tarabay, 'Israel: Iranian Drone We Shot Down Was Based On Captured US Drone' (CNN, 2018) Archived:<https://web.archive.org/web/20190412080334/https://edition.cnn.com/2018/02/12/middleeast/israel-iran-drone-intl/index.html>.

[73] Backstrom and Henderson (n.71) 497.

## 3.2. The law of armed conflict

The law of armed conflict applies during armed conflicts. The Appeals Chamber in the case of *Tadić* at The International Criminal Tribunal for the Former Yugoslavia (ICTY) is often quoted as defining the circumstances for the existence of an armed conflict:

> *'…an armed conflict exists whenever there is a resort to armed force between States or protracted armed violence between governmental authorities and organized armed groups or between such groups within a State.'*[74]

The LoAC treaty rules governing international armed conflicts between states have a significant history and are comprised from many instruments.[75] However, the discussions in this thesis are mostly concerned with the 1949 Geneva Conventions, Additional Protocol I (API) of 1977, and to a lesser extent the 1907 Hague Regulations. According to the ICJ, these provisions are all also customary rules.[76] The existence of an IAC, and the application of these rules, is from '*the resort to force'*[77] meaning the first shot of the conflict.[78] It lasts until the '*general close of military operations.*'[79]

The existence of a non-international armed conflict (NIAC), according to *Tadić*, requires the armed non-state actors (ANSAs) involved to be organised, and the violence to be '*protracted*'. These concepts have been greatly expanded upon in the *Haradinaj* Trial Judgement at the ICTY. The organisational requirement may be exhibited by a clear command structure, amongst other aspects.[80] The protraction criterion requires continuous violence over some time, rather than short isolated

[74] Prosecutor v Tadić (Interlocutory Appeal) Case No: IT-94-1-A [1995] ICTY, 70.
[75] See Roberts and Guelff (n.18).
[76] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion [1996] ICJ Reports, p.226, paras.79-84.
[77] Tadić Interlocutory Appeal (n.74) 70.
[78] Contrast Jann Kleffener, 'Scope of Application' in Dieter Fleck (ed.), The Handbook Of International Humanitarian Law (3rd edn, OUP, 2013) para.202(1) with International Law Association, 'Final Report On The Meaning Of Armed Conflict In International Law' (ILA, 2010) p.28. Also note Akande discussing that attempts to include an intensity criterion to the existence of IAC are a mistaken attempt to unify the law governing IAC and NIAC: Dapo Akande, 'Classification of Armed Conflicts: Relevant Legal Concepts' in Elizabeth Wilmshurst (ed.), International Law And The Classification Of Conflicts (OUP, 2012) 41.
[79] Kleffener (n.78) para.222.
[80] Prosecutor v Haradinaj and others (Trial Judgement) Case No IT-04-84-T [2008] ICTY, para.60.

instances.[81] Protraction has also come to be seen as incorporating an 'intensity requirement',[82] that is determined by a large number of factors.[83]

The LoAC treaty rules governing NIACs are found in Common Article 3 of the 1949 Geneva Conventions and Additional Protocol II (APII) of 1977. The rules found in Common Article 3 apply where '*armed conflict not of an international character occurs*' on the territory of a state party to the Geneva Conventions.[84] APII applies to conflicts not of an international character '*which take place in the territory of a* [state party] *between its armed forces and dissident armed forces or other organized armed groups which, under responsible command, exercise such control over a part of its territory as to enable them to carry out sustained and concerted military operations and to implement* [APII].'[85] They apply to both states and ANSAs who are engaged in the NIAC.[86]

The use of AWS could cause novel problems for determining the point at which a NIAC begins, and the applicability of the relevant rules. As AWS would not need constant monitoring, it would be possible for a single person to operate many AWS. Even if AWS were used in intense attacks, the organisational requirement for an ANSA would not be fulfilled. Thus, a situation could emerge where combat of an intensity usually considered to be part of an armed conflict is happening, but an armed conflict cannot be declared to exist due to the minimal level of organisation.[87] This could be very problematic in terms of how states ensure the safety of their populace, as declaring a NIAC without the ANSA meeting the organisational requirement would open the door to attacking all terrorists as

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[81] Juan Carlos Abella v Argentina, Report No 55/97, Case no 11.137, OEA/SerL/V/II98 doc 6 rev (IACtHR, 18 November 1997).
[82] Akande (n.78) 52.
[83] Haradinaj Trial (n.80) para.49.
[84] Common Art.3 preamble, 1949 Geneva Conventions (Hereafter: GCs).
[85] Art.1, Protocol Additional To The Geneva Conventions Of 12 August 1949, And Relating To The Protection Of Victims Of Non-International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 609 (Hereafter: APII).
[86] Common Article 3, GCs; Art.1, APII.
[87] Sasha Radin and Justin Coates, 'Autonomous Weapon Systems And The Threshold Of Non-International Armed Conflict' (2016) 30 Temple International and Comparative Law Journal, 133, 140-147.

military targets when most should be treated as criminals.[88] The potential for a claim of necessity to preclude the wrongfulness of using force in such a situation is discussed in Chapter 6.

Customary rules regulating combat have developed over the history of warfare. In 2005, the International Committee of the Red Cross published their attempt to determine the customary rules applicable in armed conflicts. The 'Customary International Humanitarian Law' study has been subject to some criticism.[89] Yet, it is still a work that makes significant steps toward a full understanding of CIL in armed conflict and is generally seen in a positive light.[90] Consequently, this work is referred to as a guide to the applicable customary rules in IACs and NIACs and note particular issues where required.

The aspects of LoAC that are most relevant to the following discussions are those related to the regulation of weapons, which are sometimes collectively referred to as 'weapons law',[91] and the regulation of combat.[92] The term of art used in LoAC for combat is 'the conduct of hostilities', it is regulated by a legal regime sometimes known as 'targeting law'.[93] Further, there is a self-contained system within LoAC that governs individual responsibility for violations of specific rules and is known as the Grave Breaches regime.[94]

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[88] See Christopher Greenwood, 'War, Terrorism, And International Law' (2003) 56 Current Legal Problems, 505.
[89] Bellinger and Haynes (n.32); Elizabeth Wilmshurst and Susan Breau, Perspectives On The ICRC Study On Customary International Humanitarian Law (CUP, 2007); Kaiyan Kaikobad et al., 'United Kingdom Materials On International Law 2005' (2006) 76 British Yearbook of International Law, 683, Legal Adviser to the Foreign and Commonwealth Office at 694-695.
[90] See, for example, Michael Wood, 'The Evolution And Identification Of The Customary International Law Of Armed Conflict' (2018) 51 Vanderbilt Journal of Transnational Law, 727.
[91] See, for example, Arts.35 and 36, Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 3 (Hereafter: API); ICRC Study, Rules 70-86.
[92] See, for example, Arts.48, 51, and 57, API; Arts.13-15, APII; ICRC Study, Rules 1-45.
[93] William H. Boothby, The Law Of Targeting (OUP, 2012).
[94] Art.49, Geneva Convention (I) for the amelioration of the condition of the wounded and sick in armed forces in the field (adopted 12 August 1949, entered into force 21 October 1960) 75 UNTS 31; Art.50, Geneva Convention (II) for the amelioration of the condition of the wounded, sick and shipwrecked members of the armed forces at sea (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 85; Art.129, Geneva Convention (III) relative to the treatment of prisoners of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 13; Art.146, Geneva Convention (IV) relative to the protection of civilian persons in time of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 287; Art.86(1), API; ICRC Study, Rules 149-161.

## 3.3. International human rights law

However, LoAC is not the only international legal regime that exists in situations of armed conflict. Apart from Israel,[95] is it universally accepted by states that international human rights law (IHRL) *does* apply in armed conflicts. Indeed, the ICJ[96] and the ICCPR Human Rights Committee in a General Comment have stated that IHRL continues to apply during armed conflict;[97] and, therefore, would apply to the use of AWS in armed conflict. However, there is still some dispute as to *how* it applies. In order to resolve the simultaneous applicability of two bodies of law, a *lex specialis* approach has been used by the ICJ,[98] the Inter-American Commission[99] and Court of Human Rights,[100] and the European Court of Human Rights.[101] Consequently, this thesis will follow this concept. In doing so, the work of Murray[102] is drawn upon. He outlines a *lex specialis* approach for applying LoAC as a primary framework and IHRL as a secondary framework that is intended to be used by practitioners. As this thesis is focussed on real world applications, Murray's work is appropriate to follow. There is no comparable term to the 'conduct of hostilities' in IHRL to refer to combat, and so Murray uses the phrase 'active hostilities' to refer to such situations.[103] This thesis shall, at times, also use this phrase.

The primary instruments of IHRL are multi-lateral treaties. There are international agreements, such as the International Covenants on Civil and Political Rights (ICCPR). There are also regional agreements, such as the European (ECHR), Inter-American (IACHR), and African (ACHPR)

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[95] See Green (n.35) 124-126.
[96] Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory, Advisory Opinion [2004] ICJ Reports, p.136, paras.106-113.; Armed Activities on the Territory of the Congo (Democratic Republic of the Congo v Uganda) Judgement [2005] ICJ Reports 2005, p.168, para.216.
[97] The Nature of the General Legal Obligation Imposed on States Parties to the Covenant (Human Rights Committee, 80th session) 2004 UN Doc. GC.31 CCPR/C/21/Rev.1/Add. 13, para.11; Consideration Of Reports Submitted By States Parties Under Article 40 Of The Covenant: Croatia, Yugoslavia' (Human Rights Committee, 46th session) 1993 UN Doc. CCPR/C/SR.1202/Add.1, para.23.
[98] Nuclear Weapons Opinion (n.76) para.25; Wall Opinion (n.96) para.106; Armed Activities case (n.96) para.216.
[99] Coard et al v United States, Report No 109/99, Case 10951, Decision (IACtHR, 29 September 1999)., para.42.
[100] Serrano Cruz v El-Salvador, Preliminary Objections (IACtHR, 23 November 2004)., para.112; Case of the Afro-Descendant Communities Displaced from the Cacaria River Basin (Operation Genesis) v Colombia, Judgment (IACtHR, 20 November 2013) para.221; Mapiripan Massacre v Colombia, Judgement (IACtHR, 15 September 2005) para.115.
[101] Hassan v United Kingdom, App no:29750/09 (ECtHR, 16 September 2014)., para.102.
[102] Daragh Murray (ed), Practitioners' Guide To Human Rights Law In Armed Conflict (OUP, 2016).
[103] Murray (n.102) 4.30.

Conventions. They protect people and their fundamental rights and freedoms from abuse by state power through obligating states to protect, fulfil, or respect rights, and these rules are enforced through a responsibility regime. IHRL case law is extensive, and it is drawn from at length throughout this thesis. There are cases that are relevant to the use of autonomy in weapon systems in situations of law enforcement[104] and border security.[105] But, as this work is focussed upon analysing AWS in situations of armed conflict, they are not discussed in this thesis.

In the following analysis, the decisions of The European Court are cited more than other bodies. This is merely because the Court in Strasbourg has generated more decisions on the application of IHRL to armed conflict than other similar bodies. The views of the Inter-American Court, and less-so the African Court, are also considered to see different trends across regions, and to understand the different obligations which might affect states acting in multi-national military coalitions.[106]

In terms of customary IHRL, Meron suggests that the particular nature of human rights means that '*opinio juris appears to have greater weight than state practice*'[107] and that the burden of proof for creating customary human rights law should be lighter than CIL generally.[108] However, this is not a view shared by the majority of international lawyers, nor the International Law Commission in its work on the formation of CIL.[109] Even so, considering the vast number of human rights violations that occur, it would seem difficult to identify a general practice of states abiding by their human rights obligations in order to form protective customary IHRL rules.[110]

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[104] Kakoulli v Turkey, App no:38595/97 (ECtHR, 22 November 2005) paras.108 and 115; Kallis and Androulla Panayi v Turkey, App no:45388/99 (ECtHR, 27 October 2009) paras.60 and 63; also see Maya Brehm, 'Academy Briefing No.9: Defending The Boundary' (Geneva Academy, 2017).
[105] Streletz, Kessler and Krenz v Germany, App nos:34044/96, 35532/97 and 44801/98 (ECtHR, 22 March 2001); Klaus Dieter Baumgarten v Germany, Comm No. 960/2000 (HRComm, 31 July 2003) UN Doc. CCPR/C/78/D/960/2000; also see Brehm (n.104).
[106] See Murray (n.102) 5-6.
[107] Theodor Meron, Human Rights And Humanitarian Norms As Customary Law (Clarendon Press, 1991) 99.
[108] Meron (n.107) 131.
[109] ILC 2018, para.66.
[110] Brian Lepard, 'Toward a New Theory of Customary International Human Rights Law' in Brian Lepard (ed.), Reexamining Customary International Law (CUP, 2017) 240.

The right of most relevance to the discussion of AWS is the right to life, which is considered in terms of both substantive and procedural obligations across Chapters 4 to 6. Generally, the substantive obligation of the right to life protects people from an arbitrary deprivation of life by requiring state forces to only use lethal force where they believe it is absolutely necessary[111] to protect life.[112] Generally, a killing in an armed conflict that is in accordance with LoAC is not thought to be arbitrary.[113]

Yet, the European Convention does not explicitly deal with a standard of arbitrariness, but provides a list of exceptional circumstances where lethal force may be used, including defending people from unlawful violence, to affect an arrest, or to quell a riot or insurrection.[114] Thus, under a strict reading of the European Convention, there would appear to be little room for interpretation using LoAC as *lex specialis*. However, the Court has referred to LoAC rules as a way of interpreting compliance with the right to liberty with regard to cases of internment.[115] As such, one can expect the European Court to interpret the right to life in accordance with LoAC as *lex specialis*.[116] Indeed, the Court has interpreted right to life obligations in light of LoAC, by tacitly allowing targeting based upon status,[117] not requiring threats to be immediate,[118] and implicitly incorporating LoAC rules into its judgements.[119] Thus, across the different IHRL regimes, LoAC and IHRL rules applicable to the development and use of AWS can be applied along similar lines.

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111 Nachova and Others v Bulgaria, App nos:43577/98 and 43579/98 (ECtHR, 6 July 2005) paras.94-95; McCann and Others v the United Kingdom, App no:18984/91 (ECtHR, 27 September 1995) para.200.

112 Art.6, ICCPR; Art.4, IACHR; Art.4, ACPHR.

113 Nuclear Weapons Opinion (n.76) para.25.

114 Art.2(2), ECHR.

115 Hassan (n.101) para.102-111; Varnava and Others v Turkey, App no:16064/90 (ECtHR, 18 September 2009) para.185.

116 Christof Heyns et al., 'The International Law Framework Regulating The Use Of Armed Drones' (2016) 65 International and Comparative Law Quarterly, 791, 822; Stuart Wallace, The Application Of The European Convention On Human Rights To Military Operations (CUP 2019) 119.

117 McCann (n.111) para.194; Ergi v Turkey, App no:66/1997/850/1057 (ECtHR, 28 July 1998) para.79; Cordula Droege, ‘Elective affinities? Human rights and humanitarian law’ 90 International Review of the Red Cross, 501, 533.

118 Nachova (n.111) para.95 ; Droege (n.117) 533; Isayeva, Yusupova and Bazayeva v Russia, App nos:57947/00, 57948/00 and 57949/00 (ECtHR, 24 February 2005) para.181; Nils Melzer, Targeted Killing In International Law (OUP, 2008) 389.

119 Wallace (n.116) 80-93 also note the inconsistencies of approach to incorporation of LoAC.

As the discussion in the following sub-sections shows, depending upon the situation, a state may be expected to apply the full range of human rights obligations where they exert *de facto* control,[120] or they may be able to '*divide and tailor*' the applicable rights which are relevant to the individuals in the circumstances.[121] At a minimum, states would be expected to guarantee the right to life, the prohibition on torture, enforced disappearances, and arbitrary detention.[122] In accordance with the *lex specialis* approach of international courts, the substantive obligation to protect the right to life would be fulfilled by complying with LoAC.

In terms of the procedural obligation to investigate deaths and significant injuries as part of the right to life, it is also applicable during armed conflict.[123] Such investigations must be transparent,[124] prompt,[125] independent,[126] and capable of examining the use of lethal force in the circumstances.[127]

In difficult circumstances, the procedural obligation may be interpreted flexibly depending upon the situation, and in the light of LoAC.[128] Standard procedures should be followed as much as possible.[129] But, where an investigation is hampered due to the site of examination being in the battlespace or under enemy control, a reasonable delay[130] or use of less effective means of investigations may be used without violating the procedural obligation.[131]

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[120] Loizidou v Turkey, App no:15318/89 (ECtHR, 13 March 1995) para.56; Cyprus v Turkey, App no: 25781/94 (ECtHR, 10 May 2001) para.77.
[121] Al-Skeini (n.131) para.137.
[122] Murray (n.102) para.3.21.
[123] Georgia v Russia (II), App no:38263/08 (ECtHR, 13 December 2011) para.72.
[124] See Wallace (n.116) 132-135.
[125] Ergi (n.117) para.82; for more, see Wallace (n.116) 111-112, 135-139.
[126] Hugh Jordan v United Kingdom, App no:24746/94 (ECtHR, 4 August 2001) para.106.
[127] Paul and Audrey Edwards v United Kingdom, App no:46477/99 (ECtHR, 14 June 2002) 72-73.
[128] Velcea and Mazăre v. Romania, App no:64301/01 (ECtHR, 1 December 2009); Velikova v. Bulgaria, App no:41488/98 (ECtHR, 18 May 2000) para.80; Murray (n.102) para.3.69-3.70.
[129] Kaya v Turkey, App no:158/1996/777/978 (ECtHR, 19 February 1998) paras.89-91.
[130] Nachova (n.111) para.113.
[131] Al-Skeini v United Kingdom, App no:55721/07 (ECtHR, 7 July 2011) para.164, 168; Yasa v Turkey, App no:63/1997/847/1054 (ECtHR, 2 September 1998) para.104.

### 3.3.1. Derogations

Some IHRL treaties allow for their application to be modified by state parties through derogation.[132] Of those human rights treaties that allow for derogations, the ICCPR and IACHR do not allow them with respect to the right to life. Still, as noted above, under those systems, a killing in conformity with LoAC would be lawful under IHRL.

However, under the ECHR, Article 15 allows for derogation of the right to life, to the extent strictly required, in times of '*war … threatening the life of the nation*'. 'War' historically only referred to IACs,[133] but can now be understood to include NIACs also.[134] Such a measure must be taken to deal with the relevant situation, and be in accordance with other international legal obligations (LoAC in this case), and the Council of Europe must be informed.[135]

Thus, the content of the right to life would be changed in armed conflicts following a derogation.[136] This could mean that the LoAC rules applicable to active hostilities would regulate combat without the substantive right to life being applied. However, a killing unlawful under LoAC would not abide by the terms of the derogation, and so would trigger the application of the right to life and subsequent investigations regulated by IHRL.[137]

Thus, the consequence of such derogations is the absence of human rights protections for civilians, and military personnel,[138] during combat, and killings that are lawful under LoAC not being examined in terms of their compliance with IHRL.[139] This removes any ability for victims to launch litigation against states if their right to life is violated during conduct that is lawful under LoAC. Despite the apparent legal benefit, no state has yet derogated from the right to life under the European

[132] Derogation clauses are found in Art.4, ICCPR; Art.15, ECHR; Art.27, IACHR. However, there are no derogation clauses found in the ICESCR, or the ACHPR.
[133] Wallace (n.116) 6.
[134] Louise Doswald-Beck, 'The right to life in armed conflict: does international humanitarian law provide all the answers?' (2006) 88 International Review of the Red Cross, 881, 883.
[135] See Wallace (n.116) 193.
[136] Murray (n.102) 4.73.
[137] Wallace (n.116) 116, 118-121.
[138] Wallace (n.116) 101-106.
[139] Wallace (n.116) 194.

Convention during armed conflict.[140] Only the UK has suggested it will presume to do so in future conflicts,[141] and so this thesis proceeds to also examine the IHRL obligations which would be applicable to states who choose not to derogate.

### 3.3.2. IHRL jurisdiction

Human rights agreements are intended to apply wherever state parties have jurisdiction.[142] This is not the same as other exercises of jurisdiction. For example, foreign crimes and criminals can sometimes come within a state's criminal jurisdiction.[143] Criminal jurisdiction relates to the exercise of sovereign rights.[144] However, human rights jurisdiction is concerned with whether a state has *de facto* control over an area, or people, such that human rights obligations are triggered and the state becomes the guarantor of the rights of people under their control.[145] Consequently, it is the '*physical power and control*' that state agents have over others which is the crucial factor in triggering these obligations.[146]

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[140] Murray (n.102) 4.73; States have, however, derogated with regard to detention in domestic security situations, see Wallace (n.116) 197-199.

[141] Marko Milanovic, 'UK To Derogate From The ECHR In Armed Conflict' (Ejiltalk.org, 2016) Archived:<https://web.archive.org/web/20161026071716/http://www.ejiltalk.org/uk-to-derogate-from-the-echr-in-armed-conflict/>.

[142] Art.1, ECHR; Art.1, IACHR; Art.2, ICCPR; note that the ACPHR does not contain a jurisdiction clause. See Murray (n.101) paras.3.12-3.13.

[143] See the statement of the Home Office Minister, in Kaiyan Kaikobad et al., 'United Kingdom Materials On International Law 2006' (2007) 77 British Yearbook of International Law, 597, 756; Cutting's Case in John Bassett Moore, A Digest of International Law (Vol.II) (Government Printing Office 1906) 228; Joyce v Director of Public Prosecutions [1946] AC 347; M. Christian Tomuschat (rapp.) 'Universal Criminal Jurisdiction With Regard To The Crime Of Genocide, Crimes Against Humanity And War Crimes' (Institute de Driot International, 2005) para.1.

[144] Samantha Besson, 'The Extraterritoriality Of The European Convention On Human Rights: Why Human Rights Depend On Jurisdiction And What Jurisdiction Amounts To' (2012) 25 Leiden Journal of International Law, 857, 869; Marko Milanovic, 'From Compromise To Principle: Clarifying The Concept Of State Jurisdiction In Human Rights Treaties' (2008) 8 Human Rights Law Review, 411, 420-422.

[145] Wallace (n.116) 24.

[146] Al-Skeini (n.131) para.136.

### 3.3.3. Application of IHRL in armed conflicts on a state's own territory

If a state were engaged in a NIAC in its own country, then areas that the state has *de facto* control over would be within their human rights jurisdiction.[147] This extends to vessels and aircraft, that are part of a state's jurisdiction.[148] Yet, it is difficult to determine whether a state has *de facto* control when its territory is contested.[149]

The European Court has mixed practice in this area. In one line of cases, the Court has suggested that where an adversary takes territory from the territorial state such that the territorial state loses *de facto* control, this would rebut a presumption of the territorial state being in control.[150] Such a situation changes the territorial state's human rights jurisdiction, rather than removes it, and the territorial state should still take '*diplomatic, economic, judicial or other measures*' to secure the rights guaranteed by the Convention.[151] As such, human rights obligations can be modified where a state loses *de facto* control over its territory.

Conversely, in another line of cases, the Court stated that even if the presumption of the territorial state being in control is rebutted,[152] the human rights jurisdiction and obligations of the territorial state remain unchanged.[153] This can be attributed to the reluctance of the Court to allow a situation where there would be no *de jure* guarantor of human rights.[154] These two lines of cases present a legal grey area. In anticipation that an IHRL tribunal might require states to abide by their human rights obligations despite a loss of *de facto* control, AWS use during NIACs on a state's own

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[147] Ilaşcu and Others v Moldova and Russia, App no:48787/99 (ECtHR, 8 July 2004) paras.311, 331; Assanidze v Georgia, App no:71503/01 (ECtHR, 8 April 2004) para.139.
[148] Hirsi Jamaa and Others v Italy, App no:27765/09 (ECtHR, 23 February 2012) para.77.
[149] Francoise Hampson, 'Direct Participation In Hostilities And The Interoperability Of The Law Of Armed Conflict And Human Rights Law' (2011) 87 International Law Studies, 187, 189.
[150] Ilaşcu (n.147) para.312; Assanidze (n.147) paras.139-142; Azemi v Serbia, App no:11209/09 (ECtHR, 5 November 2013) para.47.
[151] Ilaşcu (n.147) para.330-331; Assanidze (n.147) p.139-142.
[152] Isayeva v Russia, Judgment, App no:57950/00 (ECtHR, 24 February 2005) para.178.
[153] Sargsyan v Azerbijan, App no:40167/06 (ECtHR, 16 June 2015) paras.146-150.
[154] Wallace (n.116) 31-32.

territory should be in accordance with the full range of human rights obligations of the state as far as is practicable.

### 3.3.4. Extraterritorial application of IHRL

Extraterritorial human rights jurisdiction is allowed for in IHRL regimes[155] in exceptional circumstances,[156] such as security[157] and military operations.[158] Extraterritorial jurisdiction can be based upon the effective control of an area, or a state agent's exercise of authority and control, including during the exercise of public powers.[159]

Effective control is where, for all intents and purposes, one state has control over a portion of another state.[160] This applies in situations of military occupation of another state,[161] or when one state has '*decisive authority*' or '*effective influence*' over a local administration.[162] The exercise of effective control brings people in the area within the human rights jurisdiction of the state exercising that control.[163] Controlling states are expected to apply the full range of human rights obligations.[164] Yet, obligations may be divided and tailored where such jurisdiction is temporary.[165]

State agent authority and control is where a state agent, e.g. military personnel,[166] exert such authority/control over someone in another state that the individual comes under the jurisdiction of

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155 Art.1, ECHR; Art.1, IACHR; Art.2, ICCPR; note that the ACPHR does not contain a jurisdiction clause. See Murray (n.101) paras.3.12-3.13.

156 Al-Skeini (n.131) paras.131 and 133.

157 Öcalan v Turkey, App no:46221/99 (ECtHR, 12 May 2005) para.91; Issa and Others v Turkey, App no:31821/96 (ECtHR, 16 November 2004) para.55.

158 Al-Saadoon and Mufdhi v United Kingdom, App no:61498/08 (ECtHR, 2 March 2010) para.140; Al-Skeini (n.131) paras.131-140; Case of Al-Jedda v United Kingdom, App no:27021/08 (ECtHR, 7 July 2011); Markovic and other v Italy, App no:1398/03 (ECtHR, 14 December 2006); Pad v Turkey, App no:60167/00 (ECtHR, 28 June 2007); Loizidou (n.120) para.62.

159 Al-Skeini (n.131) paras.133-140.

160 Al-Skeini (n.131) paras.138-140.

161 Armed Activities case (n.96) para.178.

162 Catan and Others v the Republic of Moldova and Russia, App nos:43370/04, 8252/ 05, 18454/06 (ECtHR, 19 October 2012) paras.106-107.

163 Cyprus v Turkey (n.120) para.77.

164 Loizidou (n.120) para.56, 62.

165 Issa (n.157) paras.74-76; Murray (n.101) paras.3.56-3.58.

166 Cyprus v Turkey, App nos:6780/74 and 6950/75 (ECommHR, 26 May 1975) 125, 136.

the state which that agent represents.[167] Such jurisdiction clearly applies in situations of taking prisoners, for example.[168] As this Chapter discusses below (Section 5.8), state agents can be viewed as acting through AWS such that they could exert control over individuals. In circumstances of human rights jurisdiction being based upon state agent authority/control, obligations may be divided and tailored to the situation at hand.[169] There is debate as to whether an instantaneous act such as bombing or shooting someone is enough to exert the required level of control.[170]

In one line of cases, the European Court stated that neither aerial bombing, [171] nor the boarding of a drug-smuggling ship by commandos,[172] constituted acts of control because it did not involve any *ex ante* exercise of control over those killed,[173] and there was no '*"cause and effect" notion of "jurisdiction"*'.[174] Conversely, the Inter-American Commission decided that a military aircraft shooting down a civilian aircraft in international airspace *did* constitute an exercise of control.[175] In addition, the European Court has decided that the killing of civilians by a helicopter gunship,[176] and the shooting of Cypriot civilians from the Turkish Republic of Northern Cyprus *were* acts of control.[177] The case law of IHRL courts does not provide us with any firm answers. However, the European Court has maintained a position that it does not want to be involved in reviewing all uses of force by contracting states,[178] and so is unlikely to bring instantaneous lethal acts within its purview in the future.[179]

[167] Al-Skeini (n.131) paras.133-137.
[168] Al-Skeini (n.131) paras.137; Issa (n.157) para.71; Murray (n.101) para.5.110.
[169] Al-Skeini (n.131) para.136-137.
[170] For example, see Al-Saadoon and Others v Secretary of State for Defence [2016] EWCA Civ 811 paras.9-72.
[171] Bankovic and Others v Belgium and 16 other Contracting States, App no:52207/99 (ECtHR, 12 December 2001) paras.34-82.
[172] Medvedyev and others v France, App no:3394/03 (ECtHR, 29 March 2010) para.64; note that in this case, the subsequent confinement of the ships crew to quarters was deemed to be an act of control.
[173] Bankovic (n.171) paras.34-82.
[174] Medvedyev (n.172) para.64.
[175] Alejandre v Cuba, Report No 86/99 (IAComHR, 29 September 1999) para.25.
[176] Pad (n.158) para.54.
[177] Andreou v Turkey, App no:45653/99 (ECtHR, 27 January 2010) para.25.
[178] Wallace (n.116) 116.
[179] Marko Milanovic, 'Al-Skeini And Al-Jedda In Strasbourg' (2012) 23 European Journal of International Law, 121, 123, 132.

In an attempt to clarify the discrepancies of the state agent authority/control approach to jurisdiction with regard to instantaneous acts, the European Court suggested that the performance of policing or security operations as '*public powers*' could be a base for jurisdiction.[180] This requires effective control over an area before a state agent can exert such control over an individual to bring them within the human rights jurisdiction of their state.[181] This, therefore, mixes both the personal jurisdiction of state agent authority and control with the spatial jurisdiction of effective control.[182] This approach has been followed in several cases,[183] despite criticism in academic literature[184] and domestic courts.[185] It presents us with a situation whereby an individual could be shot from a distance and not be under the human rights jurisdiction of a contracting state, but would be under their jurisdiction if they had been shot whilst in the custody of that state.[186] As such, it is possible that the European Court will again attempt to clarify the situation.

In terms of how these three bases for jurisdiction can apply to AWS, where a state engages in active hostilities within an extraterritorial area under its effective control, then this would seem to come under its human rights jurisdiction. However, an instantaneous act of killing by an AWS without *ex ante* control by a state agent would not come within the human rights jurisdiction of a state, unless it is within an extraterritorial area of effective control and a sufficient jurisdictional link is created by the exercise of public powers.[187] One could imagine a state using AWS to defend an area under its effective control from attack due to the intensity of violence, or use of communication-jamming by the enemy, thus bringing attacks by the AWS within the human rights jurisdiction of the deploying

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[180] Al-Skeini (n.131) para.149.
[181] Cedric Ryngaert, 'Clarifying The Extraterritorial Application Of The European Convention On Human Rights (Al-Skeini V The United Kingdom)' (2012) 28 Utrecht Journal of International and European Law, 57, 59.
[182] Wallace (n.116) 58-59.
[183] Pisari v Moldova and Russia, App no:42139/12 (ECtHR, 21 April 2015); Jaloud v The Netherlands, App no:47708/08 (ECtHR, 20 November 2014).
[184] Friederycke Haijer and Cedric Ryngaert, 'Reflections On Jaloud V. The Netherlands' (2015) 19 Journal of International Peacekeeping, 174, 176-182; Aurel Sari, 'Untangling Extra-Territorial Jurisdiction From International Responsibility In Jaloud V. Netherlands: Old Problem, New Solutions' (2014) 53 Military Law and the Law of War Review, 287.
[185] Al-Saadoon (n.170) para.70.
[186] Al-Saadoon (n.170) para.59
[187] Sari (n.184) 297-298.

state. In addition, as Chapter 5 notes, it would be possible for adversaries to surrender to an AWS, and subsequently be taken prisoner. In such a situation, they would be subject to the state authority/control of the commander using the AWS and would, therefore, come within the IHRL jurisdiction of the deploying state. Such actions would be regulated by both LoAC as *lex specialis* and IHRL as a secondary framework. However, the use of AWS away from the spatial jurisdiction of the deploying state would not seem to come under their human rights jurisdiction, and so would be regulated solely by LoAC.

#### 3.3.5. Application of IHRL to NSAs

As this Chapter noted above (Section 3.3.3), where an armed non-state actor is so powerful that they push state forces out of a territory, this could, potentially, alter the human rights jurisdiction of the territorial state. One could argue that where the ANSA is supported by a state, that the territory under the *de facto* control of the ANSA comes within the human rights jurisdiction of the supporting state.[188]

However, where the ANSA is not in receipt of external support, only the ANSA itself could be thought of as having enough *de facto* control over the area to be a guarantor of human rights. The UN Security Council, General Assembly, and Human Rights Council have all addressed IHRL obligations towards ANSAs,[189] and a UN Special Rapporteur suggests that, in such a situation, ANSAs should be obligated to respect and protect the right to life.[190] Yet, this all hinges upon the ANSA in question voluntarily respecting and protecting the rights of people under their *de facto* control. At least 230 ANSAs have accepted some human rights responsibilities,[191] but there are no guarantees that ANSAs

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[188] Ilaşcu (n.147) para.312; Wallace (n.116) 32.
[189] See Jessica Burniske, Naz Modirzadeh and Dustin Lewis, 'Armed Non-State Actors And International Human Rights Law: An Analysis Of The Practice Of The U.N. Security Council And The U.N. General Assembly' (Harvard Law School Program on International Law and Armed Conflict, 2017).
[190] Report Of The Special Rapporteur On Extrajudicial, Summary Or Arbitrary Executions On Armed Non-State Actors: The Protection Of The Right To Life, Agnes Callamard (Human Rights Council, 38th Session) 2018 UN Doc A/HRC/38/44 paras.67-78.
[191] Geneva Call, 'Thematic: Human Rights', Their Words (Geneva Call, 2019).

will shoulder such obligations during armed conflicts or at all. As such, the use of AWS by an ANSA could result in them being used in a vacuum of human rights jurisdiction, hence the reluctance of the European Court to accept that states losing *de facto* control equates to a loss of human rights jurisdiction.

### 3.4. State responsibility

There is a substantial history of rules on state responsibility emanating from CIL and judicial decisions. The work of the International Law Commission in its Draft Articles on the Responsibility of States for Internationally Wrongful Acts compiled substantial amounts of evidence from both of these sources. These rules have generally, although not exclusively,[192] met with a positive reaction.[193] As the Articles themselves are soft law, they can be treated as an interpretive guide to how these rules should be applied. In Chapter 6, the Articles are used to describe the responsibility regime that exists for states who violate their obligations through using AWS.

### 3.5. International criminal law

The treaty international criminal law rules that are of most relevance to the use of AWS are found in the Rome Statute of the International Criminal Court (ICC). This is because they apply into the future, whereas the rules of previous international criminal tribunals applied to specific situations. Still, the statutes and decisions of the International Criminal Tribunals for the Former Yugoslavia and Rwanda, the Special Court for Sierra Leone, and the Nuremberg Trials, amongst others, are relevant to assisting the interpretation and progress of ICL. The ICC statute regulates four major crimes:

[192] See comments of the United States, State Responsibility: Comments and observations received from Governments (International Law Commission, 53rd Session) 2001 Un Doc. A/CN.4/515, 45.
[193] The articles have been cited 154 times by international courts, tribunals and other bodies up to 2012. See the Decisions of such bodies following an explanation of each article in United Nations, Materials on the Responsibility of States for Internationally Wrongful Acts (United Nations Legislative Series, 2012) UN Doc. ST/LEG/SER B/25.

aggression; genocide; crimes against humanity; war crimes. AWS, like any other weapon, could be used in the commission of such crimes. Chapter 6 explores how this could be done, and how responsibility could be attributed, particularly regarding controllers of AWS who can be deemed criminally responsible for 'acting through' a machine.

### 3.6. Other legal regimes

In addition to the bodies of law considered in this thesis, Crootof notes that the law of the sea could apply to marine and submarine AWS in much the same way as it applies to conventional naval vehicles,[194] also space law could apply to AWS that are equipped with nuclear weapons in outer space, or are stationed on celestial bodies.[195] Further, those AWS using the electromagnetic spectrum or international telecommunications networks would be governed by the International Telecommunications Union Constitution and Convention.[196] In addition, those aerial AWS functioning outside of armed conflict would be subject to the Convention on International Civil Aviation.[197] Finally, the law on neutrality is also relevant where belligerent parties enter the jurisdiction of neutral states.[198] However, none of these bodies of international law will be considered in this thesis as they regulate highly-specialised situations either far narrower, or well beyond, the present investigation of AWS in armed conflict.

Administrative law is also relevant in the domestic sphere. Lieblich and Benvenisti suggest that, when considering combat as a form of executive action, requirements to exercise constant

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[194] Arts.19, 29, 31, 39, 88, 95, 107, 111, 192-196, 224, 236, United Nations Convention on the Law of the Sea (adopted 10 December 1982, entered into force 16 November 1994) 1833 UNTS 3 (Hereafter: UNCLOS); Rebecca Crootof, 'The Varied Law of Autonomous Weapon Systems' in Andrew P Williams and Paul D Scharre (eds.), Autonomous Systems (NATO, SACT, 2016) 109-111.
[195] Arts.4, Treaty on principles governing the activities of States in the exploration and use of outer space, including the moon and other celestial bodies (adopted 27 January 1967, entered into force 10 October 1967) 610 UNTS 205; Crootof (n.194) 111-113.
[196] Crootof (n.194) 113-114.
[197] Crootof (n.194) 114.
[198] See William Boothby, 'How Far Will the Law Allow Unmanned Targeting to Go?' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013) 49-50.

discretion would be impossible and therefore AWS would be unlawful under this body of law. However, the authors themselves admit that this is an argument quite firmly placed in the *lex ferenda*[199] and so will not be considered here.

4. The applicability of weapons law rules

Having outlined the potential sources and bodies of international law which can apply to AWS, the thesis now considers the application of the legal regime applicable to weapons. The phrase 'weapons law' is generally used to refer to the LoAC rules applicable to weapons, this thesis also includes applicable IHRL rules. Although it may sound counterintuitive, AWS must first be defined in terms of the weapons law regime in LoAC in order to apply them. Then, the very nature of AWS must be considered to determine if it makes them unlawful *per se*. Following this discussion, the challenge of applying legal rules normally applied to fighters is discussed.

4.1. Classification of AWS

As we saw in the discussion of different AWS definitions in the last Chapter, the *autonomous* nature of these systems in the selection and engagement of targets is their major defining aspect. [200] Such critical functions have always been a task carried out by fighters. Some authors wrongly suggest that AWS could, therefore, be classed as a combatant due to misunderstanding the performance of human-like activities as actually approaching being a human and therefore a combatant.[201]

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[199] Eliav Lieblich and Eyal Benvenisti, 'The obligation to exercise discretion in warfare: why autonomous weapons systems are unlawful' in Nehal Bhuta, et al. (eds), Autonomous Weapons Systems (CUP, 2016) 245-283.

[200] Anja Dahlman, 'Towards A Regulation Of Autonomous Weapons – A Task For The EU?' (Europeanleadershipnetwork.org, 2019) Archived:<https://web.archive.org/web/20190917160943/https://www.europeanleadershipnetwork.org/commentary/towards-a-regulation-of-autonomous-weapons-a-task-for-the-eu/>.

[201] David Akerson 'The Illegality of Offensive Lethal Autonomy' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013) 88-90; Thompson Chengeta, 'Are

Aside from these metaphysical issues, AWS cannot be defined as combatants under international law. Article 43 of API defines combatants as members of the armed forces[202] who are under a responsible command and are subject to an '*internal disciplinary system*.'[203] Whilst AWS could certainly be used under a responsible command, they cannot be subject to discipline, as they are just machines and so cannot be combatants according to LoAC.

In addition to engaging in the roles formerly exclusive to fighters, AWS are, fundamentally, artefacts used for conducting attacks. In order for the legal rules regulating weapons to apply to AWS, they must be defined as such under LoAC. This thesis is mostly focussed upon physical systems that will create a kinetic effect in the same vein as the Taranis and nEUROn UAVs currently in development (see Chapter 2). As such, whilst some so-called 'cyber-weapons' could be AWS, they are not the focus here.[204]

*Autonomous* UAVs firing munitions would be instruments intended to cause damage within an armed conflict, and so would be a '*means*' of warfare. This is a broad category encompassing equipment including platforms, weapons, and weapon systems.[205] The following paragraphs discuss which type of *means* is most appropriate for AWS. Means of warfare are contrasted by '*methods'* of warfare. These are the tactical ways in which military capabilities are employed to harm the enemy.[206]

One could see UAVs as a 'platform' delivering munitions to the target rather than an offensive technology in and of itself. A platform is generally seen to be equipment from which an activity is carried out by sub-systems, for example carrying surveillance cameras or missiles.[207] The execution of

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Autonomous Weapon Systems The Subject Of Article 36 Of Additional Protocol I To The Geneva Conventions?' (2016) 23 U.C. Davis Journal of International Law & Policy, 65, 77-81.

[202] Art.43(2), API

[203] Art.43(1), API

[204] See Tallinn Manual (n.52) Rule 103 and accompanying commentary

[205] Humanitarian Policy and Conflict Research, Commentary On The HPCR Manual On International Law Applicable To Air And Missile Warfare (Harvard University, 2010) (Hereafter: AMW Commentary), Rule 1(t); (ff)(3).

[206] One could argue that an autonomous attack is a method of warfare, see Boothby 2012 (n.93) 282.

[207] AMW Commentary (n.205) Rule 1(b); (ff).

various tasks and application of algorithms in combat, however, makes AWS qualitatively different from other simple platforms.[208]

As AWS play a significant role in creating military violence, they could be considered as weapons. There is no universal definition of 'weapon' in LoAC.[209] However, the commentary of the Air and Missile Warfare Manual states: '*"Weapon" means a means of warfare used in combat operations, including a gun, missile, bomb or other munitions, that is capable of causing either (i) injury to, or death of, persons; or (ii) damage to, or destruction of, objects*.'[210] As it is the munitions that an AWS would actually fire that impart injury and damage, an AWS is more than just a weapon.

A 'weapon system' is defined as: '*A combination of one or more weapons with all related equipment, materials, services, personnel, and means of delivery and deployment*.'[211] Thus, as an AWS will be a combination of munitions, and everything else it needs to be deployed, the term weapon system is most appropriate. As AWS can be categorised as weapon systems, and a means of warfare, for the purposes of international law, this means that the relevant weapons law rules are applicable to them.

### 4.2. Weapons law, weapons reviews, and whether AWS are unlawful *per se*

The weapons law regime is applied during weapons reviews and regulates the development of weapons by assessing their ability to comply with international law during their study, development, and use.[212] This is done because the right of parties to conflicts to choose different

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[208] Paul Scharre, Army Of None (WW Norton & Company, 2018) 27-28.
[209] Geneva Academy of International Humanitarian Law and Human Rights, 'Weapons System', Weapons Law Encyclopedia (Weapons Law, 2013).
[210] AMW Commentary (n.205) Rule 1(ff).
[211] US Department of Defense, DOD Dictionary Of Military And Associated Terms (US DOD, 2018) see 'weapon system'.
[212] Art.36, API; See reference to different reviews (or 'gates') taking place during the development of weapons: UK Ministry of Defence, UK Weapons Reviews (Development, Concepts and Doctrine Centre, 2016) 4; Australian UNOG Delegation, 'The Australian Article 36 Review Process' 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 30 August 2018) UN Doc. CCW/GGE.2/2018/WP.6, 4.

means and methods of warfare is not unlimited.[213] International law does not specify how weapons should be assessed. But, states have developed weapons review frameworks to apply the legal rules relevant to means of warfare.[214]

Some authors have argued that AWS will be so complex that current methods of review are inadequate, and the lawfulness of an AWS could not be guaranteed.[215] Yet, testing of complex systems can take place against simulations or physical facsimiles of the battlespace that the AWS will be used in to give reviewers an understanding of how the complexities of the system will act on operations such that they should be able to make determinations as to its compliance with legal rules.[216]

Weapons reviews have not proliferated to all states, however. The vast majority of states who are required by treaty[217] to perform legal reviews of weapons do not.[218] This is indeed a problem for legal regulation of weapons as countries without a review process, or one that is inadequate, could be fielding weapons that would have been prohibited in states which respect international law with more seriousness. However, this thesis is concerned with the sufficiency of current international law, rather than the inadequacy of some weapons reviews. So, in the next Chapter, the relevant rules are applied to AWS to determine whether they are unlawful as a type of weapon. But, at this point, it is important to determine whether AWS are outright unlawful.

The lawfulness of weapons is dependent upon the absence of a prohibition rather than a need for authorisation.[219] As such, a weapon is unlawful *per se* if it is either specifically prohibited or cannot be used in conformity with the rules regulating the development and use of weapons.[220] As the next

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213 Art.35(1), API.
214 See, for example, US Manual, para.6.2; UK Ministry of Defence, UK Weapons Reviews (Development, Concepts and Doctrine Centre, 2016).
215 Sharkey 2017 (n.225) 178-181; Sharkey 2010 (n.225) 378-381.
216 For more on this, see Chapter 4, Section 5.5.2.
217 Art.36, API.
218 Vincent Boulanin, 'Implementing Article 36 Weapon Reviews In The Light Of Increasing Autonomy In Weapon Systems' (SIPRI, 2015).
219 US Manual, paras. 1.3.3.1, 6.2.1; Nuclear Weapons Opinion (n.76) para. 52.
220 Nuclear Weapons Opinion (n.76) paras.64-74; Justin McClelland, 'The Review Of Weapons In Accordance With Article 36 Of Additional Protocol I' (2003) 85 International Review of the Red Cross, 397, which refers to a 'two-pronged' approach.

Chapter notes, there are several weapons with autonomy that are prohibited, but there is no rule of international law that specifically prohibits AWS.

In terms of regulatory rules which all means of warfare must be built in accordance with, weapons which are of a nature to cause superfluous injury or unnecessary suffering,[221] or are inherently indiscriminate[222] are always unlawful. At this point, it can be said that whether an AWS causes a prohibited level of harm is related to the munitions used by the system rather than the *autonomous* nature of the system itself. Further, as with other advanced weapons, AWS are likely to be highly accurate and therefore capable of being used discriminately.[223] As such, AWS are unlikely to be *per se* unlawful.

But, AWS could still be used in unlawful ways. This is the same for any other lawful weapon. For example, whilst a rifle could be used to carry out an unlawful massacre, it could also be used to carry out lawful attacks.[224] This is an important distinction to make, as conclusions about the lawfulness of a weapon *per se* based upon a potential unlawful *use* of a weapon[225] simply obfuscate the debate[226] and go beyond what the law requires. Indeed, the 'Campaign to Stop Killer Robots' is

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[221] Declaration Renouncing The Use, In Time Of War, Of Certain Explosive Projectile (adopted11 December 1868, entered into force 11 December 1868); ICRC Study, Rule 70.
[222] ICRC Study, Rule 71.
[223] William H Boothby, Weapons And The Law Of Armed Conflict (2nd edn, OUP, 2016) 69; Michael W. Meier, 'Lethal Autonomous Weapon Systems (LAWS): Conducting A Comprehensive Review' (2016) 30 Temple International and Comparative Law Journal, 119, 129; see also P.W. Singer, Wired For War (Penguin Press, 2009) 31.
[224] Schmitt and Thurnher (n.2) 243-244.
[225] HRW 2012 (n.227) 30; Noel Sharkey, 'Why Robots Should Not Be Delegated With The Decision To Kill' (2017) 29 Connection Science, 177, 178-181; Noel Sharkey, 'Saying 'No!' To Lethal Autonomous Targeting' (2010) 9 Journal of Military Ethics, 369, 378-381; Peter Asaro, 'On Banning Autonomous Weapon Systems: Human Rights, Automation, And The Dehumanization Of Lethal Decision-Making' (2012) 94 International Review of the Red Cross, 687, 696-699; Chengeta Article 36 (n.201) 91, 98.
[226] Michael N. Schmitt, 'Autonomous Weapon Systems And International Humanitarian Law: A Reply To The Critics' (2013) Harvard National Security Journal Features Archived:<https://web.archive.org/web/20190917164404/https://harvardnsj.org/wp-content/uploads/sites/13/2013/02/Schmitt-Autonomous-Weapon-Systems-and-IHL-Final.pdf>, 2.

arguing for an international prohibition on AWS,[227] despite them not being unlawful *per se*. A weapon cannot be considered unlawful *per se* simply because it is '*novel or employs new technology*'.[228]

## 5. The regulatory challenge

In the previous Chapter, we saw that AWS can do more than previous weapon systems because they conduct targeting.[229] It has already been demonstrated how international law can apply to AWS *qua* weapons. But, in order for international law to apply to AWS in their totality, it must also regulate them as being subject to the same rules as fighters during active hostilities. It is, however, unclear how this can happen. Simply applying current international law rules to AWS by analogy to fighters would be insufficient as the responsibility regime that reinforces rules of conduct cannot apply to AWS. Thus, AWS present two regulatory challenges: can non-human entities abide by rules intended for humans? And how can responsibility be attributed for the actions of a robot?

### 5.1. Human judgement and technological analyses

In order to address the application of legal rules to AWS, it must be determined whether it is possible for non-human entities to comply with them. The work of Wagner,[230] Egeland,[231] Chengeta,[232] and Human Rights Watch[233] suggests that there is something fundamental about autonomy, or the lack of human involvement in targeting, that prevents LoAC rules from being complied with. This idea suggests that there is something implicit in *homo sapiens* that is required to fulfil these rules intended

[227] See, for example, Human Rights Watch, 'Losing Humanity' (Human Rights Watch, 2012).
[228] US Manual, para. 6.2.1.
[229] Crootof (n.119) 105.
[230] Markus Wagner, 'The Dehumanization Of International Humanitarian Law: Legal, Ethical, And Political Implications Of Autonomous Weapon Systems' (2014) 47 Vanderbilt Journal of Transnational Law, 1371.
[231] Kjølv Egeland, 'Lethal Autonomous Weapon Systems Under International Humanitarian Law' (2016) 85 Nordic Journal of International Law, 89.
[232] Thompson Chengeta, 'Measuring Autonomous Weapon Systems Against International Humanitarian Law Rules' (2016) 5 Journal of Law and Cyber Warfare, 63.
[233] HRW 2012 (n.227); Human Rights Watch, 'Shaking The Foundations' (Human Rights Watch, 2014).

for humans.[234] With some very difficult combat decisions requiring qualitative analysis, such as weighing the proportionality of incidental harm against military advantage,[235] this is true.

Qualitative assessments are currently beyond the capabilities of today's technology, and, due to the inherent complexities, may never be possible for machines to determine.[236] But, an incapability to do everything is not necessarily fatal to the capability to lawfully do something. As such, autonomy in and of itself does not prevent legal compliance by an *autonomous* system, but does, at this time, require human beings to perform some of the tasks of targeting. Consequently, this leads us to ask what level of technological capability is required for an AWS to *autonomously* perform those tasks that do not currently require human judgement.

The works of Schmitt,[237] Thurnher,[238] Boothby,[239] Sassóli,[240] Crootof,[241] Anderson, Reisner, and Waxman[242] all take a view of AWS by comparing the relevant legal requirements to the technological capabilities available now or in the near future. These authors generally agree that autonomy in weapon systems today is not yet developed enough for lawful use beyond very narrow operational

[234] Asaro (n.225) 700.
[235] Sharkey 2017 (n.225) 179-180.
[236] Boothby 2013 (n.198) 56-57; Sharkey 2017 (n.225) 179.
[237] Schmitt (n.226).
[238] Schmitt and Thurnher (n.2); Jeffrey Thurnher, 'No One At The Controls: The Legal Implications Of Fully Autonomous Targeting' (2012) 67 Joint Force Quarterly, 77; Jeffrey S Thurnher, 'The Law That Applies To Autonomous Weapon Systems' (ASIL, 2013) Archived:<https://web.archive.org/web/20180605195524/https://www.asil.org/insights/volume/17/issue/4/law-applies-autonomous-weapon-systems>; Jeffrey Thurnher, 'Means and Methods of the Future: Autonomous Systems' in Paul A. L. Ducheine, Frans P. B. Osinga and Michael N. Schmitt (eds.), Targeting: The Challenges Of Modern Warfare: 2016 (TMC Asser Press, 2015) 177-199.
[239] Boothby 2016 (n.223) 247-257; William H. Boothby, Conflict Law: The Influence Of New Weapons Technology, Human Rights And Emerging Actors (Asser Press, 2014) 108-112; Boothby 2012 (n.93) 282-286; Boothby 2013 (n.198) 61-62.
[240] Marco Sassóli, 'Autonomous Weapons And International Humanitarian Law: Advantages, Open Technical Questions And Legal Issues To Be Clarified' (2014) 90 International Law Studies, 308.
[241] Rebecca Crootof, 'The Killer Robots Are Here: Legality And Policy Implications' (2015) 36 Cardozo Law Review, 1837.
[242] Kenneth Anderson, Daniel Reisner and Mathew Waxman, 'Adapting The Law Of Armed Conflict To Autonomous Weapon Systems' (2014) 90 International Law Studies, 335.

contexts (such as defensive systems that protect military bases by automatically attacking incoming ordnance).[243]

By contrast, some authors suggest that AWS will never have enough technical capability to perform legally required battlefield tasks in accordance with the law.[244] The difference in opinion can be accounted for through methodology. Authors who view AWS as technologically inadequate in comparison to LoAC rules base their assessment on what technology is available today and apply that to all future AWS.[245] The better view is taken by those authors mentioned in the previous paragraph. Through outlining what is required for compliance with the legal rules and then determining what technological capabilities an AWS would need to meet the compliant standard, these authors show the capabilities and limitations of the underlying technologies that make up AWS. From this, it is possible to see what tasks it might be possible to delegate to an AWS and which need to be retained by humans.

In doing so, Scharre's paradigm for viewing autonomy can be useful.[246] If a mission requires *tasks* A, B, and C, but the *sophistication* of the system can only automate A and B, then the *human-machine relationship* will primarily revolve around task C.[247] It is important to remember that technologies are continually advancing, and so whilst some systems might be legally inadequate for some tasks today, future iterations may be able to perform at or above the legally required standard in the near future. Indeed, Gillespie and West suggest that AWS could be developed to be

[243] Raytheon Corporation, 'Phalanx Close-In Weapon System' (Raytheon, 2016) Archived:<https://web.archive.org/web/20190726165802/https://www.raytheon.com/capabilities/products/phalanx/>; Rafael, 'Iron Dome' (2019) Accessed 24 June 2020. Available at:<https://www.rafael.co.il/worlds/air-missile-defense/short-range-air-missile-defense/>; Schmitt and Thurnher (n.2) 246; Boothby 2013 (n.198) 62.
[244] Sharkey 2017 (n.225) 178-181; Sharkey 2010 (n.225) 378-381; Egeland (n.231) 13-14.
[245] Sharkey 2017 (n.225) 178-181; Sharkey 2010 (n.225) 378-381; Egeland (n.231) 13-14.
[246] Scharre (n.208) 27-28.
[247] This is referred to as the 'legal-compliance model' of understanding AWS. See Peter Burt, 'Off The Leash: The Development Of Autonomous Military Drones In The UK' (Drone Wars, 2018) 13, citing Joshua Hughes, 'What is autonomy in weapon systems, and how do we analyse it? – An international law perspective' in Joshua Hughes (ed.), Autonomy In Future Military And Security Technologies: Implications For Law, Peace, And Conflict (The Richardson Institute, 2018) 33-44.

technologically compliant with current legal frameworks,[248] and Arkin outlines what legal rules it would be technologically possible for an AWS to comply with in the near future.[249] Thus, in order for international law to sufficiently regulate AWS, it must be capable of guiding the development of these systems such that only those that abide by the weapons law framework are produced, and restricting the use of these systems such that they are subject to the same rules as fighters are during combat. In Chapters 4 and 5, the *autonomous* nature of AWS is compared to legal rules on developing and using weapons, respectively, to see if this is possible.

### 5.2. Responsibility for using force

We noted in the last Chapter that attribution of accountability is a major moral requirement for the use of AWS to be ethically permissible. Human Rights Watch[250] and Chengeta[251] argue that attribution of individual responsibility is required for the lawful use of AWS. Strictly speaking, there is no requirement for the law to provide an individual responsibility mechanism for when regulations are violated. Indeed, violations of international law are generally the responsibility of states and not individuals.

Thus, the legal logic of Human Rights Watch and Chengeta has been subject to criticism.[252] Still whilst an individual responsibility mechanism is not strictly required by law, the absence of it could create impunity for individual users of AWS that would be a negative development. Thus, in order for international law to sufficiently regulate a responsibility paradigm for AWS, it would need to hold states (and potentially non-state actors) responsible when their state agents (or non-state actor

[248] Robin West and Tony Gillespie, 'Requirements For Autonomous Unmanned Air Systems Set By Legal Issues' (2010) 4 The International C2 Journal, 1; Tony Gillespie, 'New Technologies And Design For The Laws Of Armed Conflict' (2015) 160 The RUSI Journal, 50.

[249] Ronald Arkin, Governing Lethal Behaviour In Autonomous Robots (CRC Press, 2009).

[250] Human Rights Watch, 'Mind The Gap' (Human Rights Watch, 2015).

[251] Thompson Chengeta, 'Accountability Gap, Autonomous Weapon Systems And Modes Of Responsibility In International Law' (2016) 45 Denver Journal of International Law, 1.

[252] Charles James Dunlap, 'Accountability And Autonomous Weapons: Much Ado About Nothing?' (2016) 30 Temple International and Comparative Law Journal, 63, 65, 71, 75.

equivalent) carries out an internationally wrongful act, and also hold individuals responsible when they carry out a criminal act.

### 5.3. Options for dealing with the regulatory challenge

On the face of it, there would seem to be three options to regulate the use of AWS in combat: first, avoid the issue of whether or not AWS can be sufficiently regulated by prohibiting them; second, create specific regulation for AWS that would rearticulate, *mutatis mutandis*, current human-centric legal rules on the development, use, and responsibility for weapons; third, apply international law to the people who develop and use AWS in such a way that the current rules indirectly regulate these systems, and hold these people responsible for the actions of the system. The first and second options can be discussed together.

### 5.4. The potential for a specific international instrument regulating AWS.

For both prohibitionist and regulatory approaches to AWS, the ideal outcome for each camp would be a comprehensive treaty. Prohibitionists obviously desire an international agreement that outlaws AWS.[253] The regulatory camp, however, would favour a treaty that covers the development, manufacture, use, and responsibility for AWS, in addition to anti-proliferation measures.[254]

In the hope of finding a way forward between these two camps, talks have been taking place at the United Nations since 2014. This has been under the auspices of the Certain Conventional Weapons Convention (CCW).[255] This convention is a 'living instrument' in the sense that regular review

[253] HRW 2012 (n.227) 5.
[254] Anderson et al. (n.242) 406-408; Crootof (n.119) 1897.
[255] 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 (with Protocols I, II and III) (adopted 10 October 1980 entered into force 2 December 1983) 1342 UNTS 137 (Hereafter: CCW).

conferences can initiate committees to examine particular issues and can adopt additional protocols.[256]

One of the additional protocols to the CCW prohibits blinding-laser weapons.[257] This was agreed after a successful civil society campaign.[258] AWS prohibitionists have been open about basing their movement for AWS proscription on this previously successful campaign.[259] However, research by Crootof[260] and Watts[261] suggests that there are significant differences between the campaigns and AWS are unlikely to be prohibited.[262]

Indeed, states are split between positions of for and against a prohibition, or for continuing discussions. Currently, there are 28 out of 125 high contracting parties in favour of a prohibition,[263] and five in opposition to a ban.[264] This divergence means that the CCW is unlikely to agree any international instrument on AWS as this body relies upon consensus to make decisions.[265] The meaning of 'consensus' in international law is generally taken to mean that there is an absence of any formal objection.[266] As we saw in the last Chapter, states have not yet even agreed on a common

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[256] Boothby 2016 (n.223) 92.
[257] Protocol (IV) on Blinding Laser Weapons to the CCW.
[258] On this campaign and others, see Brian Rappert, et al., 'The Roles Of Civil Society In The Development Of Standards Around New Weapons And Other Technologies Of Warfare' (2012) 94 International Review of the Red Cross, 765.
[259] See Human Rights Watch and International Human Rights Clinic, 'Precedent For Preemption: The Ban On Blinding Lasers As A Model For A Killer Robots Prohibition' (2015) Archived:<https://web.archive.org/web/20170519102833/https://www.hrw.org/sites/default/files/supporting_resources/robots_and_lasers_final.pdf>.
[260] Rebecca Crootof, 'Why The Prohibition On Permanently Blinding Lasers Is Poor Precedent For A Ban On Autonomous Weapon Systems' (Lawfare, 2015) Archived:<https://web.archive.org/web/20181030050403/https://www.lawfareblog.com/why-prohibition-permanently-blinding-lasers-poor-precedent-ban-autonomous-weapon-systems>.
[261] Sean Watts, 'Autonomous Weapons: Regulation Tolerant Or Regulation Resistant?' (2016) 30 Temple International and Comparative Law Journal, 177.
[262] Also see Scharre (n.208) 331-345 for a discussion on what factors have resulted in agreed weapons bans being complied with by states.
[263] Campaign to Stop Killer Robots, 'Country Views On Killer Robots' (Stopkillerrobots.org, 2018) Archived:<https://web.archive.org/web/20190912144030/https://www.stopkillerrobots.org/wp-content/uploads/2018/11/KRC_CountryViews22Nov2018.pdf>.
[264] Campaign to Stop Killer Robots, 'Convergence On Retaining Human Control Of Weapons Systems' (Stopkillerrobots.org, 2018) Archived:<https://web.archive.org/web/20190605204018/https://www.stopkillerrobots.org/2018/04/convergence/>.
[265] Art.8, CCW; note that 'agree' in the treaty text is read to mean 'consensus', see Boothby 2016 (n.223) 99.
[266] This definition is usually taken from Art.161(8)(e), UNCLOS (n.194).

definition of AWS. Further, these disagreements are within a wider trend amongst states avoiding large treaties dealing with LoAC issues.[267] Thus, there is currently no hope for an international agreement being reached on AWS.

### 5.5. Legal personhood and legal agenthood

In contrast to the international discussions, academic literature has suggested that robots could be specifically regulated by providing them with legal personality either on the international or domestic levels. If this is done on the domestic level, it would not require an international treaty. Doing so could enable relevant legal rules to be applied to AWS with a subsequent capability for attributing responsibility for violating those rules.[268] Fictional legal personhood is provided to corporations as dealing with a single artificial legal person is more efficient than dealing with multiple people and allows for financial transparency and accountability.[269] Different rights and responsibilities could be ascribed to an AWS as a legal person, depending upon the precise approach.[270]

Yet, the creation of artificial legal personhood for AWS would transfer responsibility for unlawful acts from the persons who caused them onto a fictional entity. This can lead to a risk that artificial legal personhood for an AWS '*would shield human actors from accountability*'.[271] States discussing AWS at the United Nations have managed to endorse a view that transference of

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[267] Boothby 2014 (n.239) 437; Peter Lee, 'Death, Truth And Knowing In The Drones Imaginarium' (The Body of War: Drones and Lone Wolves, Story Institute Lancaster, 24-25 November 2016).

[268] Luciano Floridi and J.W. Sanders, 'On The Morality Of Artificial Agents' (2004) 14 Minds and Machines, 349; For the notion of 'electronic persons', EU Committee on Legal Affairs, 'Draft Report With Recommendations To The Commission On Civil Law Rules On Robotics (2015/2103(INL))' (2016) Archived:<https://web.archive.org/web/20190803144706/http://www.europarl.europa.eu/doceo/document/JURI-PR-582443_EN.pdf?redirect>, para.31(f).

[269] Ugo Pagallo, 'Vital, Sophia, And Co.—The Quest For The Legal Personhood Of Robots' (2018) 9 Information, 230, 10.

[270] Ugo Pagallo, The Laws Of Robots (Springer Netherlands, 2013) 152-170.

[271] International Tin Council Case, JH Rayner (Mincing Lane) Ltd. v. Department of Trade and Industry [1989] 3 WLR 969, 986-987; Joanna J. Bryson, Mihailis E. Diamantis and Thomas D. Grant, 'Of, For, And By The People: The Legal Lacuna Of Synthetic Persons' (2017) 25 Artificial Intelligence and Law, 273, 287.

responsibility away from human beings is undesirable,[272] and so legal personhood is not a solution to the regulatory challenge of AWS.

Still, as Pagallo correctly states, even if robots are not provided with legal personality, they can still be legal agents in a similar way to children or animals in the modern world, or slaves in Ancient Rome.[273] Yet, as Crootof notes, the use of analogies to construct a legal approach to AWS should not take wholesale transplants of frameworks for dealing with other legal agents as this can stretch or constrain what is needed for dealing with AWS.[274] As such, a *sui generis* approach to dealing with them must be developed.

Legal agency is where an entity acts on behalf of a principal and is subject to the control of the principal.[275] In the classic formulation of legal agency, the agent is a facilitator for the acts of the principal and incurs no rights or responsibilities.[276] These reside with the principal.[277] Such agency can be established in relationships of the principal having authority,[278] or power,[279] over the agent, and this need not be a *de jure* relationship.[280] This would seem to include the relationships between an AWS and those who exert control over them.

We noted in Chapter 2 that AWS are subject to their programming, and any instructions they are given by their users.[281] According to Ohlin, this places these systems into a functionally similar

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[272] See Report Of The 2018 Session Of The Group Of Governmental Experts On Emerging Technologies In The Area Of Lethal Autonomous Weapons Systems, by Chairperson Amandeep Singh Gill, 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 23 October 2018) UN Doc. CCW/GGE.1/2018/3, paras.23(f) and (g).
[273] Pagallo 2013 (n.270) 40-43; Pagallo 2018 (n.269) 1-2.
[274] Rebecca Crootof, 'Autonomous Weapon Systems And The Limits Of Analogy' (2018) 9 Harvard National Security Journal, 1.
[275] Roderick Murray, Agency: Law and Principles (3rd edn., OUP, 2016) 1.01.
[276] Phonogram Ltd v Lane [1982] 3 CMLR 615, 23; Murray (n.275) 1.07.
[277] Pagallo 2013 (n.270) 40-43; Pagallo 2018 (n.269) 1-2.
[278] Murray (n.275) 1.28.
[279] Murray (n.275) 1.29.
[280] Peter Watts and F.M.B Reynolds (eds.), Bowstead & Reynolds on Agency (19th edn., Sweet & Maxwell, 2010) 1-010.
[281] Elliot Winter, 'Autonomous Weapons In Humanitarian Law: Understanding The Technology, Its Compliance With The Principle Of Proportionality And The Role Of Utilitarianism' (2018) 6 Groningen Journal of International Law, 183, 193; Joseph Weizenbaum, Computer Power And Human Reason (WH Freeman, 1976) 259-260.

position as combatants, as both are subordinate to the control of a superior in during combat.[282] Indeed, a soldier obeys the orders of their commander, and an AWS obeys their algorithms. The legal relationship of commanders to their subordinates is not close enough to be one of legal agenthood. Commanders do have authority and power over their subordinates and may be responsible for unlawful acts which they '*knew or should have known*' their subordinates were engaged in.[283] But, their subordinates are not subject to absolute control. Military personnel are under an obligation to question, and disobey, orders they believe to be unlawful.[284] Whilst a soldier may be a subordinate, they are still their own person and subject to responsibility for their own actions.

An AWS, however, would follow its programming and instructions without even comprehending that questioning may be a possibility.[285] As such, the controlling relationship between those who exert control over AWS and the system is absolute. This would seem to establish the necessary connection to define an AWS as a legal agent of its controllers.

Control is '*the sending of messages which effectively change the behaviour of the recipient*.'[286] As such, it is the changing of the AWS behaviour that transforms the AWS from a simple machine into a legal agent performing actions at the behest of those controlling it. The consequence of such a relationship is important to outline.[287] The result of this agenthood is that the legal rules that govern the development and use of AWS can be applied by, and to, those who exert control over AWS.

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[282] Jens David Ohlin, 'The Combatant's Stance: Autonomous Weapons On The Battlefield' (2016) 92 International Law Studies, 1, 11-21.
[283] Art.28, Rome Statue Of The International Criminal Court 1998 (adopted 17 July 1998, entered into force 1 July 2002) 2187 UNTS 3.
[284] ICRC Study, Rule 154.
[285] '*contrary to what is suggested by science-fiction scenarios, the danger is not that robots begin to disobey. Quite the reverse: it is that they never disobey.*', See Gregoire Chamayou, Drone Theory (Penguin Books 2015) 217; note that Arkin seeks to develop an 'ethical governor' which would evaluate the morality and legality of all orders before enacting them. See Ronald Arkin, Governing Lethal Behaviour In Autonomous Robots (CRC Press, 2009)127-153.
[286] Norbert Weiner, The Human Use of Human Beings: Cybernetics and Society (Eyre and Spottiswoode, 1950) 8.
[287] See DeMott in Samir Chopra and Laurence F. White, A legal theory for autonomous artificial agents (University of Michigan Press, 2011) 18-19.

Subsequent to this, where an AWS violates a legal rule whilst subject to the control of a particular entity, the controller (or principal) can be held responsible.

### 5.6. Approaches to applying international law to AWS via controlling relationships

Having outlined that a control relationship can generate the legal agenthood of an AWS, and so law can be applied to them, and through them, how the controlling relationships work must be outlined in this context. In relation to AWS, there are three major approaches. The first approach for applying law to AWS suggests that, the strength of the connection with the system must be sufficiently strong such that there is '*meaningful human control*' and so the operator is responsible for the application of legal rules during the use of an AWS. The second and third approaches, are varieties of arguing that legal rules should be applied to entities which exert control over AWS and responsibility for AWS should be ascribed to them where an AWS is their legal agent. There is some debate about which entities should be seen as controlling AWS, and how the relationships should be seen. The second approach sees controlling entities as forming a socio-technical system with quasi-legal personhood. The third approach, which this thesis argues for, considers each controlling entity to exert control distinctly with their responsibility separate from other entities.

### 5.7. Meaningful human control

Meaningful human control (MHC) is a concept advocated by the anti-AWS lobby.[288] It has been subject to much debate, with 192 different combinations of seemingly synonymous terms for this concept.[289] It is a method of optimising the human-machine relationship such that the best qualities

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[288] Campaign to Stop Killer Robots, 'The threat of fully autonomous weapon systems' (Stopkillerrobots.org, 2019) Archived:<https://web.archive.org/web/20190929102338/https://www.stopkillerrobots.org/learn/>.
[289] The report of the 2018 GGE on AWS lists a number of different adjective combinations. See the Report of 2018 GGE (n.272) Annex III, paras.18-23.

of both can work together. Different approaches to this optimisation[290] include: human-machine teaming;[291] centaur warfighting;[292] an intelligent partnership;[293] symbiotic autonomy;[294] human-centred autonomy.[295] MHC is the most common approach to trying to optimise the human-machine relationship, and so will be focussed upon here.

Despite the various conceptions of MHC, there are some common characteristics: first, a human operator has full contextual and situational awareness to make a conscious decision to engage in each attack; second, the operator has sufficient time and information to make a decision that they can be sure is morally, ethically, and legally correct and is not guided toward a decision by the system itself; third, the operator deciding on engagements is responsible for their actions; fourth, that there are means for aborting an engagement; fifth, that operators are adequately trained to ensure effective control over the system.[296]

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[290] For state and NGO views on human-machine interactions, see Amandeep Singh Gill, 'Chart-2 Consideration Of The Human Element In The Use Of Lethal Force; Aspects Of Human-Machine Interaction In The Development, Deployment And Use Of Emerging Technologies In The Area Of Lethal Autonomous Weapons Systems' (Geneva, 30 August 2018) Archived:<https://web.archive.org/web/20190918064830/https://www.unog.ch/80256EDD006B8954/(httpAssets)/A37FBECB28CF7D7FC125826C00495E97/$file/Chart.2.pdf>.

[291] Development, Concepts and Doctrine Centre, 'Human-Machine Teaming (JCN 1/18)' (UK Ministry of Defence, 2018).

[292] Scharre (n.208) 321-325.

[293] See UK UNOG Delegation, 'Statement To The Informal Meeting Of Experts On Lethal Autonomous Weapons Systems 11 - 15 April 2016’ 2016 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 14 April 2016) Archived:<https://web.archive.org/web/20180420101121/https://www.unog.ch/80256EDD006B8954/(httpAssets)/37B0481990BC31DAC1257F940053D2AE/$file/2016_LAWS+MX_ChallengestoIHL_Statements_United+Kingdom.pdf> and UK UNOG Delegation, 'Statement To The Informal Meeting Of Experts On Lethal Autonomous Weapons Systems 11 - 15 April 2016' 2016 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 12 April 2016) Archived:<https://web.archive.org/web/20180420101156/https://www.unog.ch/80256EDD006B8954/(httpAssets)/44E4700A0A8CED0EC1257F940053FE3B/$file/2016_LAWS+MX_Towardaworkingdefinition_Statements_United+Kindgom.pdf>.

[294] Russell Brandom, 'Humanity And AI Will Be Inseparable, Says CMU's Head Of Machine Learning' (The Verge, 2016) Archived:<https://web.archive.org/web/20190422200926/https://www.theverge.com/a/verge-2021/humanity-and-ai-will-be-inseparable>.

[295] Mark Riedl, 'Human-Centered Artificial Intelligence' (Medium, 2017) Archived:<https://web.archive.org/web/20180430082355/https://medium.com/@mark_riedl/human-centered-artificial-intelligence-70b019f956d1>.

[296] See, for example, Michael Horowitz and Paul Scharre, 'Meaningful Human Control In Weapon Systems: A Primer' (Center for a New American Security, 2015) Archived:<https://web.archive.org/web/20190919104630/https://s3.amazonaws.com/files.cnas.org/documen

The mandatory inclusion of a human in decision-making in each attack means that if MHC were adopted, it would, in effect, prevent the use of *fully-autonomous* systems. As such, it is a prohibition of AWS through the back door, hence its popularity with the anti-AWS lobby.

Implementation of this concept would remove the advantages that AWS bring. Further, it is difficult to reconcile with international law rules and current targeting practices. The legal regime governing the conduct of hostilities places requirements upon fighters to protect civilians but does not say how this should be done (Chapter 5). By forcing humans to take meaningful control of attacks, this goes beyond what the law requires.[297] Additionally, attacks using artillery or some missiles against targets beyond-visual-range that take place today are unlikely to meet the MHC requirements even when they are perfectly legal due to the inability of attackers to have full awareness of the situation at the site and time of attack.[298] Thus, MHC also goes further than current military doctrine.[299] Consequently, it is not a method of applying current law that could be used to assess its sufficiency for regulating AWS.

Still, there are aspects of the MHC concept which would be beneficial when using *semi-autonomous* weapon systems in order to avoid 'automation bias'. This is where humans using a system begin to trust the system more than themselves. For example, many drivers blindly follow satellite navigation systems with some ending up in dangerous situations, despite obvious signs that they were

ts/Ethical_Autonomy_Working_Paper_031315.pdf?mtime=20160906082316>; Article 36, 'Key Elements Of Meaningful Human Control' (2016) Archived:<https://web.archive.org/web/20190720004947/http://www.article36.org/wp-content/uploads/2016/04/MHC-2016-FINAL.pdf>; Elke Schwarz, 'ICRAC Statement On The Human Control Of Weapons Systems At The August 2018 CCW GGE' 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 28 August 2018) Archived:<https://web.archive.org/web/20190919104758/https://www.icrac.net/icrac-statement-on-the-human-control-of-weapons-systems-at-the-august-2018-ccw-gge/>.

[297] Rebecca Crootof, 'A Meaningful Floor For "Meaningful Human Control"' (2016) 30 Temple International & Comparative Law Journal, 53, 61-62.

[298] Merel Ekelhof, 'Autonomous Weapons: Operationalizing Meaningful Human Control' (Humanitarian Law & Policy, 2018) Archived:<https://web.archive.org/web/20190730050511/https://blogs.icrc.org/law-and-policy/2018/08/15/autonomous-weapons-operationalizing-meaningful-human-control/>.

[299] Ekelhof (n.298).

on the wrong course.[300] Automation bias can lead to performing errors of commission, i.e. approving system recommendations which contradict training or other indicators, or omission, i.e. missing events/decision-making opportunities when not prompted by the system.[301] Additional training of the operators of these systems does not prevent automation bias,[302] but increasing their awareness of being held accountable for their actions can reduce the number of incidents.[303]

Automation bias can lead to '*functional autonomy*',[304] meaning that if an operator approves the suggestions of a machine without fully thinking about the relevant issues, the human oversight that is supposed to act as a safeguard is actually worthless. Thus, automation bias combined with the ease of killing at a distance, could result in operators of *semi-autonomous* weapon systems simply engaging all targets suggested by the machine[305] without fully appreciating what they are doing.[306] The system would be functioning *autonomously* for all intents and purposes. Such a situation is hugely problematic because a system that is not supposed to be operating beyond human control is, in effect, doing so. However, Sharkey suggests that providing '*sufficient decision-making time*' could enable deliberative reasoning by operators of *semi-autonomous* weapon systems such that automation bias can be neutralised. [307]

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[300] Greg Milner, 'Death By GPS' (Ars Technica, 2016) Archived:<https://web.archive.org/web/20190602041744/https://arstechnica.com/cars/2016/05/death-by-gps/>.

[301] Linda J. Skitka, Kathleen L. Mosier and Mark Burdick, 'Does Automation Bias Decision-Making?' (1999) 51 International Journal of Human-Computer Studies, 991.

[302] Linda J. Skitka, et al., 'Automation Bias And Errors: Are Crews Better Than Individuals?' (2000) 10 The International Journal of Aviation Psychology, 85; also see Raja Parasuraman and Dietrich H. Manzey, 'Complacency And Bias In Human Use Of Automation: An Attentional Integration' (2010) 52 Human Factors: The Journal of the Human Factors and Ergonomics Society, 381.

[303] Linda J. Skitka, Kathleen Mosier and Mark D. Burdick, 'Accountability And Automation Bias' (2000) 52 International Journal of Human-Computer Studies, 701.

[304] Heather M. Roff, 'The Forest For The Trees: Autonomous Weapons And "Autonomy" In Weapons Systems' [2016] Unpublished Essay.

[305] Or, on a target list as is the case with contemporary drone operations. Thanks to James A. Sweeney for this point.

[306] Report Of The Special Rapporteur On Extrajudicial, Summary Or Arbitrary Executions On the Right to Life and Armed Drones, Christof Heyns (68th Session, 13 September 2013) UN Doc. A/68/382, para.17

[307] Noel Sharkey, 'Staying in the loop: human supervisory control of weapons', in Nehal Bhuta, et al. (eds.), Autonomous Weapons Systems (CUP, 2016) 34-37.

As such, parts of MHC could be helpful for operations using *semi-autonomous* weapon systems (or modes). But, implementation of it as a whole would both prevent the benefits of *fully-autonomous* systems being realised and place an unnecessary burden on military forces. As such, it is '*deceptively alluring but substantively vague and unhelpful*'[308] and cannot work as a method of applying law to AWS.

## 5.8. Approaches based upon controlling entities

As an alternative to MHC, this thesis now considers that when entities such as politicians, weapons manufacturers, and users make decisions about how AWS should act, they contribute to changing behaviours of the system in an exercise of control. As Sections 5.5-5.6 noted above, such an approach enables AWS to be seen as legal agents of those controlling them, and the application of legal rules to AWS through such persons who can be held responsible for violations of those rules. There are two approaches to doing this, either by focussing upon the relationships between the controlling entities and the AWS, or on the effect the decisions have upon the AWS.

The former approach is outlined in the work of Kruipy, who describes a matrix of relations between politicians, arms manufacturers, weapons designers, commanders, and operators that creates a socio-technical system.[309] This thesis does not dispute that such interactions could be viewed as a socio-technical system, but the implication of Kruipy's work is that this system as a whole is responsible for the actions of an AWS.[310] In effect, this would be creating quasi-legal personhood for the socio-technical system controlling AWS. As such, it repeats the problem of shielding individual wrongdoers from their responsibility.

[308] Deeks, Lubell, and Murray (n.66) 16.
[309] Tetyana Kruipy, 'Regulating a Game Changer: Using a Distributed Approach to Develop an Accountability Framework for Lethal Autonomous Weapon Systems' (2018) 50 Georgetown Journal of International Law, 45.
[310] Kruipy (n.309) 111.

Consequently, the better view is to see persons exerting control over AWS discretely and in parallel, without necessarily impacting on the control exercised by other entities. One entity may decide to use an AWS in situation A, and another may decide to use it for tasks B. Those decisions do not necessarily affect the lawfulness of the other but do contribute to the way in which an AWS can be used. The contribution of each controlling entity ultimately delineates what an AWS can or cannot do *autonomously*. When this is encoded into the programming of the AWS it creates what Lessig refers to as an 'architecture',[311] as explained below, this is built up in layers of control.

When the controlling entities make decisions in accordance with the law, this places a boundary upon what an AWS can do. By being completely subject to their programming and instructions, the resultant AWS should only be able to operate in accordance with those legal rules. By placing legally compliant actions into the programming of an AWS, this means it is not just a translation of law into code. But, the code becomes a means of enforcing the law as unlawful actions should not be possible.[312] Even if an AWS is equipped with machine learning, these algorithms should be programmed in such a way that legally-critical parts of its code cannot be re-learned or re-programmed by the system itself: the programming of the system is wholly under human control. In determining how an AWS will function, the controlling entities act through the AWS.

In terms of those who control AWS, we have already viewed Kruipy's suggestion of politicians, manufacturers, and users of these systems. However, it is important to remember the role of weapons reviewers. As Corn notes, they only approve weapons for use in situations, and according to guidance, which, to them, renders unlawful actions unforeseeable.[313] As such, they play a key role in exerting control over AWS to enforce legal compliance.

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[311] Lessig uses the term 'architecture' to describe encoded regulation in cyberspace, but the concept is equally applicable to other systems running on code. See Lawrence Lessig, Code: Version 2.0 (Basic Books, 2006).
[312] Lessig (n.311) 61.
[313] Geoffrey Corn, 'Autonomous Weapon Systems: Managing The Inevitability Of 'Taking The Man Out Of The Loop', in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016) 233.

By deciding how an AWS should act, these controlling entities also outline how human beings will need to act in concert with the AWS. LoAC rules regulating combat require the performance of certain actions. When some of these actions are delegated to machines, those which remain must be performed by humans in order to maintain legal compliance. For Lessig, the potential to perform tasks is seen as doors; whether or not a system is allowed to perform a task the 'door' is open or locked, respectively.[314]

Brownsword refers to this idea as 'technological management'.[315] He suggests that technologies can be constructed in such a way as to 'technologically manage' undesirable behaviours such that they become impossible to perform. A classic example of this is geo-restricting GPS-enabled golf carts so that they can only be used on specifically intended paths and cannot be abused by joyriders, or cause damage to the greens.[316] In the present case, AWS could be constructed in such a way to be in conformity with the rules regulating weapons, and only function *autonomously* in accordance with the rules of targeting. As we shall see in Chapters 4 and 5, taking this approach to AWS can render non-compliance with some rules impossible.

So, for example, a state may decide to engage in an armed conflict. This defines the situation an AWS could be used in, and the relevant legal rules. A weapons reviewer defines how the AWS could be lawfully developed and used. The manufacturers build AWS in such a way as to be legally compliant, or to enable lawfully compliant usage of the system. Finally, commanders/operators instruct an AWS as to what it should do. Only after each layer of control has been exerted can the system actually engage in targeting.

This is not without issue, however. Brownsword notes that by constructing technologies in such a way as to enforce compliance with the law, this can lead to atrophy of moral judgement

[314] See Lessig (n.311) 81-82.
[315] Roger Brownsword, 'In The Year 2061: From Law To Technological Management' (2015) 7 Law, Innovation and Technology, 1, 8-9.
[316] Brownsword (n.315) 5.

because users of the technology need not make the 'right' choices about using it.[317] However, as human judgement is required to lawfully perform some tasks using AWS for the foreseeable future, this criticism is only partly applicable to the layers of control approach.

By enforcing legal compliance through code, this means that rather than requiring an AWS to understand and comprehend all the relevant international law rules, something that is impossible in the present and near-future,[318] AWS only needs to be able to perform certain legal-centric tasks within a wider architecture of control. This reduces the capability required of AWS from a (near-)human level of understanding to being a tool used by humans for certain tasks.[319] As such, the discussion in Chapters 4 and 5 outlines different 'doors'. Those 'open' to AWS can be *autonomously* performed by the system, and those 'locked' must be performed by a human. Thus, this also delineates a legally required minimum level of human control over, and involvement with, AWS.[320]

By exercising control over AWS and contributing to constraining their *autonomous* behaviour, each controlling entity can be thought of as adding a layer of control to limit potential AWS actions. This can be thought of as constituting four levels of concentric circles (political, procurement, technical, and tactical control (See Fig.1). Each layer of control narrows the possible behaviours that an AWS could *autonomously* perform until only those which are lawfully compliant and operationally desirable are left.

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[317] Roger Brownsword, 'What the World Needs Now: Techno-Regulation, Human Rights and Human Dignity' in Roger Brownsword (ed.) Global Governance and the Quest for Justice Volume 4: Human Rights (Hart, 2004). 231-231; Brownsword (n.315) 34-38.
[318] On the future potential for algorithms to comprehend some aspects of the law and help lawyers to gain further understanding, see Kevin D. Ashley, Artificial Intelligence And Legal Analytics (CUP, 2017).
[319] This is not intended to imply an instrumentalist approach. See Elke Schwarz, 'The (Im)Possibility Of Meaningful Human Control For Lethal Autonomous Weapon Systems' (Humanitarian Law & Policy Blog, 2018) Archived:<https://web.archive.org/web/20190716220002/https://blogs.icrc.org/law-and-policy/2018/08/29/im-possibility-meaningful-human-control-lethal-autonomous-weapon-systems/>.
[320] This notion has been discussed previously but has not actually been investigated. See Thompson Chengeta, 'What Level Of Human Control Over Autonomous Weapon Systems Is Required By International Law?' (Ejiltalk.org, 2018) Archived:<https://web.archive.org/web/20180825122142/https://www.ejiltalk.org/what-level-of-human-control-over-autonomous-weapon-systems-is-required-by-international-law/>.

The layers of control approach to understanding human control over autonomous weapon systems.

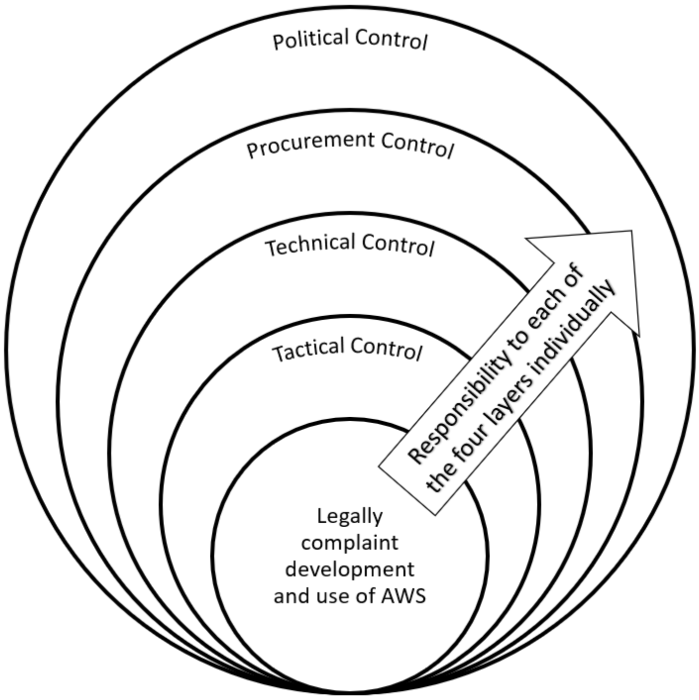


*Figure 1. A diagram illustrating how the layers of control approach to controlling AWS can be seen as concentric circles.*

### 5.8.1. Political Control

The outer layer of this architecture is the political control exercised by states, or non-state actors (NSAs), whose forces use AWS. This is inspired by the UK '*perspective on human control over weapon development and targeting cycles'* document.[321] However, the rest of that framework focuses upon specific details related to UK policy rather than international law generally and so is unnecessarily complicated for present purposes.

By deciding upon the international obligations, domestic laws (or NSA equivalent), policies, and strategic direction to abide by, these entities set the widest possible boundary within which an

[321] UK UNOG Delegation, 'Human Machine Touchpoints: The United Kingdom's Perspective On Human Control Over Weapon Development And Targeting Cycles' 2018 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 8 August 2018) UN Doc. CCW/GGE.2/2018/WP.1, 5-6.

AWS could be used. For example, an AWS could not be employed during an armed conflict without the approval of the state or NSA that is engaged in the conflict. Consequently, by deciding how AWS will be used, the exercise of political control also determines which legal regimes are relevant.

The reference to NSAs exercising political control is intentional as there is a trend of increasing democratisation of technology mixed with an erosion of the state monopoly on violence[322] leading to NSAs acquiring advanced offensive technologies.[323] Thus, one would expect that NSAs will eventually acquire AWS.[324]

By deciding upon the initiation of an armed conflict, political control is, fundamentally, concerned with the *Jus ad Bellum*. We have already seen that issues that AWS cause for this body of law are beyond the scope of this thesis. It is important to note also that, by deciding to engage in a conflict, this results in certain legal rules, such as those regulating targeting under LoAC and IHRL becoming relevant. Further, the obligations in IHRL and most of LoAC are directed at states, and so responsibility for the exercise of political control can be dealt with under the state responsibility regime and lead to states being held responsible if legal rules are violated (see Chapter 6).

### 5.8.2. Procurement control

The next layer is procurement control. This is inspired by what Corn refers to as '*procurement responsibility*'.[325] Where a procurement team, and specifically a weapons reviewer (see Chapter 4),

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[322] See, for example, Guadalupe Correa-Cabrera, Michelle Keck and José Nava, 'Losing The Monopoly Of Violence: The State, A Drug War And The Paramilitarization Of Organized Crime In Mexico (2007–10)' (2015) 4 State Crime Journal, 77.
[323] For example, Thomas Gibbons-Neff, 'ISIS Drones Are Attacking U.S. Troops And Disrupting Airstrikes In Raqqa, Officials Say' (Washington Post, 2017) Archived:<https://web.archive.org/web/20190924144006/https://www.washingtonpost.com/news/checkpoint/wp/2017/06/14/isis-drones-are-attacking-u-s-troops-and-disrupting-airstrikes-in-raqqa-officials-say/?noredirect=on>.
[324] Dyani Sabin, 'ISIS Will Use Killer Robots One Day, Says A.I. Expert' (Inverse, 2017) Archived:<https://web.archive.org/web/20190725103910/https://www.inverse.com/article/32929-isis-killer-robots>.
[325] Corn (n.313) 230-238.

evaluates weapons to be purchased or developed, they must apply the international law rules relevant to the intended use of the weapon.[326] They can advise on the lawfulness of weapons in development,[327] and authorise final products for use subject to particular conditions that should render unlawful conduct unforeseeable.[328] This narrows the boundaries of potential AWS uses.

In terms of exercising procurement control, this involves the application of the LoAC and IHRL rules relevant to weapons, and their use. As this Chapter has discussed, it is imperative to consider AWS as relevant both to the rules on weapons and on targeting. In the following Chapter, we see how these rules must be applied to AWS in a flexible manner to ensure sufficient regulation of AWS and their ability to select and engage targets. In terms of responsibility for this type of control, Chapter 6 explores in detail the notion of 'procurement responsibility', that Corn suggests, and applies it as a modest *lex ferenda* advancement of the law.[329]

### 5.8.3. Technical control

There is an enduring influence which programmers, designers, and engineers (collectively referred to here as 'developers') have over the *autonomous* systems they create, that this thesis calls 'technical control'. This is inspired by McFarland's concept of 'autonomous control' which also suggests that developers exert control over *autonomous* systems through programming them.[330]

By writing the underlying code for an AWS, developers determine how it will comprehend objects in its environment. In the targeting context, this means that developers decide what

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[326] Art.36, API.
[327] Marie Jacobsson, 'Modern Weaponry And Warfare: The Application Of Article 36 Of Additional Protocol I By Governments' (2006) 82 International Law Studies, 183, 188; Alexander Bolt, 'The Use of Autonomous Weapons and the Role of the Legal Adviser' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013) 131-133.
[328] Corn (n.313) 230-238.
[329] Corn (n.313) 219.
[330] See Tim McFarland, 'Autonomous Weapons And Human Control' (Humanitarian Law & Policy, 2018) Archived:<https://web.archive.org/web/20190719081210/https://blogs.icrc.org/law-and-policy/2018/07/18/autonomous-weapons-and-human-control/>.

characteristics are relevant to targeting, input those into a database,[331] and programme how the system should sense and process these characteristics. Thus, it is developers who define what a 'target' is to an AWS. For example, if an AWS recognises the barrel, tracks, and shape of a tank as indicating a target, it could only do this because someone programmed it to do so.[332] Thus, developers have an enormous impact on how AWS will perform targeting.

With regard to technical control, the use of machine learning algorithms could seem to remove the influence of developers because the learning algorithms themselves would be writing part of the code of an AWS. However, developers must decide what sort of learning algorithms will be used,[333] and what they can learn, thereby exerting control over them. Thus, whilst the influence of programmers may be less direct than with symbolic algorithms, it is not absent.[334] Ultimately, whether a system is programmed with symbolic or learning algorithms, all of their outputs could be traced back to the decision of a programmer exerting control.[335] Indeed, by remembering that all of the actions and choices of AWS are the result of their programming and instruction, we can again see that AWS do not *make decisions*, but they *apply decisions* from their algorithms.[336]

In order that only lawful targets are recognised, the criteria used by developers must be something that signifies lawful targetability.[337] So, for example, an enemy uniform would indicate a targetable person,[338] but someone holding a firearm could not be used to differentiate between an

[331] Brian Handy (ed.), 'Royal Air Force: Aircraft And Weapons' (Royal Air Force, 2007) 87; Vincent Boulanin and Maaike Verbruggen, 'Mapping The Development Of Autonomy In Weapon Systems' (SIPRI, 2017) 24.
[332] Weizenbaum (n.281) 259-260.
[333] For an overview of some major computational methods that could be used in AWS, see International Panel on the Regulation of Autonomous Weapons, 'Computational Methods In The Context Of LAWS' (Stiftung Wissenschaft und Politik, 2017) 9-13.
[334] See McFarland (n.330).
[335] Weizenbaum (n.281) 259-260.
[336] Winter (n.281) 193.
[337] Using characteristics to identify targets goes back to at least biblical times, with Gileadite soldiers identifying Ephraimites by their pronunciation of the word 'shibboleth'. See Henry Wansbrough (ed.), The New Jerusalem Bible (Darton, Longman & Todd, 1985) Judges 12:6.
[338] Art.48, API; ICRC Study, Rule 1.

adversary or a civilian who is armed for their own protection.[339] Thus, choosing lawful target characteristics is key to enabling lawful targeting by AWS.

As developers will be selecting the criteria which signify targets for an AWS database, we can see a parallel to intelligence analysts who consider target criteria in developing target lists for military operations such as targeted killing.[340] Targeted killing is the extraterritorial killing of a designated (suspected) terrorist.[341] Such designations are made through applying target criteria to suspicious individuals.[342] Heller suggests that only five of the 14 criteria used by the US to identify individuals for targeted killing are lawfully compliant.[343] The results of using these criteria suggest that unlawful targets have been attacked.[344] What this shows us is that the complexities of why someone is a target have been simplified into the chosen criteria, and these simplifications are so wide as to include non-terrorists. As Gramsci noted, '[t]*o simplify means to misrepresent and falsify*.'[345] Consequently, AWS developers need to be in close contact with both procurement teams and users of AWS to ensure that the criteria they choose to identify targets are not overly-simplified such that unlawful targets are being attacked by AWS.

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339 Art.13(3), APII; AMW Commentary (n.205) Rule 12(a), para.3.

340 For a discussion on the legal issues of target lists in general, see Aurel Sari, 'Missing The Mark: Reprieve, 'Kill Lists' And Human Rights Advocacy' (EJIL Talk, 2016) Archived:<https://web.archive.org/web/20161114070952/http://www.ejiltalk.org/missing-the-mark-reprieve-kill-lists-and-human-rights-advocacy/>; The term 'target list' is used here to maintain conceptual distinction between those used in conventional military operations and that within an AWS, despite target lists now also being maintained in databases. See John Pike, 'Modernized Integrated Database (MIDB)' (Global Security, 2019) Archived:<https://web.archive.org/web/20170425014944/http://www.globalsecurity.org/intell/systems/midb.htm>.

341 Markus Gunneflo, Targeted killing: A legal and political history (CUP, 2016) 1.

342 In targeted killing, target criteria are known as 'signatures' which are used to identify targets for 'signature strikes' as opposed to 'personality strike' where the identity of the target is known to be of 'high-value'. See Columbia Law School, 'The Civilian Impact Of Drones: Unexamined Costs, Unanswered Questions' (Columbia Law School, 2012) 8-9.

343 Kevin J. Heller, 'One Hell Of A Killing Machine': Signature Strikes And International Law' (2013) 11 Journal of International Criminal Justice, 89.

344 Spencer Ackerman, '41 Men Targeted But 1,147 People Killed: US Drone Strikes – The Facts On The Ground' (The Guardian, 2014) Archived:<https://web.archive.org/web/20190910112222/https://www.theguardian.com/us-news/2014/nov/24/-sp-us-drone-strikes-kill-1147>.

345 Cited in John Schwarzmantel, The Routledge Guidebook to Gramsci's Prison Notebooks (Routledge, 2015) 279.

Thus, the exercise of technical control is relevant to both the development of weapons and their use. In Chapters 4 and 5, this thesis considers how technical control is essential to building AWS in conformity with the LoAC and IHRL rules relevant to both weapons and to targeting. Chapter 6 discusses how failures to comply with these rules can generate criminal responsibility for individual developers of AWS, and for senior management of the companies who manufacture these systems under ICL. It also explores how AWS manufacturing companies could be held responsible as legal persons.

#### 5.8.4. Tactical control

The final level of control is held by the operators and commanders of AWS. By deciding that an AWS should be employed on a particular mission, and instructing it on what to do, they exert 'tactical control' over AWS. This is inspired by ways of controlling weapons with autonomy that are in use today.[346] For example, a commander/operator,[347] would decide that an AWS should be employed against targets A and could function *autonomously* in B time-frame at C location using D weapons (or causing E effects).[348]

In order to determine these restrictions, commanders would need to evaluate where the enemy is expected to be, when they are expected to be there, and what available munitions are capable of completing the task. Further, they would need to consider the expected civilian presence and any harm that might come to them, along with any precautions which could minimise civilian harm,[349] and what would be a proportionate amount of harm in comparison to the expected military

[346] See, Scharre (n.208) 162-169.
[347] The precise role of each would depend upon the formation of AWS units and the mission. A mission planner may also make these decisions.
[348] Boothby 2013 (n.198) 56-57; Ford suggests that all systems, autonomous and non-autonomous, are restricted in terms of space, time and effect and that this creates a method of control. See Christopher M. Ford, 'Autonomous Weapons And International Law' (2017) 69 South Carolina Law Review, 423, 455-458, citing William H. Boothby, Weapons And The Law Of Armed Conflict (OUP, 2009) 233, and Asaro (n.225) 695.
[349] Art.57, API; ICRC Study, Rules 15-21.

advantage if some harm is unavoidable.[350] Thus, an AWS could not be used to 'fish' for targets a commander is unaware of. This means that AWS will be less susceptible to enemy-initiated diversionary tactics,[351] and if, somehow, a civilian object is misidentified as a target it could only be engaged if it is present at the site and time of the attack. Therefore, this reduces the overall risk which an erroneously programmed AWS would pose to civilians.

Creating such restrictions happens with beyond-visual-range attacks carried out by artillery, or some missiles today[352] – the commander makes decisions about targets, precautions, and the acceptability of incidental civilian harm based on intelligence, rather than direct observation.[353] The similarities between AWS and beyond-visual-range attacks are even stronger when considering that a commander may need to attack an object not in the memory of the AWS, for example, if adversaries occupy an abandoned civilian building. The AWS could not recognise it as a target, but a commander could instruct the system to attack a particular set of coordinates, for example. Such *ad hoc* attacks grant more control to a commander as it removes any freedom that the AWS would otherwise have. Yet, unlike artillery shells and missiles, an AWS may be contactable in some operational circumstances so giving a commander an ability to re-call an AWS provides them with greater control where possible and necessary.[354]

Therefore, the rules of LoAC and IHRL relevant to targeting are of primary relevance to the exercise of tactical control and can be applied by commanders/operators. In Chapter 5, we see how AWS could be used for target engagement and how human beings would need to perform some tasks in this process. Consequently, responsibility for failures to comply with the legal rules is discussed in

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[350] Arts.51(5)(b) and 57(2)(iii) and57(2)(b), API; ICRC Study, Rule 14.
[351] Backstrom and Henderson (n.71) 496.
[352] On beyond visual range attacks by aircraft, and how they do not exhibit meaningful human control, see Ekelhof (n.298); See Boothby 2013 (n.198) 58 referring to tactical cruise missiles; See Akerson (n.201) 86, referring to intercontinental ballistic missiles; also note Backstrom and Henderson (n.71) 488, 489.
[353] On the importance of intelligence in modern targeting, see Merel A.C. Ekelhof, 'Lifting The Fog Of Targeting: "Autonomous Weapons" And Human Control Through The Lens Of Military Targeting' (2018) 71 Naval War College Review, 1, 63; Boothby 2016 (n.223) 256-257.
[354] See, for example, Laurent Orseau and Stuart Armstrong, 'Safely Interruptible Agents.' (2016) Proceedings of the 32nd Conference on Uncertainty in Artificial Intelligence, 25-29 June 2016) 68.

Chapter 6. That discussion is primarily focussed on the individual criminal responsibility of AWS operators, and the responsibility of their commanders.

## 6. Conclusion

This Chapter has outlined the sources and regimes of international law that are relevant to AWS. Through discussing these systems as weapons, it has noted that LoAC and IHRL rules regulate their development. In terms of the behaviours that AWS are expected to engage in during combat, this Chapter has shown how the LoAC and IHRL rules relevant to targeting can be applied to them.

The meaningful human control approach and approaches based on controlling entities were discussed. The later approaches were preferred as methods by which law could be indirectly applied to these systems as legal agents of those who exert control over them; specifically the layers of control approach was favoured in order to show and apply responsibility for each controlling entity separately from the others, rather than as a controlling socio-technical system.

Following the layers of control approach allows controlling entities to apply legal rules to restrict the *autonomous* functions of AWS so that their behaviour is in accordance with legal rules. Ultimately, then, this not only enables international law to regulate the development of AWS as weapons, but also their use in combat, and responsibility for their abuse under international law. The application of these rules is discussed in detail in Chapters 4, 5, and 6, respectively.

Chapter 4: Applying the weapons review framework to AWS

1. Introduction

The previous chapters outlined that autonomous weapon systems (AWS) are weapon systems that have a computational capacity to apply algorithmic rules about attacks, and so they must be considered in terms of both weapons law and targeting law. The present Chapter discusses AWS *qua* weapon systems with particular regard to the legal framework applied during weapons reviews, that are required under Article 36 of Additional Protocol I (API). The requirement for reviewing weapons exists because the right of parties to conflicts to choose different means and methods of warfare is not unlimited.[1] As such, this Chapter demonstrates how weapons law can sufficiently regulate the development of AWS by applying its rules to deal with the novelty of AWS, and preventing unlawful weapons with autonomy from being produced. Chapter 5 follows on from this and looks at the ability of AWS to be used in conformity with, and apply, targeting rules.

2. Weapons in the layers of control

One could assume that compliance with weapons law would primarily come under technical control, i.e. the control exerted by weapons developers, as it is they who must produce weapons that comply with international law. However, as we saw in the last Chapter, weapons are subject to weapons reviews by the states who intend to use them.[2] This is an exercise of procurement control through which a reviewer determines if a weapon can be lawfully used, and how that should be done. Thus, both technical and procurement control are exerted over weapons in the development phase,

[1] Art.35(1), Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 3 (Hereafter: API).
[2] Art.36, API; Justin McClelland, 'The Review Of Weapons In Accordance With Article 36 Of Additional Protocol I' (2003) 85 International Review of the Red Cross, 397, 401.

and so contribute to restricting AWS to being developed and used in lawful ways through implementing each layer of control respectively.

Procurement control is exerted by: communicating with and feeding back information to manufacturers on what capabilities they need new weapons to have to ensure legal compliance;[3] actually testing the system to determine that they abide by legal rules in the weapons review framework[4] and can be authorised for use;[5] writing guidance for how weapons should be used so as to be in conformity with legal rules relevant to targeting.

In terms of technical control, this is exercised through the production of the system. As the previous Chapter noted, with AWS, this is regulated by both the rules traditionally applied to weapons, and those applied to targeting due to the significant impact that weapons developers have on the ability of an AWS to engage in targeting. As such, when an AWS is reviewed, the evaluation must consider them under both weapons law and targeting law.

This requires a reviewer to embrace the flexibility of weapons review frameworks to interpret rules slightly differently (as the obligation to conduct reviews does not state how they should be done, this provides freedom to tailor the testing to the novelty of the new weapon). For example, interpreting the prohibition of indiscriminate weapons to consider the accuracy of a system to recognise targets rather than just hit its aimpoint. Further, the flexibility of the framework allows for the incorporation of targeting rules that would not be applied to conventional weapons reviews. Doing so allows the novelty of *autonomous* targeting to be evaluated within the weapons review framework. This should allow reviewers, in their exercise of procurement control, to construct ways to use an AWS

[3] Alexander Bolt, 'The Use of Autonomous Weapons and the Role of the Legal Adviser' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013) 131-133.
[4] Marie Jacobsson, 'Modern Weaponry And Warfare: The Application Of Article 36 Of Additional Protocol I By Governments' (2006) 82 International Law Studies, 183, 188; See reference to different reviews (or 'gates') taking place during the development of weapons: UK Ministry of Defence, UK Weapons Reviews (Development, Concepts and Doctrine Centre, 2016) 4; Australian UNOG Delegation, 'The Australian Article 36 Review Process' 2018 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 30 August 2018) UN Doc. CCW/GGE.2/2018/WP.6, 4.
[5] Geoffrey Corn, 'Autonomous Weapon Systems: Managing The Inevitability Of 'Taking The Man Out Of The Loop', in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016) 230-238.

where unlawful conduct is, to them, unforeseeable.[6] In this thesis, however, the weapons law regime, and the targeting law regime are considered in separate chapters so that each can receive the required focus. Consequently, this Chapter and the next should be read together.

It is important to remember that applying targeting rules to AWS does not mean that such systems would need to be able to apply these rules itself, but merely that the system can be employed in such a way as to comply with targeting law.[7] Indeed, these legal obligations are imposed on the people using an AWS, and not the machine itself.[8]

3. A historical example

Often, when new technologies produce remarkable results, those who are particularly enthusiastic about it can view the technology as being far better than it is. For example, when chess computers were first developed, many thought they would also be capable of strategic decision-making due to the inherent strategizing when humans play chess.[9] Thus, it is vitally important that weapons reviewers take a realistic approach to understanding the capabilities of AWS technologies. A vignette from the US experience during the Vietnam War illustrates how wayward things can go when technology is trusted beyond its capability.

Between 1968-1972, during the Vietnam War of 1955-1975,[10] there were a series of US military operations known collectively as 'The Electronic Battlefield'.[11] These operations used sensors to detect acoustic, magnetic, electro-magnetic and seismic changes in areas of known activity by the

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[6] Corn (n.5) 233.
[7] See Kathleen Lawand, 'Reviewing The Legality Of New Weapons, Means And Methods Of Warfare' (2006) 88 International Review of the Red Cross, 925, 928-929.
[8] Also see US Manual, para.6.5.9.3.
[9] Garry Kasparov, Deep Thinking (John Murray Publishers, 2017) 26-28.
[10]Jesse Gatlin, 'Igloo White (Initial Phase)' (Project CHECO, 7th US Air Force ,1968).
[11] Paul Dickson, The Electronic Battlefield (2nd edn, Foxacre Press, 2012); Anthony Tambini, Wiring Vietnam (Scarecrow Press, 2007).

then US adversaries, the North Vietnamese Army (NVA).[12] This, supposedly, allowed the US to know the time and location of NVA movements.[13]

The US Air Force part of the project was known as Operation Igloo White.[14] It was an attempt to prevent NVA forces from circumventing the then in-force de-militarized zone between North and South Vietnam[15] by traversing the 8,100-mile-long Ho Chi Minh Trail through Laos and Cambodia and into the South Vietnamese Delta.[16]

The jungle-covered 'trail' was actually a sophisticated network of roads and encampments transporting thousands of NVA soldiers into South Vietnam.[17] The Air Force air-dropped sensors to discover NVA positions and personnel travelling along the trail.[18] Through tracking the time and distance between different sensor activations,[19] US computer technicians were able to estimate the time of arrival at a pre-selected attack location lower down the Trail.[20] Air strikes were launched to coincide with the arrival of supposed NVA personnel at these locations.[21]

Initially, forward air controllers would visually confirm targets for attack aircraft.[22] Eventually, a sub-operation called 'Operation Commando Bolt' was launched in October 1969[23] and sensor activations were then analysed by a computer.[24] A three-person team evaluated the computer analysis

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[12] For a detailed explanation of the different types of sensors used, see Tambini (n.11) 29-46.
[13] Tambini (n.11) 10, 75; Dickinson (n.11) 85.
[14] Operation Igloo White existed within Operation Command Hunt which covered all bombing of the Ho Chi Minh Trail, not just those operations that were directed using sensors. See Earl H Tilford, Setup: What The Air Force Did In Vietnam And Why (Air University Press, 1991); Gatlin (n.10); Philip Caine, 'Igloo White July 1968 - December 1969' (Project CHECO, 7th US Air Force, 1970); Henry Shields, 'Igloo White January 1970 - September 1971' (Project CHECO, 7th US Air Force 1971).
[15] Alan Rohn, 'Vietnamese DMZ' (Vietnam War, 2014) Archived:<https://web.archive.org/web/20190717171216/https://thevietnamwar.info/vietnamese-dmz/>.
[16] Tambini (n.11) 130
[17] Tambini (n.11) vii, 130-131
[18] John Correll, 'Igloo White' (2004) 87 Air Force Magazine, 57.
[19] Caine (n.14) 12.
[20] Tambini (n.11) 75.
[21] Tambini (n.11) xii, 75; Dickinson (n.11) 86-87.
[22] Gatlin (n.10); Tambini (n.11) 164-165.
[23] Shields (n.14) 15-18.
[24] Caine (n.14) 16-17.

and recommended times and locations of strikes.[25] This was transmitted to computers on-board aircraft that gave a course to fly on and an appropriate speed so that weapons release was timed to synchronise with the arrival of supposed adversaries in the pre-determined target area.[26]

Skilled technicians could use sensors to determine general information about what was happening on the Trail,[27] but could not identify the causes of sensor activations with any accuracy. False positives were regularly misinterpreted and acted upon, with civilians, dead bodies, cattle,[28] water buffalo, jungle elephants, and even the wind causing sensor activations that resulted in attacks being launched.[29] Civilians were plainly put at risk of being mistakenly and unlawfully attacked, with US bombing in these areas creating 17,000 refugees.[30]

Military officers taking part in, and overseeing, these operations should have recognised that this was unlawful according to US interpretations of the law at the time.[31] Yet, following a display of the technology, then US Commander in Vietnam General Westmorland, called for '*a full automated battlefield*'.[32] An effective evaluation of these systems that considered legal rules would have found this operation to be unlawful.

From this example, we can see that it is imperative for weapons reviewers to take a realistic view of the technologies they evaluate in order that they are accurately assessed, and to prevent undue enthusiasm about AWS from overpowering the legal reality. Weapons should be reviewed in terms of their normal or expected use, according to several interpretations of the weapons review

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[25] Caine (n.14) 16-18.
[26] Pilots were originally given the speed and course to fly (Shields (n.14) 21), but this was later automated, see Dickinson (n.11) 86-87; Tambini (n.11) 75; Harry Blout, 'Air Operations In Northern Laos 1 Apr - 1 Nov 1970' (Project CHECO, 7th US Air Force, 1971) 26-27.
[27] Tambini (n.11) 20
[28] Dickinson (n.11) 41-42
[29] Dickinson (n.11) 109
[30] Cornel University, The Air War in Indochina, 1971, cited in Dickinson (n.11) 92
[31] US Department of the Army, The Law of Land Warfare FM27-10 (Department of the Army, 1956) paras.25, 41.
[32] Dickinson (n.11) 75

obligation.[33] Thus, the exercise of procurement control is legally required to be in realistic terms. If a weapon passes or fails a review due to exceptional circumstance, that is not a judgement of how the weapon would normally work in the field and so serves little purpose. With regard to AWS, this means that they would need to be assessed in terms of what data their sensors and processors can deal with, i.e. quantitative rather than qualitative data, in realistic scenarios.

4. Weapons reviews

The conformity of a weapon system with the relevant legal rules was perhaps most famously discussed by the International Court of Justice in their Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons.[34] However, weapons are routinely evaluated in the context of a weapons review by states before they are used.[35] This is an analysis of a technology for its conformity with the weapons law rules, and any policy requirements that a reviewing state wishes to apply (a non-state actor may voluntarily review weapons, but there is no legal obligation to). States party to API are obligated to carry out reviews under Article 36. However, some states not party to API carry out reviews, with the US beginning their domestic process two years before API was adopted.[36] The API obligation states:

> '*In the study, development, acquisition or adoption of a new weapon, means or method of warfare, a High Contracting Party is under an obligation to determine whether its employment would, in some or all circumstances, be prohibited by this Protocol or by any other rule of international law applicable to the High Contracting Party*.'

[33] Yves Sandoz, Christophe Swinarski and Bruno Zimmermann (eds.), Commentary On The Additional Protocols Of 8 June 1977 To The Geneva Conventions Of 12 August 1949 (Martinus Nijhoff Publishers, 1987); William H Boothby, Weapons And The Law Of Armed Conflict (2nd edn, OUP, 2016) 343; Michael Bothe, et al., New Rules For Victims Of Armed Conflicts (Martinus Nijhoff, 1982) 200-201.
[34] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion [1996] ICJ Reports, p.226.
[35] Vincent Boulanin, 'Implementing Article 36 Weapon Reviews In The Light Of Increasing Autonomy In Weapon Systems' (SIPRI, 2015)
[36] US Manual, para.6.2.3., and fn.18, p.314.

This treaty obligation is only applicable in International Armed Conflicts (IACs). But, this does not mean that states are relieved from their responsibility to field only lawful weapons in Non-International Armed Conflicts (NIACs).[37]

It is unclear whether there is a customary obligation to review weapons for use in IACs or NIACs. Several authors suggest there are obligations,[38] others submit that they arguably exist,[39] and some are undecided.[40] As Jevglevskaja points out, however, all arguments for weapons reviews being a customary obligation are grounded in the customary rules that weapons reviews are based upon, and the logic that in order to abide with these rules, weapons must be reviewed.[41] This implies a duty to review weapons to ensure that customary rules of the law of armed conflict (LoAC) are not breached by the development and use of newly devised, or acquired, equipment and tactics.[42] This is in contrast to the normal evaluation of customary international law (CIL) based on the existence of state practice and *opinio juris*.[43] There does not, however, appear to be sufficient evidence of either element to create a customary rule in the traditional sense.[44]

On the point of customary law, this thesis makes use of the International Committee of the Red Cross (ICRC) 'Customary International Humanitarian Law' Study as a general reference point for

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[37] Humanitarian Policy and Conflict Research, Commentary On The HPCR Manual On International Law Applicable To Air And Missile Warfare (Harvard University, 2010) (Hereafter: AMW Commentary), Rule 9, para.3 of commentary.

[38] Michael N. Schmitt and Jeffrey Thurnher, '"Out Of The Loop": Autonomous Weapon Systems And The Law Of Armed Conflict' (2013) 4 Harvard National Security Journal, 231, 271; AMW Commentary, Rule 9 (note that this only applies to *means* of warfare); Kenneth Anderson, Daniel Reisner and Mathew Waxman, 'Adapting The Law Of Armed Conflict To Autonomous Weapon Systems' (2014) 90 International Law Studies, 335, 398, fn.27.

[39] International Committee of the Red Cross, A Guide To The Legal Review Of New Weapons, Means And Methods Of Warfare (ICRC, 2006) 4; Daragh Murray, Practitioners' Guide To Human Rights Law In Armed Conflict (OUP, 2016) para.7.25.

[40] Michael N Schmitt and Liis Vihul, Tallinn Manual 2.0 On The International Law Applicable To Cyber Operations (CUP 2017)(Hereafter: Tallinn Manual), Rule 110, para.4 of commentary.

[41] Natalia Jevglevskaja, 'Weapons Review Obligation Under Customary International Law' (2018) 94 International Law Studies, 1887, 188.

[42] ICRC (n.39) 4; Jean-Marie Henckaerts and Louise Doswald-Beck, Customary International Humanitarian Law, Volume I: Rules (CUP, 2005) (Hereafter: ICRC Study) Rule 71 (final paragraph of commentary).

[43] Jevglevskaja (n.43) 188.

[44] Jevglevskaja (n.43) 207-213.

applicable CIL. But, as it has been particularly criticised in its assessment of weapons law,[45] the present Chapter cites this work as additional evidence of legal rules regarding weapons, rather than as a guide to rules as in other chapters.

### 4.1. The applicable law

As Article 36 is present in a LoAC treaty, one could assume that this means that only LoAC is applicable during weapons reviews. However, the Article allows for '*any other rule of international law applicable to the High Contracting Party*' to be applied. Thus, the treaty obligation itself allows for an interpretation of the lawfulness of weapons beyond that found purely within LoAC. The national manuals of the UK,[46] the US,[47] Canada,[48] Australia,[49] and New Zealand[50] take a narrow view and only refer to LoAC in interpreting this obligation.[51]

Yet, the Danish manual explicitly refers to LoAC and International Human Rights Law (IHRL), in particular, the right to life and freedom from torture. But, the application of IHRL is stated in this document to only be relevant to the assessment of less-than-lethal weapons.[52] Further, the German

[45] D. Turns, 'Weapons In The ICRC Study On Customary International Humanitarian Law' (2006) 11 Journal of Conflict and Security Law, 201.
[46] UK Ministry of Defence, Manual Of The Law Of Armed Conflict (OUP, 2004) para.6.20.1; This position is the same in UK Ministry of Defence, 'Legal Review Of Newly Acquired Or Developed Weapons Or Associated Equipment (2009DIN04-217)' (Development, Concepts and Doctrine Centre, 2009); note however UK Ministry of Defence, UK Weapons Reviews (Development, Concepts and Doctrine Centre, 2016) 4 refers to '*all relevant rules of international law*'.
[47] US Manual, para. 6.2.
[48] Canadian Office of the Judge Advocate General, Law Of Armed Conflict At The Operational And Tactical Levels (National Defence, 2001) para.530.
[49] Australian Defence Headquarters, Law Of Armed Conflict, ADDP 06.4 (Defence Publishing Service, 2006) para, 4.2.
[50] New Zealand Defence Force, DM 69 (2 Ed) Manual Of Armed Forces Law, Volume 4 Law Of Armed Conflict (Directorate of Legal Services, 2017) para.7.4.1.
[51] Reportedly, the UK is considering whether to take IHRL into account in its weapon reviews. See Dustin A. Lewis, 'Legal Reviews Of Weapons, Means And Methods Of Warfare Involving Artificial Intelligence: 16 Elements To Consider' (Humanitarian Law & Policy Blog, 2018) Archived:<https://web.archive.org/web/20190912154010/https://blogs.icrc.org/law-and-policy/2019/03/21/legal-reviews-weapons-means-methods-warfare-artificial-intelligence-16-elements-consider/>.
[52] Jes Rynkeby Knudsen, Military Manual On International Law Relevant To Danish Armed Forces In International Operations (Danish Ministry of Defence, 2016) Section 9.4 (hereafter: Danish Manual)

manual refers to '*the rules of international treaty law and customary international law*', as '*determined by the Federal Ministry of Defence*',[53] but offers no further explanation. As such, it can be assumed that LoAC is the primary framework they would consider. Sweden, in its International Law Monitoring of Arms Project considers LoAC (including disarmament treaties) and IHRL.[54] But, this mechanism appears to take a wider role than Article 36 reviews and includes evaluations of proposed weapons procurement by Swedish Police, Coast Guard, and Prison Service,[55] and so the precise rules applied in that process are unclear.[56] Additionally, of those international expert manuals which refer to weapons reviews (the Air and Missile Warfare Manual and the Tallinn Manual on Cyber-Warfare), neither expand on the bodies of law to be considered.[57]

Thus, in the totality of available resources that refer to the bodies of law applied in weapons reviews, it would appear that LoAC is the primary (and in some cases only) legal regime that new means and methods are evaluated against. This is not overly problematic regarding compliance with IHRL, as it is broadly consistent with LoAC in terms of understanding the legality of weapons and provides further context for that understanding.[58] Indeed, LoAC duties to review weapons are consistent with IHRL requirements to consider '*foreseeable consequences*' or '*foreseeable risks*' associated with the use of weapons or other state activity.[59] Such consequences and risks may include long-term effects, such as if shrapnel may have carcinogenic effects in the body.[60] It is important to note that states are required to evaluate products they purchase in terms of their compliance with

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[53] Germany, Federal Ministry of Defence, Law Of Armed Conflict Manual (2013) para.405.
[54] Jacobsson (n.4) 185.
[55] Jacobsson (n.4) 186.
[56] For wider information on national weapons review policies of Sweden, the United States, Norway, and Australia, see Isabelle Daoust, Robin Coupland and Rikke Ishoey, 'New Wars, New Weapons? The Obligation Of States To Assess The Legality Of Means And Methods Of Warfare' (2002) 84 International Review of the Red Cross, 345, 354-361; for more information on the review processes of Germany, Switzerland, the UK, and the US, see Boulanin (n.35) 19-25; for information on Article 36 reviews by specific US services in relation to AWS, see Ryan Poitras, 'Article 36 Reviews & Autonomous Weapon Systems: Supporting An International Review Standard' (2018) 34 American University International Law Review, 465.
[57] AMW Commentary (n.37) Commentary to Rule 9; Tallinn Manual (n.40) Commentary to Rule 110.
[58] See Murray (n.39) paras.7.22-7.29 and 7.04-7.10.
[59] Murray (n.39) para.7.05.
[60] Murray (n.39) paras.7.06-7.07.

IHRL obligations under the bourgeoning business and human rights regime (see Chapter 6, Section 8.2).

In summary, then, weapons reviews must include relevant LoAC rules, but states can choose to include other international law rules as relevant. This may include IHRL[61], disarmament law,[62] or specialised regimes such as law of the sea for maritime weapons. Consequently, in the exercise of procurement control, a reviewer (or reviewing team)[63] may consider a wide variety of legal rules that might be applicable. As such, the application of IHRL in weapons reviews would slightly expand the focus on the review, with application of LoAC rules on their own already fulfilling most of the IHRL requirements with regard to evaluating weapons.

### 4.2. What is subject to review?

As the previous Chapter (Section 4.1) noted, AWS are a weapon system and can, therefore, be considered as a *means* of warfare. States are obligated to initiate reviews during the '*the study, development, acquisition or adoption of a new weapon, means or method*[s] *of warfare*.'[64] When considering algorithmic technologies, it is important to take a broad view of how different sub-systems impact upon the lawfulness of the system overall. Indeed, the UK Weapons Review policy includes opportunity to review '*data links and software used for processing target data*'.[65] As such, whilst an

[61] Note that Sweden, Switzerland, and the UK do give consideration to the ability of a weapon to be used in conformity with IHRL as some operations may be governed by IHRL as the primary framework, such as law enforcement operations during peacekeeping, see Boulanin (n.35) 6.
[62] Lawand (n.7) 929.
[63] UK MoD 2009 (n.46) para.9.
[64] Art.36, API; Note the minority view that AWS are '*robot-combatants*' and so are not subject to review. See Thompson Chengeta, 'Are Autonomous Weapon Systems The Subject Of Article 36 Of Additional Protocol I To The Geneva Conventions?' (2016) 23 U.C. Davis Journal of International Law & Policy, 65, 76-81.
[65] UK MoD 2016 (n.46) 4.

AWS would be tested as a whole, the component parts, in particular the software, could be considered individually.[66]

Whilst the obligation routinely applies during the '*study, development, acquisition or adoption*' of new systems,[67] a modified weapon can also be thought of as 'new' for the purposes of Article 36 and, therefore, be subject to re-review.[68] This is of particular importance if an AWS is equipped using machine learning algorithms.[69] In order to be classified as 'new', a modification through machine learning should cause a system to operate in a way not contemplated by the original review that potentially affects the ability of the system in question to be used in compliance with the relevant legal rules (the same test would, presumably, apply to other types of software update).[70] However, where a system is learning continuously during operations, it may be difficult to re-review a weapon after each modification. Thus, where the weapons reviewers could understand what stimuli a system would be exposed to, and how that might change the programming of the system, then a system could be authorised for use during a period of time or a particular operation/exercise, after which the system would need to be re-reviewed.[71]

However, other commentators suggest that machine learning would add unpredictability to the system, and therefore systems using such algorithms in their critical functions are incompatible

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[66] This is particularly important where parts of an AWS many be produced by different manufacturers. Alan Backstrom and Ian Henderson, 'New Capabilities In Warfare: An Overview Of Contemporary Technological Developments And The Associated Legal And Engineering Issues In Article 36 Weapons Reviews' (2012) 94 International Review of the Red Cross, 483, 510.

[67] Opportunities to review are thought of as 'gates' which a new system must pass through. See Australian UNOG Delegation (n.4)4; UK MoD 2016 (n.46) 4.

[68] James Farrant and Christopher Ford, 'Autonomous Weapons And Weapon Reviews: The UK Second International Weapon Review Forum' (2017) 93 International Law Studies, 389, 403; UK MoD 2016 (n.46) 4; Boothby 2016 (n.33) 346 and 355; McClelland (n.2) 404; Daoust et al. (n.56) 352; Tallinn Manual (n.40) commentary to Rule 110, para.9; Danish Manual (n.52) 381; also note references to states changing their legal opinions in response to improvements in weapons in Declaration Renouncing The Use, In Time Of War, Of Certain Explosive Projectile (adopted 11 December 1868, entered into force 11 December 1868).

[69] Farrant and Ford (n.68) 403.

[70] Farrant and Ford (n.68) 406

[71] Farrant and Ford (n.68) 407

with the traditional weapons review regimes.[72] If a system is truly unpredictable, then it could not be reviewed as it would be impossible to assess it in its normal or expected use.[73] Consequently, it could not pass an initial review or be lawfully used. We saw in Chapter 2 that whilst the precise actions of an AWS may be unpredictable, their behaviours would be generally foreseeable and so this point does not particularly affect the ability of a reviewer to assess an AWS.

A decision to re-evaluate weapons where the effects of a weapon may be different from the initial review is also required by IHRL. Failure to initiate re-review after such information comes to light may indicate that a state '*knew or ought to have known'* about risks associated with the weapon.[74]

5. The review criteria

In terms of the actual considerations of a weapons review, Article 36 does not lay out a framework for review. States, therefore, consider whether a weapon is prohibited by a particular legal instrument, or if it is possible to use the weapon in conformity with generally applicable rules regarding weapons. The criteria used in all publicly known review frameworks ask whether a system is specifically prohibited, is of a nature to cause superfluous injury or unnecessary suffering, and if it is inherently indiscriminate.[75] Some reviews also evaluate whether a weapon will cause a prohibited

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[72] Netta Goussac, 'Safety Net Or Tangled Web: Legal Reviews Of AI In Weapons And War-Fighting' (Humanitarian Law & Policy Blog, 2019) Archived:<https://web.archive.org/web/20190919080050/https://blogs.icrc.org/law-and-policy/2019/04/18/safety-net-tangled-web-legal-reviews-ai-weapons-war-fighting/>.
[73] Sandoz et al. (n.33) 343; Bothe et al. (n.33) 200-201.
[74] Murray (n.39) para.7.29; For negligent appreciations of risk in other contexts, see Brincat and Others v Malta, App nos:60908/11, 62110/11, 62129/11, 62312/11 and 62338/11 (ECtHR, 24 July 2014), and O'Keefe v Ireland, App no:35810/09 (ECtHR, 28 January 2014).
[75] UK MoD 2009 (n.46) para.10; US Manual, para.6.2.2; New Zealand manual (n.50) para.7.3.1; Australian UNOG Delegation (n.4) 5.

level of environmental harm, and whether a weapon is likely to be prohibited in the near future.[76] Others also appraise the ability of a weapon to abide by the Martens Clause.[77]

With regard to *highly-automated* and *autonomous* systems, however, Boothby suggests that, in his opinion, a reviewer should also consider whether the way in which the weapon system is going to be used would enable compliance with, at a minimum:[78] the prohibition on indiscriminate attacks,[79] precautions in attack,[80] distinction,[81] and the doubt rules.[82] Thus, a reviewer should consider both weapons and targeting law together and be satisfied that the AWS can be used in conformity with both regimes.[83] As was noted above, this thesis separates these regimes into distinct chapters.

Where specific knowledge is needed in order to adequately conduct a review, a reviewer can routinely call on experts for advice. This may include medical specialists who can provide a greater understanding of how a munition would affect the human body[84] or experts in computer science in the case of AWS.[85]

### 5.1. Specific prohibitions

The first question that a review must answer is whether a weapon is subject to a prohibition. There is a significant body of treaty and customary laws proscribing specific weapons. This is sometimes known as disarmament law.[86] It follows a trend from ancient times of prohibiting weapons

[76] UK MoD 2009 (n.46) para.10; Australian UNOG Delegation (n.4) 5.
[77] Australian UNOG Delegation (n.4) 5.
[78] Boothby 2016 (n.33) 348-349.
[79] Art.51(4)-(6), API; Art.13(2), APII; ICRC Study, Rules 11 and 12.
[80] Art.57, API; ICRC Study, Rules 15-21.
[81] Art.48, API; Art.13(3), APII; ICRC Study, Rules 1, 6, and 7; Nuclear Weapons Opinion (n.34) para.78.
[82] Arts.50(1), and52(3), API; ICRC Study, Rules 6 (Situations of doubt as to the character of a person) and 10 (Situations of doubt as to the character of an object).
[83] William Boothby, 'Dehumanisation: Is There a Legal Problem Under Article 36?' in Wolff Heintschel von Heinegg, Robert Frau and Tassilo Singer (eds.), Dehumanization Of Warfare (Springer, 2018) 40-41.
[84] Daoust et al. (n.56) 352-353; Lawand (n.7) 929.
[85] Also note UK policy which encourages reviews to '*engage widely*' with experts. See UK MoD 2009 (n.46) para.11.
[86] See Lawand (n.7) 929.

thought to be particularly offensive to contemporary sensibilities such as poisons and poisoned weapons,[87] and crossbows.[88]

In modern times, those weapons that are specifically prohibited under treaty and CIL are: explosive projectiles under 400 grams in weight,[89] or 'exploding bullets';[90] asphyxiating gases;[91] bullets which expand or flatten easily in the human body;[92] poisons and poisoned weapons;[93] automatic submarine contact mines;[94] asphyxiating, poisonous or other gases, and bacteriological methods of warfare;[95] bacteriological (biological) and toxin weapons;[96] environmental modification techniques;[97] herbicides;[98] weapons with non-detectable fragments;[99] mines, booby-traps, and other devices designed to kill, injure or damage and which are actuated manually, by remote control or

[87] These were prohibited by Greek, Roman, and Hindu customs, see Adam Roberts and Richard Guelff, Documents On The Laws Of War (3rd edn, OUP, 2004) 53.
[88] Pope Innocent II banned the use of crossbows against Christians in 1139, see Paul Scharre, Army Of None (WW Norton & Company, 2018) 331.
[89] St Petersburg Declaration 1868 (n.68).
[90] ICRC Study, Rule 78.
[91] Hague Declaration (II) Concerning Asphyxiating Gases (adopted 29 July 1899, entered into force 4 September 1900).
[92] Hague Declaration (III) Concerning Expanding Bullets (adopted 29 July 1899, entered into force 4 September 1900); Arts.8(2)(b)(xix) and 8(2)(e)(xv), Rome Statue Of The International Criminal Court 1998 (adopted 17 July 1998, entered into force 1 July 2002) 2187 UNTS 3 (Hereafter: ICC Statute); ICRC Study, Rule 77; Also note William Boothby, 'Difference In The Law Of Weaponry When Applied To Non-International Armed Conflict' (2012) 88 International Law Studies, 197, 198-204, 205.
[93] Art.23(a), Convention (IV) respecting the Laws and Customs of War on Land and its annex: Regulations concerning the Laws and Customs of War on Land (adopted 18 October 1907, entered into force 26 January 1910); Arts.8(2)(b)(xvii) ad 8(2)(e)(xiii), ICC Statute; ICRC Study, Rule 72.
[94] Convention (VIII) Relative to the Laying of Automatic Submarine Contact Mines (adopted 18 October 1907, entered into force 18 January 1910)(Hereafter: Hague Convention VIII).
[95] Geneva Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (adopted 17 June 1925, entered into force 8 February 1928); Arts.8(2)(b)(xviii) and 8(2)(e)(xiv), ICC Statute.
[96] Convention on the prohibition of the development, production and stockpiling of bacteriological (biological) and toxin weapons and on their destruction (adopted 19 April 1972, entered into force 26 March 1975) 101 UNTS 163 (Hereafter: Biological Weapons Convention); Arts.8(2)(b)(xxvii) and 8(2)(e)(xvi), ICC Statute; ICRC Study, Rule 73.
[97] Convention on the prohibition of military or any other hostile use of environmental modification techniques (adopted 10 December 1976, entered into force 5 October 1978) 1108 UNTS 151 (Hereafter: ENMOD Treaty); Also note Boothby 2012 (n.92) 204-205.
[98] ICRC Study, Rule 76.
[99] Protocol (I) on Non-Detectable Fragments to, 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 (with Protocols I, II and III) (adopted 10 October 1980 entered into force 2 December 1983) 1342 UNTS 137.(Hereafter: CCW) ; Arts.8(2)(b)(xxviii) and 8(2)(e)(xvii), ICC Statute; ICRC Study, Rule 79.

automatically after a lapse of time;[100] incendiary weapons;[101] blinding laser weapons;[102] explosive remnants of war;[103] chemical weapons;[104] anti-personnel mines;[105] riot-control agents as a method of warfare;[106] cluster munitions.[107]

Some of these proscriptions are only designed to apply in IACs.[108] But, as Boothby points out, the effect of prohibiting such weapons means they should not be present in the arsenals of signatory states. This means that they would not be available for use in NIACS.[109] They are, therefore, functionally prohibited in NIACs also, despite there being no specific legal obligation.

Where a reviewer evaluates a weapon in terms of whether it is prohibited under any of these regulations, or any national laws, they exercise their procurement control by preventing any weapon which contravenes this rule from passing review. But, there is no specific prohibition of autonomy in weapon systems.[110] One could look at the prohibitions on submarine-mines and landmines to suggest that it is the *autonomous* nature of these systems that is problematic, rather than the specific systems themselves. However, upon a reading of the exact provisions, it is apparent that they are focused on reducing or minimising harm to those not involved in combat.

[100] Amended Protocol II on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices to CCW (Hereafter: CCW Amended Protocol II); ICRC Study, Rules 80, 81, 82, and 83.
[101] Protocol (III) on Prohibitions or Restrictions on the Use of Incendiary Weapons to CCW; ICRC Study, Rules 84 and 85
[102] Protocol (IV) on Blinding Laser Weapons to CCW; Arts.8(2)(b)(xxix) and8(2)(e)(xviii), ICC Statute; ICRC Study, Rule 86
[103] Protocol (V) on Explosive Remnants of War to CCW
[104] Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (adopted 3 September 1992, entered into force 29 April 1997) 1974 UNTS 45 (Hereafter: Chemical Weapons Convention); ICRC Study, Rule 74.
[105] Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction (adopted 18 September 1997, entered into force 1 March 1999) 2056 UNTS 211 (Hereafter: Anti-Personnel Mines Conventions).
[106] ICRC Study, Rule 75.
[107] Convention on Cluster Munitions (adopted 30 May 2008, entered into force 1 August 2010) 3688 UNTS 39 (Hereafter: Cluster Munitions Convention).
[108] Chemical Weapons Convention; Biological Weapons Convention; Anti-Personnel Mines Convention; Cluster Munitions Convention.
[109] Boothby 2012 (n.92) 198.
[110] US Manual, para.6.5.9.2.

The 1907 Convention on automatic submarine contact mines prohibits the use of such weapons beyond human control or where they are emplaced to harm innocent civilians in specific instances.[111] As such, they are not outlawed because of their autonomy. Concerns regarding human control are relevant to AWS, as an uncontrollable *autonomous* system would be undesirable. AWS are, however, subject to multiple layers of control and so do not raise the same concerns as automatic submarine contact mines. Thus, whilst this prohibition cannot outlaw AWS, it does inform us that AWS should remain under human control.

There is a similar rationale in the Certain Conventional Weapons Convention (CCW) Protocol dealing with mines, booby-traps and other devices.[112] Some of the general provisions of the protocol prohibit use of such weapons against civilians.[113] But, those most relevant to AWS proscribe the irresponsible use of mines, booby-traps, and other devices by preventing them from being made safe,[114] or using them in geographically[115] or temporally[116] unrestricted ways. As with the 1907 Convention, the CCW protocol does not focus upon the autonomy in the weapon system but places restrictions upon the use of these weapons in order that they are directed at lawful targets. What can be learned from these provisions is that placing restrictions upon the time, space, and effects[117] of how a weapon with autonomy can use that autonomy would enable greater civilian protection. We saw in the last Chapter that such restrictions are key to the exercise of tactical control by commanders.

Consequently, there is no evidence of a weapon ever being prohibited based upon the autonomy it has with regard to attacks. Still, ensuring that weapons with autonomy are under some

[111] Arts.1 and 2, Hague Convention VIII.
[112] 'Other devices' means weapons similar to mines and booby-traps.
[113] Art.3(3), (7), (8), (9), (10), CCW Amended Protocol II.
[114] Art.3(5), (6), CCW Amended Protocol II.
[115] Art.5, CCW Amended Protocol II, note that this provision does not apply to remotely-delivered mines. Specific restrictions on their use are deal with in Art.6, but this does not provide for geographic restrictions.
[116] Technical Annex Art.3, CCW Amended Protocol II.
[117] Note also the consideration of these dimensions as methods of controlling AWS in Christopher M. Ford, 'Autonomous Weapons And International Law' (2017) 69 South Carolina Law Review, 413; also note the discussion of these dimensions of control in the next Chapter.

human control and are restricted in their *autonomous* functions in time, space, and effects so that only lawful targets can be attacked would seem to be good practice for use of AWS.

### 5.2. Likelihood of a future prohibition

In terms of whether AWS are likely to be subject to a prohibition in the future, the previous Chapter (Section 5.4) noted that there is no consensus between states on the international level in terms of either regulating or prohibiting AWS. Thus, no new protocol to the CCW banning AWS is likely to come into being.

However, after several years of discussions, campaigners for a prohibition on AWS are contemplating initiating a treaty-making process outside of the CCW forum: '*If the CCW cannot deliver a negotiating mandate in 2019—after six years of work—it is time to look elsewhere*.'[118] This happened with the Ottawa Convention prohibiting anti-personnel mines that was agreed during *ad hoc* conferences outside the auspices of the CCW due to the frustrations from pro-ban states with slow progress.[119] However, such a move would only bind those states that consent to a treaty. Any states that oppose a prohibition on AWS (France, Israel, Russia, the United Kingdom, and the United States)[120] could not be compelled to sign such an agreement. As these states are developing some of the most advanced weapons with autonomy,[121] any prohibition is unlikely to affect these countries or

[118] Campaign to Stop Killer Robots, 'Statement To The Convention On Conventional Weapons Group Of Governmental Experts On Lethal Autonomous Weapons Systems' 2019 Group of Governmental Experts on Lethal Autonomous Weapons Systems (Geneva, 27 March 2019) Archived:<https://web.archive.org/web/20190919085101/https://www.unog.ch/80256EDD006B8954/(httpAssets)/6FDBADBE15A26515C12583CB003E9791/$file/KRC_StmtCCW_27Mar2019_TODELIVER.pdf>.

[119] Melissa Chan, 'The Rise Of The Killer Robots – And The Two Women Fighting Back' (The Guardian, 2019) Archived:<https://web.archive.org/web/20190822142738/https://www.theguardian.com/world/2019/apr/08/the-rise-of-the-killer-robots-jody-williams-mary-warehan-artificial-intelligence-autonomous-weapons>.; See also Anti-Personnel Mines Convention.

[120] See Campaign to Stop Killer Robots, 'Convergence On Retaining Human Control Of Weapons Systems' (Stopkillerrobots.org, 2018) Archived:<https://web.archive.org/web/20190605204018/https://www.stopkillerrobots.org/2018/04/convergence/>.

[121] Berenice Baker, 'Taranis Vs. Neuron - Europe's Combat Drone Revolution - Airforce Technology' (Airforce Technology, 2014) Archived:<https://web.archive.org/web/20190306141311/https://www.airforce-

their weapons review processes. However, should such a prohibition be agreed and subsequently become CIL and these states fail to announce themselves as persistent objectors, then the customary prohibition would apply to them.[122]

During a weapons review, a reviewer would need to assess the current obligations, and the future likelihood of their state prohibiting AWS either unilaterally or as part of a multi-lateral treaty. By doing so, a reviewer exercises their procurement control over the AWS.

### 5.3. Of a nature to cause superfluous injury or unnecessary suffering

In terms of prohibiting weapons that cause superfluous injury or unnecessary suffering,[123] and are not already specifically prohibited, this principle originates in the 1868 St Petersburg Declaration. The instrument suggested that, in order to weaken enemy forces, it is sufficient to '*disable*' (i.e. make *hors de combat*) adverse combatants and that uselessly aggravating their suffering would go beyond this purpose.[124] As Boothby states, weapons that would cause such suffering '*exceed the legitimate object to be accomplished by States in war. If it exceeds that which is legitimate, it is illegitimate and thus unlawful*.'[125]

technology.com/features/featuretaranis-neuron-europe-combat-drone-revolution-4220502/>; Israel Aerospace Industries, 'Harop' (IAI, 2018) Accessed 24 June 2020. Available at:<https://www.iai.co.il/p/harop>; Noel Sharkey, 'Killer Robots From Russia Without Love' (Forbes, 2018) Archived:<https://web.archive.org/web/20181128204229/https://www.forbes.com/sites/noelsharkey/2018/11/28/killer-robots-from-russia-without-love/>; Scott Wierzbanowski, 'Collaborative Operations In Denied Environment (CODE)' (DARPA, 2018) Archived:<https://web.archive.org/web/20190430115949/https://www.darpa.mil/program/collaborative-operations-in-denied-environment>.

[122] Fisheries (United Kingdom v Norway) Judgement [1951] ICJ Reports, p.116, p.131; ILC 2018, Conclusion 15 and accompanying commentary; International Law Commission, ' Report of The International Law Commission on the Work of its Seventieth session' (2018) UN Doc. A/73/10, para.66, Commentary to Conclusion 15.

[123] For a medical perspective on this concept from the ill-fated SIrUS project, see Robin M. Coupland and Peter Herby, 'Review Of The Legality Of Weapons: A New Approach' (1999) 81 International Review of the Red Cross, 583; See also McClelland (n.2) 400.

[124] This concept is repeated in Nuclear Weapons Opinion (n.34) para.78.

[125] Boothby 2016 (n.33) 47.

This prohibition is restated in API and is a customary rule in IACs and NIACs (according to the ICRC); it deals with those weapons '*of a nature*',[126] rather than those that are '*calculated to cause*', unnecessary suffering or superfluous injury.[127] This is an important distinction. A weapon of a nature to cause such prohibited harm would create that damage whenever it is used,[128] whereas one that is used with the intention to cause such injury would not always do so.[129] This is not to say that a weapon the result of which is great or horrendous suffering,[130] or no chance of survival,[131] is necessarily banned. One can only judge what is superfluous or unnecessary in comparison to what *is* necessary.[132] This principle outlaws weapons '*of a nature*'[133] to cause such injuries, and a weapon would only fail a review on this ground if the harm caused by the weapon goes beyond military necessity for all circumstances.[134] This is consistent with IHRL, where a distinction can also be made between weapons of a nature to cause superfluous injury or unnecessary suffering and those that could be used to cause such harm.[135] A weapon causing superfluous injury or unnecessary suffering may be in qualitative terms (the weapon causes an increased level of suffering to the target(s)), or quantitative (the weapon causes harm to more people than those targeted).[136]

With regard to AWS, there is nothing about the *autonomous* nature of such machines that would necessarily generate a level of harm unnecessary for all situations. Indeed, whether the selection and engagement of targets is done by a system using AI software or by a human being has

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[126] Art.35, API; ICRC Study, Rule 70.
[127] The discrepancy comes from a difference in translation from the original French versions of the 1899 and 1907 Hague Conventions, respectively. See Roberts and Guelff (n.87) 77, fn.3; Boothby 2016 (n.33) 48-49; However note that '*calculated to cause*' might be the more accurate translation, see US Manual, para.6.6.1., fn.124.
[128] Boothby 2016 (n.33) 49.
[129] Yoram Dinstein, The Conduct Of Hostilities Under The Law Of International Armed Conflict (2nd edn, CUP, 2012) 64.
[130] Legality of the Threat or Use of Nuclear Weapons, Dissenting Opinion of Judge Higgins [1996] ICJ Reports, p.583 (Hereafter: Higgins Dissenting Opinion) paras.13-18.
[131] Dinstein (n.129) 65.
[132] McClelland (n.2) 400, *'Without determining what is militarily necessary it will not be possible to establish whether injuries are superfluous or the suffering unnecessary*.'
[133] Art.35, API; ICRC Study, Rule 70.
[134] See W. Hays Parks, 'Means And Methods Of Warfare' (2006) 38 George Washington International Law Review, 517, fn.25.
[135] Murray (n.39) para.7.04.
[136] McClelland (n.2) 407.

no bearing on the subsequent damage that will be caused: assuming the same munitions are used, the injuries caused would be the same regardless how a decision to fire was made. Thus, the issue of whether a weapon is of a nature to cause superfluous injury or unnecessary suffering is, in fact, directly related to the munitions used by the system rather that its control processes.

One could argue that, as with drones used in counterterrorism operations,[137] AWS create psychological harm to those living in their zones of operation and therefore cause an unnecessary level of suffering. Whilst psychological suffering is horrific, this rule is focussed upon prohibiting '*the employment of arms which uselessly aggravate the sufferings of disabled men, or render their death inevitable*.'[138] It is, therefore, focussed upon physical injury and the psychological implications of using AWS do not fit within the understanding of this weapon review criteria.

Consequently, there is nothing about autonomy in a weapon system that necessarily makes it cause superfluous injury or unnecessary suffering, and so, generally, AWS could not fail a weapons review under this ground. By adjudging that issues of superfluous injury and unnecessary suffering are related to the munitions used by an AWS, rather than the system itself, a reviewer can exercise their procurement control to ensure that prohibited munitions are not used with AWS.

### 5.4. Environmental harm

With regard to the international legal protections of the environment in times of armed conflict, those rules that are most relevant to the use of AWS in military operations are contained in the 1976 Convention on the prohibition of military or any hostile use of environmental modification techniques (ENMOD treaty) and in API. The ENMOD treaty prohibits

[137] James Cavallaro, Stephan Sonnenberg and Sarah Knuckey, 'Living Under Drones: Death, Injury And Trauma To Civilians From US Drone Practices In Pakistan' (International Human Rights and Conflict Resolution Clinic, Stanford Law School and NYU School of Law, Global Justice Clinic 2012.

[138] St Petersburg Declaration (n.68); also note that there are no references made to psychological harm in the commentary to Rule 70 of the ICRC Study, nor in the API commentary regarding the scope of the prohibition, Sandoz et al. (n.33) paras.1417-1425.

'*military or any other hostile use of environmental modification techniques having widespread, longlasting or severe effects as the means of destruction, damage or injury to any other State Party.*'[139]

Such a level of harm would require

'*serious or significant disruption or harm to human life, natural and economic resources or other assets*' for '*a period of months'* approximating a season over '*an area on the scale of several hundred square kilometres.*'[140]

Environmental modification techniques are a method of warfare specifically designed to use the natural environment as a weapon.[141] In order to enable this, an AWS would need to be specifically programmed to perform, or learn, such techniques. Thus, the required specificity of the programming indicates that this would not be a general feature of AWS, and, through their exercise of procurement control, a reviewer would need to advise manufacturers not to include such programming in a system. Therefore, weapon systems with autonomy would generally pass this part of the review. Ensuring that such capabilities are not present in an AWS is an exercise of technical control that, through technological management, should close the 'door' and prevent these unlawful capabilities being included in an AWS.

In terms of the environmental protections in API,[142] this relates to prohibiting the use of environmentally damaging weapons such as defoliants or pollutants according to the treaty negotiations.[143] Thus, those weapons that cause '*widespread, long-term and severe'* environmental damage are prohibited by the protocol. Although an almost identical term is used in the ENMOD

[139] Art.1, ENMOD Treaty.
[140] ENMOD Treaty Annex, 'Understandings regarding the Convention'.
[141] US Manual, para.6.10.3, fn.215.
[142] Arts.35(3) and 55, API.
[143] Sandoz et al. (n.33) paras.1443, 1450; note that the US interprets this to mean 'herbicides', see US Manual, para.6.17.

treaty,[144] the formulation in API is less firm. The API rapporteur suggested that precise agreement on defining these terms was impossible, and that the most cogent understanding of the API rules is:

> '*What the article is primarily directed to is thus such damage as would be likely to prejudice, over a long term, the continued survival of the civilian population or would risk causing it major health problems*.'[145]

IHRL is consistent with this understanding and can provide additional regulation of weapons that may affect the sustainability of food and water, or other objects indispensable for survival, for the civilian population.[146]

As the API prohibition relates primarily to munitions that have an environmentally damaging effect of the prohibited level, this does not affect AWS unless they are equipped with such munitions. Even then, it would be the munitions themselves that are unlawful, rather than the AWS. However, should a particular model of AWS use a radioactive or carcinogenic substance as part of its propulsion system, for example, and there was a particular risk of exposure to such a substance if the AWS was damaged, this could give rise to that particular system failing a review. But, this is not related to the *autonomous* nature of AWS and so could not apply to all *autonomous* systems.

Thus, in their exercise of procurement control, a reviewer could, if possible, require developers to produce an AWS so that it cannot use an environmentally damaging munition. For example, the AWS could be programmed not to fire a missile unless a code associated with a pre-approved type of (non-environmentally harmful) munition was inputted prior to its mission. Where this is not possible, a reviewer would need to advise commanders to avoid equipping environmentally harmful munitions to an AWS. Ergo, compliance with this rule is dependent upon tactical control, but could potentially also involve technical control. Note also that attacks using conventional means that

[144] Note the difference between '*long-term'* in API, and '*longlasting'* in the ENMOD treaty.
[145] Report of the Rapporteur, cited in Sandoz et al. (n.33) paras.1454; Also note Boothby 2016 (n.33) 83.
[146] Murray (n.39) para.7.10, see also Section 5.1 in the next Chapter.

could cause a similarly prohibited level of harm are discussed separately in the next Chapter (Section 5).

### 5.5. Of an indiscriminate nature

The consideration of whether a weapon is of an indiscriminate nature is sometimes thought to relate only to the prohibition of such weapons found in API.[147] However, it has a much deeper history. The API rules prohibiting weapons that cannot be directed at a military objective[148] or cannot be controlled[149] are actually orientated to prohibit weapons that are incapable of being used in accordance with the distinction and proportionality targeting principles, respectively.[150] Distinction prohibits attacks against civilians and civilian objects.[151] For it to be impossible for a weapon to abide by this rule, it would need to be so inaccurate that it cannot be relied upon to hit the target it is aimed at.[152] Weapons that have contravened this part of the prohibition include bombs attached to balloons and rockets without guidance systems.[153]

Proportionality requires that, if there is incidental harm to civilians to be expected from an attack, it is prohibited for it to be excessive in comparison to the military advantage to be gained.[154] For it to be impossible to use a weapon in accordance with this rule, it would need to have uncontrollable effects such that there is an inevitability of excessive civilian harm.[155] Therefore, the minimal military utility associated with such weapons is always outweighed by the incidental harm.[156]

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[147] Chengeta (n.64) 94.
[148] Art.51(4)(b), API.
[149] Art.51(4)(c), API.
[150] US Manual, para.6.7; Higgins Dissenting Opinion, para.24; Michael N. Schmitt, 'The Principle of Discrimination in Twenty First Century Warfare', in Michael N. Schmitt, Essays On Law And War At The Fault Lines (TMC Asser Press, 2012) paras.8 and 14; Michael W. Meier, 'Lethal Autonomous Weapon Systems (LAWS): Conducting A Comprehensive Review' (2016) 30 Temple International and Comparative Law Journal, 119, 129.
[151] Arts.48 and 52(2), API; Art.13(2), APII; ICRC Study, Rules 1 and 7.
[152] Art.51(b), API; ICRC Study, Rule 12(b).
[153] US Manual, para.6.7.3; Schmitt (n.150) para.8.
[154] Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14.
[155] Art.51(c), API; ICRC Study, Rule 12(c).
[156] US Manual, para.6.7.4

Examples of such weapons include communicable diseases,[157] tiny incendiary devices tied around the necks of bats,[158] and anti-tank mines strapped to the back of dogs.[159]

At this point, it is important to note that an AWS could be equipped with nuclear weapons. It has been suggested that the massive destructive force of nuclear weapons would always make their use disproportionate and therefore they are indiscriminate weapons.[160] However, it is not impossible to imagine that the use of nuclear weapons in a military area without civilian presence could be lawful, particularly if low-yield nuclear weapons are used.[161] As such, an AWS equipped with nuclear weapons would not necessarily be indiscriminate,[162] even if the opportunities for lawfully using nuclear weapons are very rare.

A weapon that would always violate the distinction and proportionality rules is prohibited.[163] By preventing such indiscriminate weapons from passing review, a weapons reviewer encourages more accurate weapons to be developed. Increased precision allows for force to be applied to the exact intended target, and simultaneously reduce incidental civilian harm. Consequently, in this area, military and humanitarian concerns converge.[164] Further, as IHRL requires the force applied to be the minimum that is absolutely necessary, weapons that go beyond this to create disproportionate, and therefore indiscriminate, levels of harm are inconsistent with this rule.[165]

One should not, however, view the fact that highly-accurate weapons increase the ability of a military force to abide by the distinction and proportionality rules as meaning that less-accurate weapons cannot be used in accordance with them. Indeed, weapons should be assessed in terms of

[157] US Manual, para.6.7.4; Schmitt (n.150) para.8.
[158] See Greenwood referring to an example provided by the US Navy, cited in US Manual, p.340, fn.151.
[159] Turns (n.45) 235.
[160] Nuclear Weapons Opinion (n.34) para.92.
[161] See Nuclear Weapons Opinion (n.34) para.94.
[162] See Nuclear Weapons Opinion (n.34) para.95.
[163] Nuclear Weapons Opinion (n.34) para.78.
[164] Sandoz et al. (n.33) para.1958; note also Boothby 2016 (n.33) 60-61, 69; McClelland (n.2) 408.
[165] Murray (n.39) para.7.09.

their intended use[166] and a weapon that is not very accurate could, for example, still be intended to be used against areas of land which become military objectives.[167] Thus, it would not be indiscriminate or prohibited.[168]

Regarding the low threshold for weapons to be discriminate, along with the poor military utility of indiscriminate weapons, it suggests that the likelihood of any AWS being inherently indiscriminate is very low.[169] As Boothby notes, the increasing technological sophistication of precision weapons means that this prohibition is increasingly likely to be complied with.[170] Robotic weapons are often highly accurate, with some claiming up to 100% accuracy, due to being able to provide a platform more stable than the human body from which to fire.[171] As such, one would expect an AWS to be highly accurate and discriminating, and to pass this part of review without difficulty.

Normally, the consideration of whether a weapon is indiscriminate, is related to the munitions used as they create the actual effects in the battlespace.[172] However, as AWS will apply algorithms to potentially lethal decisions, it seems appropriate to consider the on-board computer in terms of this rule. This is because, in terms of direction at a military objective, this prohibition is fundamentally about the accuracy of the weapon. With AWS, the accuracy of the system being able to fire a munition at its target is already accounted for, but the accuracy of the AWS in determining the target is not.

This could quite reasonably be considered with the discussion of the distinction targeting rules in the next Chapter. But, it is assessed here as target recognition by AWS first needs to be shown to be possible and accurate before it can be applied to actual targeting situations. Indeed, it is of imperative importance for the reviewer to determine whether the machine can distinguish proposed

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166 Michael W. Meier, 'Lethal Autonomous Weapons Systems Is It the End of the World as We Know It . . . Or Will We Be Just Fine?' in Winston S. Williams and Christopher M. Ford(eds.), Complex Battlespaces: The Law Of Armed Conflict And The Dynamics Of Modern Warfare (OUP, 2019) 306.
167 US Manual, para.6.7.2.
168 US Manual, para.6.7.3-6.7.4.
169 Meier (n.150) 129; Greenwood (n.158).
170 Boothby 2016 (n.33) 69.
171 P.W. Singer, Wired For War (Penguin Press 2009) 31.
172 Boothby 2018 (n.83) 39.

(lawful) targets from non-targets[173] during testing. In terms of the actual technologies which could be used by an AWS to recognise targets, most would appear to need some development before reaching maturity, as the following sub-section demonstrates.

### 5.5.1. Target recognition technologies

Computer vision algorithms would seem to be the predominant data processing method to be used by an AWS as the characteristics that will be recognised by an AWS to indicate a target are likely to be similar to those used by human beings. Such technologies can, in some circumstances, exceed human abilities. People generally have a 5% error rate in classifying images.[174] Machines using computer vision have shown error rates of 4.58%.[175] These, admittedly impressive, tests were carried out under laboratory conditions and not the messy and unstructured real world. Still, these technologies are expected to maintain an exponential rate of progress[176] and will likely be able to replicate their laboratory performance beyond those boundaries in the near future.

Other methods of sensing data from potential targets could include using nano-robotics to sample the metallic content, or '*metallic footprint*', of objects to determine whether it is made of gun metal and therefore a weapon.[177] In terms of objects, this method could potentially identify military equipment such as artillery pieces or tanks. But, in terms of identifying people, this could only

[173] Boothby 2018 (n.83) 39.
[174] Andrej Karpathy, 'What I Learned From Competing Against A Convnet On Imagenet' (Karpathy Github, 2014) Archived:<https://web.archive.org/web/20190914180008/http://karpathy.github.io/2014/09/02/what-i-learned-from-competing-against-a-convnet-on-imagenet/>.
[175] Ren Wu, et al., 'Deep Image: Scaling Up Image Recognition' (2015) <https://web.archive.org/web/20171118111440/https://arxiv.org/pdf/1501.02876v2.pdf>; Alex Hern, 'Computers Are Now Better Than Humans At Recognising Images' (The Guardian, 2015) Archived:<https://web.archive.org/web/20190523144342/https://www.theguardian.com/global/2015/may/13/baidu-minwa-supercomputer-better-than-humans-recognising-images>.
[176] Computing power generally doubles roughly every 18 months. See Gordon Moore, 'Progress In Digital Integrated Electronics' (1975) Technical Digest International Electron Devices Meeting, IEEE, 11. This may be slowing, Tom Simonite, ' Moore's Law Is Dead. Now What?' (MIT Technology Review, 2016) Accessed 24 June 2020. Available at:<https://www.technologyreview.com/2016/05/13/245938/moores-law-is-dead-now-what/>.
[177] William H. Boothby, Conflict Law: The Influence Of New Weapons Technology, Human Rights And Emerging Actors (Asser Press, 2014) 108.

differentiate between those who are armed and those who are not. Using such a method to recognise enemy fighters, for example, could misidentify those who are armed: for personal protection;[178] for ceremonial reasons;[179] police officers; hunters.[180] Further, the development of advanced plastics and objects manufactured using nanotechnologies with reduced metal content indicates that they will likely be used to build weapons and so this method of identifying arms would likely have limited applicability in the future.[181]

In terms of identifying civilians directly participating in hostilities (DPH),[182] because they do not wear a uniform they can usually only be distinguished through their actions. As such, to differentiate from someone who is armed for their own protection and someone who is armed to directly participate in hostilities, one would need to look at their behaviour (for a discussion of this in terms of targeting rules, see Chapter 5, Section 3.2). Some progress has been made toward using AI systems to recognise peoples' intentions and emotions, and proponents suggest could be used to identify when an individual is about to engage in an attack.[183] If this is possible, it could, potentially, be used to identify civilians DPH. However, current attempts at creating technologies for this have so far been unsuccessful.[184] Consequently, it is presently unforeseeable that an AWS could lawfully use a technology to identify a target based upon their emotional state as an indication of their intentions.

Yet, it may be possible to recognise *some* civilians DPH based upon objective behavioural measures. For example, Ford suggests that an AWS using radar and a spectrograph might be able to

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[178] AMW Commentary (n.37) Commentary to Rule 12(a), para.3.
[179] Al-Skeini v United Kingdom, App no:55721/07 (ECtHR, 7 July 2011) paras.35-36.
[180] Jeroen van den Boogaard, 'Proportionality And Autonomous Weapons Systems' (2016) 2016-17 Amsterdam Center for International Law, 15.
[181] Boothby 2014 (n.177) 108, fn.62.
[182] Art.13(3), APII.
[183] SBIR, 'Adversary Behavior Acquisition, Collection, Understanding, And Summarization (ABACUS) Tool' (SBIR, 2012) Archived:<https://web.archive.org/web/20190919095142/https://www.sbir.gov/sbirsearch/detail/398783>.; Noah Shachtman, 'Army Tracking Plan: Drones That Never Forget A Face' (Wired, 2011) Archived:<https://web.archive.org/web/20180910175130/https://www.wired.com/2011/09/drones-never-forget-a-face/>.
[184] Lisa Feldman Barrett, et al., 'Emotional Expressions Reconsidered: Challenges to Inferring Emotion From Human Facial Movements' (2019) 20 Psychological Science in the Public Interest, 1.

detect an individual planting a roadside bomb.[185] Other potential examples include: someone in possession of explosives in or near a combat zone;[186] the presence of an armed individual within a restricted area that is well signposted;[187] a person not from a friendly force firing weapons in a high-intensity combat zone;[188] or a person who attacks the AWS (see Chapter 5, Section 3.3).[189] Programming these abilities would enable distinction of some civilians DPH in some circumstances. However, in areas where celebratory gunfire is common, returning any fire in a combat zone could result in an AWS attacking misidentified civilians.[190]

Other suggestions for recognising civilians DPH involve individualised targeting akin to 'targeted killing'. Where a person has already been adjudged to be a lawful target, an AWS could use facial recognition[191] or iris scanning[192] to identify such persons. On a wider scale, Henderson et al. suggest that if biometric data on enemy forces could be stolen, then they could be targeted individually using similar methods.[193] As with the discussion of target characteristics in the previous Chapter, the lawfulness of engaging in this behaviour would depend upon the quality of criteria.

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[185] Ford (n.117) 438.

[186] Kevin J. Heller, 'One Hell Of A Killing Machine': Signature Strikes And International Law' (2013) 11 Journal of International Criminal Justice, 89, 95-96.

[187] This is the same concept of operations as the Samsung SGR-A1 sentry gun. See John Pike, 'Samsung Techwin SGR-A1 Sentry Guard Robot' (Global Security, 2011) Archived:<https://web.archive.org/web/20190827141904/https://www.globalsecurity.org/military/world/rok/sgr-a1.htm>.

[188] Technologies exist for locating firing weapons, which an AWS could use to identify shooters who would distinguish themselves as directly participating. See Raytheon Corporation, 'Boomerang III' (Raytheon, 2019) Archived:<https://web.archive.org/web/20190820114216/https://www.raytheon.com/capabilities/products/boomerang>.

[189] Such a person would distinguish themselves as directly participating. See Ronald Arkin, Governing Lethal Behaviour In Autonomous Robots (CRC Press 2009) 46, 60. Arkin suggests that an AWS could act as 'bait' to encourage adversaries to fire upon it and distinguish themselves, or fire upon the general direction of adversaries to encourage them to return fire thereby distinguishing themselves.

[190] See, for example, Al-Skeini (n.179) paras.35-36.

[191] Shachtman (n.183).

[192] Such technology is now available on smartphones, see Shams, 'List Of All Eye Scanner (Iris, Retina Recognition) Smartphones' (Webcusp, 2016) Archived:<https://web.archive.org/web/20181122005317/http://webcusp.com/list-of-all-eye-scanner-iris-retina-recognition-smartphones/>.

[193] Ian S Henderson, Patrick Keane and Josh Liddy, 'Remote and autonomous warfare systems: precautions in attack and individual accountability' in Jens David Ohlin (ed.), Research Handbook On Remote Warfare (Edward Elgar, 2017) 346.

### 5.5.2. Simulation, bias, and basic algorithms

In order to test target recognition capabilities, a reviewer might need to evaluate the performance of the system in recognising targets and non-targets in a variety of different situations. Setting up physical facsimiles of the intended operating environments could require significant investment and time, and so a reviewer might use computer simulations.[194] Simulations could be run thousands of times so that a statistical assessment of system performance could be seen and compared to a desired standard.[195]

However, a reviewer might also need to evaluate the simulation software. Weapons reviews are already comprehensive enough to test software related to targeting.[196] Should weapons systems include software that models effects of several potential attacks in order to determine the most appropriate,[197] this would also need to be tested.

With the lawful use of AWS being dependent upon correctly functioning software, a reviewer would need to be aware of potential biases that could be present in the algorithms.[198] If the dataset that targeting algorithms were trained on was developed or curated in such a way that it biases the results, this could create the potential for sexist or racist effects to be produced through, for example, a greater likelihood of recognising a particular type of person as a target.[199] Such effects are unlawful under LoAC.[200]

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[194] Backstrom and Henderson (n.66) 508-509.
[195] Defense Science Board, 'Summer Study On Autonomy' (US Department of Defense, 2016) 29; Meier (n.188) 309.
[196] UK MoD 2016 (n.46) 4
[197] Defense Science Board (n.195) 33-34; Meier (n.188) 312.
[198] Joni R. Jackson, 'Algorithmic Bias' (2018) 15 Journal of Leadership, Accountability and Ethics, 55.
[199] Noel Sharkey, 'The Impact Of Gender And Race Bias In AI' (Humanitarian Law & Policy Blog, 2018) Archived:<https://web.archive.org/web/20190721041416/https://blogs.icrc.org/law-and-policy/2018/08/28/impact-gender-race-bias-ai/>.
[200] Common Article 3(1) to the 1949 Geneva Conventions; Arts. 9(1), 75(1), and 84(4)(c), API

In order to pass review, an AWS would need to display an ability to recognise at least some lawful targets reliably.[201] The system could then be authorised for missions against targets of the same nature which it has previously displayed an ability to recognise.[202] This would allow AWS to be lawfully used even if target recognition technologies do not reach a high level of sophistication and can only be used to identify the most basic of objects, such as the shape of artillery pieces or tanks.[203] The expected incremental development of AWS indicates that as the technology advances,[204] AWS will become lawfully capable of recognising more types of targets in different circumstances. Where this can be shown during review, the system could be authorised for those types of engagements also.

In terms of procurement control, a reviewer should ensure that an AWS can be used in conformity with the distinction and proportionality principles in order to abide by the prohibition on indiscriminate weapons. Through their exercise of technical control, manufacturers can ensure that weapons they produce are not inherently indiscriminate by building them so that they are highly accurate, recognise only those targets they are supposed to, and do not, as a feature of their use, create a level of incidental harm that would be excessive in all circumstances.

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[201] Backstrom and Henderson (n.66) 508.
[202] Bill Boothby, 'Autonomous Attack - Opportunity Or Spectre?' (2015) 16 Yearbook of International Humanitarian Law 2013, 71,78-79; Boothby 2016 (n.33) 253; Boothby 2018 (n.83) 39-40.
[203] Brian Handy (ed.), 'Royal Air Force: Aircraft And Weapons' (Royal Air Force, 2007) 87; John Cherry and Christopher Korpela, 'Enhanced Distinction: The Need For A More Focused Autonomous Weapons Targeting Discussion At The LAWS GGE' (Humanitarian Law & Policy Blog, 2019) Archived:<https://web.archive.org/web/20190912145902/https://blogs.icrc.org/law-and-policy/2019/03/28/enhanced-distinction-need-focused-autonomous-weapons-targeting/>.
[204] Anderson et al. (n.38) 388-395.

## 5.6. The Martens Clause

The Martens Clause was originally formulated at the 1899 Hague Peace Conference.[205] It has been updated in 1907,[206] 1949,[207] and 1977.[208] Today, the version found in API is commonly used when referring to the Martens Clause:

> '*In cases not covered by this Protocol or by other international agreements, civilians and combatants remain under the protection and authority of the principles of international law derived from established custom, from the principles of humanity and from the dictates of public conscience*.'[209]

The Clause serves two purposes. First, to prevent the assumption that anything not explicitly prohibited in API is permitted (particularly where API reflects CIL at the time of adoption).[210] Second, to ensure that the principles detailed in API apply regardless of future developments in conflict situations or technologies.[211] Clearly then, due to the lack of specific regulation of AWS, and their novelty, the Martens Clause is relevant to AWS. This rule is of particular relevance to Article 36, as it could come within the '*any other rule of international law*' element of that obligation. As such, it could be applied during a weapons review. Indeed, the ICRC suggests that states should apply the Martens

[205] Preamble, Convention (II) with Respect to the Laws and Customs of War on Land and its annex: Regulations concerning the Laws and Customs of War on Land (adopted 29 July 1899, entered into force 4 September 1900).
[206] Preamble, Hague Convention (IV) 1907 (n.93).
[207] Art.64, Geneva Convention (I) for the amelioration of the condition of the wounded and sick in armed forces in the field (adopted 12 August 1949, entered into force 21 October 1960) 75 UNTS 31; Art.62, Geneva Convention (II) for the amelioration of the condition of the wounded, sick and shipwrecked members of the armed forces at sea (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 85; Art.142, Geneva Convention (III) relative to the treatment of prisoners of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 135; Art.158, Geneva Convention (IV) relative to the protection of civilian persons in time of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 287.
[208] Preamble, APII.
[209] Art.1(2), API.
[210] Nuclear Weapons Opinion (n.34) para.84.
[211] Sandoz et al. (n.33) para.55.

Clause during their weapons reviews.[212] Australia is the only country to publicly acknowledge they do so.[213]

The Clause is, however, difficult to understand and apply as it has been subject to widely differing interpretations. In a report by Human Rights Watch (HRW), they argue that AWS contravene the '*principles of humanity and the dictates of public conscience*.'[214] However, this is based upon a moralistic understanding of humanity,[215] rather than a legal one,[216] with HRW focussing on how empathy and compassion are required in order to treat others humanely.[217] Yet, treating others humanely and the '*principles of humanity*' in the Martens Clause are not the same thing.

The work of Meron[218] and Cassese[219] suggests that not only are there legal understandings of humanity in the Martens Clause (which is different from the principle of humanity that is sometimes referred to in LoAC),[220] but that relevant case law and documents generally reflect basic LoAC provisions of: the rules in Common Article 3;[221] the prohibition on targeting civilians;[222] the limitation on means and methods;[223] the prohibition on torture;[224] the principle of distinction;[225] sparing civilians

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[212] ICRC (n.39) 17.
[213] Australian UNOG Delegation (n.4) 5.
[214] Art.1(2), API.
[215] Human Rights Watch, 'Heed The Call' (Human Rights Watch, 2018) 19-27.
[216] See Theodor Meron, 'The Martens Clause, Principles Of Humanity, And Dictates Of Public Conscience' (2000) 94 The American Journal of International Law, 78; Antonio Cassese, 'The Martens Clause: Half A Loaf Or Simply Pie In The Sky?' (2000) 11 European Journal of International Law, 187.
[217] HRW (n.215) 21.
[218] Meron (n.216) 82-83.
[219] Cassese (n.216) 202-208.
[220] Meaning that '*infliction of suffering, injury, or destruction unnecessary to accomplish a legitimate military purpose*' is forbidden. US Manual, para.2.3
[221] Case Concerning Military And Paramilitary Activities in and Against Nicaragua (Nicaragua v United States of America) Merits [1986] ICJ Reports, p.14, para.218; The Corfu Channel Case (UK v Albania) Judgement [1949] ICJ Reports, p.4, 22; United Nations: Secretary-General's Report On Aspects Of Establishing An International Tribunal For The Prosecution Of Persons Responsible For Serious Violations Of International Humanitarian Law Committed In The Territory Of The Former Yugoslavia (1993) 32 International Legal Materials, 1159, 1191.
[222] Prosecutor v Martić (Trial Judgement) Case No: IT-95-11-T [2007] ICTY, para.13.
[223] Martić (n.222) para.13; Report On The Situation Of Human Rights In Kuwait Under Iraqi Occupation, Walter Kälin (Economic and Social Council, 48th Session) 1992 UN Doc. E/CN.4/1992/26, para.36
[224] Prosecutor v Furundžija (Trial Judgement) Case No: IT-95-17/1 [1998] ICTY, para.137; Klinge case (1946), Annual Digest and Reports of Public International Law Cases, Year 1946, 263, and K.W. case (1950), 30 Revue de droit penal de criminologie (1949-1950) 562-568, cited in Cassese (n.216) 202-203, 207.
[225] Kälin (n.223) para.36

as much as possible;[226] the prohibition on belligerent occupiers exercising collective punishment;[227] acts not prohibited not being automatically permitted;[228] delineating the degree and types of violence that may be used by belligerents.[229] Thus, the understanding of '*humanity'* that HRW suggest not only does not have any basis in law, but law itself suggests a completely different conception.

Further, the HRW report also overemphasises the impact which public opinion can have in terms of the Martens Clause and seems to suggest that a general groundswell of public opinion would create a legal rule.[230] As Meron notes, there is no elaboration in international law as to how public conscience should be observed, quantified, or implemented. Further, he reminds us that public opinion can easily be swayed under certain circumstances, such as the popularity of anti-Semitism and fascism prior to World War II,[231] and so should not always be listened to. Furthermore, Greenwood argues that 'public conscience' is such a vague concept that it is impractical and has garnered little support anyway.[232] Thus, despite the arguments of HRW, there is no delineated threshold that would enable public opinion to outlaw a means or method of warfare and so it cannot function as a legal notion.

Whilst '*humanity*' in terms of the Martens Clause could be defined as a multi-dimensional workable legal concept, it is not applied in practice and nor are the '*dictates of public conscience*'.[233] In the Australian weapons review process, the Martens Clause is used

[226] Kälin (n.223) para.36
[227] Rauter case (1949), Annual Digest and Reports of Public International Law Cases, Year 1949, 541, cited in Cassese (n.216) 203-204.
[228] Colombian Constitutional Court Ruling No. C-225/95, 207-208.
[229] The War Office, The Law Of War On Land (HMSO, 1958) para.3.
[230] HRW (n.215) 28-43.
[231] Meron (n.216) 83-85.
[232] Christopher Greenwood, Historical Development and Legal Basis', in: Dieter Fleck and Michael Bothe, The Handbook Of Humanitarian Law In Armed Conflicts (1st edn, OUP, 1995) para.129(2).
[233] Note, however, that the ICRC does suggest considering a weapon in terms of the principles of humanity and the dictates of public conscience where treaty law is silent. See, ICRC (n.39) 17.

*'in the narrow sense of preserving customary international law. That is the Martens clause 'prevents the assumption that anything which is not explicitly prohibited by the relevant treaties is therefore permitted.''*[234]

Indeed, the Clause is a reminder that customary principles apply even in the absence of specific regulation.[235] Therefore, if customary law is applied as part of the weapons review framework, the Clause is already taken into account when evaluating weapons.[236] Still, Dinstein notes that it may enable an evolved understanding of customary principles to be applied to weapons assessments.[237] Consequently, as CIL rules have already applied alongside treaty rules in the earlier discussion of the weapons review framework, it has already been established that AWS could be used in conformity with the Martens Clause. Thus, an exercise of procurement control would enforce the Martens Clause by not approving weapons which could not be used in accordance with customary rules.

6. Guidance

This Chapter has alluded to the concept of a weapon only being authorised for use in certain situations. The US[238] and Australian[239] weapons review policies refer to reviewers providing advice/guidance on the use of a weapon once it has passed review.[240] Therefore, a reviewer could advise that an AWS should only be used in particular circumstances.[241] A reviewer could also suggest that AWS commanders/operators should carry out particular training, or changes to doctrine for using the weapon.[242] As such, in evaluating weapons, not only does the reviewer set the boundaries that

[234] Australian UNOG Delegation (n.4) 5, citing Sandoz et al. (n.33) para.55; note suggestions for reviewing new weapons against customary law separately from the Martens Clause, see Daoust et al. (n.56) 350-351.
[235] William H Boothby, New Technologies And The Law In War And Peace (CUP, 2019) 40; Greenwood (n.232) para.129(2); for other interpretations of the Martens Clause, see Sean Watts, 'Regulation-Tolerant Weapons, Regulation-Resistant Weapons And The Law Of War' (2015) 91 International Law Studies, 540, 557-558.
[236] Meier (n.166) 306-307.
[237] Dinstein (n.129) 9, citing Greenwood (n.232).
[238] US Manual, para.6.2.2.
[239] Australian UNOG Delegation (n.4) 6.
[240] Also note Boothby 2016 (n.33) 345-346; Boothby 2018 (n.83) 39-40.
[241] Boothby 2018 (n.83) 39-40.
[242] US Manual, para.6.2.2.

manufacturers must abide by in order to produce a lawful weapon (see Section 2), they can also place requirements onto operators/commanders to ensure lawful use of AWS.[243]

For example, a reviewer could require a particular standard of accuracy in target recognition to be satisfied that an AWS will recognise lawful targets, or require a manufacturer to include relevant safety features such as deactivation processes.[244] This safeguard is currently in development.[245] A reviewer could also require operators/commanders to exercise their human judgement in evaluating the proportionality of an intended attack. As the next Chapter demonstrates, this guidance will have a significant impact upon how AWS are used.

In terms of testing, however, an important point to note is that some algorithms produced today are so complex that they cannot be understood by human beings. As such, this creates massive difficulties for manufacturers, reviewers, and users of systems to actually understand what the system will do, and how it uses the algorithms it is programmed with.[246] Where a reviewer cannot understand or adequately test a weapon, they should not pass it for review as a lack of knowledge about the workings of the system would prevent the provision of adequate guidance to commanders and operators of AWS. Such knowledge is required for operators to fulfil their legal duties,[247] and for the exercise of command responsibility.[248] Where this information cannot be provided, it could constitute

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[243] Corn (n.5) 233.
[244] Lewis (n.51); Laurent Orseau and Stuart Armstrong, 'Safely Interruptible Agents.' (2016) Proceedings of the 32nd Conference on Uncertainty in Artificial Intelligence, 25-29 June 2016) 68.
[245] Cherry and Korpela (n.203).
[246] See Joshua G. Hughes, 'The Law Of Armed Conflict Issues Created By Programming Automatic Target Recognition System Using Deep Learning Methods' (2018) 21 Yearbook of International Humanitarian Law, 99.
[247]Marco Sassóli, 'Autonomous Weapons And International Humanitarian Law: Advantages, Open Technical Questions And Legal Issues To Be Clarified' (2014) 90 International Law Studies, 308, 324; Ford (n.117) 456.
[248] Command responsibility involves ensuring that subordinates are adequately trained in LoAC. If this standard can be applied, *mutatis mutandis*, to AWS, then this would require a commander to ensure that such systems are compliant with relevant international law. See Decision Pursuant to Article 61(7)(a) and (b) of the Rome Statute on the Charges of the Prosecutor Against Jean-Pierre Bemba Gombo (Pre-Trial Chamber II) Case No: ICC-01/05-01/08-424 [2009] ICC, para.438

a state failure to fulfil its obligations under Article 36.[249] As such, a reviewer could require manufacturers to produce AWS with algorithms that are understandable, or can be explained.[250]

Where, however, a system is not found to perform satisfactorily in particular circumstances, then reviewers should recommend that an alternative means of warfare is used in such situations.[251] Alternatively, they could suggest certain changes to the functioning of a system that would enable legal compliance[252] (for example the use of an AWS in a *semi-autonomous* mode). Where an AWS fails to perform the required tasks, it would fail a review.

## 7. Conclusion

At the outset of this Chapter, we saw that evaluating AWS using realistic interpretations of their capabilities is key to a successful review. Such understanding is also key to knowing if a system using machine learning needs re-review.

We have evaluated AWS in terms of weapons law and determined that there is nothing in the *autonomous* nature of these systems that would cause them to be necessarily unlawful under this regime: they are not specifically prohibited, or likely to be so; they do not necessarily cause superfluous injury or unnecessary suffering; they would not necessarily cause a prohibited level of environmental harm; they are not inherently indiscriminate; they do not breach the Martens Clause.

The discussion of prohibited weapons yielded useful suggestions of good practice: that AWS should be kept under some level of human control; that when AWS operate beyond direct human control, they should be restricted in their *autonomous* functions in terms of time, space, and effects. In addition, the discussion of weapons which are inherently indiscriminate concluded that, in terms of

[249] Sassóli (n.247) 324.
[250] Note that Lewis suggests transparency of algorithms is a key aspect of successfully reviewing a system using AI. See Lewis (n.51).
[251] Boothby 2018 (n.83) 41.
[252] Boothby 2018 (n.83) 43.

AWS, the ability of the system to distinguish targets from non-targets was the deciding factor for whether a weapon with autonomy should pass a review on this ground because most munitions these days are highly accurate. Indeed, it is the control system that is most relevant to lawful targeting.

The exercise of procurement control is key to the development and eventual use of AWS, as the exercise of this concept should, as Corn notes, make unlawful use of AWS unforeseeable.[253] Thus, the reviewer, in their guidance, should set boundaries within which an AWS *could* be used lawfully; for this thesis, the implementation of guidance can be seen as creating a layer of procurement control. By providing feedback to AWS developers, they enable some undesirable behaviours to be made impossible through technological management in an exercise of technical control. Further, if AWS users follow their advice on how AWS should be used then they enable and promote the lawful use of AWS, and no legal issues should arise. Thus, weapons reviews are a key event for implementing human control over AWS in the procurement and technical layers, and for contributing to AWS being developed in compliance with the applicable law so as to enable lawful use of AWS under technical control.

Consequently, we can see that current international law rules *are* sufficient to regulate the development of AWS as their real-world application would ensure AWS that pass review cannot be, by their nature, unlawful. However, this requires the flexibility of the weapons review framework to be used to expand the consideration of inherently indiscriminate weapons from its usual concerns of the accuracy and effects of munitions to incorporate looking at the ability of an AWS to distinguish targets. It is the ability of the framework to be used flexibly that enables current international law to sufficiently regulate AWS as weapons. If the weapons review framework is strictly applied, and the *autonomous* nature of AWS is not adequately evaluated, then current international law would not be able to regulate AWS properly and so would be insufficient.

[253] Corn (n.5) 233.

As such, it is the quality of the review that determines whether AWS are sufficiently regulated by weapons law. Therefore, a conclusion of this Chapter that AWS are lawful weapons should not be construed as suggesting that all future AWS would be lawful weapons. The next Chapter shows how they could be used lawfully.

Chapter 5: Applying targeting law to the use of AWS

1. Introduction

Having applied the legal rules governing weapons to autonomous weapon systems (AWS) and determined that they can sufficiently regulate AWS in terms of them being a means of warfare, this thesis now turns to consider the efficacy of targeting law rules with regard to the use of AWS. To do so, this Chapter demonstrates how the exercise of tactical control within the limitations of technical control, and the guidance of procurement control, can enable the lawful use of AWS.

Targeting is often thought to be the sole preserve of fighters in the battlespace. However, according to the US Department of Defense, targeting is '*The process of selecting and prioritizing targets and matching the appropriate response to them, considering operational requirements and capabilities.*'[1] As developers populate the database that AWS will use to recognise targets, they are clearly involved in the selection of targets within this process. Consequently, targeting law must also be considered during the manufacturing stages of an AWS – which is happening with some advanced systems using autonomy.[2]

It is important to demonstrate the enduring influence of developers that, via programming, affects how AWS will perceive and recognise targets.[3] Such technical control exists above the tactical control exerted through operators/commanders instructing AWS in terms of where, when, and what

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[1] US Department of Defense, DOD Dictionary Of Military And Associated Terms (US DOD, 2018)(Hereafter: DoD Dictionary) see 'Targeting'.
[2] Keith Rigby, 'Future Design Drivers For Autonomous Systems Technology' (Royal Aeronautical Society, London, 19 July 2017), Rigby, who leads development of the Taranis UAV, stated that parts of Dennis Mandsager (ed.), Rules Of Engagement Handbook (International Institute of Humanitarian Law, 2009) were being incorporated into the programming of the Taranis system.
[3] Tim McFarland, 'Autonomous Weapons And Human Control' (Humanitarian Law & Policy, 2018) Archived:<https://web.archive.org/web/20190719081210/https://blogs.icrc.org/law-and-policy/2018/07/18/autonomous-weapons-and-human-control/>; Brian Handy (ed.), 'Royal Air Force: Aircraft And Weapons' (Royal Air Force, 2007) 87; Vincent Boulanin and Maaike Verbruggen, Mapping The Development Of Autonomy In Weapon Systems (SIPRI, 2017) 24; Joseph Weizenbaum, Computer Power And Human Reason (WH Freeman, 1976) 260.

targets to attack, and which munitions should be used.[4] Before a commander can use an AWS to perform a task, the developer must build the capability to perform that task into the AWS. Therefore, these systems apply the instructions set by the commander/operator according to their programming.[5] A weapon system that is employed in targeting would have already been through a weapons review, and so should only be used within the boundaries set by the reviewer in their guidance for using the AWS. Thus, having the recognition of targets under technical control, how the AWS will function on each mission under tactical control, and both of these subject to the procurement control of a reviewer shows that targeting is a clear example of how AWS operate within layers of control.

The legal rules governing targeting are found in customary international law (CIL),[6] treaty law,[7] and case law[8] that make up the law of armed conflict (LoAC) and international human rights law (IHRL) as is applicable to targeting. Also relevant are the domestic military manuals of states,[9] and international expert manuals.[10] The violation of the legal targeting rules results in responsibility and is discussed in the next Chapter.

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[4] Christopher M. Ford, 'Autonomous Weapons And International Law' (2017) 69 South Carolina Law Review, 413, 455.

[5] Elliot Winter, 'Autonomous Weapons In Humanitarian Law: Understanding The Technology, Its Compliance With The Principle Of Proportionality And The Role Of Utilitarianism' (2018) 6 Groningen Journal of International Law, 183, 193.

[6] The CIL rules in Jean-Marie Henckaerts and Louise Doswald-Beck, Customary International Humanitarian Law, Volume I: Rules (CUP, 2005)(Hereafter: ICRC study) are used as a guide to the applicable rules, having noted the criticisms and overall positive reception of it in Chapter 3.

[7] There are many treaties governing and regulating the conduct of hostilities, for a detailed list see Adam Roberts and Richard Guelff, Documents On The Laws Of War (3rd edn, OUP, 2004).

[8] See, for example, Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion [1996] ICJ Reports, p.226.

[9] For example, UK Ministry of Defence, Manual Of The Law Of Armed Conflict (OUP, 2004)(Hereafter: UK Manual); US Department of Defense, Law Of War Manual 2015, Updated May 2016 (Office of the General Counsel, 2016)(Hereafter: US Manual); Canadian Office of the Judge Advocate General, Law Of Armed Conflict At The Operational And Tactical Levels (National Defence, 2001); Australian Defence Headquarters, Law Of Armed Conflict, ADDP 06.4 (Defence Publishing Service, 2006); Germany, Federal Ministry of Defence, Law Of Armed Conflict Manual (2013); Jes Rynkeby Knudsen, Military Manual On International Law Relevant To Danish Armed Forces In International Operations (Danish Ministry of Defence, 2016).

[10] For example, HPCR, 'Manual On International Law Applicable To Air And Missile Warfare' (Harvard University 2009) (AMW Commentary); Michael N. Schmitt and Liis Vihul (eds), Tallinn Manual 2.0 On The International Law Applicable To Cyber Warfare (CUP, 2017)(Hereafter: Tallinn Manual).

In Chapter 2, we saw that the *autonomous* use of AWS during armed conflicts in the near to medium-term is likely to be for attacks in communication-denied environments, and in situations of combat at super-human intensities. Both of these situations would be instances of active hostilities and so LoAC would be the primary legal framework (*lex specialis*) with IHRL reinforcing its provisions as a supplementary legal framework.[11] Recall also from Chapter 3 that the human rights jurisdiction of states exists where states have *de facto* control over territory, where state agents exercise control or authority over a person, or a state is exercising public powers, and this triggers the application of IHRL obligations with regard to the actions of military personnel from that state. In this Chapter, the IHRL discussion centres around the substantive obligation under the right to life, although others are mentioned where relevant.

The reinforcement of LoAC rules by IHRL does not necessarily create onerous additional steps for a military force engaged in combat, as human rights obligations can be interpreted flexibly in these situations. Where there are no serious time constraints regarding the use of AWS, the actions of the force deploying them will be subject to close scrutiny.[12] Where a fast response is required by AWS users, the level of scrutiny will not be as close.[13] If an operation includes both pro-active and reactive elements, there will be flexibility with regard to those aspects that do not allow for much deliberation.[14]

If a human rights tribunal examines an attack, the force under investigation will be required to explain, and provide evidence of, its rationale for choosing the means and methods used in the attack and why others were not selected. Generally, such a question would focus on why less harmful means and methods were not used. For example, why use an air strike to achieve a goal when ground

[11] For more on this, and situations of 'Active Hostilities' in comparison with 'Security Operations' (where IHRL would be the primary framework with LoAC being a supplementary framework), see, Daragh Murray, Practitioners' Guide To Human Rights Law In Armed Conflict (OUP 2016) paras. 4.25-4.71.
[12] Esmukhambetov and Others v Russia, App no:23445/03 (ECtHR, 29 March 2011) para.138; Isayeva v Russia, Judgment, App no:57950/00 (ECtHR, 24 February 2005) para.184-200.
[13] Ahmet Ozkan and Others v Turkey, App no:21689/93 (ECtHR, 6 April 2004), paras.296-305.
[14] Murray (n.11) para.5.57.

troops could likely achieve the same with less civilian harm.[15] With regard to AWS, a force should be required to explain, and evidence, why an attack used such a system and why it was deployed in a *fully-autonomous* mode, rather than a *semi-autonomous* one, and what the level of human oversight was and why. This would be particularly relevant to cases where the circumstances at the site of attack change after an AWS is launched and the actual level of civilian harm is greater than expected.[16] As the next Chapter details, violations of IHRL are a matter of state responsibility, but the same conduct might breach rules of individual criminal responsibility also.

2. Legal issues of technical and tactical control within procurement control

With regard to the legal rules relevant to targeting, the following LoAC rules are considered in terms of technical and tactical control: distinction;[17] the prohibition on indiscriminate attacks;[18] the rules on environmental protection;[19] precautions in attack.[20] Although the proportionality principle is often discussed in its own right, it is discussed here in terms of its constituent parts in the rules on indiscriminate attacks and precautions in attack.[21] Further, some of these rules make very similar requirements and so there is some overlap between the analysis of them in this Chapter. As IHRL is a secondary framework in this discussion, such rules are applied as reinforcement for each of the LoAC obligations, but these would only be applicable where the situation is within the human rights jurisdiction of a state, subject to derogations.

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[15] Esmukhambetov (n.12) para.148.
[16] Marco Sassóli, 'Autonomous Weapons And International Humanitarian Law: Advantages, Open Technical Questions And Legal Issues To Be Clarified' (2014) 90 International Law Studies, 308, 331-332.
[17] Art.48, Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 3 (Hereafter: API); Art.13(2), Protocol Additional To The Geneva Conventions Of 12 August 1949, And Relating To The Protection Of Victims Of Non-International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 609 (Hereafter: APII); ICRC Study, Rules 1 and 7.
[18] Art.51, API; ICRC Study, Rule 11.
[19] Art.35(3), API; ICRC Study, Rules 43-45.
[20] Art,57, API; ICRC Study, Rules 15-21.
[21] Arts.51(5)(b), 57(2)(a)(iii), and 57(2)(b), API.

The importance of applying these rules to weapons developers is underlined by the fact that once target characteristics are inputted into an AWS database,[22] any entity matching these criteria could be attacked. This, therefore, suggests that such entries should be regularly re-reviewed. Indeed, target lists for targeted killing are reconsidered every 60 days.[23] Having regular chances to update target criteria not only reduces the likelihood that civilians will be misidentified, but also provides the benefit of being able to keep up with adversaries who make changes to the exterior of their clothing or equipment to increase the camouflage effect. This would require accurate and consistent data collection.[24] Consequently, the exercise of technical control and inclusion of weapons developers within the targeting cycle is not a single occurrence but is a role of continuing participation that is subject to targeting rules.[25]

Tactical control, on the other hand, revolves around the instructions that a commander or operator gives to the AWS about what it should do in each mission. For example, a commander, or mission planner, would decide that an AWS should be employed against target(s) A and could function *autonomously* in B time-frame at C location using D weapons (or causing E effects).[26] Thus, the targeting law regime applies to these decisions as they form the engagement part of hostilities. As we saw in Chapter 3, this is reminiscent of beyond-visual-range attacks, particularly with *ad hoc* targeting (i.e. where a target is not present in the AWS database and so, like using a missile or artillery, the commander could input coordinates for the AWS to fire munitions at). When deciding to use an AWS in *autonomous* or *ad hoc* targeting, the commander would need to take all decisions on the basis of intelligence that is reasonably available in advance of the mission.[27] By evaluating available

[22] Handy (n.3) 87; Boulanin and Verbruggen (n.3) 24.
[23] See Cora Currier, 'The Kill Chain: The Lethal Bureaucracy Behind Obama's Drone War' (The Intercept, 2015) Accessed 24 June 2020. Available at:<https://theintercept.com/drone-papers/the-kill-chain/>.
[24] Note the failures in data collection leading to strategic errors during the Vietnam War. See Antoine Bousquet, The Scientific Way of Warfare (Columbia University Press, 2009) 155-156.
[25] Such actions would not amount to '*direct participation in hostilities*' under most definitions, as this is a support role, see Section 3.2.
[26] Ford (n.4) 455.
[27] On the importance of intelligence in modern targeting, see Merel A.C. Ekelhof, 'Lifting The Fog Of Targeting: "Autonomous Weapons" And Human Control Through The Lens Of Military Targeting' (2018) 71 Naval War College Review, 61, 63.

intelligence, a commander, and their advisors, can determine what restrictions to place on an AWS so that civilians, their property, and other protected entities are safeguarded and applicable legal rules are complied with. This may include, where possible, human oversight of the AWS, or use of a *semi-autonomous* mode.

The ability of a commander to use an AWS for targeting, and the ability of a developer to input targets into an AWS database, would both be subject to the guidance of a weapons reviewer following an assessment of the AWS. By abiding by the boundaries that a reviewer lays out for building and using an AWS, developers and commanders/operators should ensure that AWS are legally complaint under the weapons and targeting law regimes. This Chapter, therefore, outlines what the guidance of a reviewer will likely be with regard to how AWS should be developed and used in ways that enable AWS to be used in legally compliant ways under targeting law.

A key aspect of ensuring AWS can be used lawfully is the exercise of technological management.[28] As was previously noted in Chapter 3, this is a method of constructing technologies whereby undesirable, or unlawful, actions are made impossible for the system to perform *autonomously*. However, the necessity of qualitative analysis in the battlespace requires human judgement, and so cannot be technologically managed. Following the guidance of a reviewer should result in the lawful development and use of AWS.[29] This arguably 'manages' the behaviour of AWS developers and users by opening or closing certain 'doors'.[30] But, unlike machines, humans can choose to go against their guidance for nefarious ends, responsibility for such actions is discussed in the next Chapter. The present Chapter now moves to look at the application of legal targeting rules and

[28] Roger Brownsword, 'In The Year 2061: From Law To Technological Management' (2015) 7 Law, Innovation and Technology, 1; Roger Brownsword, 'Technological Management And The Rule Of Law' (2016) 8 Law, Innovation and Technology, 100; Roger Brownsword, 'What the World Needs Now: Techno-Regulation, Human Rights and Human Dignity' in Roger Brownsword (ed.) Global Governance and the Quest for Justice Volume 4: Human Rights (Hart, 2004); see also Lessig's 'architecture' Lawrence Lessig, Code: Version 2.0 (Basic Books, 2006) 61.
[29] Geoffrey Corn, 'Autonomous Weapon Systems: Managing The Inevitability Of 'Taking The Man Out Of The Loop', in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016) 233.
[30] Lawrence Lessig, Code: Version 2.0 (Basic Books, 2006) 81-82.

consider how the exercise of technical, tactical, and procurement control can apply the relevant law to AWS so that their use can be sufficiently regulated by preventing the AWS from being used for certain behaviours and outlining the roles of humans and machines that, together, can meet legal thresholds.

3. Distinction

The first rule of targeting is the distinction principle. This applies in both international armed conflicts (IACs) and non-international armed conflicts (NIACs) and is present in both treaty[31] and customary international law,[32] with the International Court of Justice referring to it as a '*cardinal*' principle of LoAC.[33] It is re-stated in Additional Protocol I, as: '*Parties to the conflict shall at all times distinguish between the civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives*.'[34] Combatants include all members of armed forces, except medical and religious personnel.[35] In both IACs and NIACs, civilians are protected from attack '*unless and for such time as they take a direct part in hostilities*.'[36] The precise meaning of direct participation has created substantial controversy, and is discussed in Section 3.2.[37]

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[31] Art.48, API; Art.13(3), APII.
[32] ICRC Study, Rule 1, 6 and 7.
[33] Nuclear Weapons Case (n.8) para.78.
[34] Art.48, API.
[35] Art.43(2), API; ICRC Study, Rules 3, 25-28, 30, on medical transports see rule 29, on humanitarian personnel see rules 32 and 33.
[36] Art.51(3), API; Art.13(3), APII.
[37] Compare Nils Melzer, Interpretive Guidance On The Notion Of Direct Participation In Hostilities Under International Law (ICRC, 2009) against Michael Schmitt, 'The Interpretive Guidance On The Notion Of Direct Participation In Hostilities: A Critical Analysis' (2010) 1 Harvard National Security Journal, 5; Kenneth Watkin, 'Opportunity Lost: Organised Armed Groups And The ICRC "Direct Participation In Hostilities" Interpretive Guidance' (2010) 42 N.Y.U. Journal of International Law and Politics, 641; Bill Boothby, 'And For Such Time As: The Time Dimension To Direct Participation In Hostilities' (2010) 42 New York University Journal of International Law and Politics, 741.

The LoAC distinction rules protecting civilians from attack[38] are reinforced by IHRL as any killing not in compliance with this principle would be an arbitrary deprivation of life.[39] The classification of individuals or objects as being targetable must be made with '*properly verified information*.'[40] IHRL suggests that, if suspected violations of the distinction rule and the attendant IHRL obligations were investigated, states may be required to provide evidence of target choices being lawful.[41] Mere assertion that their actions are lawful would be insufficient.[42] Further, in evaluating the target verification process, all '*surrounding circumstances including such matters as the planning and control'* of the operation could be examined.[43] Consequently, not only are LoAC rules relevant to targeting also applicable to weapons developers and military personnel through their actions within the targeting process, their actions being within the '*surrounding circumstances*' means that IHRL rules are also applicable to them.

In order to comply with these rules, an AWS would firstly need to be capable of differentiating entities that are lawfully targetable, and those that are not. We saw in the previous Chapter that the accuracy of target recognition would be examined during the weapons review process (Chapter 4, Section 5.5.1). Recognition of an enemy combatant[44] in an IAC is enough for the rule to be complied with[45] and so an AWS that can recognise their uniform would be legally capable of differentiating enemy combatants. The same approach can be taken to recognising members of a uniformed paramilitary in an IAC,[46] or an organised armed group (OAG)[47] in a NIAC.[48] Such a method of

[38] Art.48, API; Art.13(3), API; ICRC Study, Rule 1.
[39] Murray (n.11) paras.5.22-5.28.
[40] The Public Committee against Torture in Israel and others v The Government of Israel and others, Judgment (Case no HCJ 769/02) [2005] Israeli High Court of Justice, para.40; Murray (n.11) para.5.62
[41] Esmukhambetov (n.12) para.145; Murray (n.11) para.5.62.
[42] Esmukhambetov (n.12) para.145; Murray (n.11) para.5.62.
[43] Esmukhambetov (n.12) para.138; Murray (n.11) para.5.62.
[44] Combatants are member of the armed forces (other than medical and religious personnel): Art.43(1), API.
[45] Murray (n.11) para.5.35.
[46] Art.43(3), API.
[47] This is the term of art used to designate an armed non-state actor which engages in a conflict.
[48] Although the international law governing NIAC does not create a combatant status based on group membership, the consensus view of states allows for targeting on this basis. See, for example, Gloria Gaggioli, 'Targeting Individuals Belonging To An Armed Group' (2018) 51 Vanderbilt Journal Of Transnational Law, 901.

recognition would be lawful as long as the entry in the AWS database reflects a lawful target.[49] The ability of the system to recognise targets based upon attire is due to an exercise of technical control, but the actual decision to do so would come under tactical control of a commander who decides to use the AWS against these targets. The ability of the AWS to lawfully perform these actions would need to be demonstrated to a reviewer in order for them to allow it under their guidance.

However, one only needs to watch news footage of a conflict involving armed non-state actors to see that any uniform worn by an OAG is often irregular and changeable.[50] This clearly demonstrates the need to re-review entries in target databases regularly so that *autonomous* targeting can take place against the most up-to-date targets.

Yet, combat zones are rarely only populated by uniformed adversaries. Civilians are defined in targeting rules as '*persons who are not members of the armed forces.*'[51] According to the International Committee of the Red Cross (ICRC), this is a customary rule in IAC.[52] International law is ambiguous as to the status of this rule, *mutatis mutandis*, in NIAC.[53] Yet, those expert manuals that elaborate on the definition of civilians in NIAC are clear that '*civilians are all those who are not fighters*'[54] as such, this means anyone '*who* [is not a] *members of the State's armed forces, dissident armed forces, or other organised armed groups*.'[55] Thus, such persons are civilian and are protected from attack unless they directly participate in hostilities.[56]

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[49] Marco Sassòli, 'Can autonomous weapon systems respect the principles of distinction, proportionality and precaution?' in ICRC, Autonomous Weapon Systems: Technical, Military, Legal And Humanitarian Aspects (ICRC, 2014) 41.
[50] See, for example, Simon Tomlinson, 'From The Afghani Robe To Suicide Bomber, How ISIS Differentiates Ranks' (Mail Online, 2015) Archived:<https://web.archive.org/web/20170112025556/http://www.dailymail.co.uk/news/article-3253113/From-Afghani-robe-suicide-bomber-s-black-uniform-ISIS-differentiates-ranks-various-outfits.html>.
[51] ICRC Study, Rule 5.
[52] Art.50, API
[53] ICRC Study, Rule 5, Summary.
[54] Michael N. Schmitt, Charles H.B. Garraway and Yoram Dinstein, The Manual On The Law Of Non-International Armed Conflict With Commentary (International Institute of Humanitarian Law, 2006)(Hereafter: NIAC Manual) para.1.1.3.
[55] Tallinn Manual, Commentary to Rule 91, para.4.
[56] Art.51(3), API; Art.13(3), APII; ICRC Study, Rule 6

In order for an AWS to comply with this rule, it would need to be able to distinguish civilians as those who are not engaged in fighting. As we saw in Chapter 2, *autonomous* systems are subject to the closed-world assumption, the result being that anything not recognised as a target is assumed to be a non-target.[57] This protects civilians as it would be impossible for an AWS to select them as a target. This method should also provide the required special protection to humanitarian aid workers[58] and journalists[59] who also have civilian status (also note the discussion in the next sub-Section). As such, the 'door' to attacking these entities is closed through technological management. A weapons reviewer would need to be convinced that this does protect civilians in order to allow an AWS to be used in areas of civilian presence.

### 3.1. Recognition of non-combatants and peacekeepers

The distinction principle is wider and more complicated than just differentiating between enemy uniforms and civilians. Medical and religious military personnel have a neutral status.[60] They are, therefore, non-combatants and protected from attack[61] (unless such persons directly participate in hostilities, or if medical personnel engage in self-defence).[62] However, as medical and religious personnel are usually attached to militaries, they often wear the same, or very similar, uniforms to combatants.[63] An AWS programmed to attack such uniforms on the presumption that all persons

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[57] Ronald Arkin, Governing Lethal Behaviour In Autonomous Robots (CRC Press, 2009) 63; Alan Backstrom and Ian Henderson, 'New Capabilities In Warfare: An Overview Of Contemporary Technological Developments And The Associated Legal And Engineering Issues In Article 36 Weapons Reviews' (2012) 94 International Review of the Red Cross, 483, 490.
[58] Art.71(2), API; Art.18(2), APII; ICRC Study, Rule 31.
[59] Art.79, API; ICRC Study, Rule 34.
[60] Ipsen (n.62) para.315(4).
[61] They '*shall be respected and protected under all circumstances.*' Art.IX, Convention for the Amelioration of the Condition of the Wounded and Sick in Armies in the Field (adopted 6 July 1906); Art.15(1), API
[62] Art.13(1) and (2), API; Knut Ipsen, 'Combatants and Non-Combatants', in Dieter Fleck (ed.), The Handbook Of International Humanitarian Law (3rd edn, OUP, 2013) para,316(b) and (c).
[63] See, for example, British Army, 'Army Medical Services' (British Army, 2019) Archived:<https://web.archive.org/web/20190907040550/https://www.army.mod.uk/who-we-are/corps-regiments-and-units/army-medical-services/>. Also note '*Chaplains wear the uniforms of the British Army and accompany their soldiers wherever they go... They are non-combatants and do not bear arms.*' British Army, 'Royal Army Chaplains' Department' (British Army, 2019)

wearing them are enemy combatants would unlawfully target these non-combatants. Distinguishing non-combatant personnel would require an AWS to recognise small changes to their uniform, such as altered epaulettes. This would likely be difficult, especially from a distance.

As such, where intelligence suggests that non-combatant personnel could be present at the site of the attack, operators could use the AWS in a *semi-autonomous* mode where there are communication-links (this would also allow lawful targeting where non-combatant personnel directly participate in hostilities). Otherwise, a commander could choose not to launch the attack in order to facilitate their protection. However, where it is imperative that the attack takes place, a commander could proceed with it but incorporate any expected presence of non-combatant personnel into a proportionality calculation (see Section 6.5). As non-combatants have a neutral status, any harm toward them would not provide military advantage and so this would become incidental harm.[64]

Similar steps may be required to protect peacekeepers, who are subject to special protection under CIL,[65] if they wear a uniform that is similar to adversaries. Yet, if the uniform of the peacekeepers is not included in the target database of the AWS, then they should be protected in the same way as civilians. Alternatively, the uniform of peacekeepers, along with the Red Cross worn by humanitarian aid workers,[66] or other symbols designating protected persons could be inputted into a no-strike list that could be uploaded to the AWS by a commander. A no-strike list is a database of objects in the area of operations that it is prohibited to attack due to legal or policy constraints.[67] Whatever method is taken, a weapons reviewer would need to be satisfied that these persons could be respected and protected by the programming of the AWS developer, and the decisions of a commander, in order to allow targeting by AWS as part of their guidance on using them. However, commanders would need

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Archived:<https://web.archive.org/web/20190626181414/https://www.army.mod.uk/who-we-are/corps-regiments-and-units/royal-army-chaplains-department/>.

[64] Literature is scant on how to deal with medical and religious personnel present at the site of attack. See, for example, Ipsen (n.62) section III; ICRC Study, Rule 3; Yoram Dinstein, The Conduct Of Hostilities Under The Law Of International Armed Conflict (2nd edn, CUP, 2012) 163-165.

[65] ICRC Study, Rule 33.

[66] Art.38, API; Art.12, APII; ICRC Study, Rules 31.

[67] DoD Dictionary, see 'No-Strike List'.

to keep abreast of what specially protected persons are present in the battlespace to ensure that adversaries do not abuse these protections by placing protected symbols on their own uniforms to avoid being attacked.[68]

3.2. Civilians directly participating in hostilities

The threshold at which civilians can be said to be directly participating in hostilities (DPH) and therefore subject to attack is a legal grey area. Common Article 3 to the Geneva Conventions refers to '*active'* participation, and the Additional Protocols refer to 'direct' participation,[69] as does the ICRC interpretation of CIL.[70] The terms are interchangeable.[71] International law offers no further clarification upon what constitutes such participation. Unlike uniformed adversaries, there may be no outward indication that an individual of civilian appearance is actually a fighter. Thus, the analysis in this Chapter must turn to the state practices of identifying such participation in order to determine if AWS could do so.

One commonly cited interpretation of DPH is offered by the ICRC. It focuses on the behaviours of individuals and their links to the armed conflict.[72] Another regularly discussed approach is provided by Watkin and focusses upon the roles that civilians DPH would be playing during combat.[73] Both of these interpretations require a qualitative assessment of what the individuals in question would actually be doing. As this thesis has noted previously, it is currently unforeseeable[74] that AWS will be able to perform qualitative analysis.[75] Even if it does become possible for machines to perform

[68] Art.85(f), API.
[69] Art.51(3), API; Art.13(3), APII.
[70] ICRC Study, Rule 6.
[71] NIAC Manual, para.1.1.2(2).
[72] Melzer (n.37) 46.
[73] Watkin (n.37) 691.
[74] William Boothby, 'How Far Will the Law Allow Unmanned Targeting to Go?' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013) 56-57.
[75] Some research suggests that software is capable of some very simple 'abstract' thinking, but this is nowhere near the level of understanding DPH. See David G.T. Barrett, et al., 'Measuring Abstract Reasoning In Neural Networks' [2018] arXiv Archived:<https://web.archive.org/web/20190926153725/https://arxiv.org/pdf/1807.04225.pdf>.

qualitative analysis,[76] there are so many relevant factors that the resultant software may be impossibly complex to programme.[77]

Yet, under other interpretations, DPH can be assessed by focussing upon the acts carried out by such individuals. They include:

> '*attacking the enemy, his materiel or facilities; sabotaging enemy installations; acting as members of a gun crew or artillery spotters; delivering ammunition; or gathering military intelligence in the area of hostilities*.'[78]

Comprehending these specific behaviours would require qualitative analysis. However, the focus on actions constituting direct participation allows this Chapter, as the previous Chapter discussed, to note that some activities *do* objectively amount to DPH as there is no reason for a civilian to perform such an action in the circumstances. For example, handling explosives in a combat zone[79] or planting a roadside bomb.[80] If an AWS were equipped with the correct sampling technologies, and the correct data entries were present in its memory, a civilian DPH could be lawfully recognised in this manner. Whether a commander would be able to use an AWS to distinguish civilians DPH in this way would be dependent firstly upon the developers being able to programme this functionality, and the reviewer accepting that it can accurately and reliably identify such persons. However, the specific behaviours that the AWS uses to recognise civilians DPH would be a decision for the commander as the nefarious implication of certain behaviours may only become apparent at the time they occur. For example, using the handling of explosives to identify civilians DPH would be impractical in areas near a legitimate munitions factory.

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[76] See Noel E. Sharkey, 'The Evitability Of Autonomous Robot Warfare' (2012) 94 International Review of the Red Cross, 787, 789.
[77] Noel Sharkey, 'Why Robots Should Not Be Delegated With The Decision To Kill' (2017) 29 Connection Science, 177, 179.
[78] NIAC Manual, para.1.1.2(3).
[79] This could potentially be sampled using nano-robotics; Kevin J. Heller, 'One Hell Of A Killing Machine': Signature Strikes And International Law' (2013) 11 Journal of International Criminal Justice, 89, 95-96.
[80] Ford (n.4) 438.

In the earlier discussion of OAG members, it was noted that they often wear irregular and changeable uniforms. In a fast-moving armed conflict, OAG members or civilians DPH may temporarily adopt identifying insignia. If this is not included in the AWS database, then, if an AWS is built in such a way, a commander could, potentially, instruct an AWS to attack persons displaying the insignia or other characteristic. In order for this to happen, a reviewer would need to outline in their guidance the types of insignia that would be acceptable and how they should be recognised. This would merge technical and tactical control in the hands of the commander, such that they are responsible for their choice in instructing an AWS to attack a target, but also for their inputting of insignia being accurate. In all other ways, this would be the same as *autonomous* targeting.

Alternatively, a commander could use an AWS for *ad hoc* attacks against people in irregular, or no, uniform, for example instructing an AWS to attack a particular set of coordinates where they know there is a concentration of OAG members or civilians DPH. Where *autonomous* attack is impossible, *ad hoc* attacks could become a common method for attacking civilians DPH or members of an OAG.[81]

*Ad hoc* attacks would need to be based upon sufficient intelligence[82] that a commander can assess the lawful targetability of a proposed target and employ an AWS. Where intelligence is lacking, an assessment of the target *in situ* would need to be made. This would require the AWS to be used in a *semi-autonomous* mode during targeting. If, however, communications are impossible, then the lawfulness of the attack could not be determined, and the attack would need to take place by other means, or not at all.[83]

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[81] Backstrom and Henderson (n.57) 492.
[82] See Ekelhof (n.353) 63.
[83] Note that Boothby makes this same point in relation to the precautionary duties to verify targets and choosing means and methods of combat to reduce civilian harm. William H Boothby, Weapons And The Law Of Armed Conflict (2nd edn, OUP, 2016) 254.

3.3. 'Self-defence'

There is one method of distinguishing targets that would appear to be definitive in both IACs and NIACs for both combatants, members of OAGs, and civilians DPH. People who attack an AWS would be distinguishing themselves as carrying out a hostile act, to which the AWS could respond in 'self-defence'. Indeed, Arkin notes that an AWS used in this way could function as 'bait' to lure out attackers.[84]

Use of the concept of 'self-defence' in armed conflict has generated some significant recent debate.[85] However, as a legal basis for launching an attack, it relates to acts to defend of oneself (or one's unit) from aggressive acts unconnected to the armed conflict (for example being attacked by an angry farmer who is protecting their crops).[86] Indeed, LoAC itself only conceptualises 'attacks' as meaning '*acts of violence against the adversary, whether in offence or in defence.*'[87] Thus, acts of 'self-defence' during active hostilities are regulated under LoAC targeting law. Unlike self-defence in criminal law, LoAC contains no rules that would de-legitimise an act of 'self-defence' following an intentional provocation of an adversary causing them to launch an initial attack.[88] Consequently, it would not seem unlawful under targeting law to use an AWS as 'bait' in order to identify adversaries.

For an AWS to be able to respond to an attack, its attackers would need to be accurately recognised. Technologies exist whereby the direction of an attacker can be accurately determined.[89] An AWS could use this to lawfully distinguish their attackers. The ability of the AWS to do this would

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[84] Arkin (n.57) 46, 60.
[85] See, for example, Elvina Pothelet and Kevin Jon Heller, 'Symposium on Soldier Self-Defense and International Law: Highlighting and Framing the Issue' (Opinio Juris, 2019) Archived: <https://web.archive.org/web/20191228220402/http://opiniojuris.org/2019/04/29/symposium-on-soldier-self-defense-and-international-law-highlighting-and-framing-the-issue%ef%bb%bf/>
[86] Adil Ahmad Haque, 'Soldier Self-Defense Symposium: Self-Defense vs. Combatant Immunity' (Opinio Juris, 2019) Archived:<https://web.archive.org/web/20190504063321/http://opiniojuris.org/2019/05/02/soldier-self-defense-symposium-self-defense-vs-combatant-immunity/>
[87] Art.49(1), API.
[88] Hans F.R. Bodens Hosang, 'Force protection, unit self-defence and personal self-defence' in Dieter Fleck and Terry D. Gill, The Handbook of International Law of Military Operation (2nd edn., OUP, 2015) para.24.17.
[89] Raytheon Corporation, 'Boomerang III' (Raytheon, 2019) Archived:<https://web.archive.org/web/20190820114216/https://www.raytheon.com/capabilities/products/boomerang>.

need to be programmed by the developers and shown to be an accurate and reliable method of distinguishing adversaries for a reviewer to authorise such an approach.

### 3.4. Distinction of objects

In terms of targeting objects, they must be a military objective in order to be targetable. This means the object must, by its

> '*nature, location, purpose or use make an effective contribution to military action and whose total or partial destruction, capture or neutralization, in the circumstances ruling at the time, offers a definite military advantage*.'[90]

The four types of military objective are defined as: objects of a military nature are objectives at all times, such as warships or military aircraft (unless they are repurposed as medical transport/care facilities for example);[91] the location of an object can transform it into a military objective if it obstructs

> '*the field of fire for attack on another valid military objective*,'[92] or it is '*a site that must be seized or because it is important to prevent the enemy from seizing it, or otherwise because it is a matter of forcing the enemy to retreat from it*';[93]

in terms of use and purpose, '[t]*he criterion of 'purpose' is concerned with the intended future use of an object, while that of 'use' is concerned with its present function*.'[94] For example, a civilian hotel or factory might be, or about to be, converted into accommodation for troops, or an armament

[90] Art.52(2), API; ICRC Study, Rule 8.
[91] Horace B. Robertson, Jr., 'The Principal Of The Military Objective In The Law Of Armed Conflict' (1998) 72 International Law Studies,197, 208-209; Yves Sandoz, Christophe Swinarski and Bruno Zimmermann (eds.), Commentary On The Additional Protocols Of 8 June 1977 To The Geneva Conventions Of 12 August 1949 (Martinus Nijhoff Publishers, 1987) para.2020.
[92] Robertson (n.91) 208-209; Sandoz et al. (n.91) para.2021.
[93] Sandoz et al. (n.91) para.2021.
[94] Sandoz et a. (n.91) para.2022.

factory, respectively.[95] As such, their future purpose or present use following conversion may make them a military objective.

Objects of a military nature are always objectives, and so as long as an AWS could accurately and reliable recognise them in accordance with a reviewer's guidance, such use of AWS in targeting would comply with this rule. However, making an assessment as to whether an object has become a military objective due to its location, use, or purpose requires contemporaneous qualitative judgements. This can only be assessed by the commander,[96] '*in the circumstances ruling at the time*'. Objects that become military objectives due to their location, use, or purpose, are fundamentally civilian and may only be attacked '*for such time as they are military objectives*' according to the customary rule suggested by the ICRC for both IACs and NIACs.[97]

In the opinion of Jachec-Neale, military advantage with regard to neutralising military objectives[98] is '*an expected contribution to the success of military operations*.'[99] The UK manual also stresses that the status of a military objective must be tested by asking the question '*does it make an effective contribution to military action?*'[100] This decision, and therefore the choice of whether the relevant objects become military objectives, is an exercise of tactical control and would need to be made during mission planning.[101]

The use of an AWS in a *semi-autonomous* mode would allow such decisions to be made at the moment of attack. But, where there are no communication links, and *fully-autonomous* modes must be used, intelligence about the target must be evaluated in advance of the mission. Only where the intelligence allows for an object to be categorised as a military objective, the destruction of which

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[95] Sandoz et al. (n.91) para.2022; Robertson (n.91) 209.
[96] Backstrom and Henderson (n.57) 492
[97] ICRC Study, Rule 10.
[98] Note that this is different to military advantage with regard to proportionality, see Section 6.5.
[99] Agnieszka Jachec-Neale, The Concept Of Military Objectives In International Law And Targeting Practice (Routledge, 2015) 116.
[100] UK Manual, para.5.4.5.
[101] Backstrom and Henderson (n.57) 492.

offers a military advantage at the time of attack, may it be lawfully attacked. Where this is not possible, the attack could not lawfully take place. Such a decision is an exercise of tactical control within the guidelines of procurement control.

As with defining civilians, the definition of civilian objects is also in the negative: '*civilian objects are all those which are not military objectives*.'[102] This is a customary rule in both IAC and NIAC according to the ICRC,[103] and is also present in treaty rules for IAC,[104] and NIAC.[105] Thus, any object not defined as a military objective would need to be treated as civilian by the AWS. By not including them in the target database of an AWS, they would be protected to the extent possible under technical control by closing the 'door'. By not subjecting them to *ad hoc* targeting, they would be protected as far as possible under tactical control. Both of these guidelines should be included in a reviewer's guidance.

Such a method of distinguishing civilian objects would also provide the required protection to specially protected objects. Such objects are: cultural objects and places of worship; [106] works or installations containing dangerous forces;[107] objects of a humanitarian nature;[108] specially protected zones;[109] demilitarised zones;[110] non-defended localities.[111]

[102] ICRC Study, Rule 9.
[103] ICRC Study, Rule 9, Summary.
[104] Art.52(1), API.
[105] Art.2(7), Amended Protocol II on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices to, 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 (with Protocols I, II and III) (adopted 10 October 1980 entered into force 2 December 1983) 1342 UNTS 137 (Hereafter: CCW).
[106] Art.53, API; Art.16, APII; Second Protocol to The Hague Convention of 1954 for the Protection of Cultural Property in the Event of Armed Conflict (adopted 26 March 1999, entered into force 9 March 2004) 2253 UNTS 172 (Hereafter: Cultural Property Convention PII); ICRC Study, Rules 38, 39, 40.
[107] Art.56, API; Art.15, APII; ICRC Study, Rule 42.
[108] Art.70(4), API; Art.18(2), APII; ICRC Study, Rule 32.
[109] Art.23, Geneva Convention (I) for the amelioration of the condition of the wounded and sick in armed forces in the field (adopted 12 August 1949, entered into force 21 October 1960) 75 UNTS 31 (Hereafter: GCI); Art.14, para.1, Geneva Convention (IV) relative to the protection of civilian persons in time of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 287 (Hereafter: GC IV); ICRC Study, Rule 35.
[110] Art.85(3)(d), API; ICRC Study, Rule 36.
[111] Arts.59(1) and 85(3)(d), API; Art.3, Update Statute of the International Criminal Tribunal for the Former Yugoslavia (adopted 25 May 1993, updated 7 July 2009) UNSC Res.1877; ICRC Study, Rule 37.

We noted above that some objects of a military nature, battleships for instance, may be repurposed as medical facilities (i.e. hospital ships). If the shape of an object is programmed as a key criterion for target recognition by an AWS, this could result in unlawful targeting as the shape would remain the same. To provide the required protection, symbols such as the Red Cross could be programmed into a no-strike list and inputted into the AWS as representing a prohibited target by the commander or developer.[112] Other symbols, such as those denoting religious buildings could be similarly programmed. However, as with humanitarian aid workers mentioned above, commanders would need to keep updated on what specially protected objects are present in the battlespace to ensure that adversaries do not abuse these protections by placing protected symbols on their own equipment to avoid being attacked.[113]

However, where specially protected objects become military objectives through their use or purpose[114] at the relevant time,[115] they could only be attacked using an AWS through *ad hoc* targeting as they would not be recognisable by an AWS acting *autonomously*. Any attack against cultural property that has become a military objective requires special care,[116] and any attack against a work or installation containing a dangerous force requires every necessary and due precaution to be taken.[117] The onus for exercising that care, or taking those precautions, lies with the commander. This would include instructing an AWS to engage in attacks despite the presence of a protective symbol – the obvious risks that this could pose to other protected objects would require such use of *autonomous* targeting to be very tightly restricted. These requirements should be included in the relevant guidance.

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112 Art.38, API; Art.12, APII; ICRC Study, Rules 29, 30, 32.
113 Art.85(f), API.
114 Art.52(2), API; ICRC Study, Rules 8 and 10; Art.4(2) Convention for the Protection of Cultural Property in the Event of Armed Conflict (adopted 14 May 1954, entered into force 7 August 1956) 249 UNTS 215; Art.6, Cultural Property Convention PII.
115 ICRC Study, Rule 10.
116 During hostilities, 'special protection' is functionally the same as 'ordinary protection'. See UK Manual, para.5.26.4 fn. 123.
117 UK Government, 'Statement On Ratification Of Additional Protocol I' (2002) para.(n); French Government, 'Statement On Ratification Of Additional Protocol I' (2001) para.15; ICRC Study, Rule 42.

IHRL reinforces the LoAC rules protecting civilian objects during armed conflict.[118] In terms of the right to property, any interference with an individual's enjoyment of this right would need to be necessary and proportionate and in pursuit of a legitimate aim.[119] The aims of an operation can only be assessed at the time, and the responsibility for executing such an assessment resides with the commander. As with IHRL rules regulating the targeting of individuals, states would need to evidence their target choices as being lawful.[120]

### 3.5. The doubt rules

Attackers must be confident that the targets they have chosen are lawful. The doubt rules are found in API, and state that, in relation to targeting persons '[i]*n case of doubt whether a person is a civilian, that person shall be considered to be a civilian*'[121] and, in relation to targeting objects '[i]*n case of doubt whether an object which is normally dedicated to civilian purposes, such as a place of worship, a house or other dwelling or a school, is being used to make an effective contribution to military action, it shall be presumed not to be so used.*'[122] IHRL reinforces these provisions by requiring that target choices are made upon '*well based information*'.[123]

These treaty rules apply in IAC, but there is no similar treaty rule for application in NIAC. This is because combatant status only applies in IACs,[124] and the rules relating to doubt as to this status; in NIACs, civilians DPH are, by definition, civilians and any doubt would relate to whether their activities amounted to DPH.[125]

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[118] Arts.48 and 52(2), API; Art.13(1), APII; ICRC Study, Rule 7.
[119] Esmukhambetov (n.12) para.174; Murray (n.11) para.5.44.
[120] Esmukhambetov (n.12) para.145; Murray (n.11) para.5.62.
[121] Art.50, API.
[122] Art.52(3), API.
[123] PCATI v Israel (n.40) para.40; Murray (n.11) para.5.62.
[124] Murray (n.11) para.5.37.
[125] Tallinn Manual, Commentary to Rule 95, para.5.

With regard to the customary character of these rules, the ICRC suggests that there is a doubt rule in relation to targeting persons in IAC, but that there is insufficient state practice to suggest a similarly applicable customary rule in NIAC – although they also submit that it would '*seem justified*' to apply the customary IAC rule, *mutatis mutandis*, in NIACs.[126] With regard to targeting objects, The ICRC found no customary doubt rules applicable in IAC or NIAC, but note that careful assessments must be made and that '[i]*t cannot be automatically assumed that any object which appears dubious may be subject to lawful attack.*'[127]

The rules of doubt are of particular importance to AWS, as they relate directly to what level of mathematical probability is acceptable for a target to be 'recognised'. When an *autonomous* system recognises an entity from its database, it must compare its sensor readings to the expected target characteristics in its memory. Some manufacturers of weapons with autonomy are aiming for 100% accuracy in their sensor identification.[128] Such a high level of accuracy may not be needed. Reviewers and commanders would need to determine a level of probability that reflects the doubt rules, above which an entity can be said to have been identified as a target, and below which they would be assumed to be a civilian.[129]

The precise doubt threshold is undefined in international law. Current conceptions of it are at a human standard.[130] The UK manual suggests that potential targets should only '*be given the benefit of the doubt and treated as a civilian'* where '*substantial doubt'* remains following an assessment of all information available at the time.[131] Further, the International Criminal Tribunal for the Former Yugoslavia has suggested that the doubt rule from API relating to human targets[132] should be assessed

[126] ICRC Study, Rules 6 on Situations of doubt as to the character of a person.
[127] ICRC Study, Rules 10 on Situations of doubt as to the character of an object.
[128] Rigby (n.2) According to this lecture, BAE systems are aiming for 100% accuracy in positively identifying enemy vehicles within a $10m^2$ area from 10km away.
[129] Alexander Bolt, 'The Use of Autonomous Weapons and the Role of the Legal Adviser' in Dan Saxon (ed.), International Humanitarian Law And The Changing Technology Of War (Martinus Nijhoff, 2013) 131-133; Backstrom and Henderson (n.57) 494-495.
[130] See Sassòli (n.16) 319.
[131] UK Manual, para.5.3.4.
[132] Art.50(1), API.

in terms of whether a reasonable person, in the circumstances at the time, '*could not have believed that the individual he or she attacked was a combatant*.'[133]

However, the doubt threshold could be re-conceptualised for AWS with a minimum level of acceptable doubt programmed into the AWS. Kruipy suggests that AWS would need to be able to recognise military objectives with 99.9% accuracy.[134] Yet, Schmitt and Thurnher,[135] along with Ford,[136] have suggested that any algorithmic application of the doubt rule should be set at the level of a reasonable human in the same battlespace.[137] As such, a reviewer could determine a minimum level of acceptable doubt and advise developers to programme this into the system. Further, they could provide a commander with a range of circumstances in which the doubt level could be altered above this. Ultimately, the decision regarding the level of doubt chosen would fall to the commander.

### 3.6. Protecting those *hors de combat*

A key aspect for complying with the distinction principle is the protection of those *hors de combat*. People with *hors de combat* status are those who are: in the power of an adverse Party; have clearly expressed an intention to surrender; have been rendered unconscious or are otherwise incapacitated by wounds or sickness, and therefore are incapable of defending themselves.[138] Such persons may not be made the object of attack, as LoAC prohibits a denial of quarter.[139] IHRL reinforces this as any killing not in accordance with LoAC would be an arbitrary deprivation of life.[140]

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133 Prosecutor v Galić (Trial Judgement) Case No: IT-98-29-T [2003] ICTY, para.55.

134 Tetyana Kruipy, 'Of Souls, Spirits and Ghosts: Transposing The Application Of The Rules Of Targeting To Lethal Autonomous Robots' (2015) 16 Melbourne Journal of International Law Archived:<https://web.archive.org/web/20190703191648/https://law.unimelb.edu.au/__data/assets/pdf_file/0011/1586819/16106Krupiy2.pdf>.

135 Michael N. Schmitt and Jeffrey Thurnher, '"Out Of The Loop": Autonomous Weapon Systems And The Law Of Armed Conflict' (2013) 4 Harvard National Security Journal, 262-265.

136 Ford (n.4) 442.

137 Sassòli (n.16) 319.

138 Art.41(2), API; ICRC Study, Rule 47.

139 Arts.40, 41(1), API; Art.4, APII; Common Article 3(1) to the GCs; ICRC Study Rules 46 and 47.

140 Murray (n.11) paras.5.22-5.28, 5.167.

However, the protection offered by *hors de combat* status only exists provided that such persons abstain from any hostile act and do not attempt to escape.[141] This is a treaty rule in both IACs[142] and NIACs,[143] and, according to the ICRC, is a customary rule in both IACs and NIACs.[144]

In terms of those in the power of an adverse party, this is primarily related to those in prisoner of war camps or similar installations.[145] Although most camps would be outside of combat zones,[146] one cannot predict that fighting will avoid the location of a camp. Still, the location of such objects should be communicated to other parties to the conflict,[147] and could be added to a no-strike list by a commander. Updating an AWS with this database would facilitate compliance with the rule by a commander exercising their tactical control. This would be needed where, for example, an adverse military installation is converted into a prison camp, as an AWS would still recognise the installation as a target.

With regard to adversaries who express an intention to surrender, developers could play a role in protecting these people by inputting notions of capitulation, such as a 'hands up, don't shoot' gesture,[148] or a white flag as an expression of a desire to communicate.[149] Algorithms could then be written so that no attack takes place in that location at that time once the relevant observation is made.[150] In such a situation, adversaries would be surrendering to an AWS.

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141 Art.41(2), API; ICRC Study, Rule 47.
142 Art.41(2), API.
143 Common Article 3(1) to the GCs; Art.4, APII.
144 ICRC Study, Rule 47.
145 Arts.41(2)(a) and 44(1), API.
146 Art.19, Geneva Convention (III) relative to the treatment of prisoners of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 135 (Hereafter: GC III); Art.83, GC IV; ICRC Study, Rule 121.
147 Art.23, GC III; Art.83, GC IV
148 This is reportedly possible with the Samsung SGR-A1 sentry gun system John Pike, 'Samsung Techwin SGR-A1 Sentry Guard Robot' (Global Security, 2011) Archived:<https://web.archive.org/web/20190827141904/https://www.globalsecurity.org/military/world/rok/sgr-a1.htm>.
149 Russell Buchan, 'The Rule of Surrender in International Humanitarian Law' (2018) 51(1) Israel Law Review, 3, 20-21.
150 Corn suggests that such a capability would be essential in AWS. See Geoffrey Corn, 'Autonomous Weapon Systems: Managing The Inevitability Of 'Taking The Man Out Of The Loop', in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016) 231.

Surrender to an uninhabited system is not entirely unheard of,[151] but does create difficulties in terms of prisoner arrest and evacuation (unless, of course, AWS hardware and software develops to the point of being able to do this). The most obvious solution would be for an AWS to alert commanders to the situation who could then deploy ground troops to deal with the prisoners. But, as Van Den Boogaard points out, how long would a surrendering adversary need to wait until human forces can capture them? Would an AWS resume targeting once the adversary becomes too tired to hold their hands aloft?[152] In this situation, it would appear that reverting to a *semi-autonomous* mode would be beneficial whilst also notifying surrendered adversaries they are protected from attack unless they re-engage in hostile acts or try to escape.[153]

The position under LoAC that prisoners must be cared for[154] is reinforced by IHRL as the state must provide care where they are able to do so.[155] Prisoners come under the authority and control of a state force and therefore their jurisdiction.[156] The position of vulnerability and subordination that prisoners are in must be taken into account.[157] Whilst applicable rights could be 'divided and tailored' in this context,[158] the capturing state would be responsible for enabling prisoner's enjoyment of their rights to food, water, health, life, and freedom from torture.[159]

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[151] During the Gulf War, several Iraqi troops surrendered to a UAV. See Smithsonian, 'Pioneer RQ-2A UAV' (National Air and Space Museum, 2019) Archived:<https://web.archive.org/web/20190721075225/https://airandspace.si.edu/collection-objects/pioneer-rq-2a-uav>.

[152] Jeroen van den Boogaard, 'Proportionality And Autonomous Weapons Systems' (2016) 2016-17 Amsterdam Center for International Law 13.

[153] Art.41(2)(c), API; ICRC Study, Rule 47, 'Loss of protection'.

[154] Art.41, API.

[155]Rouse v Philippines, Comm No. 1089/2002 (HRComm, 25 July 2005) UN Doc. CCPR/C/84/D/1089/2002, para.7.8; Keenan (n.157) para.91; General Comment No. 14: The Right to the Highest Attainable Standard of Health Food (UN Committee on Economic, Social and Cultural Rights, 22nd Session) 2000 UN Doc. E/C.12/2000/4 (Hereafter: CESCR GC.14), para. 36; In Osman v United Kingdom, App no:87/1997/871/1083 (ECtHR, 28 October 1998), para.116, it was held that authorities must do '*all that could be reasonably expected of them to avoid a real and immediate risk to life*'.

[156] Al-Skeini v United Kingdom, App no:55721/07 (ECtHR, 7 July 2011) para.137; Issa and Others v Turkey, App no:31821/96 (ECtHR, 16 November 2004) para.71.

[157] Juvenile Reeducation Institute v Paraguay, Judgment (IACtHR, 2 September 2004) para.152; also see Keenan v United Kingdom, App no:27229/95 (ECtHR, 3 April 2001) para.91.

[158] Al-Skeini (n.156) para.137; Murray (n.11) para.5.110.

[159] Arts.11 and 12, International Covenant on Economic, Social and Cultural Rights (adopted 16 December 1966, entered into force 3 January 1976) 993 UNTS 3; Keenan (n.157) paras.89, 111; Murray (n.11) para.5.110.

The caring for prisoners who surrender to an AWS may be possible where their surrender occurred near to ground forces of the AWS-deploying state. However, as AWS are likely to be operating in hostile and communication-denied environments, this presents a parallel with commandos operating behind enemy lines who may capture adversaries but are not in a position to arrest and evacuate them. API states that in such '*unusual conditions of combat'*, that prisoners '*shall be released and all feasible precautions shall be taken to ensure their safety*.'[160] The UK manual suggests that where prisoners are released far from their own lines, they should be left with provisions and means to return to safety (map, compass, etc.).[161] Thus, where a commander determines that such a situation could happen, then an AWS could be equipped with a survival pack that could be left with any temporary prisoners.[162] Such direct provision would comply with IHRL as the prisoners would be provided with the means to realise their rights.[163]

Alternatively, the location and condition of those *hors de combat* through surrender could be reported to a third party humanitarian organisation, so that care may be provided or facilitated.[164] Programming this capability would come under technical control but the decision-making to authorise such measures would come under tactical control. A reviewer would need to be convinced of the ability of an AWS to do all of this before allowing it in their guidance.

In the case of those incapacitated by wounds or sickness, it would be difficult to programme injuries or incapacitation into an AWS database so that they could be recognised, and especially difficult for software to recognise that an injury or sickness is incapacitating. As such, unless highly-

[160] Art.41(3), API.
[161] UK Manual, para.5.8.1.
[162] For example, Google X is developing delivery UAVs for providing emergency medical supplies following disasters. See X, 'Wing' (X, 2019) Archived:<https://web.archive.org/web/20190824034745/https://x.company/projects/wing/>.
[163] General Comment No. 15: The Right to Water (UN Committee on Economic, Social and Cultural Rights, 29th Session) 2003 UN Doc. E/C.12/2002/11 (Hereafter: CESCR GC.15), para. 25; See also General Comment No. 12: The Right to Adequate Food (UN Committee on Economic, Social and Cultural Rights, 20th Session) 1999 UN Doc. E/C.12/1999/5 (Hereafter: CESCR GC.12), para. 15; UK Manual, para.5.8.1; Murray (n.11) para.5.111
[164] Murray (n.11) pg.145, fn.214.

advanced systems *could* recognise these characteristics,[165] then there does not appear to be a solution under technical control. Therefore, where possible, operators could monitor AWS engagements and suspend attacks where there is a risk of attacking those incapacitated.[166] Thus, responsibility for compliance with this rule would come under tactical control.

Additionally, the protection of those *hors de combat* extends to those parachuting from aircraft in distress,[167] but not to paratroopers.[168] As such, the ideal solution would seem to be for AWS to be programmed not to target parachutists unless authorised by a commander who expects airborne troops in the battlespace. Further, the protection of those parachuting in distress is forfeited if they engage in hostilities.[169] As such, operators could monitor and authorise engagements against such persons, where possible.

Our discussion of those *hors de combat* so far has only referred to ideal situations where an AWS could be used in *semi-autonomous* modes or prevented from firing due to technological fixes. However, where it is not an ideal situation, such persons might be attacked unbeknownst to the AWS operators/commanders. Under API this is not always unlawful: '*A person who is recognized or who, in the circumstances, should be recognized to be hors de combat shall not be made the object of attack.*' As such, compliance with this rule is based upon what attackers are capable of recognising in the prevailing circumstances at the time. The Air and Missile Warfare Manual recommends a '*reasonable attacker'* standard[170] and suggests that unless a person indicates *'an intention to surrender in a way that the* [attacker] *can perceive and understand*,'[171] then an '*attack may lawfully be conducted because*

[165] Note that medical diagnosis systems are ever advancing. See Nicola Davis, 'AI equal with human experts in medical diagnosis, study finds' (The Guardian, 2019) Archived:<https://web.archive.org/web/20191003063322/https://www.theguardian.com/technology/2019/sep/24/ai-equal-with-human-experts-in-medical-diagnosis-study-finds>.
[166] AMW Commentary, Rule 15(b), paras.5 and 6.
[167] Art.42, API; ICRC Study, Rule 48.
[168] Art.42(3), API.
[169] UK LoAC Manual (n.9) para.5.7; ICRC Study, Rule 48, Interpretation.
[170] AMW Commentary, Rule 15(b), para.6.
[171] AMW Commentary, Rule 15(b), para.5.

*the desire to surrender has not been effectively communicated*'.[172] This would also apply to those suffering from wounds or sickness.[173]

In such a situation, deploying an AWS with no ability to recognise any type of person *hors de combat* could technically comply with the rule as there would be no circumstances where the system could recognise such persons. However, this would not account for the choice that a commander might have over the types (or modes) of systems they could employ.[174] For example, if an AWS in a *semi-autonomous* mode could perform the mission and protect those *hors de combat*, but *fully-autonomous* targeting took place and did not protect such persons, then the rule would seem to have been broken. However, if an AWS were operating *fully-autonomously* and no other system could have been employed on the mission, or no other system could have recognised those *hors de combat*, then the rule would seem to be complied with.

Further, it is unclear in law how commanders should deal with attacks which might cause incidental harm to those *hors de combat*. Literature suggests that commanders are under a duty to respect and protect such enemy personnel and therefore they should only be subject to unavoidable incidental harm.[175] With regard to AWS, it would seem appropriate to operationalise this in the same way as dealing with other people who may be *hors de combat*. Due to the necessary contextual knowledge required for complying with the *hors de combat* rules, the guidance of a reviewer would only be able to re-state the law and provide options for a commander to carry out as the circumstances require. As such, compliance with this rule is very much within the exercise of tactical control.

[172] AMW Commentary, Rule 15(b), para.5.
[173] AMW Commentary, Rule 15(b), para.6.
[174] See Section 6.4.
[175] Aurel Sari and Kieran Tinkler, 'Collateral Damage And The Enemy' [2019] British Yearbook of International Law, 107.

4. Prohibition on indiscriminate attacks

The prohibition on indiscriminate attacks applies in IACs and NIACs through treaty law[176] and CIL, according to the ICRC.[177] Complying with these prohibitions is an area where technological management can have a great impact through making it impossible to perform some aspects of indiscriminate attacks. Thus, technical control can play a large role in abiding by these rules, alongside tactical control. A reviewer would need to be convinced of such abilities before authorising them, however. Each type of indiscriminate attack is now considered in turn.

Firstly, regarding the prohibition of attacks against objects that are not a specific military objective,[178] this can be prevented by only programming military objectives as targets into the AWS database in the same way that enables compliance with distinction: any object not programmed into the memory of an AWS as a target could not be selected as a target (the closed world-assumption).[179] This would protect civilian objects from *autonomous* attack. However, with *ad hoc* targeting, compliance with this rule would be dependent upon the target being deemed a military objective by a commander. Thus, compliance with the rule would also require AWS users to only use this mode of functioning against lawful targets. Such a capability would need to be approved by a reviewer.

In terms of the prohibitions against employing means and methods that cannot be directed at a specific military objective,[180] or cannot be limited,[181] we saw in Chapter 4 (Section 5.5) that AWS in and of themselves would not constitute such weapons and the developers could also prevent some inherently indiscriminate munitions being used by an AWS. This is not something that should be abused under tactical control as there is no obvious reason to enable a system to be equipped with inaccurate or uncontrollable munitions or used in an uncontrollable way. As such, compliance with this rule would normally be assured at the manufacturing stage, but commanders would also need to

[176] Art.51(4)-(6), API; Art.13(2), APII.
[177] ICRC Study, Rules 11 and 12.
[178] Art.51(4)(a), API; ICRC Study, Rule 12(a).
[179] Arkin (n.57) 63.
[180] Art.51(4)(b), API; ICRC Study, Rule 12(b).
[181] Art.51(4)(c), API; ICRC Study, Rule 12(c).

ensure they only use discriminate munitions with AWS. This would also need to be authorised in a reviewer's guidance.

Attacks that treat multiple separated objects as a single objective in areas of civilian presence are prohibited,[182] unless the military objectives are not sufficiently spaced out as to allow individual targeting.[183] As such, a reviewer could require AWS to be produced in such a way that these attacks are prevented through technological management. But, they could give responsibility to a commander to turn off this function where the objectives are not sufficiently spaced out in accordance with the exception to the rule.

With regard to the prohibition on indiscriminate attacks due to being disproportionate, once a determination is made that an attack would create an excessive level of civilian harm in comparison to the expected military advantage[184] and the attack is cancelled, the prohibition would be complied with. It may be possible for an AWS to perform some of the proportionality calculation, as Section 6.5 discusses below. Where the system calculates a disproportionate level of incidental harm and is programmed to stop attacking, that would seem to comply with the rule.

Finally, the prohibition on reprisals against civilians and the civilian population would be prevented under technical control as such persons would not be inputted to the AWS target database.[185] However, such an ability could still be open to abuse by nefarious AWS users through *ad hoc* targeting.

[182] Art.51(5)(a), API; ICRC Study, Rule 13.
[183] ICRC Study, Rule 13, Interpretation.
[184] Art.51(5)(b), API; ICRC Study, Rule 14.
[185] Art.51(6), API; ICRC Study, Rules 145-148.

5. Prohibition on environmental harm

In terms of protecting the environment,[186] the last Chapter noted the application of these rules with regard to environmentally damaging weapons.[187] But, these rules also prohibit conventional attacks that cause the same level of prohibited harm.[188] Whilst there are treaty provisions for the application of this rule in IACs,[189] there are no similar provisions for NIACs. Further, according to the ICRC, this rule has a customary character in relation to IACs, but there is no fully-formed rule for NIACs.[190] The United States is seen as a persistent objector to the customary provision, and so this customary rule does not apply to them.[191] Plus, the UK and France are persistent objectors to the customary rule with regard to nuclear weapons.[192]

5.1. Environmental protection under the ENMOD Treaty

Conventional attacks that create environmental modification techniques and cause '*widespread, longlasting or severe effects*' on the natural environment[193] are unlawful. Such techniques are those that deliberately manipulate '*the dynamics, composition or structure of the Earth, including its biota, lithosphere, hydrosphere and atmosphere, or of outer space*.' Attacks against environmentally sensitive objects could create such a result. For example, bombing a volcano, or area of tectonic activity, and initiating an eruption or earthquake might create the prohibited level of environmental harm.[194] A reviewer would need to state in their guidance that AWS should not be used

[186] Environmental protection has also been referred to, in a wider sense, as being an '*essential interest*' of states by the ICJ. See Gabčíkovo-Nagymaros Project (Hungary/Slovakia) Judgement [1997] ICJ Reports, p.7, para.53.
[187] Convention on the prohibition of military or any other hostile use of environmental modification techniques (adopted 10 December 1976, entered into force 5 October 1978) 1108 UNTS 151 (Hereafter: ENMOD Treaty); Arts.35(3) and 55, API; Sandoz et al. (n.91) paras.1443, 1450; US Manual, para.6.17.
[188] Art.1, ENMOD Treaty; Arts.35(3) and 55, API.
[189] Art.1, ENMOD Treaty; Arts.35(3) and 55, API.
[190] ICRC Study, Rule 45.
[191] ICRC Study, Rule 45, Summary.
[192] ICRC Study, Rule 45, Summary.
[193] Art.1, ENMOD Treaty.
[194] ENMOD Treaty Annex, 'Understanding relating to Article II'; AMW Commentary, Section M. Para.4.

for these activities. Such objects should not be included in an AWS database and so could not be attacked *autonomously*. This would be the responsibility of developers. Any use of *ad hoc* targeting for such nefarious purposes would be the responsibility of the commander.

## 5.2. Environmental protection under Additional Protocol I

The environmental protection rules in API prohibit attacks creating environmental harm that is '*widespread, long-term and severe*'.[195] For example, attacks on super-tankers,[196] or oil refineries,[197] where the effects would cause '*such damage as would be likely to prejudice, over a long term, the continued survival of the civilian population or would risk causing it major health problems*'[198] are prohibited. Where environmentally sensitive targets are absent from the AWS database, they would be protected from *autonomous* attack via the closed-world assumption. However, attacks near such objects might cause unintended consequences. For example, flaming debris from an attack near an oil refinery might cause a fire. Commanders should take care to minimise risks toward such objects. Abiding by this rule is also relevant to procurement control as a reviewer's guidance would need to outline how a developer or commander can enable compliance with the legal rule.

With regard to the prohibited level of harm, IHRL can assist in defining this whilst also reinforcing the LoAC rules on environmental protection. As Murray suggests,[199] actions that would affect the enjoyment, by the civilian population, of their rights to food, water,[200] and health,[201] would constitute such a level of unlawful damage. Further, acts that interfere with these rights may also

[195] Arts.35(3) and 55, API.
[196] Boothby (n.83) 84.
[197] Murray (n.11) p.150, fn.257.
[198] Report of the Rapporteur, cited in Sandoz et al. (n.91) para.1454; Also note Boothby (n.83) 83.
[199] Murray (n.11) para.5.129.
[200] CESCR GC.15, para. 12(b); CESCR GC.12, para. 8; CESCR GC.14, para. 43.
[201] CESCR GC.14, para. 15.

contravene the protection of objects indispensable to the survival of the civilian population, which applies in IACs and NIACs under both treaty and customary law.[202]

Such objects include '*foodstuffs, agricultural areas for the production of foodstuffs, crops, livestock, drinking water installations and supplies and irrigation works.*'[203] However, attacking such objects in an IAC is not unlawful if it is the only source of sustenance for, or supports military actions of, an adverse party, as long as the civilian population is not left without adequate food and water.[204] Whether such an attack would be lawful requires contemporaneous decision-making by a commander, and is therefore within tactical control. The ability of an AWS to be used in such an attack would be subject to procurement control.

## 6. Precautions in attack

In terms of the targeting rules that constitute precautions in attack, some aspects can be dealt with by making certain unlawful behaviours impossible through technological management. Due to the complexities of modern battlespaces, however, many aspects also require the simultaneous exercise of tactical control. The exercise of both technical and tactical control here would be subject to procurement control.

### 6.1. The level of responsibility

The precautionary rules contained in API are addressed directly to '*those who plan or decide upon an attack*'.[205] This could be interpreted as relating purely to commanders, yet, as this thesis has argued previously, weapons developers have an enduring impact upon the function of *autonomous*

[202] Art.54, API; Art.14, APII; ICRC Study, Rules 53-55.
[203] Art.54(2), API; Art.14, APII; ICRC Study, Rule 54, Definition of objects indispensable to the survival of the civilian population.
[204] Art.54(3), API; ICRC Study, Rule 54, Exceptions – This exception does not likely apply in NIACs.
[205] Art.57(2)(a), API.

systems that they produce. The UK Manual correctly notes that API is silent as to the level of responsibility where this duty applies, and so should be applied to all those with '*discretion in the way the attack is carried out*.'[206] To Boothby, this would include:

> '[p]*lanners of automated or autonomous missions,* […] *all those involved in the preparation of the mission, the programming of the automated or autonomous software, the review of available information, the prescribing of the areas that are to be searched and of the times when such searches are to take place, the setting of the target identification criteria for the weapon control software and so on*.'[207]

As such, with AWS, the developers, the commanders, the operators, and the commander's staff would all be seen as people who '*plan or decide upon an attack*'. Thus, the precautionary decisions cross both technical and tactical control, and also include those who support tactical control. Ultimately, however, the decision to launch an attack resides with the commander who would be legally responsible for ensuring that precautionary measures taken are appropriate.

### 6.2. Constant care

The first rule of the precautionary principle requires that constant care is taken during military operations to spare the civilian population, civilians, and civilian objects. This is a treaty rule applicable in IACs,[208] and although there is no explicit treaty rule applicable in NIACs, a similar duty is implied in Additional Protocol II.[209] A customary formulation of the rule is, according to the ICRC, applicable in both IACs and NIACs.[210] As to what actually constitutes 'constant care', the API commentary suggests that this supplements the distinction rule,[211] and that '[i]*t is quite clear that by respecting this*

[206] UK Manual, para.5.32.9.
[207] Boothby (n.83) 254.
[208] Art.57(1), API.
[209] Art.13(1), APII; ICRC Study, Rule 15, Non-international armed conflicts.
[210] ICRC Study, Rule 15.
[211] Art.48, API.

*obligation the Parties to the conflict will spare the civilian population, civilians and civilian objects.*'[212] By using AWS in such a way as to comply with the distinction principle as outlined above, this rule would be complied with.[213]

The constant care requirement is reinforced when IHRL applies, as such obligations require constant battlefield monitoring.[214] This is to ensure that only the minimum necessary number of attacks take place to sufficiently neutralise a target[215] (note also that this is reflective of the humanity principle in LoAC).[216] For instance, during *autonomous* targeting, where an enemy tank is damaged to the point that an AWS can no longer recognise it as a tank, this would seem to abide by this requirement. With regard to *semi-autonomous* targeting, an operator could cancel any further attacks once they judge that the target has been neutralised. Where *ad hoc* attacks take place in communication-denied environments, an operator would have no means to halt AWS attacks, and so the AWS might need to be restricted to engaging in single attacks against each target so that an unnecessary level of force is avoided. This would also prevent any further attacks against persons who are *hors de combat* through injuries sustained in the opening salvo of the attack.[217]

### 6.3. Target verification

With regard to the treaty[218] and customary[219] requirement in IACs and NIACs to '*do everything feasible to verify that the objectives to be attacked are neither civilians nor civilian objects and are not*

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[212] Sandoz et al. (n.91) para.2191; Note however, that the AMW manual determines that care is taken once the precautionary duties are performed, see AMW Commentary, Rule 32.
[213] Note, however, that some consideration as been given to AWS and constant care with regard to 'non-critical functions' Chris Jenks and Rain Liivoja, 'Machine Autonomy And The Constant Care Obligation' (Humanitarian Law & Policy Blog, 2018) Archived:<https://web.archive.org/web/20190703080751/https://blogs.icrc.org/law-and-policy/2018/12/11/machine-autonomy-constant-care-obligation/>.
[214] Isayeva, Yusupova and Bazayeva v Russia, App nos:57947/00, 57948/00 and 57949/00 (ECtHR, 24 February 2005) para.194; Murray (n.11) para.5.81
[215] See Isayeva and others (n.214) para.194
[216] UK Manual, para. 2.4-2.4.2.
[217] Art.41(2)(c), API; ICRC Study, Rule 47 (c).
[218] Art.57(2)(a)(i), API; Art.7, Cultural Property Convention PII.
[219] ICRC Study, Rule 16.

*subject to special protection but are military objectives*',[220] this has relevance to both *autonomous* and *ad hoc* targeting. As such, all those who '*decide upon an attack*' are required to take feasible measures to ensure that the object of attack is a military objective. Feasible measures are those that are '*practicable or practically possible, taking into account all circumstances ruling at the time, including humanitarian and military considerations*.'[221] Thus, the requirement is not absolute, but provides flexibility to the situation at hand.[222] Such considerations might include assessment of the effects of the proposed precautions on: completion of the mission; the risk to one's own forces; the humanitarian situation; costs of time and resources; the foreclosure on alternative courses of action.[223] Where precautionary measures create operational or tactical risks, or do not provide humanitarian benefit, they are not required.[224] The effect of considering risk to AWS in terms of one's own forces has a much lower impact as these systems can only be subject to physical risk as equipment rather than as a person.

In terms of using AWS, target verification could constitute ensuring that during *autonomous* targeting, the system contains the expected targets in its database, and its sensors are calibrated correctly for recognising them. In terms of *ad hoc* targeting, this would likely require evaluating the most up-to-date intelligence available to ensure that the intended target is indeed a military objective. As such, compliance with this rule is dependent upon both technical and tactical control being compliant with the legal rules outlined in a reviewer's guidance.

IHRL reinforces the requirement to verify targets, by requiring that appropriate care is taken to identify them.[225] This involves careful consideration of the facts and, where it is necessary and

[220] Art.57(2)(a)(i), API.
[221] Art.3(10), Amended Protocol II to the CCW.
[222] This is also reflected in UK Statement On Ratification Of API (n.59) para. (c), and Canadian Government, Statement On Ratification Of API (1990) (Standard for decision-making).
[223] US Manual, para.5.3.3.2.
[224] US Manual, para.5.3.3.2.
[225] Kerimova and Others v Russia, App nos:17170/04, 20792/04, 22448/04, 23360/ 04, 5681/05, and 5684/05 (ECtHR, 3 May 2011) para.250; Khatsiyeva and Others v Russia, App no:5108/02 (ECtHR, 17 January 2008) para.137.

feasible, supplementary investigation to clarify the relevant circumstances.[226] Such additional measures may include: collecting further information regarding the targetability of the proposed target; the prevailing circumstances; the likelihood of an attack; the presence of civilians.[227] Equally, in situations of targeted killing, it will be important to verify the identity of a specific individual, and the activities of the individual(s).[228]

Additionally, IHRL requires that the presence of civilians in the battlespace should be communicated to all personnel in the vicinity.[229] Thus, an AWS should be updated with the number and location of civilians prior to missions so that the system can use this information in calculating how to perform certain protective measures. For example, intelligence gathered in daytime might suggest that a large number of civilians are resident in a particular area, an AWS launched at night when these civilians are asleep at home would not be able to recognise these people in their houses and protect them. As such, the number and location of civilians could be inputted into the AWS so that it engages in operations on the assumption that the previously detected number of civilians are already present. Further, where an AWS collects intelligence during a mission, this could be communicated to its commander during, or after, the mission, as is practicable, in order that planning for other missions can be updated.

Additional target verification measurers might be needed where the situation at the site of attack has changed substantially between intelligence being received and the attack taking place, such that the status of the target cannot be assessed. For example, forward-deployed troops might need to observe a target to prevent misidentification of civilians.[230] Or, an AWS could be used in a *semi-autonomous* mode. In communication-denied environments this would not be possible, and so a commander would need to rely upon intelligence reports to ensure the correct target is chosen. If

[226] Khatsiyeva (n.225) paras.136-137.
[227] Murray (n.11) para.5.60, fn.104.
[228] Murray (n.11) para.5.60, fn.104.
[229] Isayeva (n.12) paras.186-187; Murray (n.11) para.5.61.
[230] Isayeva and others (n.214) paras.188-189; Murray (n.11) para.5.61.

these are lacking, and a commander could not be sure that their attack would abide by targeting rules then it could not lawfully take place. In summary, whilst developers do play a role in complying with the target verification rule for those targets in the AWS database, abiding by it in the actual execution of attacks is mostly an exercise of tactical control, in accordance with any additional measures outlined in a reviewer's guidance.

### 6.4. Precautions in the choice of means and methods

In terms of taking feasible precautions to choose means and methods of warfare that reduce incidental civilian harm, this is a treaty[231] and customary obligation in IACs and NIACs.[232] Developers can play a role in abiding by this rule through building AWS such that they cannot use munitions with uncontrollable effects, for example. Yet, compliance with this rule also requires that to use lawful means at their disposal in the correct way too. An overview of factors that a commander ought to consider should be included in a reviewer's guidance.

The choice of means and methods, as limited by the military circumstances, relates to choices about what weapons are to be used, and how they should be employed. This is a process sometimes called 'weaponeering'.[233] It involves choosing, amongst other factors, the most appropriate: forms of weapon guidance or control; timing of attack; method of attack, such as using air or ground systems; fusing arrangements.[234] These are all germane to targeting using conventional and *autonomous* means. However, the most relevant choices to the *autonomous* nature of AWS are the restrictions on the time, space, and effects within which the system can apply decisions *autonomously*.[235] By deciding upon the limits of these dimensions, a commander creates an area within which they delegate the

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[231] Art.57(2)(a)(ii), API; Art.7, Cultural Property Convention PII.
[232] ICRC Study, Rule 17.
[233] For more on this, see Chairman of the Joint Chiefs of Staff, 'No-Strike And The Collateral Damage Estimation Methodology (CJCSI 3160.01A)' (US Joint Staffs, 2012) pgs.D-A-20 – D-A-23; Gregory McNeal, 'Targeted Killing And Accountability' (2014) 102 The Georgetown Law Journal,681, 748-750.
[234] William H. Boothby, The Law Of Targeting (OUP, 2012) 124.
[235] Note that Ford suggests these three forms of restrictions could constitute a form of control (n.4) 457-458.

selection and engagement of targets to the AWS. In military parlance, this is known as a 'Kill-Box'.[236] This is potentially the most important part of tactical control, as it is only within these restrictions that the AWS can function *autonomously*, and the choices about AWS within each level of control will actually manifest. As such, this is the crucial moment where legal targeting rules will either be complied with or not, and whether legal responsibility for violating those rules is generated.

IHRL reinforces this LoAC obligation by requiring that operations be planned '*so as to minimise, to the greatest extent possible, recourse to lethal force*,'[237] and to '*avoid or minimise, to the greatest extent possible, the risk of a loss of life, both for persons at whom the measures were directed and for civilians*.'[238] As such, by choosing a site and time of attack where civilian presence will be minimised, and choosing munitions that can achieve the aims of the mission whilst lessening unnecessary force, these requirements should be complied with. Such actions would also abide by the duty to choose means in light of the potential for incidental damage.[239] Decisions on methods to be used in a mission should be made contemporaneously, so as to ensure that the most appropriate level of autonomy is used, as judged in the circumstances prevailing at the time.[240] Further, if munitions are to be used within a populated area, the presence of military objectives must be demonstrated.[241] As we saw in Chapter 3, in order to exert sufficient control over an AWS, commanders could not deploy an AWS in a populated area in the hope that the system would find a target but must already know their intended target to be present, and that it could be attacked within the time, space, and effects restrictions they place upon AWS.[242]

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[236] See James W MacGregor, 'Bringing The Box Into Doctrine: Joint Doctrine And The Kill Box' (US Army School of Advanced Military Studies, 2004) Archived:<https://web.archive.org/web/20191007163710/https://apps.dtic.mil/dtic/tr/fulltext/u2/a429320.pdf>.
[237] Isayeva and others (n.214) para.171; Isayeva (n.12) para.175; Murray (n.11) para.5.66.
[238] Kerimova (n.225) para.248; Murray (n.11) para.5.66.
[239] Isayeva (n.12) paras.189; Murray (n.11) para.5.66.
[240] Khamzayev and Others v Russia, App no:1503/02 (ECtHR, 3 May 2011) para.179; Kerimova (n.225) para.247; Esmukhambetov (n.12) para.148; Murray (n.11) para.5.66.
[241] Esmukhambetov (n.12) para.148; Murray (n.11) para.5.66.
[242] Ford (n.4) 457-458.

When a commander decides how to employ an AWS, they must also consider the potential actions of their adversaries.[243] For example, knowing that an attack by AWS is incoming, a nefarious adversary might position their *matériel* near to civilian objects, or use human shields, in order to prevent attacks. Where this is a possibility, commanders should be sensitive to this risk and instruct their AWS to avoid weapons release near concentrations of civilians, unless military necessity makes this absolutely unavoidable.[244] As such, whilst weapons developers can prevent the use of prohibited means of warfare by an AWS, it is the responsibility of the reviewer to outline how an AWS could be used in accordance with this rule, and is the responsibility of the commander to actually ensure compliance.

### 6.5. Precautions as to the proportionality of an attack

As with disproportionate attacks that are prohibited as indiscriminate attacks (Section 4),[245] an AWS would need to be programmed such that when it calculates an attack is disproportionate, it could not progress to engage the target. This process would comply with the similar treaty and customary precautionary requirements to cancel or suspend an attack where it becomes apparent that it would be disproportionate.[246] This treaty rule also prohibits attacks where it becomes apparent that the target is civilian or is specially protected.[247]

In terms of the requirements to refrain from launching attacks that are expected to be disproportionate, [248] and the duty to cancel or suspend attacks where it becomes apparent that the attack will be disproportionate, [249] these form the basis of the proportionality principle which in its

[243] Ergi v Turkey, Judgment (App no:66/1997/850/1057, 28 July 1998) ECtHR, paras.79-80; This extends the precaution against the effects of attacks through not placing military objectives within or near densely populated areas, Art.58(b), API; Murray (n.11) para.5.66.
[244] On military necessity, see UK Manual, paras.2.2-2.3.
[245] Art.51(5)(b), API.
[246] Art.57(2)(b), API; Art.7, Cultural Property Convention PII; ICRC Study, Rule 19.
[247] Art.57(2)(b).
[248] Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14.
[249] Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14.

treaty form only applies to IAC, but applies to both forms of conflict under CIL[250] This is a balancing of military advantage expected from the destruction required to achieve military goals against the incidental harm caused to civilians, the civilian population, and civilian objects.[251] Where this incidental harm becomes excessive in comparison to the military advantage that is expected to be gained, such attacks become disproportionate. They are, therefore, indiscriminate and prohibited.[252]

It is important to note, however, that IHRL has its own understanding of 'proportionality' that, in relation to lethality, refers to a use of force being proportionate to protect life[253] (including the lives of targets).[254] Yet, this Chapter discusses the conception of proportionality in LoAC. Where IHRL is used to inform the understanding of LoAC proportionality, this will allow greater latitude for any victims to seek redress, which increases the scrutiny of governmental forces. This is particularly in cases where a state may be required evidence decisions[255] such as how a target was chosen, the military values attributed to military objectives, and any civilian harm that was anticipated.[256]

LoAC proportionality should be evaluated in terms of the whole attack.[257] So, for example, if multiple units assault an enemy command centre, proportionality should be considered in terms of the whole attack and not in terms of each unit involved. Or, if one attack is launched in order to divert enemy forces from the main attack, this diversion should be considered within the frame of reference of the main attack.[258] IHRL reinforces this position, as it requires the context of an operation to be considered as a whole.[259] As such, where an AWS is the sole method of attack, proportionality will be

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[250] Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14.
[251] Emanuela-Chiara Gillard, Proportionality In The Conduct Of Hostilities (Chatham House, 2018) para.24.
[252] Arts.51(5)(b), API; ICRC Study, Rule 14.
[253] Benzer and Others v Turkey, App no:23502/06 (ECtHR, 24 March 2014) para.163.
[254] Kerimova (n.225) para.248.
[255] Khashiyev and Akayeva v Russia, App nos:57942/00 and 57945/00 (ECtHR, 24 February 2005) para.133.
[256] Esmukhambetov (n.12) para.1485; Murray (n.11) para.5.82.
[257] UK Statement On Ratification Of API (n.59) para. (i); also note that identical or very similar statements were made by Australia, Belgium, Canada, France, Germany, Italy, the Netherlands, New Zealand, and Spain; Note that the ICRC commentary suggests that this '*goes without saying*', Sandoz et al. (n.91) para.2218; also see Galić (n.133) paras.37, 372-387, which considers military advantage in terms of individual shelling incidents.
[258] Gillard (n.251) para.28.
[259] CESCR GC.15, para.21; Murray (n.11) para.5.136.

considered in isolation. Where an AWS is just one part of a larger attack, it will be considered on the wider level.

There is some discussion in international law literature as to whether proportionality should be evaluated on the tactical, operational, or strategic level, or all three.[260] A multi-level decision would be beyond the capacity of an AWS, but the data it collects on its missions could inform wider considerations of proportionality.[261] During situations of combat at superhuman intensity, a constant communication link could allow this information to be regularly transmitted and levels of acceptable incidental harm could be continually updated.[262] However, when an AWS is used in a communication-denied environment, it would need to be updated with proportionality information as close as practicable to the attack beginning. This would be the same situation with beyond-visual-range attacks and so would seem a reasonable position for AWS to match.

LoAC does not define 'military advantage' for the purposes of proportionality. According to the Air and Missile Warfare Manual, military advantage with regard to proportionality is that which '*directly enhances friendly military operations or hinders those of the enemy.*'[263] This should be conceptualised as relating only to military operations in the contemporaneous context of the attack,[264] and not wider political goals.[265] The anticipated military advantage must be '*concrete and direct*.'[266] This can be interpreted fairly broadly.[267] But, the expected advantages should be '*substantial and*

[260] Van Den Boogaard (n.152) pgs.28.
[261] Van Den Boogaard (n.152) 28-30.
[262] Marguiles suggests this as part of his idea of '*dynamic diligence*'. This conceptualizes having many interconnected systems which would alter legal thresholds to vary according to the situation. Whilst this would be useful for ensuring legal compliance, it goes far beyond what the law requires which does not assist this Chapter in determining the sufficiency of current law. See Peter Marguiles, 'Making autonomous weapons accountable: command responsibility for computer-guided lethal force in armed conflicts', in Jens David Ohlin (ed), Research Handbook On Remote Warfare (Edward Elgar, 2017) 431-440.
[263] AMW Commentary, Rule 1(w), para.3.
[264] AMW Commentary, Rule 1(w), para.5.
[265] AMW Commentary, Rule 1(w), para.4; Note that there are a wide range of views on this, however. See Gisel (n.267) 15-20.
[266] Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14.
[267] Sandoz et al. (n.91) para.2210; Laurent Gisel (ed.), The Principle Of Proportionality In The Rules Governing The Conduct Of Hostilities Under International Humanitarian Law (ICRC 2018) 11-12.

*relatively close, and* […] *long term* [advantages] *should be disregarded*.'[268] Thus, perfect prediction is not required, but an assessment should include real and quantifiable anticipated benefits, that are likely to occur,[269] rather than speculative ones.[270]

With regard to incidental harm, the treaty and customary rules state that this includes '*loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof*.'[271] Experts are divided as to whether mental and physical illnesses caused by attacks can be considered as incidental harm.[272] Further, economic losses can only be seen as supplemental incidental harm.[273] In terms of viewing civilian displacement as 'harm', LoAC is unclear.[274] But, IHRL does suggest that displacement emanating from the destruction of property should be considered in this half of the proportionality calculation.[275] As such, civilian displacement would only be relevant to proportionality during a mission within the human rights jurisdiction of the attacking state.

Additional IHRL concerns about property and environmental rights can also be included under incidental harm. In terms of civilian property, commanders should consider whether an attack will interfere with the right to respect for the home,[276] whether an object is essential to the survival of the civilian population,[277] and whether an object has particular cultural significance.[278] With regard to the environment, any damage to this should be included in the conception of incidental harm in order to

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[268] Sandoz et al. (n.91) para.2209; Also see UK Manual, para.5.33.3.
[269] Prosecutor v Gotovina and others (Prosecution's Public Redacted Final Trial Brief) Case No: IT-06-90-T) [2010] ICTY, para.549.
[270] Tallinn Manual, Commentary to Rule 113, para.9.
[271] Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14.
[272] Gisel (n.267) 33-34; Tallinn Manual, Commentary to Rule 92, para.8, and Rule 113, para.5.
[273] Gisel (n.267) 42-43.
[274] Gisel (n.267) 43.
[275] Bilgin v Turkey, App no:23819/94 (ECtHR, 16 November 2000) para.108; Selçuk and Asker v Turkey, App nos:12/1997/796/998–999 (ECtHR, 24 April 1998) para.87.
[276] Orhan v Turkey, App no:25656/94 (ECtHR, 18 June 2002) para.380; Esmukhambetov (n.12) para.179.
[277] Case of the Afro-Descendant Communities Displaced from the Cacaria River Basin (Operation Genesis) v Colombia, Judgment (IACtHR, 20 November 2013) para.352; Ituango Massacres v Colombia, Judgment (IACtHR, 1 July 2006) para.182.
[278] Sawhoyamaxa Indigenous Community v Paraguay, Judgment (IACtHR, 29 March 2006) para.121.

fulfil respect for it.[279] IHRL requires that both immediate and long-term environmental damage should be considered in terms of incidental harm,[280] as should the impact of this damage on civilians.[281]

Further, with regard to secondary impacts of an attack and whether they should be considered in a proportionality calculation, LoAC targeting rules are silent as to whether 'long-term',[282] or 'reverberating', effects should be considered.[283] Experts agree that they should be included,[284] and a causal link may be required.[285]

LoAC is also silent as to whether *ex post facto* judging of the proportionality of an attack should be based upon the harm that was caused, or what was expected.[286] Experts suggest that expectation or foreseeability are key to any *ex ante* assessment of the proportionality decision made by a commander.[287]

Once military advantage and incidental harm have been assessed, they must then be compared.[288] It is important to note that targeting rules only prohibit attacks where incidental harm is '*excessive*' in comparison to the expected military advantage.[289] This allows for a '*fairly broad margin of judgment'*,[290] and decisions should be made using common sense and in good faith.[291] Although many commanders may disagree in close proportionality decisions, they would likely agree to what is

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279 Nuclear Weapons Case (n.8) para.30; Also note Murray (n.11) para.5.127-5.139.
280 CESCR GC.15, para. 12(b); CESCR GC.14, para. 43.
281 Murray (n.11) para.5.139.
282 Gisel (n.267) 43-45.
283 Gisel (n.267) 43-45.
284 Tallinn Manual, Commentary to Rule 113, para.6.
285 Gisel (n.267) 46.
286 Gillard (n.251) paras.37-41.
287 Note multiple references to foreseeable harm, Gisel (n.267) 35-37, 39, 41-50; Gillard (n.251) paras.37-69; Murray (n.11) para.5.80.
288 Gillard (n.251)paras.70-74.
289 Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14; not that the ICC Statute uses a '*clearly excessive*' standard Art.8(2)(b)(iv).
290 Sandoz et al. (n.91) para.2210.
291 Sandoz et al. (n.91) para.2208.

excessive.[292] As such, a '*reasonable military commander'* standard can be applied.[293] This would vary depending upon the context of the conflict, and the phase of the conflict that the attack takes place in.[294] Due to the broad margin of judgement allowed, it can be difficult for a prosecutor to show that a commander acted unreasonably.[295] Indeed, Sassóli suggests that states should move toward determining acceptable levels of incidental harm against internationally agreed objective measures, rather than subjective measures.[296] Applying an internationally agreed formula would not only make targeting prosecutions easier, but would also provide a standard measure against which AWS could be programmed. However, states have made no moves in this direction.

Due to the many subjective and qualitative decisions involved in a proportionality decision, no AWS in the near- or medium-term would be able to perform this assessment. As such, the decisions would remain with the commander using all available intelligence. A commander would, depending upon the sophistication of the AWS available, have three options to ensure a proportionate attack: only using the AWS where there is a negligible expected risk to civilians by programming the system to cancel any attack where a non-target is present in the expected blast radius; restricting the *autonomous* functions of the AWS very tightly to reduce as far as practicable the risks of civilian harm (for example, using small munitions in areas where civilians are expected to be); determining an acceptable level of incidental harm that could be inputted into, and applied by, the machine.[297]

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[292] Prosecutor for International Criminal Tribunal for the Former Yugoslavia, 'Final Report To The Prosecutor By The Committee Established To Review The NATO Bombing Campaign Against The Federal Republic Of Yugoslavia' (ICTY, 2004) para.50.
[293] Galić (n.133) para.58; this cannot be construed as a 'reasonable robot', see Jack Bears, 'The Principle of Proportionality in an Era of High Technology', in Winston S. Williams and Christopher M. Ford, Complex Battlespaces: The Law Of Armed Conflict And The Dynamics Of Modern Warfare (OUP, 2019) 272.
[294] Schmitt and Thurnher (n.135) 255-256; Gisel (n.267) 55.
[295] See Antonio Cassese, 'War Crimes' in Antonio Cassese and Paola Gaeta (eds.), Cassese's International Criminal Law (3rd edn, OUP, 2013) 74.
[296] Marco Sassóli, International Humanitarian Law (Edward Elgar, 2019) para.10.80.
[297] Ian S Henderson, Patrick Keane and Josh Liddy, 'Remote and autonomous warfare systems: precautions in attack and individual accountability' in Jens David Ohlin (ed.), Research Handbook On Remote Warfare (Edward Elgar, 2017) 351-353. These authors also suggest a fourth option of using an AWS that, using machine learning, could learn what a proportionate attack would look like. This has not been included here due to the necessary qualitative considerations which this thesis has already decided would not be possible in any system for the foreseeable future; Schmitt and Thurnher (n.135) 254-257.

It is important to remember that recognition of civilians is in the negative (Section 3), and also subject to the doubt rules.[298] Thus, where an individual or object cannot be recognised as a lawful target, they must be treated as civilian and any harm that comes to them would fall on the incidental harm side of the proportionality equation. Requiring an AWS to cease attacks where a non-target is identified (option one) should always be proportionate, as no incidental harm should occur.

The second option would allow an AWS to proceed with an attack even if a small, and proportionate, number of civilians or civilian objects are present in the expected blast radius. As long as the number of civilians or civilian objects that the commander decides to allow an AWS to include in its blast radii are proportionate to the military advantage to be gained, then this option would also ensure compliance with the rule. Both first and second options are rather blunt and are comparable to beyond-visual-range attacks.

The third, and potentially sharper, option requires the AWS to perform collateral damage estimation (CDE). This is a policy calculation that has been used for many years to determine the level of authorisation required for missions that expect civilian casualties.[299] It involves consideration of various factors, such as:

> '*the precision of a weapon, its blast effect, attack tactics, the probability of civilian presence in structures near the target, and the composition of structures to estimate the number of civilian casualties likely to be caused during an attack*.'[300]

Schmitt and Thurnher are confident that this process could be converted into algorithms for use by AWS,[301] but there is no public evidence available to suggest this has occurred.

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[298] Arts.50(1) and 52(3), API; Art.3(8), Amended Protocol II to the CCW; ICRC Study, Rules 6 on Situations of doubt as to the character of a person*,* and Rules 10 on Situations of doubt as to the character of an object; also see Adil Ahmad Haque, 'Proportionality And Doubt' (Just Security, 2019) Archived:<https://web.archive.org/web/20190330075722/https://www.justsecurity.org/62375/proportionality-doubt/>.
[299] Schmitt and Thurnher (n.135) 255.
[300] Schmitt and Thurnher (n.135) 254-255; Chairman of the Joint Chiefs of Staff (n.233).
[301] Schmitt and Thurnher (n.135) 255.

*If* it is possible that an AWS could use CDE algorithms to provide an accurate estimation of incidental harm at the time of attack, this would go some way to enabling compliance with the rules on proportionality.[302] The AWS could compare this calculated incidental harm to an acceptable level set by the commander, and proceed according to whether the calculated harm is above or below this threshold.[303] A commander would need to determine the acceptable level of incidental harm, as this is inextricably tied to the military advantage to be gained from the attack. This is an abstract value that could not be calculated by machine. As long as the threshold of incidental harm determined by the commander is not excessive in comparison to the expected military advantage of the attack, in the context of the conflict at that time, then the attack should abide by the proportionality principle.

Consequently, if it is possible to use CDE algorithms with an AWS, then the ability to calculate incidental harm would come under the technical control of weapons developers. The estimation of military advantage and an acceptable level of collateral damage would remain within the tactical control of the commander. Such a method of abiding by the proportionality rule would need to be demonstrated to a reviewer who would also need to approve the CDE algorithms for use in AWS, along with the process for calculating military advantage.

Schmitt and Thurnher also note the usefulness of an AWS that could increase its levels of acceptable incidental harm where it recognises an attack could provide increased military advantage. They provide an example of a concentration of enemy tanks in comparison to a single enemy tank.[304] This is cautioned, however, by the fact that no AWS could be programmed to comprehend military advantage for all situations.[305] As such, the best option would be for a commander to determine alternative thresholds for different expected situations. For example, intelligence may be unclear as to the size of an expected enemy unit, or how it may advance. A commander could provide different

[302] Arts.51(5)(b), 57(2)(a)(iii), 57(2)(b), API; ICRC Study, Rule 14.
[303] Schmitt and Thurnher (n.135) 256.
[304] Schmitt and Thurnher (n.135) 257.
[305] Schmitt and Thurnher (n.135) 257.

estimations of military advantage and accordingly acceptable incidental harm depending upon different scenarios that could likely happen according to intelligence reports.

Where intelligence reports about the civilian presence at the site of attack are very unclear, the sophistication of the system is low, or human judgement is required, the only reasonable things for a commander to do when using an AWS *autonomously* would be to input thresholds of incidental harm to be very conservative, i.e. following the first or second option. In such situations, instructing an AWS that no civilian harm is acceptable may be the preferred method of ensuring that an attack is proportionate.[306]Alternatively, where possible, an AWS could be used in a *semi-autonomous* mode.

### 6.6. Warnings

In the case of the precautionary requirement to give advance warnings to civilians in the area of an attack, unless circumstances do not allow, this is a rule under treaty and CIL in both IACs and NIACs.[307] Commanders would need to make decisions on whether to use warnings, as they can only be made in the circumstances at the time of attack. Developers could, however, facilitate compliance with this provision. For example, a speaker system or a capability to drop leaflets could be fitted to an AWS in order to provide warnings when required. Other techniques, such a 'roof-knocking' (where an inert or small missile is fired at a civilian building to induce the civilians inside to flee prior to an attack)[308] could constitute a warning in a very small set of circumstances but should generally be avoided due to the ease of them becoming an attack against civilians in and of themselves which would be contrary to LoAC.[309] Regardless of the technique employed, the decision as to whether to provide

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[306] Note that, in some situations, rules of engagement may prohibit any incidental harm. See Mandsager (n.2) para.6.5(a).
[307] Art.57(2)(c), API; Art.3(11), Amended Protocol II to the CCW; ICRC Study, Rule 20.
[308] Adam Withnall, 'Israel-Gaza Conflict: Israeli 'Knock On Roof' Missile Warning Revealed In Remarkable Video' (Independent, 2014) Archived:<https://web.archive.org/web/20190506193014/https://www.independent.co.uk/news/world/middle-east/israel-gaza-conflict-israeli-knock-on-roof-missile-warning-technique-revealed-in-stunning-video-9603179.html>.
[309] Jeroen C. van den Boogaard, 'Knock On The Roof: Legitimate Warning Or Method Of Warfare?' (2017) 19 Yearbook of International Humanitarian Law, 183; Art.48, API.

warnings to civilians would reside with the commander under their exercise of tactical control. Potential methods of warning would need to be authorised by a reviewer, along with circumstances for their use.

### 6.7. Choosing an attack offering the least civilian harm for a comparable military advantage

Where there is a choice between targets offering a similar amount of military advantage, commanders should choose to attack the target that would cause the least harm to civilians. This is a treaty and customary requirement in IAC, and arguably a customary rule in NIAC.[310] Due to the contextual information needed to make such a choice, it would first seem that only commanders could make this decision at the time of attack.

For an AWS to comply with this rule during *autonomous* targeting, it would need to recognise the military advantage and incidental harm expected from attacking one target and compare it to another target, and then choose that with the lesser harm for the same advantage. Such a decision is not about the proportionality of an attack *per se*, but about military advantage and incidental harm of one attack in comparison to another. Therefore, it does not require as much qualitative assessment.

For example, if an AWS mapped the expected blast radius of its munitions onto the target and recognised three tanks in the blast radius, this might provide 3*X* military advantage as opposed to 1*X* with a single tank. If 1γ incidental harm would be created by either attack, then the attack offering 3*X* advantage should be attacked. As such, the AWS would not need to determine the actual level of military advantage to be gained from an attack, but just that there is more advantage to be gained from one attack in comparison to another where the incidental harm would be similar. Although the recognition of all the relevant factors would be difficult to programme, the actual calculation of $(3X-1\gamma)>(1X-1\gamma)$ is relatively simple, and so the rule could be complied with whilst the AWS is functioning

[310] Art.57(3), API; Art.7, Cultural Property Convention PII; ICRC Study, Rule 21.

*autonomously*. The ability of an AWS to do this would need to be demonstrated to a reviewer who could then authorise it to be used under the discretion of a commander.

## 7. Conclusion

This Chapter has argued that, and explained how, the use of AWS could be in accordance with targeting rules both in terms of *autonomous* targeting and *ad hoc* targeting. This analysis of each targeting rule has shown that the use of this legal regime can restrain how AWS are employed so that their unlawful use is prevented, and it has also displayed what commanders/operators should do in using these machines so that legal thresholds can be met.[311] As such, this means that current international law rules are capable of regulating the use of AWS at a sufficient level, and it has been shown how regulations are applied through layers of control. A secondary effect of this analysis is that the role of the human being when using an AWS is far more substantial than it would first seem when dealing with an *autonomous* system.

This Chapter has shown that human oversight is, in general, a good thing for ensuring compliance with targeting rules and should be employed as much as practicable. It has also shown what an AWS would need to be capable of doing in order to be used in accordance with the law. Where a commander is reasonably certain that an *autonomous* or *ad hoc* attack could meet legal thresholds, it could lawfully go ahead. However, where this is not so, the attack should take place in a *semi-autonomous* mode, or make use of inhabited means,[312] or, potentially, forward-deployed troops could be used to confirm the lawfulness of a target to be attacked. Where none of these options are possible, a commander should consider as much intelligence about a proposed attack as is possible in

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[311] Chengeta has suggested that a 'legally required minimum level of control' could be the key to closing any suggested accountability gaps that exist in relation to the use of AWS. See Thompson Chengeta, 'What Level Of Human Control Over Autonomous Weapon Systems Is Required By International Law?' (Ejiltalk.org, 2018) Archived:<https://web.archive.org/web/20180825122142/https://www.ejiltalk.org/what-level-of-human-control-over-autonomous-weapon-systems-is-required-by-international-law/>.
[312] Boothby (n.83) 252-257.

the circumstances and make their decision in good faith.[313] Where this is the only option, and civilian presence at the site of attack cannot be adequately assessed, then a commander should restrict the effects of an attack by AWS to be zero civilian harm. Although this may result in no attack, or only a limited portion of an attack, occurring, this may be the only method of using an AWS in a *fully-autonomous* mode in accordance with targeting rules.

Overall, this Chapter has suggested that when programming AWS, technical control needs to be exercised in two ways. First, the programming of the system and any actions it will be capable of taking must reflect legally compliant behaviour; for example, targeting based upon legally-relevant target characteristics.

Second, where the framework for lawful actions described above requires an exercise of tactical control, developers must produce an AWS in such a way that it enables a commander to use it lawfully. For example, if the model proposed by Schmitt and Thurnher[314] to allow AWS to perform proportionality calculations can be realised by programmers, then this would enable the *autonomous* use of an AWS to be lawful even where the exact amount of incidental harm that will come from an attack is unknown to a commander.

In terms of the exercise of tactical control, commanders must also make lawful decisions in order to use AWS in accordance with targeting rules – the exercise of technical control by programmers does not absolve a commander of their responsibilities. A major part of tactical control is the decision as to how an AWS should be used, such as what targets it should be employed to attack, and what restrictions on the time, space, and effects from its *autonomous* functions should be.

It is important to remember that both technical and tactical control are exercised within the procurement control exerted by weapons reviewers. As the last Chapter argued, both targeting and

[313] UK Statement On Ratification Of API (n.117) para. (c); Canadian Government (n.222)(Standard for decision-making).
[314] Schmitt and Thurnher (n.135) 256.

weapons law regimes should be assessed when reviewing AWS. Consequently, the conclusions of this Chapter should be read alongside those of the previous Chapter in order to fully appreciate the novelty of AWS and their regulation. All of these conclusions should be incorporated into the guidance of a weapon reviewer. The legal rules included in this guidance apply prospectively to outline how AWS should be built and used. Violating these legal rules will generate legal responsibility. Where such guidance is inadequate, this could also generate legal responsibility. Responsibility is discussed in the next Chapter.

Chapter 6: A responsibility paradigm for AWS

1. Introduction

Responsibility is a key part of legal systems and is also a major part of the debate surrounding autonomous weapon systems (AWS). These machines pose a challenge to traditional notions of responsibility. Unlike a human soldier who can be punished following a breach of legal rules, there is no way of punishing a machine. Indeed, putting a machine on trial would seem to be as ridiculous as historical 'animal trials'.[1] In order for current international law to sufficiently regulate responsibility for AWS, it needs to be able to apply the relevant legal rules against states (and potentially non-state actors) for their internationally wrongful acts and against individuals for their criminal acts during the development or use of AWS. As this Chapter shows, the characterisation of AWS as legal agents of those exerting control over them allows for responsibility to be traced back to those persons or entities.

Some argue that if an AWS does something unpredictable then nobody could be sufficiently tied to, and held responsible for, those actions. So the argument goes, this creates an accountability gap whereby no responsibility can be attributed for the actions of an AWS.[2] The argument for the existence of an accountability gap is present in both moral and legal discourses.[3]

[1] Sonya Vatomsky, 'When Societies Put Animals On Trial' (JSTOR Daily, 2017) Archived:<https://web.archive.org/web/20190811093208/https://daily.jstor.org/when-societies-put-animals-on-trial/>.
[2] Human Rights Watch, 'Mind The Gap' (Human Rights Watch, 2015).
[3] HRW (n.2); Robert Sparrow, 'Killer Robots' (2007) 24 Journal of Applied Philosophy, 62; Thompson Chengeta, 'Accountability Gap, Autonomous Weapon Systems And Modes Of Responsibility In International Law' (2016) 45 Denver Journal of International Law, 1.

As Chapter 2 mentioned, the concept of a *moral* accountability gap hinges upon whether AWS are seen as moral agents.[4] As AWS are merely machines,[5] they cannot be moral agents and therefore human beings controlling them must be held *morally* accountable for their use.

The *legal* argument suggests that because AWS are highly-complex machines there will be design flaws, and when these flaws encounter unforeseen events, it could cause such systems to act in unanticipated ways; as such, it would be difficult to attribute responsibility.[6] Yet, this need not cause significant legal issues, because these events are merely accidents. It is inevitable that accidents will happen,[7] and they may violate legal rules.[8] International law makes allowance for this happening and does not impose legal penalties for unavoidable accidents. [9] However, no weapon system that has a higher-than-acceptable rate of accidents would pass review and be deployed.[10] As such, this Chapter is primarily interested in determining who is responsible, and how, when AWS have been used nefariously, negligently, or recklessly; consequently, it demonstrates that the apparent 'responsibility gap' is actually quite small.

This Chapter covers political, procurement, technical, and tactical control from the layers of control outlined in Chapter 3. The consequence of control is responsibility, as each controller should be held responsible for their exercise of control when things go wrong. In order to demonstrate how each controller can be held responsible, the Chapter notes that states are obligated to remedy the wrongdoing of AWS before demonstrating the need to take a multi-dimensional approach to

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[4] Michael Robillard, 'No Such Thing As Killer Robots' (2017) 35 Journal of Applied Philosophy, 705.
[5] See EPSRC, 'Principles Of Robotics' (EPSRC, 2010) Archived:<https://web.archive.org/web/20190825042317/https://epsrc.ukri.org/research/ourportfolio/themes/engineering/activities/principlesofrobotics/>.
[6] Wendell Wallach, 'Toward A Ban On Lethal Autonomous Weapons' (2017) 60 Communications of the ACM, 28, 31.
[7] See Paul Scharre, Army Of None (WW Norton & Company, 2018) 150-160 173-179.
[8] Rebecca Crootof, 'War Torts' (2016) 164 University of Pennsylvania Law Review, 1347, 1373.
[9] Matthew C Waxman, 'Detention As Targeting: Standards Of Certainty And Detention Of Suspected Terrorists' (2008) 108 Columbia Law Review, 1365, 1394.
[10] Such a system would likely breach the rules of precautions in attack. See William H. Boothby, The Law Of Targeting (OUP, 2012) 543 548, particularly section 22.5 and accompanying footnotes; Paul Scharre, 'Autonomous Weapons And Operational Risk' (Center for a New American Security, 2016) 18-23; Michael W. Meier, 'The strategic implications of lethal autonomous weapons', in Jens David Ohlin (ed.), Research Handbook On Remote Warfare (Edward Elgar, 2017) 456-460.

responsibility for AWS. It then looks at how the current responsibility paradigm struggles to deal with AWS and outlines solutions in the rest of the Chapter for entities exerting political, procurement, technical, and tactical control.

2. The applicable law

Should one of the legal rules (i.e. primary obligations) discussed in the previous two Chapters be broken, then this would generate legal responsibility (i.e. secondary obligations). Due to the different entities that exert control over AWS, there are several bodies of law that are relevant.

States are the primary subjects of international law and therefore provide a good starting point to discuss those responsible for controlling AWS. International law regulating the responsibility of states for internationally wrongful acts is found in customary international law (CIL) and case law, and was collated into the Articles on the Responsibility of States for Internationally Wrongful Acts (the Articles) by the International Law Commission (ILC).[11] This is a soft-law instrument and guide to the actual legal rules that are used to determine if a state is responsible for breaching its obligations (and if there are any circumstances precluding wrongfulness), and how the situation can be dealt with in terms of who can respond to a breach and who can seek reparations.

Most of the discussion of state responsibility here relates to breaches of primary obligations under the law of armed conflict (LoAC) and international human rights law (IHRL). Responsibility for LoAC violations is mostly concerned with state obligations that are owed to other states and are regulated under the rules on state responsibility. IHRL is mostly concerned with state obligations that are owed to individuals. Violations for these rules are governed by a self-contained regime within IHRL. This is based upon the state responsibly regime, and so the discussion of state responsibility is also

[11] International Law Commission, ' Report of The International Law Commission on the Work of its Fifty-Third session' (2001) UN Doc. A/CN.4/SER.A/2001/Add.1 (Part 2) p.31 (Draft articles on Responsibility of States for Internationally Wrongful Acts, with commentaries. Hereafter: ARSIWA).

applicable to IHRL (particularly in state-to-state cases).[12] Specific IHRL responsibility issues are noted in Section 7.4. This Chapter also discusses the potential applicability of the state responsibility and IHRL regimes to non-state actors.[13]

Some LoAC rules are owed to individuals, the breaching of which generates individual criminal responsibility for military personnel who violate them. This is known as the 'Grave Breaches' regime.[14] There are commonalities between it and the state responsibility regime.[15] As such, both the Grave Breaches regime and the IHRL responsibility regime can be thought of as self-contained systems within a wider system of 'general' international law governing responsibility.[16]

The Grave Breaches regime also has significant links to international criminal law (ICL). ICL is a body of law that regulates violations of international obligations by individuals. Following the *ad hoc* Nuremberg Trials, and the International Criminal Tribunals for the Former Yugoslavia, Rwanda, and other situations, the prosecution of individuals under ICL now has a permanent footing at the

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[12] See Theodor Meron, 'State Responsibility For Violations Of Human Rights' (1989) 83 Proceedings of the Annual Meeting (American Society of International Law, 5-8 April 1989) 372; Art.2(3)(A), International Covenant on Civil and Political Rights (adopted 16 December 1966, entered into force 23 March 1976) 999 UNTS 171 (Hereafter: ICCPR); Art.13, Convention for the Protection of Human Rights and Fundamental Freedoms (adopted 4 November 1950, entered into force 3 September 1953) 213 UNTS 221 (Hereafter: ECHR); Art.7(6), American Convention on Human Rights (adopted 22 November 1969, entered into force 18 July 1978) 1144 UNTS 123 (Hereafter: IACHR).

[13] Cedric Ryngaert, 'State Responsibility and Non-State Actors' in Math Noortmann, August Reinisch and Cedric Ryngaert (eds.), Non-State Actors In International Law (Hart Publishing, 2015) 177.

[14] Art.50, Geneva Convention (I) for the amelioration of the condition of the wounded and sick in armed forces in the field (adopted 12 August 1949, entered into force 21 October 1960) 75 UNTS 31 (Hereafter: GC I); Art.51, Geneva Convention (II) for the amelioration of the condition of the wounded, sick and shipwrecked members of the armed forces at sea (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 85 (Hereafter: GC II); Art.131, Geneva Convention (III) relative to the treatment of prisoners of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 135 (Hereafter: GCIII); Art.148, Geneva Convention (IV) relative to the protection of civilian persons in time of war (adopted 12 August 1949, entered into force 21 October 1950) 75 UNTS 287 (Hereafter: GC IV); Arts.11 and 85, Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 3 (Hereafter: API).

[15] See, for example, Case Concerning Military And Paramilitary Activities in and Against Nicaragua (Nicaragua v United States of America) Merits [1986] ICJ Reports, p.14, para.115; Art.3, Convention (IV) respecting the Laws and Customs of War on Land and its annex: Regulations concerning the Laws and Customs of War on Land (adopted 18 October 1907, entered into force 26 January 1910)(Hereafter: HC IV); Art.91, API; First Protocol to The Hague Convention of 1954 for the Protection of Cultural Property in the Event of Armed Conflict(adopted 14 May 1954, entered into force 7 August 1956) 249 UNTS 270.

[16] Conclusions 1 and 12, International Law Commission, ' Report of The International Law Commission on the Work of its Fifty-Eighth session' (2006) UN Doc. A/CN.4/SER.A/2006/Add.1 (Part 2).

International Criminal Court (ICC). In terms of ICL, this Chapter focuses on the statutes of these Courts and their case law. The ICC is a major focus of this. Despite its troubled existence,[17] it is the premier body dealing with ICL today and regularly incorporates the case law of bodies that have gone before it. Further, the definitions of international crimes in the Rome Statute of the International Criminal Court rely heavily on accepted historical precedent and CIL[18] (although its approach to CIL has been criticised),[19] and so reflects the most cogent understanding of the legal rules available today.

Whilst these rules all exist on the international level, the rules of LoAC, IHRL, and ICL also apply on the domestic level. Internal rules of states are particularly relevant in this Chapter due to a number of potential legal gaps that are present internationally; domestic law can fill those gaps. This is particularly so when domestic criminal law has incorporated the Grave Breaches regime and ICL rules. As domestic remedies should be exhausted before elevating a case to the international level,[20] domestic courts would be the primary venue for prosecuting individual wrongdoers using AWS. This also solves some issues if it would be difficult to prosecute an individual internationally (see Section 11.1).

Not only are the LoAC and ICL rules relevant to internationally criminal acts, but so is wider domestic criminal law. For example, the nefarious lethal acts of an individual using an AWS could be defined as murder domestically, and the fatal actions of a nefarious AWS manufacturer may be

[17] See, for example, Douglas Guilfoyle, ‘This is not fine: The International Criminal Court in Trouble’ (EJIL: Talk!, 2019) Archived:<https://web.archive.org/web/20190330065740/https://www.ejiltalk.org/part-i-this-is-not-fine-the-international-criminal-court-in-trouble/>.
[18] Philippe Kirsch, ‘Foreword’ in Knut Dörmann, Louise Doswald-Beck and Robert Kolb (eds.), Elements Of War Crimes Under The Rome Statute Of The International Criminal Court (ICRC 2002) pg.xiii.
[19] See, for example, Antonio Cassese, 'The Statute Of The International Criminal Court: Some Preliminary Reflections' (1999) 10 European Journal of International Law, 144.
[20] Velásquez Rodríguez v Honduras, Judgement, Ser C No4 (IACtHR, 29 July 1988) 61-62; Art.17, Rome Statue Of The International Criminal Court 1998 (adopted 17 July 1998, entered into force 1 July 2002) 2187 UNTS 3 (Hereafter: ICC Statute).

considered corporate manslaughter. Further, domestic service law governing military discipline might be relevant to some wrongful uses of AWS.[21]

Finally, tort law is relevant. This could be of particular use for holding manufacturers responsible through product liability in the domestic sphere. Torts for the use of weapons could not be made on the basis of a manufacturer having a duty of care over those their products are used against,[22] but could be applicable where such companies do not provide required information or training for using their products.[23]

Crootof argues for the development of a regime of tort in international law to apply to AWS called 'War Torts'.[24] Crootof suggests that, where an AWS performs a sub-criminal act, or individual criminal responsibility cannot be determined, states should be held strictly liable for these 'tortuous' acts with their liability attributed using a similar framework to that used for the responsibility of states for internationally wrongful acts.[25] Whilst this may fill some gaps, it is a significant *lex ferenda* suggestion. This would require a whole new body of international law, and there is no apparent interest in doing so from states. It will, therefore, not be considered further in this thesis.

At this point, it is necessary to differentiate between accountability, responsibility, and liability. Although in general parlance they are synonymous, there are differences in legal discourse. Accountability is the widest concept, meaning that an offending entity is called to account for their

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[21] See, for example, Armed Forces Act 2006; UK Ministry of Defence, 'Manual Of Service Law (JSP 830)' (UK MoD, 2013); Laura Dickinson, 'Lethal Autonomous Weapons Systems: The Overlooked Importance of Administrative Accountability' in Eric Talbot Jensen and Ronald T. P Alcala (eds.), The Impact Of Emerging Technologies On The Law Of Armed Conflict (OUP, 2019); For other forms of administrative accountability, see Gregory McNeal, 'Targeted Killing And Accountability' (2014) 102 The Georgetown Law Journal, 681, 758-785.
[22] Swati Malik, 'Autonomous Weapon Systems: The Possibility And Probability Of Accountability' (2018) 35 Wisconsin International Law Journal, 609, 629.
[23] See, for example: Turner et al [Tammy Lou Fontenot] v TASER International, Inc [2012] Western District of North Carolina (Charlotte Division), Case no 3:10CV125-RJC-DCK; Heston et al v Taser International and City of Salinas et al [2011] US Court of Appeal (Ninth Circuit), Case no 09–15440 DC No 5:05-cv-03658-JW; Rosa v Taser International, Inc [2012] US Court of Appeals (Ninth Circuit), No 09–17792, 7950.
[24] Crootof (n.8) 1396-1402.
[25] Crootof (n.8) 1386-1402.

actions.[26] For example, a government minister explaining acts of state to parliament.[27] 'Accountability' is used here to refer to the consequences of moral wrongs.

Responsibility is narrower, meaning that an offending entity suffers legal sanction in response to their wrongdoing.[28] For example, a state accepting their wrongdoing and paying reparations, or an individual suffering incarceration. It is used here to refer to the consequences of legal wrongs.

Liability is the narrowest concept and entails sanction against an entity for particular wrongdoing.[29] Liability can emerge in various forms. For example, under command responsibility, an individual can be held responsible for their command decisions and actions but not for their actions outside of this. It is used here refer to the consequences of specific legal wrongdoing.

3. The right to a remedy

The Basic Principles and Guidelines on the Right to a Remedy and Reparation for Victims of Gross Violations of International Human Rights Law and Serious Violations of International Humanitarian Law (BP&G) are a soft-law guide that simultaneously articulates the right to a remedy under IHRL[30] and similar duties under LoAC.[31] States are obligated to provide a remedy to an internationally wrongful act, as stated in the Chorzów Factory cases.[32] These cases have been influential on the approaches of human rights conventions[33] and courts[34] in creating and articulating

[26] Marc Cornock, 'Legal Definitions Of Responsibility, Accountability And Liability' (2011) 23 Paediatric Nursing, 25, 25-26.
[27] Katharine Fortin, The Accountability Of Armed Groups Under Human Rights Law (OUP, 2017) 5.
[28] Cornock (n.26) 25.
[29] Cornock (n.26) 25-26; Menno T Kamminga, Inter-State Accountability For Violation Of Human Rights (University of Pennsylvania Press, 1992).
[30] Art.2(3), ICCPR.
[31] Art.3, HC IV; Arts.49-52, GCI; Arts.50-51, GCII; Arts.129-132, GCIII; Arts. 146-149, GCIV; Arts.11, 85-91, API.
[32] Case Concerning the Factory At Chorzów (Claim for Indemnity) (Germany v Poland) Jurisdiction (1927) PCIJ Rep Series A No 9, p.5, 21; Art.3, HC IV; Art.91, API; Case Concerning the Factory at Chorzów (Claim for indemnity) (Germany v Poland) Merits (1928) PCIJ Rep Series A No 17, p.10, 47; Art.31, ARSIWA.
[33] Art.2(3)(A), ICCPR; Art.13, ECHR; Art.7(6), IACHR.
[34] See, for example, Papamichalopoulos and Others v Greece, App no:14556/89 (ECtHR, 31 October 1995) para.36.

a comprehensive right to a remedy including access to justice,[35] and enforcement of remedies,[36] including reparations.[37]

The drafters of the BP&G suggest that the document does '*not entail new international or domestic legal obligations*'.[38] Yet, in terms of responsibility and remedies, LoAC obligations are presented as being as comprehensive as those in IHRL. LoAC contains treaty and customary[39] obligations to investigate Grave Breaches of its rules,[40] and to provide penal sanction to those who carry out such acts.[41] LoAC also contains an obligation to pay compensation '*if the case demands*',[42] meaning restitution or restoration would be insufficient to rectify material or personal losses.[43] However, treaties and state practice show mixed approaches as to whether this compensation is for individual victims or states.[44]

In order to achieve an effective remedy under LoAC, domestic victims of an internal armed conflict would need to petition their government for remedy, and foreign victims of extraterritorial military operations would need to petition their government to make claims on their behalf using the legal fiction of diplomatic protection.[45] Therefore, it is conceivable that victims of LoAC breaches by an AWS could be provided with compensation.[46] But, the convoluted and potentially unfulfilling route victims would need to take means that this might not be an effective remedy in reality.[47]

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[35] Art.2(3)(b), ICCPR; Art.13, ECHR; Art.7(6), IACHR.
[36] Art.2(3)(c), ICCPR; Art.7(6), IACHR.
[37] Art.41, ECHR; Ananyev and Others v. Russia, App nos:42525/07 and 60800/08 (ECtHR, 10 April 2012) paras.210-231
[38] Basic Principles and Guidelines on the Right to a Remedy and Reparation for Victims of Gross Violations of International Human Rights Law and Serious Violations of International Humanitarian Law (60th session, 21 March 2006) UN Doc. A/RES/60/147, 3.
[39] Jean-Marie Henckaerts and Louise Doswald-Beck, Customary International Humanitarian Law (CUP, 2005) (Hereafter: ICRC Study), Rule 158.
[40] Art.49, GCI; Art.50, GCII; Art.129, GCIII; Art.146, GCIV; Art.86(1), API
[41] Art.49, GCI; Art.50, GCII; Art.129, GCIII; Art.146, GCIV
[42] Art.3, HC IV; Art.91, API
[43] Yves Sandoz, Christophe Swinarski and Bruno Zimmermann (eds.), Commentary On The Additional Protocols Of 8 June 1977 To The Geneva Conventions Of 12 August 1949 (Martinus Nijhoff Publishers, 1987) para.3655.
[44] Dinah Shelton, Remedies In International Human Rights Law (3rd edn, OUP, 2015) 81-83.
[45] Sandoz et al. (n.43) para.3657; Shelton (n.44) 83.
[46] Boothby (n.10) 544.
[47] McFarlane v. Ireland, App no:31333/06 (ECtHR, 10 September 2010) para.114.

There may be an option, however, whereby foreign victims could argue that their right to a remedy under IHRL should include effective investigations of LoAC violations independent of their right to a remedy for violations of substantive rights. This independence would be required as an investigation into a potential violation of the right to life, for example, may not necessarily overlap with the key aspects of a potential breach of the LoAC rules.[48] This situation would be further complicated by the question of how IHRL applies during armed conflict, if derogations have taken place, and if rights have been 'divided and tailored'[49] (See Chapter 3). The situation is complicated, at best. But, it is the same for all potential violations, and not just those carried out by AWS. Still, fulfilling the right to a remedy, in both IHRL and LoAC terms, requires a sufficient responsibility regime that can identify and punish wrongdoers.[50] In order to meet these obligation, this Chapter demonstrates how the different entities controlling AWS can be held responsible under current international law.

4. Focussing on state, non-state actor, and individual responsibility in international law

Some authors have suggested that state responsibility alone would be sufficient to provide a responsibility regime for AWS.[51] However, the present Chapter argues against this view. Firstly, such a position would provide impunity to individual wrongdoers, and so is morally unacceptable.[52] Further, where a state is held responsible for the actions of its agents, that should not, and does not, [53] prevent

[48] This would be a similar situation to where, for example, a domestic remedy was insufficient. See The Nature of the General Legal Obligation Imposed on States Parties to the Covenant (Human Rights Committee, 80th session) 2004 UN Doc. GC.31 CCPR/C/21/Rev.1/Add. 13, para.16; James A. Sweeney, 'Law and policy on post-conflict restitution' in Matthew Saul and James A Sweeney (eds.), International Law And Post-Conflict Reconstruction Policy (Routledge, 2015) 278.
[49] Al-Skeini v United Kingdom, App no:55721/07 (ECtHR, 7 July 2011) para.137.
[50] Art.49, GCI; Art.50, GCII; Art.129, GCIII; Art.146, GCIV; Art.86(1), API; Art.2, ICCPR.
[51] Jeffrey Thurnher, 'No One At The Controls: The Legal Implications Of Fully Autonomous Targeting' (2012) 67 Joint Force Quarterly, 77, 82; Daniel N. Hammond, 'Autonomous Weapons And The Problem Of State Accountability' (2015) 15 Chicago Journal of International Law, 652, 662-671.
[52] Sparrow (n.3) 71.
[53] Art.25 (4), ICC Statute; Art.58, ARSIWA.

individuals being held responsible as well.[54] Although the simultaneous pursuit of individual and state responsibility might create tensions, this is not necessarily problematic.[55]

Second, whilst the responsibility of states and individuals could be generated by the same act, the violated substantive rules might not be identical for each entity and so an act that breaches one set of rules may not necessarily breach the other. For example, a state agent committing an individual war crime would not garner state responsibility unless it was part of a wider systematic pattern of wrongdoing.[56] Consequently, if only state responsibility were considered to deal with the use of AWS, then this could create a responsibility gap in international law. In response to this, the different legal regimes under which legal responsibility can be generated should be thought of as complementing each other, rather than as alternatives.[57]

Third, armed non-state actors (ANSAs) are expected to possess AWS in the near future.[58] But, the state responsibility regime has a limited application to non-state actors and it is difficult to articulate their responsibility within this regime (see Section 8). Thus, restricting the notion of responsibility for AWS to state responsibility would remove the possibility of holding ANSA members individually responsible in place of holding the ANSA responsible as a group. As such, the development of a responsibility regime for AWS needs to include states, non-state actors, and individuals.

[54] P.3 of commentary to Art.58, ARSIWA.

[55] Antonio Cassese, 'Fundamentals of International Criminal Law' in Antonio Cassese and Paola Gaeta (eds.), Cassese's International Criminal Law (3rd edn, OUP, 2013) 7-8; Beatrice I. Bonafè, The Relationship Between State And Individual Responsibility For International Crimes (Martinus Nijhoff Publishers, 2009) 24-25.

[56] Paola Gaeta, 'On What Conditions Can A State Be Held Responsible For Genocide?' (2007) 18 European Journal of International Law, 631, 641.

[57] Bonafè (n.55) 24-25; Chengeta (n.3) 3.

[58] Dyani Sabin, 'ISIS Will Use Killer Robots One Day, Says A.I. Expert' (Inverse, 2017) Archived:<https://web.archive.org/web/20190725103910/https://www.inverse.com/article/32929-isis-killer-robots>; A rudimentary AWS could be built in a weekend if legal rules were ignored. Andrew Fursman, 'Private Sector Perspectives On The Development Of Lethal Autonomous Weapon Systems' 2016 Group of Governmental Experts on Lethal Autonomous Weapons Systems Side Event (Geneva, 15 April 2016).

5. The problematic nature of the current responsibility paradigm

The current responsibility paradigm for the development and use of weapons under international law was intended to cover situations where humans are in direct control of their weapons.[59] For example, where an individual fires a missile to commit a war crime, they can be held individually responsible, and where an internationally wrongful act occurs, the state they represent can be held responsible.[60] This is possible as there is a clear chain of responsibility back to the human being (state agent). An example of this is found in UK doctrine, but similar positions are found in US[61] and Chinese doctrine[62]: '[l]*egal responsibility for any military activity remains with the last person to issue the command authorising a specific activity*.'[63]

However, with *autonomous* systems, holding a commander responsible for all the actions of an AWS ignores the impact of the deploying political entity, weapons reviewer, and weapons developers, who, as we have seen, exert control over AWS. Considering the substantial impact that each entity can have over AWS, it would seem plainly inappropriate to ignore their legal responsibility.

Imagine that an AWS developer mis-programmed something deep within the code of an AWS which meant that in some situations, civilian vehicles are misidentified as armoured personnel carriers, and this is not picked up by a weapons reviewer. Upon deployment, the commander uses this system against tanks and artillery where it works perfectly well, but, during a later mission, the system ultimately misidentifies a civilian vehicle and attacks it. Holding the AWS commander responsible

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[59] P.W. Singer, Wired For War (Penguin Press, 2009) 74.
[60] Art.1, ARSIWA; William J. Fenrick, 'Prosecution of International Crimes' in Terry D Gill and Dieter Fleck (eds.), The Handbook Of The International Law Of Military Operations (OUP, 2011) para.29.05; Moses Case, General Claims Commission (Mexico and United States), in John Bassett Moore, History And Digest Of The International Arbitrations To Which The United States Has Been A Party (Vol.III) (Government Printing Office, 1898) 3127, at 3129; Art.4, ARSIWA.
[61] See HRW (n.2) 31-32.
[62] Qiang Li and Dan Xie, 'Legal Regulation Of AI Weapons Under International Humanitarian Law: A Chinese Perspective' (Humanitarian Law & Policy Blog, 2019) Archived:<https://web.archive.org/web/20190924150139/https://blogs.icrc.org/law-and-policy/2019/05/02/ai-weapon-ihl-legal-regulation-chinese-perspective/>.
[63] Development, Concepts, and Doctrine Centre, 'The UK Approach To Unmanned Aircraft Systems' (UK Ministry of Defence, 2011) para.510; see also Development, Concepts and Doctrine Centre, 'Joint Doctrine Publication 0-30.2 Unmanned Aircraft Systems' (UK Ministry of Defence, 2017) para.4.19 stating that governments and the chain of command also have responsibility for their activities.

would seem to go against the idea that people should be held responsible for their own actions. The current situation would hold commanders responsible for other's mistakes just because they happened to be the last person commanding the system at the time the fault manifested itself.[64] Such a responsibility regime is insufficient as it does not ensure the responsibility of each person exercising control over AWS.

Despite the insufficiency of the current paradigm, it is intended to be used for attributing responsibility for AWS. The UK has rearticulated its position for weapons with autonomy:

> '[o]*nce deployed, accountability is vested in the trained operators who employ the system, and in the decisions taken by commanders at every level who have operational or tactical responsibility for the conduct of a campaign and the specialists who advise them.*'[65]

This re-articulation of the current paradigm now considers operators, commanders, and specialist advisers. But, it still does not go far enough as to include the responsibility of manufacturers for their technical control over AWS,[66] nor those who exert political control. The unwillingness to extend the chains of responsibility to manufacturers is due to another policy decision. Under UK doctrine, when equipment is delivered and accepted by the military, manufacturer responsibility is discharged.[67] By incorporating this policy decision into a responsibility regime for AWS, the insufficiency is maintained.

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[64] Note the similarly problematic development of command responsibility in the case of General Yamashita, who was held responsible for the unlawful actions of his troops despite not being in a position to know about what his troops were doing. Whilst the principles of command responsibility were rightly affirmed in this case, repeating the mistake of holding a commander responsible for something they could not control would be undesirable. Indeed, modern command responsibility does not hold commanders responsible unforeseeable activities. See the dissenting opinions of Judges Rutledge and Murphy in re Yamashita, 327 US 1 [1946] US Supreme Court; Laurel Baig, 'Omission Liability and Superior Responsibility' in Antonio Cassese and Paola Gaeta (eds.), Cassese's International Criminal Law (3rd edn, OUP, 2013) 183-187; Art.28, ICC Statute.

[65] UK UNOG Delegation, 'Human Machine Touchpoints: The United Kingdom's Perspective On Human Control Over Weapon Development And Targeting Cycles' 2018 Group of Governmental Experts on Lethal Autonomous Weapon Systems (Geneva, 8 August 2018) UN Doc. CCW/GGE.2/2018/WP.1, para.19

[66] See UK UNOG delegation (n.65) 5, fig.3 and Annex 1, 6-12.

[67] UK Approach (n.63) para.510.

The inappropriateness of the current paradigm can be clearly seen with the similar technology of self-driving cars. *Automated* cars provide an advanced form of cruise control that can keep a vehicle at an appropriate speed, in a motorway lane, and automatically brake.[68] The human 'driver' must remain able to take back driving at any point, i.e. they are '*on-the-loop*' and are responsible for ensuring the safe functioning of the vehicle at all times.[69] This, therefore, provides an obvious person to be held responsible when things go wrong and would work well with *semi-autonomous* targeting, or where *fully-autonomous* targeting is overseen by humans who can intervene when necessary.

Yet, with an *autonomous* vehicle that could take you from A to B without human intervention, people will merely provide a destination.[70] This is a parallel to the tactical control an operator has over AWS: humans instruct the system to perform particular tasks but do not otherwise intervene. Manufacturers retain technical control in relation to both technologies and should have responsibility resulting from that control. Indeed, some self-driving car manufacturers have accepted tortuous liability for the actions of their products in advance of their production and sale.[71]

Thus, we can see that the current responsibility paradigm for AWS is aligned with *automated* vehicles, despite the functionality of AWS being more like *autonomous* vehicles. The responsibility paradigm for AWS should follow this example of expanding responsible entities to those exerting control over the system, rather than the commander only.

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[68] Rob Enderle, 'The Difference Between Tesla Autopilot And Future Self-Driving Cars: Intelligence' (TechSpective, 2016) Archived:<https://web.archive.org/web/20200624174158/https://techspective.net/2016/07/08/difference-tesla-autopilot-future-self-driving-cars-intelligence/>.

[69] Ralf Herrtwich, 'The Difference Between Autonomous And Driverless Cars' (360Here, 2017) Archived:<https://web.archive.org/web/20180625001253/https://360.here.com/2017/02/06/difference-autonomous-driverless-cars/>.

[70] Justin Hughes, 'Car Autonomy Levels Explained' (The Drive, 2017) Archived:<https://web.archive.org/web/20190611203522/https://www.thedrive.com/sheetmetal/15724/what-are-these-levels-of-autonomy-anyway>.

[71] Michael Ballaban, 'Mercedes, Google, Volvo To Accept Liability When Their Autonomous Cars Screw Up' (Jalopnik, 2015) Archived:<https://web.archive.org/web/20190808195659/https://jalopnik.com/mercedes-google-volvo-to-accept-liability-when-their-1735170893>.

6. Approaches to multi-party responsibility

We noted in Chapter 3 that some authors have suggested providing AWS with legal personality so that a responsibility regime can be easily constructed to include each entity that exerts control over AWS.[72] Other authors have suggested similar approaches of sharing responsibility for AWS between controlling entities.[73] These approaches are legally problematic, as holding a collective responsible would shield individual wrongdoers[74] and goes against the tenant of international criminal law that each individual should be responsible for their own actions.[75] Further, it is also a form of collective punishment, which are prohibited.[76]

As such, this reinforces the decision in Chapter 3 that AWS should be viewed as legal agents of those controlling them, rather than legal persons.[77] As holding the controlling entities responsible together is so problematic, the responsibility of entities individually must be considered in order to sufficiently regulate AWS. This Chapter now looks at the responsibility of those exerting political control, beginning with states, and then considers non-state actors, before going on to consider individual responsibility of those exerting procurement, technical, and tactical control.

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[72] Luciano Floridi and J.W. Sanders, 'On The Morality Of Artificial Agents' (2004) 14 Minds and Machines, 349; EU Committee on Legal Affairs, 'Draft Report With Recommendations To The Commission On Civil Law Rules On Robotics (2015/2103(INL))' (2016) Archived:<https://web.archive.org/web/20190803144706/http://www.europarl.europa.eu/doceo/document/JURI-PR-582443_EN.pdf?redirect>, para.31(f).

[73] Report Of The Special Rapporteur On Extrajudicial, Summary Or Arbitrary Executions, Christof Heyns (Human Rights Council, 23rd session) 2013 UN Doc. A/HRC/23/47, para.81; Chengeta (n.3) 34-36; Tetyana Kruipy, 'Regulating a Game Changer: Using a Distributed Approach to Develop an Accountability Framework for Lethal Autonomous Weapon Systems' (2018) 50 Georgetown Journal of International Law, 45.

[74] Joanna J. Bryson, Mihailis E. Diamantis and Thomas D. Grant, 'Of, For, And By The People: The Legal Lacuna Of Synthetic Persons' (2017) 25 Artificial Intelligence and Law, 173, 287; International Tin Council Case, JH Rayner (Mincing Lane) Ltd. v. Department of Trade and Industry [1989] 3 WLR 969, 986-987.

[75] Prosecutor v Tadić (Appeal Judgement) Case No: IT-94-1-A [1999] ICTY, para.186.

[76] Art.50, Annex, HC IV; Art.87, GC III; Art.33, GC IV; Art.75(2)(d), API; Art.4(2)(b), Protocol Additional To The Geneva Conventions Of 12 August 1949, And Relating To The Protection Of Victims Of Non-International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 609 (Hereafter: APII); Art.4, Statute of the International Criminal Tribunal for Rwanda (adopted 8 November 1994, updated 31 January 2010) UNSC Res.1901 (Hereafter: ICTR Statute); Art.3(b), Statute of the Special Court for Sierra Leone (adopted 16 January 2002) UNSC Res.1315 (Hereafter: SCSL Statute); Prosecutor v. Priebke and Haas, (1998) Italian Supreme Court of Cassation, cited in Antonio Cassese (ed.), The Oxford Companion To International Criminal Justice (OUP, 2010) 879; ICRC Study, Rule 103.

[77] Ugo Pagallo, The Laws Of Robots (Springer Netherlands, 2013) 40-43; Ugo Pagallo, 'Vital, Sophia, And Co.—The Quest For The Legal Personhood Of Robots' (2018) 9 Information, 230, 230-231.

7. The responsibility of states for internationally wrongful acts

In terms of states breaching their international obligations, the following discussion is primarily concerned with violations of those customary and treaty rules discussed in the previous two Chapters. A breach of LoAC[78] or IHRL[79] obligations using AWS would generate state responsibility (unless there is an appropriate 'defence', see below Section 7.2). To whom a state may be responsible depends upon whom the obligation is owed to. A state may be obligated towards another state, or group of states (bi-lateral or multi-lateral treaties),[80] all states (*jus cogens* norms, or obligations *erga omnes*), or individuals.[81] Where these obligations are breached, a subsequent obligation to make reparation is created.[82]

With regard to obligations owed to individuals, we have already seen the difficulties of asserting one's rights in terms of a right to a remedy (Section 3). Indeed, the traditional international law view suggests that individuals have no direct recourse against foreign states apart from the legal fiction of diplomatic protection.[83] However, that discussion did note that there are some, albeit difficult, routes through which an individual may able to enforce their rights against a foreign state.

In terms of claiming that a state is responsible for violations of their obligation, the onus of establishing responsibility lies with the claimant. Where a state seeks to preclude its responsibility by relying upon the circumstances, the onus lies with that state to justify or excuse its conduct.[84]

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[78] Art.51, GCI; Art.52, GCII; Art.131, GCIII; Art.148, GCIV.
[79] Rights conferred by treaty cannot be waived by individuals. See, Arts.1(2), 7, 8(3), 14(3)(g), 23(3), ICCPR; P.10 Commentary to Art.20, ARSIWA; The Naulilaa Case (Portugal vs Germany) [1928] Vol.II UNRIAA, 1011, 1026; Art.1(2), ICESCR; p.6-7 commentary to Art.51, ARSIWA.
[80] Phosphates in Morocco (Judgement) (Italy v France) (1938) PCIJ Rep Series A/B No74, p28.
[81] Human Rights Committee (n.48) para.10.
[82] Chorzów Jurisdiction (n.32); Chorzów Merits (n.32); Art.31, ARSIWA.
[83] see Chorzów Merits (n.32) 27-28; Also see Art.5(8), Agreement on cessation of hostilities between the Government of the Federal Democratic Republic of Ethiopia and the Government of the State of Eritrea (adopted 18 June 2000, entered into force 18 June 2000) 2138 UNTS 85.
[84] P.8 introductory commentary to Chapter V, ARSIWA, pg.72.

Any '*gross or systematic*'[85] violations of CIL norms that are *jus cogens* endangers the '*survival of states and their peoples and the most basic human values*',[86] and so would generate so-called 'aggravated state responsibility'. *Jus cogens* norms relevant to AWS include: the prohibition on aggression;[87] the prohibition on genocide;[88] the prohibition on torture and inhuman or degrading treatment or punishment;[89] the 'basic rules'[90] of LoAC (the Hague and Geneva Conventions);[91] some IHRL obligations (rights to life and humane treatment, amongst others).[92]

This Chapter now discusses the general approach to consider how the actions of an AWS in breach of an obligation of its deploying state could be attributable to that state. It then considers some specific issues related to state responsibility for violations of human rights obligations (Section 7.4), and the responsibility of non-state actors (Section 8).

### 7.1. Actions of state organs giving rise to the responsibility of states

Where there is a breach of an international obligation whether by action or omission, that is attributable to a state, there is an internationally wrongful act.[93] States are responsible for every wrongful act of state that takes place.[94]

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[85] Art.40(2), ARSIWA.
[86] P.3 commentary to Art.40, ARSIWA.
[87] International Law Commission, ' Report of The International Law Commission on the Work of its seventeenth and eighteenth sessions' (1966) UN Doc. A/CN.4/SER. A/1966/Add.1, 247-249; Nicaragua case (n.15) para.190; P.4 commentary to Art.40, ARSIWA; See also numerous national statements denouncing aggression, fn.644, ARSIWA.
[88] P.4 commentary to Art.40, ARSIWA; see also ILC (n.87) 261.
[89] Art.1, Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (adopted 10 December 1984, entered into force 26 June 1987) 1465 UNTS 85; P.5 commentary to Art.40, ARSIWA.
[90] P.5 commentary to Art.40, ARSIWA.
[91] Legality of the Threat or Use of Nuclear Weapons, Advisory Opinion [1996] ICJ Reports, p.226, para.79; Prosecutor v Kupreškić and others (Trial Judgement) Case No IT-95-16 [2000] ICTY, para.520.
[92] See Francisco Forrest Matin, et al., International Human Rights And Humanitarian Law : Treaties, Cases And Analysis (CUP, 2006).
[93] The Corfu Channel Case (UK v Albania) Judgement [1949] ICJ Reports, p.4, 22-23; Case Concerning United States Diplomatic and Consular Staff in Tehran (United States v Iran) Judgement (1980) ICJ Reports, p.3, paras.63-67; Art.2, ARSIWA.
[94] Phosphates in Morocco (n.80) 28; Art.1, ARSIWA.

This responsibility covers all state organs and agents when performing acts of state.[95] As we have seen, AWS should be thought of as the legal agents of the humans who exert control over them. Where that person is a state agent, for example, military personnel, using an AWS to breach a state obligation within or beyond their authority,[96] those acts should be thought of as being the responsibility of the state they represent.

The rules on state responsibility make allowance for the actions of legal agents to be seen as those of the principal state agent.[97] In the ILC Articles, this rule is specifically formulated to apply only to people acting as legal agents.[98] There are two solutions to this issue. Either an AWS is seen as equivalent to any other weapon, such as a rifle, and using it is seen as the action of the state agent controlling the system. Alternatively, the rule can be interpreted in a broad manner to include a non-human AWS as a legal agent. Either way, the actions of an AWS under the control of a state agent are attributable to a state. Therefore, in terms of responsibility, it is the behaviours of the state agent acting through an AWS that are crucial.

Consequently, where an AWS malfunctions and an internationally wrongful act is performed by accident, it is difficult to attribute responsibility for the AWS to the state because it would not be part of the 'conduct' of the operator/commander.[99] The state using the AWS could voluntarily adopt its malfunctioning behaviour as its own, but would be under no obligation to do so.[100]

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[95] Moses Case (n.60) 3127, at 3129; Art.4, ARSIWA; On state organs beyond the legislative, executive, or judicial, see, for example, GATT Panel Report, Japan – Trade in Semi-Conductors, L/6309 (adopted 4 May 1988) BISD 35S/116.

[96] Estate of Jean-Baptiste Caire (France v United Mexican States) [1929] Vol.V UNRIAA,516; See The Panama Star and Herald case in, John Bassett Moore, A Digest of International Law (Vol.VI) (Government Printing Office, 1906) 775, at 779-780; Art.7, ARSIWA.

[97] D Earnshaw and Others (Great Britain v United States) (Zafiro case) [1925] Vol.VI. UNRIAA, 160, 160-165; Charles S Stephens and Bowman Stephens (USA v United Mexican States [1927] Vol.IV UNRIAA, 265, 265-268; Lehigh Valley Railroad Company, Agency of Canadian Car and Foundry Company, Limited, and Various Underwriters (Sabotage Cases: 'Black Tom' case and 'Kingsland' case) (United States v Germany) [1930] Vol.VIII UNRIAA, 84, 84-101; Art.8, ARSIWA.

[98] Art.8 ARSIWA.

[99] Art.4(1), ARSIWA.

[100] Diplomatic and Consular Staff (n.93) para.74; Art.11, ARSIWA; for an example of this, see Israel adopting the behaviour of a '*volunteer group*' who captured Adolf Eichmann as its own, Official Records Of The Security Council, Fifteenth Year, 866th Meeting (22 June 1960) UN Doc. S/PV/866 (Golda Meir, para.18).

## 7.2. Circumstances precluding wrongfulness

It is important to note that where a 'wrongful' act may happen, some circumstances may preclude that wrongfulness. They are: consent;[101] self-defence;[102] countermeasures;[103] necessity;[104] force majeure;[105] distress.[106] However, none of these circumstances can be used to shield a state from the responsibility of performing an act prohibited by *jus cogens* norms.[107] Issues of consent, self-defence, and countermeasures do not raise specific issues with regard to AWS and so will not be discussed here.

Force majeure can preclude the wrongfulness of breaching an obligation if the breach occurs due to the irresistible force of unforeseen circumstances beyond the control of the state, which make the obligation materially impossible to comply with.[108] As has been discussed, states are obligated to review new weapons to ensure they abide by LoAC[109] and major errors in programming should be identified during testing, not doing so would breach this obligation. However, suppose an ostensibly minor coding error in an AWS was missed during review and this error ultimately resulted in the AWS misidentifying a civilian object as a military objective, thereby violating the review obligation. Such a

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[101] The Savarkar Case (Great Britain, France) [1911] Vol.XI UNRIAA, 243, 254; Art.54(b), Vienna Convention on the Law of Treaties (adopted 23 May 1969, entered into force 27 January 1980) 1155 UNTC 331; Art.22(1), Vienna Convention on Diplomatic Relations (adopted 18 April 1961, entered into force 24 April 1964) 500 UNTS 95 (Hereafter: VCLT); Art.20, ARSIWA.

[102] Nuclear Weapons (n.91) paras.25, 30, 79, 89; Art.51, Charter of the United Nations (adopted 26 June 1945, entered into force 24 October 1945)(Hereafter: UN Charter); Art.21, ARSIWA.

[103] Gabčíkovo-Nagymaros Project (Hungary/Slovakia) Judgement [1997] ICJ Reports, p.7, para.83; Art.22, ARSIWA.

[104] R.Y. Jennings, 'The Caroline And Maclood Cases' (1938) 32 American Journal of International Law, 82, 85, note the '*necessity of self*-defence'; Art.25, ARSIWA.

[105] Case Concerning the Payment of Various Serbian Loans Issues in France (France v Serbia) (1929) PCIJ Rep Series A No 20/21, p.6, 39-40; Art.23, ARSIWA.

[106] International Law Commission, ' Report of The International Law Commission on the Work of its Thirtieth session' (1978) UN Doc. A/CN.4/SER.A/1978/Add.1 (Part 1), 125; Art.24, ARSIWA.

[107] Arts.53 and 64, VCLT; Case Concerning Application of the Convention on the Prevention and Punishment of the Crime of Genocide (Bosnia and Herzegovina v Serbia and Montenegro) Counter-claims [1997] ICJ Reports, p.243, para.35; Art.26, ARSIWA.

[108] P.2 commentary to Art.23, ARSIWA.

[109] There would be a failure to '*determine'* if the new weapon violates legal rules: Art.36, API; also note the implied duties in CIL to test weapons discussed in Chapter 4 Section 4.1.

situation would necessarily be unforeseen, as it was not identified during testing. It would also be an irresistible force, as the AWS would have no ability to divert from its programming. Therefore, where a state could not prevent such wrongful acts occurring, this could be seen as a situation of force majeure absolving the state of responsibility.

In terms of distress, this generally applies to situations where a state agent is in personal peril, or those under their protection are in peril.[110] As AWS are machines, they cannot experience personal peril. However, the wrongfulness of its actions could be precluded if people under its protection were in peril. For example, a large AWS may be capable of casualty evacuation and programmed to take the quickest route to the nearest medical facility, potentially traversing the territory of another state. In such a case, the wrongfulness of unlawfully crossing an international border could be precluded.[111]

A defence of necessity is intended to preclude the wrongfulness of an action taken where non-performance of an obligation[112] is the only means to avert a grave and imminent peril that would damage an essential interest of a state,[113] and it does not also impair an essential interest of other states or the international community as a whole.[114] It has been suggested that where cyber-attacks are harmful to another state but do not rise to the level of an armed attack, the victim state could respond on grounds of necessity as there would be no lawful response available under the *Jus ad Bellum*.[115] Similarly, using grounds of necessity could be used by states when responding to uses of AWS by non-state or terrorist adversaries. As we saw in Chapter 3, where a fleet of AWS are commanded by a single private person, their acts could not be characterised as being within a non-international armed conflict as the 'organisation' prong of the *Tadić* test would not be fulfilled.[116] A

[110] P.1 commentary to Art.24, ARSIWA.
[111] US Department of State, 'Bulletin: Vol.XV, No.376' (US Government Printing Office, 1946) 501-505.
[112] This distinguishes the ground of necessity from *force majeure*. In the latter case, the circumstances make performance of the obligation impossible. See Michael N Schmitt and Liis Vihul, Tallinn Manual 2.0 On The International Law Applicable To Cyber Operations (2nd edn, CUP 2017) (Hereafter: Tallinn Manual), Rule 26, Commentary para.12.
[113] Gabčíkovo-Nagymaros (n.103) paras.51-52; Art.25(1)(a), ARSIWA.
[114] Gabčíkovo-Nagymaros (n.103) para.58; Art.25(1)(b), ARSIWA.
[115] Tallinn Manual, Rule 26, commentary para.18.
[116] Prosecutor v Tadić (Interlocutory Appeal) Case No: IT-94-1-A [1995] ICTY, para.70.

victim state could respond through non-performance of the obligations not to use force in other states if the adversaries are in in another territory,[117] or the obligation not to apply LoAC rules to what would be '*internal disturbances*' if the adversaries are within the state's territory.[118] As such, this would allow a level of force normally associated with armed conflict to be used outside of an armed conflict without generating state responsibility. As we have seen in Chapter 4, the Martens Clause acts as a reminder that customary rules and principles of international law continue to apply even in situations without specific regulation.[119] A state acting in such a situation would have their actions, and responsibility for them, regulated under customary rules. The responsibility of states for breaching these rules would be attributed and dealt with in the normal way. Thus, it can be said that even in this extreme situation, the use and responsibility for AWS could be sufficiently regulated. However, it is important to note that the ability to use grounds of necessity to preclude the wrongfulness of an act more akin to self-defence is not settled.[120]

## 7.3. The use of AWS by armed non-state actors giving rise to state responsibility

Armed non-state actors are expected to acquire AWS in the near future.[121] Where a state effectively controls an ANSA using AWS, the group would become an organ of the state; the state would be responsible for the actions of that group in the same way as a group using conventional arms.[122] An ANSA using an AWS in the absence of state authority when state authority should have been present would be the responsibility of the state[123] (unless the state could do nothing to prevent

[117] Art.2(4), UN Charter.
[118] Art.1(2), APII.
[119] Art.1(2), API; Preamble, APII.
[120] Brownlie considers that acts of necessity would only be an appropriate in situations of intervening because of a natural catastrophe. See Ian Brownlie, International Law and the Use of Force by States (OUP, 1963), 432.
[121] Sabin (n.58).
[122] Nicaragua case (n.15) paras.109-115; Art.8, ARSIWA.
[123] Art.9, ARSIWA.

unlawful actions by the ANSA).[124] The use of AWS by an insurrectional movement that then goes on to become the state would be the responsibility of the 'new' state.[125] Finally, a state could voluntarily adopt the actions of an ANSA using AWS and accept responsibly for their actions; whilst this may be unlikely, states have done this in the past.[126]

## 7.4. The responsibility of states under human rights regimes

The Articles are intended to apply across all fields of international law, including to human rights regimes,[127] and are focussed upon state-to-state interaction. States have the right to hold other states responsible under IHRL as they are obligations *erga omnes*,[128] but this is rare due to the political and economic costs and the lack of direct 'injury' to the state claiming wrongfulness.[129] Further, despite intended cross-international law application of the Articles, this does not prevent IHRL being *lex specialis* with regard to responsibility,[130] particularly where the use of AWS violates substantive IHRL obligations, or an inadequate investigation into the use of AWS violated procedural obligations under the right to life.

In the IHRL responsibility regime, domestic enforcement of rights is the primary avenue for remedy that must be exhausted before individuals may petition a regional human rights body.[131] As with general state responsibility, non-repetition of violations, redress to victims, and condemnation

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[124] Sambiaggio Case (of a general nature) (Italy-Venezuela) [1904] Vol.X UNRIAA, 499, 513; International Law Commission, ' Report of The International Law Commission on the Work of its twenty-fourth session' (1972) UN Doc. A/CN.4/SER.A/1972/Add.1, 135-136; Art.9, ARSIWA.
[125] Bolívar Railway Case (Great Britain v Venezuela) [1903] Vol.IX UNRIAA, 445, 453; Moore (n.96) 956; Art.10, ARSIWA.
[126] Diplomatic and Consular Staff (n.93) para.74; Art.11, ARSIWA; Golda Meir (n.100).
[127] Art.1, ARSIWA.
[128] Case Concerning Barcelona Traction, Light and Power Company, Limited (Belgium v Spain) New Application: 1962, Second Phase [1970] ICJ Reports, p.3, para.33-34.
[129] Philip Alston and Ryan Goodman, International Human Rights (OUP, 2013) 99; Dinah Shelton, Remedies In International Human Rights Law (2nd edn, OUP, 2005) 99.
[130] Alston and Godman (n.129) 99.
[131] Velásquez Rodríguez (n.20) 61-62.

of wrongdoers are key to sufficient remedies under the IHRL-specific system.[132] Thus, if a judicial body were to rule that AWS had been used in the violation of human rights by a state, condemning the perpetrators and requiring guarantees of non-repetition along with some form of redress of victims would be required.

## 8. The international legal responsibility of non-state actors

When referring to armed non-state actors, one normally thinks of '*insurgents, rebels, terrorists, militias, criminal cartels, or gangs*.'[133] But, international organisations that use military forces, such as NATO operations or UN Peacekeeping are also ANSAs. There is a responsibility regime for their actions,[134] but the regulation of AWS under this regime does not pose novel issues. As such, the following discussion focusses on the common conception of ANSAs.

### 8.1. The responsibilities of armed non-state actors under international law

The proliferation of AWS to ANSAs is not expected to be limited to those groups who receive state backing.[135] Therefore, the responsibility of such groups for using these systems *qua* groups must be considered. ANSAs may or may not hold territory and may operate beyond their territory. They may act at, above, or below, the threshold of armed conflict.[136] Here though, the discussion is focussed on those party to an armed conflict.

Whilst international law is primarily focussed on states, some international obligations have been directed towards ANSAs. For example, if an ANSA engages in a successful rebellion, the rebellious

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[132] Dinah Shelton, 'Enforcement and remedies', in Scott Sheeran and Nigel S. Rodley (eds.), Routledge Handbook of International Human Rights Law (Routledge, 2013) 678.
[133] Report Of The Special Rapporteur On Extrajudicial, Summary Or Arbitrary Executions On Armed Non-State Actors: The Protection Of The Right To Life, Agnes Callamard (Human Rights Council, 38th Session) 2018 UN Doc A/HRC/38/44, para.4.
[134] Responsibility of international organizations (66th session, 27 February 2012) UN Doc. A/RES/66/100.
[135] Sabin (n.58).
[136] Callamard (n.133) para.4.

actions become the responsibility of the 'new' state.[137] In armed conflicts, ANSAs are governed by CIL,[138] Common Article 3 to the Geneva Conventions, and Additional Protocol II where the ANSA holds territory.[139] Thus, if ANSAs used AWS to breach customary or treaty obligations, they should, logically, be held responsible. However, very few ANSAs have ever attempted to provide reparation for LoAC failures they are responsible for in a non-international armed conflict (NIAC).[140] Thus, even if an ANSA took responsibility for the wrongful use of AWS, little would come of this.

In terms of IHRL applicable to ANSAs, we saw in Chapter 3 that human rights obligations have been placed upon some NSAs who hold territory.[141] This is despite the reticence of IHRL Courts to accept NSAs as being capable of filling a legal vacuum[142] and guaranteeing human rights.[143]

The ability for such groups to provide a remedy for their violation of any obligations is limited. Truth, peace and reconciliation commissions, compensation commissions, or symbolic reparations may be appropriate in the absence of judicial bodies.[144] If the perspective of ANSAs as guarantors of IHRL is rejected, then the human rights jurisdiction of the territorial state is maintained and they would be responsible for such obligations on its territory, whether or not they have *de facto* control. Still, as we shall see in Section 11.4, members of ANSAs could still be held individually criminally responsible for their actions using AWS.

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[137] Bolívar Railway (n.125) 453; Moore (n.96) 956; Art.10, ARSIWA.
[138] See ICRC Study, note discussion on its worth in Chapter 3, Section 3.2; also see Andrew Clapham 'Focussing on armed Non-State Actors' in Andrew Clapham and Paola Gaeta (eds.), The Oxford Handbook Of International Law In Armed Conflict (OUP 2014) 779-782.
[139] See Art.1, APII.
[140] Emanuela-Chiara Gillard, 'Reparation For Violations Of International Humanitarian Law' (2003) 85 International Review of the Red Cross, 529, 534-535.
[141] See Jessica Burniske, Naz Modirzadeh and Dustin Lewis, 'Armed Non-State Actors And International Human Rights Law: An Analysis Of The Practice Of The U.N. Security Council And The U.N. General Assembly' (Harvard Law School Program on International Law and Armed Conflict, 2017); Callamard (n.133) paras.10-18.
[142] Legal Consequences for States of the Continued Presence of South Africa in Namibia (South West Africa) notwithstanding Security Council Resolution 276 (1970), Advisory Opinion [1971] ICJ Reports, p.16, para.125; Callamard (n.133) para.47.
[143] Sargsyan v Azerbijan, App no:40167/06 (ECtHR, 16 June 2015) paras.146-150; Isayeva v Russia, Judgment, App no:57950/00 (ECtHR, 24 February 2005) para.178.
[144] Callamard (n.133) paras.84-94.

There are further issues of ANSAs being held responsible for their actions as a group under LoAC and IHRL: NIAC responsibility mechanisms have been poor; state parties to NIAC are bound by IHRL treaties whereas ANSAs are subject to a limited range of obligations (if any), thus creating an inequality between parties; application of NIAC rules requires a 'nexus' to the conflict,[145] and so civilians beyond areas of armed conflict or in/near situations of combat not rising to an armed conflict may not have any entity responsible for their protection.[146] The limited scope for ANSAs to be held responsible as a group for their use of AWS is, arguably, insufficient. However, this is the same as any ANSA actions, and so AWS are not subject to a specifically insufficient regime. Further, ICL can fill this gap by holding the members of an ANSA individually criminally responsible.

8.2. State responsibilities and duties in relation to business and human rights

The relationship between businesses and human rights is a developing area of international law.[147] It is, somewhat, regulated under the standard rules of state responsibly. Where businesses, such as AWS manufacturers, are sufficiently tied to the state that it acts like a state organ, it can be treated as one.[148] A state would need to exert '*meaningful control*'[149] for this to happen.[150] Holding special voting rights[151] or even state-ownership,[152] would not meet the threshold unless they are accompanied by meaningful control.[153] Although state responsibility for AWS would primarily be rooted in the exercise of tactical control by commanders/operators, it could also exist through the

[145] Arts.2,5, and 6, APII and Art.75, API; also see Fortin (n.27) 47-51.
[146] See Callamard (n.133) para.28.
[147] See, for example, Elaboration of an international legally binding instrument on transnational corporations and other business enterprises with respect to human rights (Human Rights Council, 26th session) 2014 UN Doc. A/HRC/RES/26/9, para.1.
[148] WTO, United States – Definitive anti-dumping and countervailing duties on certain products from China (11 March 2011) WT/DS379/AB/R, para.318.
[149] Note that this phrase does not have the same meaning as that in 'meaningful human control'.
[150] US-China Anti-dumping (n.148) paras.318-320.
[151] Christina Balis, 'State Ownership In The European Defence Industry: Change Or Continuity?' (Avascent 2013) Archived:<https://web.archive.org/web/20181003142224/https://www.avascent.com/wp-content/uploads/2013/01/Avascent-State-Ownership.pdf> 6.
[152] Aude Fleurant, et al., 'The SPIRI Top 100 Arms-Producing And Military Service Companies, 2017' (SPIRI, 2018) note the state ownership of arms manufacturers by China (pg.2) and India (pg.7).
[153] US-China Anti-dumping (n.148) paras.318-320.

technical control of their manufacturers if they are considered as a state organ. Even if an AWS manufacturer is not a state organ, a state could voluntarily adopt the relevant behaviour as its own but would not be obliged to.[154] So, for example, if a state-controlled business provided AWS for the specific purpose of carrying out a genocide, then such arbitrary deprivations of life would seem to be attributable to the state.[155]

A specific soft-law regime for business and human rights has also been developed. The Guiding Principles on Business and Human Rights develop a '*protect, respect, remedy*' framework.[156] Duties towards protecting human rights, and remedying their breaches, are placed upon states, whilst the responsibility to respect human rights is placed upon businesses.[157]

Under IHRL, states have indirect responsibilities to ensure that businesses within their jurisdiction, and those companies that they do business with, respect human rights. As most of the businesses involved in developing potential AWS technologies are private companies (e.g. BAE Systems,[158] Northrop Grumman,[159] Samsung[160]), states have an indirect responsibility to ensure that these companies respect human rights when they purchase such technologies. This applies whether the producer is within[161] or outside of their territory.[162] Thus, states would be obligated to ensure that

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154 Diplomatic and Consular Staff (n.93) para.74; Art.11, ARSIWA; Golda Meir (n.100).
155 For specific examples of businesses assisting in atrocities, see Section 11.1.
156 Annex, Art.1, Report of the Special Representative of the Secretary General on the issue of human rights and transnational corporations and other business enterprises, John Ruggie: Guiding Principles on Business and Human Rights: Implementing the United Nations "Protect, Respect and Remedy" Framework (Human Rights Council, 17th session) 2011 UN Doc. A/HRC/17/31 (Hereafter: B&HR Guiding Principles).
157 Note that 'responsibility' is used rather than 'duty' as businesses are not yet bound by human rights. See John Ruggie, 'The UN "Protect, Respect And Remedy" Framework For Business And Human Rights Outline' (Business & Human Rights, 2010) Archived:<https://web.archive.org/web/20170904203338/https://business-humanrights.org/sites/default/files/reports-and-materials/Ruggie-protect-respect-remedy-framework.pdf>, 2.
158 BAE Systems, 'Taranis' (BAE Systems, 2016) Archived:<https://web.archive.org/web/20190812060713/https://www.baesystems.com/en-uk/product/taranis1>.
159 Northrop Grumman, 'X-47B UCAS Makes Aviation History…Again!' (Northrop Grumman, 2017) Archived:<https://web.archive.org/web/20190912001747/https://www.northropgrumman.com/Capabilities/x47bucas/Pages/default.aspx>.
160 John Pike, 'Samsung Techwin SGR-A1 Sentry Guard Robot' (Global Security, 2011) Archived:<https://web.archive.org/web/20190827141904/https://www.globalsecurity.org/military/world/rok/sgr-a1.htm>.
161 Commentary to Principle 2, B&HR Guiding Principles.
162 Principles 5 and 6, B&HR Guiding Principles.

AWS manufacturing processes are IHRL compliant, and the resultant product could be used in compliance with IHRL. This reinforces the requirement to perform weapons reviews from an IHRL perspective.

States should retain all documents related to the procurement of AWS from a private company. If the development or use of AWS were subject to an investigation by an IHRL tribunal, the tribunal would only have the power to compel the state to produce documents. The AWS manufacturer would be beyond their jurisdiction. As such, the state would be the only source of the relevant documents.

Specific concern in the *Guiding Principles* is given to business and human rights in conflict zones.[163] Although arms manufacturers are generally not present in conflict zones, their products are. As such, states should take civil, administrative, or criminal legal steps against companies within their jurisdiction that commit, or contribute to, human rights abuses.[164] Further, the use of private military contractors (PMCs) by states is ever increasing.[165] Should a state employ a PMC that uses AWS, then the state would be obligated to ensure that the PMC's use of such systems is in accordance with IHRL.

Within this regime, states are also under a duty to remedy human rights abuses through the creation of grievance mechanisms.[166] Thus, where an AWS manufacturer is complicit in human rights abuses, states must enable the bringing of claims by creating mechanisms for remedy in order that their responsibility for AWS can be sufficiently regulated.

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[163] Principle 7, B&HR Guiding Principles.
[164] Commentary to Principle 7, B&HR Guiding Principles.
[165] For example, BBC, 'What Are Private Security Companies Doing In Afghanistan?' (BBC News, 2018) Archived:<https://web.archive.org/web/20190530193957/https://www.bbc.co.uk/news/world-46400647>.
[166] See Principles 25-31, B&HR Guiding Principles.

9. International criminal law

This Chapter now turns to the applicability of international criminal law to the people involved in developing and using AWS. The following sections demonstrate how an AWS could perform the *actus reus* of several international crimes. Then, this thesis argues that those who exert control over AWS could be held responsible for acting through AWS to commit these crimes when they also possess the *mens rea* elements of the crimes, such that the use of AWS in contravention of ICL can be sufficiently regulated. This includes arguments for abandoning national policies that shield manufacturers from responsibility for their actions.[167] In presenting an argument for a new paradigm of individual responsibility better suited to AWS, this Section also demonstrates how ICL could be applied to the senior management of AWS manufacturers, and the developers and users of AWS using existing legal precedents. Finally, the present Chapter looks at different modes of liability of command responsibility and the *lex ferenda* 'procurement responsibility' emanating from the exercise of procurement control.[168]

ICL may have evolved by the time AWS are in common usage, or there may be some international instrument dealing with AWS. But, this should not create retroactive jurisdiction over the development and use of weapons with autonomy prior to that prohibition. To do so would go against the principle of *nullum crimen sine lege,* which is '*solidly embedded in ICL*.'[169]

The International Criminal Court may exercise its jurisdiction over crimes of genocide, crimes against humanity, war crimes, and aggression,[170] where the crimes occurred on the territory of a state party[171] or the person accused of a crime is a national of a state party.[172] In such cases, a state party

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[167] See Section 5.
[168] Geoffrey Corn, 'Autonomous Weapon Systems: Managing The Inevitability Of 'Taking The Man Out Of The Loop', in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016) 228-238.
[169] Antonio Cassese, 'The Principle of Legality' in Antonio Cassese and Paola Gaeta (eds.), Cassese's International Criminal Law (3rd edn, OUP, 2013) 30.
[170] Art.5, ICC Statute.
[171] Art.12(2)(a), ICC Statute.
[172] Art.12(2)(b), ICC Statute.

may refer itself to the ICC,[173] the Prosecutor may initiate their own investigation,[174] or the UN Security Council may refer a situation to the prosecutor.[175]

The crime of aggression has been activated under ICC jurisdiction, and an AWS could be used in the acts constituting this crime. But, this offence is concerned with the choice to initiate an aggressive war,[176] which is unlikely to be delegated to an AWS.[177] Thus, it is the actions of these leaders that would be subject to a responsibility regime, and not those of the AWS. As such, the use of AWS under political control in a crime of aggression can be sufficiently regulated through subjecting these leaders to an individual responsibility regime.

Yet, there are a number of states who are developing AWS and are not party to the ICC, namely China, India, Israel, Russia, and the US.[178] Unless nationals from these states acted in a situation where the ICC has jurisdiction,[179] the application of ICL in these states would generally be done through their domestic law. With regard to Grave Breaches of LoAC, all states are obligated to investigate and provide penal sanctions for such acts[180] as the Geneva Conventions have become customary international law.[181] However, other international crimes would be defined domestically; such definitions are broadly similar to those found in the statutes of international tribunals such as the ICC.[182] Thus, many of the conclusions regarding unlawful behaviours by AWS from this Chapter could be applied in domestic courts. Yet, the self-contained responsibly mechanism in LoAC would be

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[173] Art.13(a), ICC Statute.
[174] Art.13(c), ICC Statute.
[175] Art.13(b), ICC Statute; Chapter VII, Charter of the United Nations (adopted 26 June 1945, entered into force 24 October 1945).
[176] Art.8 *bis* element 2, ICC, Elements Of Crimes (International Criminal Court 2011) (Hereafter: Elements of the Crimes).
[177] For discussion of AI systems in strategic decision-making, see Ashley Deeks, Noam Lubell and Darragh Murray, 'Machine Learning, Artificial Intelligence, And The Use Of Force By States' 10 Journal of National Security Law & Policy, 1.
[178] See Vincent Boulanin and Maaike Verbruggen, 'Mapping The Development Of Autonomy In Weapon Systems' (SIPRI, 2017) 125-129.
[179] Note the inclusion of US nationals in the Prosecutors preliminary investigation into Afghanistan. See Decision Pursuant to Article 15 of the Rome Statute on the Authorisation of an Investigation into the Situation in the Islamic Republic of Afghanistan (Pre-Trial Chamber II) Case No.ICC-02/17 [2019] ICC, 17-20.
[180] Art.49, GCI; Art.50, GCII; Art.129, GCIII; Art.146, GCIV; Art.86(1), API.
[181] Nuclear Weapons (n.91) para.79; Kupreškić (n.91) para.520.
[182] See, for example 18 U.S. Code § 1091 – Genocide; US Crimes Against Humanity Act of 2010.

useful domestically if there is no realistic method of prosecuting a wrongdoer under ICL rules where the ICC and its jurisprudence are unpopular.[183]

Investigating unlawful acts performed by AWS could be made relatively simple in comparison to human beings as one would expect that all AWS actions and processes could be logged and examined *ex post facto*. This is of particular relevance where the substantive rules of targeting are '*purposely loose*',[184] which can lead to difficulty in determining whether a proportionality decision is lawful when it is a 'close call',[185] for example. It can be exceedingly difficult to prosecute someone whose behaviour falls within this grey area.[186] Thus, where investigators can reconstruct the programming of an AWS and the instructions it was given, it may be possible to separate out the shades of grey into distinct lawful or unlawful choices. However, if the algorithms used to make decisions are highly-complex, this could hamper investigations.[187] Perhaps, therefore, this creates another requirement that only 'explainable' algorithms should be used so that investigators could actually understand what happened.[188]

## 10. The core crimes as they relate to AWS

The following discussion of genocide, crimes against humanity, and war crimes focusses upon their definitions under the Rome Statute, as this generally reflects CIL.[189] However, this consideration

[183] See, for example, BBC, 'US Issues Threat To War Crimes Court' (BBC News, 2018) Archived:<https://web.archive.org/web/20190823073608/https://www.bbc.co.uk/news/world-us-canada-45474864>.
[184] Antonio Cassese, 'War Crimes' in Antonio Cassese and Paola Gaeta (eds.), Cassese's International Criminal Law (3rd edn, OUP, 2013)(Hereafter: Cassese WC) 74.
[185] Experts have noted that it is difficult to determine what qualifies as excessive in relation to a violation of the proportionality rule; see Laurent Gisel (ed.), The Principle Of Proportionality In The Rules Governing The Conduct Of Hostilities Under International Humanitarian Law (ICRC, 2018) 62-65.
[186] Note, for example, the Prosecutor abandoning a charge including the causing of disproportionate harm, Prosecutor v Dragomir Milošević (Trial Judgement) Case No: IT-98-29/1-T [2007] ICTY, para.308.
[187] See Joshua G. Hughes, 'The Law Of Armed Conflict Issues Created By Programming Automatic Target Recognition System Using Deep Learning Methods' (2018) 21 Yearbook of International Humanitarian Law, 99.
[188] See Wojciech Samek, Thomas Wiegand and Klaus-Robert Muller, 'Explainable Artificial Intelligence: Understanding, Visualising And Interpreting Deep Learning Models' [2017] arXiv Archived:<https://web.archive.org/web/20190924160742/https://arxiv.org/pdf/1708.08296.pdf>.
[189] Kirsch (n.18) pg.xiii.

of the crimes is limited to what an AWS could perform. Thus, it is focussed upon those crimes related to killing, harm to persons, and destruction of property, although others are considered. Following the explanation of the core crimes in relation to AWS, the Chapter then discusses how individuals could be held responsible for their actions controlling these systems.

### 10.1. Genocide

The aspects of the crime of genocide related to the following discussion are defined as:

> '*any of the following acts committed with intent to destroy, in whole or in part, a national, ethnical, racial or religious group, as such: (a) Killing members of the group; (b) Causing serious bodily or mental harm to members of the group;*'[190]

An AWS could, by firing munitions, perform attacks that kill or cause serious bodily harm, thereby fulfilling the *actus reus* part of the offence. In order to fulfil the mental elements, an individual with either technical or tactical control would need to possess the requisite intent to engage in the unlawful conduct, or have knowledge that the unlawful acts will occur as a consequence of their actions,[191] with the special intent to destroy the relevant group in whole or in part.[192]

Further, as the Elements of the Crimes document that accompanies the ICC Statute suggests, rape and sexual violence could constitute '*serious bodily or mental harm*'[193] and therefore an *actus reus* of genocide (rape is also an *actus reus* of crimes against humanity and war crimes). Although 'robots don't rape'[194] is a common argument for the moral superiority of using AWS, feminist analysis

[190] Art.6, ICC Statute.
[191] Art.30, ICC Statute.
[192] See Arts.6(a)(3) and (b)(3), Elements of the Crimes.
[193] Art.6(b) fn.3, Elements of the Crimes.
[194] Ryan Khurana, 'In Defense Of Autonomous Weapons' (The National Interest, 2018) Archived:<https://web.archive.org/web/20181103014212/https://nationalinterest.org/feature/defense-autonomous-weapons-33201>.

of this position shows that in the same way that human soldiers can be ordered to 'weaponise' rape and sexual violence, developers could be ordered to programme an AWS to commit such acts.[195]

There have been problematic definitions of rape in ICL[196] and many definitions of rape require penetration by male genitalia.[197] However, rape according to the ICC Statue can be performed '*with any object*'[198] and requires the '[invasion] *of the body of the victim…however slight*.'[199] Thus, it is possible for an AWS, as an object, to perform the act of rape as an international crime. In terms of AWS and other acts of sexual violence constituting '*serious bodily or mental harm*',[200] this requires that the perpetrator committed against a person, or caused a person to engage in, an '*act of a sexual nature by force*' of a comparable gravity to other pre-defined crimes against humanity and war crimes of a sexual nature.[201] As such, it is possible that an AWS could perform the required acts of a sexual nature for the purposes of causing serious bodily or mental harm as a crime of genocide.

In order for the offences to be completed, the conduct required for the genocidal acts must be able to effect the destruction of the group in whole or in part, and be part of a manifest pattern to do so.[202] As such, even a single instance of genocidal violence would be enough for the offence to be completed if it is part of such a pattern.[203] However, the offender must genuinely intend to destroy the group,[204] and this intent cannot be based on delusions that single acts of violence would affect the

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[195] Charli Carpenter, '"Robot Soldiers Would Never Rape": Un-Packing The Myth Of The Humanitarian War-Bot' (Duckofminerva.com, 2014) Archived:<[https://web.archive.org/web/20190912145010/https://duckofminerva.com/2014/05/robot-soldiers-would-never-rape-un-packing-the-myth-of-the-humanitarian-war-bot.html](https://web.archive.org/web/20190912145010/https://duckofminerva.com/2014/05/robot-soldiers-would-never-rape-un-packing-the-myth-of-the-humanitarian-war-bot.html)>.
[196] Prosecutor v Jean-Paul Akayesu (Trial Judgement) Case No: ICTR-96-4-T [1998] ICTR, para.597; Prosecutor v Delalić and others (Trial Judgement) Case No: IT-96-21-T [1998] ICTY, para.479; Antonio Cassese, 'Crimes Against Humanity' in Antonio Cassese and Paola Gaeta (eds.), Cassese's International Criminal Law (3rd edn, OUP, 2013)(Hereafter: Cassese CAH) 96-97.
[197] See, for example, s.1, Sexual Offences Act 2003 UK; Prosecutor v Furundžija (Trial Judgement) Case No: IT-95-17/1 [1998] ICTY, para.185.
[198] Arts.7(1)(g)-1, 8(2)(b)(xxii)-1, 8(2)(e)(vi)-1, Elements of the Crimes.
[199] Arts.7(1)(g)-1, 8(2)(b)(xxii)-1, 8(2)(e)(vi)-1, Elements of the Crimes.
[200] Art.6(b), ICC Statute.
[201] Arts.7(1)(g)-6, 8(2)(b)(xxii)-6, 8(2)(e)(vi)-6, Elements of the Crimes.
[202] Art.6(a)(4) and (b)(4), Elements of the Crimes.
[203] Prosecutor v Ndindabahizi (Trial Judgement) Case No: ICTR-2001-71-I [2004] ICTR, para.471; Prosecutor v Jean Mpambara (Trial Judgement) Case No: ICTR-01-65-T [2006] ICTR, para.8.
[204] Mpambara (n.203) para.8.

entire group.[205] For example, programming an AWS to kill all members of a particular group in a location where they are not present would not complete the offence.

### 10.2. Crimes against humanity

The aspects of crimes against humanity related to this discussion are defined as:

> '*any of the following acts when committed as part of a widespread or systematic attack directed against any civilian population, with knowledge of the attack: (a) Murder; (b) Extermination; … (g) Rape, … any other form of sexual violence of comparable gravity; … (k) Other inhumane acts of a similar character intentionally causing great suffering, or serious injury to body or to mental or physical health.*'[206]

In terms of murder, the victim must die as a result of the conduct.[207] However, the perpetrator need not intend to kill the victim but could have intended to inflict grievous bodily harm, knowing that such harm would likely kill the victim, and be reckless as to that harm.[208] More generally, a perpetrator need not anticipate the specific consequences of their conduct, but must be aware of the risk that their actions might bring about to the victim.[209] For example, programming an AWS without adequate restrictions on its *autonomous* targeting, or tampering with such restrictions, might cause substantial harm that could not be anticipated. In regards to extermination, a particular population needs to be targeted in a way to '*bring about the destruction of a numerically significant part of the population.*'[210] This Chapter has already discussed the crimes of rape and sexual violence above, and that an AWS could commit the relevant acts for the offences. For those offences that entail killing or forms of sexual

[205] Mpambara (n.203) fn.7.
[206] Art.7, ICC Statute.
[207] Akayesu (n.196) paras.589-590.
[208] Akayesu (n.196) paras.589-590.
[209] See *T. and K.*, and *Finta* in Cassese's Companion (n.76) 673-675, 943; Cassese CAH (n.196) 99, fn.37.
[210] Prosecutor v Radislav Krstic (Trial Judgement) Case No: IT-98-33-T [2001] ICTY, para.503.

violence other than rape, more than one person must be affected (only one person within the widespread or systematic attack need be affected for rape to be a crime against humanity).[211]

Regarding '*other inhumane acts*', this is a residual clause,[212] which could allow for other serious physical and mental harms caused by AWS to be considered within the meaning of crimes against humanity.[213] For example, it is claimed that the use of uninhabited aircraft vehicles (or 'drones') has created psychological issues for those living under their zones of operation,[214] this could potentially also be applied to AWS. As such, we can see that AWS could be used to perform the required behaviours constituting each crime noted above.

For the offences to be completed, the perpetrator must have the requisite intent. First, the perpetrator needs to intend to engage in the conduct, and mean to cause the relevant consequence, or know that it will happen in the ordinary course of events,[215] and then have the additional knowledge of the context which the crimes take place in.[216]

For the offences to become crimes against humanity, they must be part of an '*attack directed at any civilian population*'.[217] This requires that there is a '*course of conduct involving the multiple commission of* [the] *acts*.'[218] Although the perpetrator need not know everything about the attack,[219] they must know that there is an attack against the civilian population and that their acts comprise part of it,[220] or at least be aware that there is a risk of their behaviour being part of the attack.[221] If the

[211] Art.7(1)(a), (1) (b) (1), (g)-6 (1), Elements of the Crimes.
[212] Cassese CAH (n.196) 98.
[213] Prosecutor v Pauline Nyiramasuhuko (Trial Judgement) Case No: ICTR-98-42-T [2011] ICTR, para.6127.
[214] James Cavallaro, Stephan Sonnenberg and Sarah Knuckey, 'Living Under Drones: Death, Injury And Trauma To Civilians From US Drone Practices In Pakistan' (International Human Rights and Conflict Resolution Clinic, Stanford Law School and NYU School of Law, Global Justice Clinic 2012) 80-87.
[215] Art.30, ICC Statute; para.2, General Introduction, Elements of the Crimes.
[216] Cassese CAH (n.196) 98-100.
[217] See In Re Albrecht (No2) (1949) 16 ILR, 396, at 398; Art.7, introductory para.2, Elements of the Crimes.
[218] Art.7, introductory para.3, Elements of the Crimes.
[219] Prosecutor v Dragoljub Kunarac and others (Trial Judgement) Case No IT-96-23-T& IT-96-23/1-T [2001] ICTY, para.434; Art.7, introductory para.2, Elements of the crimes.
[220] Tadić (Interlocutory Appeal)(n.116) para.248.
[221] Prosecutor v Blaškić (Trial Judgement) Case No IT-95-14-T [2000] ICTY para.247, 251.

attack is in an emergent stage, the intent to further it satisfies this mental element.[222] Where this special intent exists alongside the intent to bring about the result of the individual offence and one of the offences have been committed, a crime against humanity exists. Should an individual with control over an AWS have the required intent, and an AWS performs the relevant acts due to that control, a crime against humanity would have been fulfilled.

## 10.3. War crimes

The war crimes related to this discussion are: wilful killing;[223] inhumane treatment;[224] wilfully causing great suffering, or serious injury to body or health;[225] extensive destruction of property not demanded by military necessity;[226] intentionally directing attacks against the civilian population;[227] intentionally directing attacks against civilian objects;[228] intentionally directing attacks against personnel or objects of a humanitarian or peacekeeping character;[229] intentionally launching an attack in the knowledge that it would be disproportionate in terms of civilian losses or environmental harm;[230] attacking undefended places of residence which are not military objectives;[231] killing or wounding a combatant who is *hors de combat*;[232] making improper use of a flag of truce, of enemy insignia/uniforms, or protected insignia;[233] intentionally directing attacks against buildings which are specially protected;[234] treacherously killing or wounding adversaries;[235] declaring that no quarter will

[222] Art.7, introductory para.2, Elements of the Crimes.
[223] Art.8(2)(a)(i), ICC Statute.
[224] Art.8(2)(a)(ii), ICC Statute.
[225] Art.8(2)(a)(iii), ICC Statute.
[226] Art.8(2)(a)(iv), and (e)(xii) ICC Statute.
[227] Art.8(2)(b)(i), and (e)(i), ICC Statute.
[228] Art.8(2)(b)(ii), ICC Statute.
[229] Art.8(2)(b)(iii), (b)(xxiv) (e)(ii), (e)(iii) ICC Statute.
[230] Art.8(2)(b)(iv), ICC Statute.
[231] Art.8(2)(b)(v), ICC Statute.
[232] Art.8(2)(b)(vi), ICC Statute.
[233] Art.8(2)(b)(vii), ICC Statute (for example, specifically targeting the insignia of protected persons).
[234] Art.8(2)(b)(ix), (e)(iv), ICC Statute.
[235] Art.8(2)(b)(xi), (e)(ix), ICC Statute.

be given;[236] committing rape, or any other form of sexual violence;[237] violence to life and person, in particular murder against civilians and those *hors de combat*.[238]

It is important to note that the ICC statute includes several crimes related to the use of prohibited weapons in an IAC.[239] However, as we saw in Chapter 4 (Section 5.1), decisions to use such weaponry would be made by those using AWS and are not related to the *autonomous* nature of AWS attacks. Therefore, they are not further discussed here, save to say that the person deciding to use and employ such weapons on an AWS could be held responsible for their actions.

The mental element of war crimes must involve intent and knowledge, meaning that the perpetrator means to engage in the conduct and means to cause the consequence or knows that it will occur in the ordinary course of events.[240] Whilst the ICC could have jurisdiction over individual instances of war crimes, the Court is more focussed upon when such crimes are '*committed as part of a plan or policy or as part of a large-scale commission.*'[241] Thus, an individual instance of using an AWS to perform a war crime is more likely to be prosecuted in domestic courts, but could be conducted at the ICC.[242]

### 10.3.1. The context of armed conflict

Having shown that AWS could commit acts prohibited under ICL, this thesis now demonstrates how people exerting control over such acts can be responsible for them. The commission of war crimes requires that the unlawful conduct take place in the context of, and be associated with, an armed conflict, and the perpetrator be aware of the existence of that (international or non-international)

[236] Art.8(2)(b)(xii), (e)(x), ICC Statute.
[237] Art.8(2)(b)(xxii), (e)(vi), ICC Statute.
[238] Art.8(2)(c)(i), ICC Statute.
[239] Arts.8(2)(b)(xvii), 8(2)(b)(xviii), 8(2)(b)(xix), 8(2)(b)(xx), ICC Statute.
[240] Art.30, ICC Statute.
[241] Art.8(1), ICC Statute.
[242] Also note the distinction between minor criminality within an armed context and '*serious violations*' of LoAC: Tadić (Interlocutory Appeal)(n.116) para.94.

armed conflict.[243] Consequently, the manufacturing of AWS, or other weapons, in advance of an armed conflict is difficult to reconcile with this provision. As McFarland and McCormack note, whilst it could be shown that weapons development in preparation for a conflict was '*associated with*' it, a prosecutor could not show it to be '*in the context of*' the conflict.[244] This is because weapons manufacturing prior to a conflict would precede the context of the armed conflict.

The concept of criminal conduct '*closely related to hostilities*' has been considered by the International Criminal Tribunal for the Former Yugoslavia (ICTY) and the International Criminal Tribunal for Rwanda (ICTR) in terms of acts committed at *geographic* distance, rather than *temporal* distance from the conflict.[245] However, the ICTY and the Special Court for Sienna Leone (SCSL) have accepted the notion that aiding and abetting such crimes could be performed in advance of the armed conflict.[246] Despite this case law, Article 22(2) of the ICC statute states that definitions shall be strictly construed and not extended by analogy. Thus, such precedents cannot be applied to ICC deliberations. This arguably creates a responsibility gap whereby AWS weapons manufacturers could programme a system to conduct acts constituting a war crime but could not be held responsible as war criminals because their behaviour takes place in advance of the armed conflict. Similar behaviour that constituted acts of genocide or crimes against humanity would not be immune from prosecution as no armed conflict is required for such crimes. Further, domestic courts might not require this context for a war crimes prosecution, or may apply ICTY and SCSL case law to expand their understanding.

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[243] See the last two requirements for each crime under Art.8, Elements of the Crimes. See also Cassese WC (n.184) 77-79.

[244] Tim McFarland and Tim McCormack, 'Mind The Gap: Can Developers Of Autonomous Weapons Systems Be Liable For War Crimes?' (2014) 90 International Law Studies, 361, 372-374.

[245] Prosecutor v Dusko Tadić (Trial Judgement) Case No IT-94-1-T [1997] ICTY, para.573; Tadić (Interlocutory Appeal)(n.116) para.70; Kunarac and others (Trial)(n.219) paras.402, 568; Prosecutor v Dragoljub Kunarac and others (Appeal Judgement) Case No: IT-96-23-T& IT-96-23/1-A [2002] ICTY paras.57-58; Prosecutor v Mitar Vasiljevic (Trial Judgement) Case No: T-98-32-T [2002] ICTY para.25; Prosecutor v Georges Anderson Nderubumwe Rutaganda (Appeal Judgement) Case No ICTR-96-3-A [2003] ICTR para.570.

[246] McFarland and McCormack (n.244) 376-378; Prosecutor v Blaškić (Appeal Judgment) Case No: IT-95-14-A [2004] ICTY para.48; Prosecutor v Taylor (Trial Judgement) Case No: SCSL-03-01-T [2012] SCSL para.484.

Still, where the manufacturing of weapons takes place at the same time as the conflict, this could fall within the '*context of*' the conflict. As such, AWS developers could come under ICC jurisdiction should they use, through their technical control, an AWS to perform a war crime during a conflict that is contemporary with manufacture.

The fact that AWS manufacturers and their employees are likely to be civilian is irrelevant for the purposes of war crimes, as there is no requirement that the perpetrators be combatants in an IAC or NIAC, or directly participating in hostilities in a NIAC.[247] Civilians may commit war crimes against other civilians or combatants in IAC, and against other civilians in a NIAC whether or not the victims are directly participating in hostilities. For an ordinary crime to become a war crime, there needs to be a link to the armed conflict that '*played a substantial part in the perpetrator's ability to commit*' the offence.[248]

## 11. Identifying types of potential offender

This Chapter now moves to discuss the international criminal responsibilities of those involved in manufacturing AWS, and then moves to those who use, oversee, and review them. Their responsibility in terms of intent, negligence, and recklessness is discussed where relevant.

### 11.1. International criminal responsibilities of AWS manufacturing companies and their senior management

ICL has almost exclusively dealt with individuals. However, in the *I.G. Farben* case, a post-WWII US military tribunal partly dealt with the company who manufactured chemical gas used in Nazi extermination camps as a legal person. The company was seized, its war-making facilities dissolved,[249]

[247] See Art.8, ICC statue.
[248] Kunarac and others (Appeal) (n.245) para. 58; Rutaganda (n.245) paras.569-570.
[249] Arts.1-3, Control Council No.9 (Providing for the Seizure of Property Owned By I.G. Farbenindustrie and the Control hereof) 1945 (Hereafter: Control Council No.9).

and a committee also took control of its research.[250] As we have seen, the use of legal personhood to attribute responsibility is not ideal as it shields individual wrongdoers. However, if it is impossible to determine which individuals are responsible for unlawfully programming an AWS, then taking legal action against their company would be better than nothing.

Dealing with a company as a legal person is unlikely to happen on the international level. First, because ICC jurisdiction only covers '*natural persons*',[251] and so the ICC could not prosecute a company. Second, international law has completely failed to hold companies responsible for their criminality in recent years.[252] As such, taking this approach in the absence of individual criminal responsibility for employees of AWS manufacturers would need to be done on the domestic level.

It is important to note that whilst this thesis has focussed on the developers who actually build and programme AWS, senior managers of their companies can also be held individual criminally responsible on the international level for their unlawful failures. For example, several 'Nazi Industrialists' were prosecuted under US jurisdiction following the Nuremberg Trials.[253] Thus, there is no bar to holding senior management of an AWS manufacturer legally responsible under ICL if they were to play a willing role in international crimes as an accessory.[254]

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[250] Art.3(c), Control Council No.9.
[251] Art.25(1), ICC Statute; also see Art.5, ICTR statute; Art.6, ICTY statute.
[252] Katherine Tyler, 'Prosecuting Companies For Crimes Against Humanity' (The Law of Nations, 2017) Archived:<https://web.archive.org/web/20190405140119/https://lawofnationsblog.com/2017/04/03/prosecuting-companies-crimes-humanity/>.
[253] See United States v. Friedrich Flick (Vol. VI), United States V. Carl Krauch (Vols. VII-VIII) (Hereafter: I.G. Faben Case), and United States v. Alfried Kripp (Vol. IX) (Hereafter: Krupp Case) in Nuremberg Military Tribunals, Trials Of War Criminals Before The Nuremberg Military Tribunals Under Control Council Law No. 10, Nuremberg, October 1946-April 1949 (US Government Printing Office, 1950); for more on these cases, see Matthew Lippman, 'War Crimes Trials Of German Industrialists: The "Other Schindlers."' (1995) 9 Temple International and Comparative Law Journal, 173.
[254] Art.25(3)(c), ICC Statute.

### 11.2. 'Acting through' AWS and the 'control of the crime' approach

In terms of AWS developers and commanders/operators, both exert control over the system and how it will function on operations (technical and tactical control, respectively) within the guidance of a weapons reviewer (procurement control). If they instructed an AWS to perform an international crime, they would plainly have the necessary *mens rea*. We saw in Chapter 3 that AWS can be understood as being the legal agents of those controlling them, and so the acts of the AWS can be seen as the acts of the controller. ICL has dealt specifically with the performance of the *actus reus* of a crime by a legal agent.

In ICL, this concept is known as 'acting through' another (or the 'control of crime' approach, or 'control theory') it was brought into ICL as a method of holding the Nazi regime responsible as an internationally criminal organisation.[255] It developed from German law where a direct perpetrator (*Vordermann*) is controlled by an indirect perpetrator (*Hintermann*).[256] For example, an individual who uses their superior position to control and coerce, or exploit, an innocent child to perform a criminal act on their behalf.[257] In such situations, the controlling indirect perpetrator can be held responsible for the acts of the innocent direct perpetrator. It has been incorporated into the ICC statute in terms of controlling entities acting through other people.[258]

ICC case law has, so far, only considered control theory in relation to military commanders acting through their subordinates in a hierarchical structure.[259] Judges Fullford and Van der Wyngart have criticised this approach and suggested that Article 25(3)(a), which allows for individual criminal

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[255] Claus Roxin, 'Crimes As Part Of Organized Power Structures' (2011) 9 Journal of International Criminal Justice, 193.
[256] Jens David Ohlin, 'The Combatant's Stance: Autonomous Weapons On The Battlefield' (2016) 92 International Law Studies, 1, 11-14; Neha Jain, 'Autonomous Weapon Systems: new frameworks for individual responsibility' in Nehal Bhuta, et al.(eds), Autonomous Weapons Systems (CUP, 2016) 308-310.
[257] Claus Roxin, Täterschaft und Tatherrschaft (Walter de Gruyter, 2007) 127, cited in Jain (n.) 309.
[258] Art.25(3)(a), ICC Statute.
[259] Situation in the Democratic Republic of the Congo in the Case of the Prosecutor v Germain Katanga and Mathieu Ngudjolo Chui (Pre-Trial Chamber) Case No: ICC-01/04-01/07 [2008] ICC.

responsibility when acting through another, should be understood to focus on cases of co-perpetration.[260] The Article, however, clearly allows for cases of acting through another:

> '*a person shall be criminally responsible […] if that person: (a) Commits such a crime, whether as an individual, jointly with another or through another person, regardless of whether that other person is criminally responsible*.'

Despite the criticism, the Court has taken the correct approach and has interpreted 'acting through' to include relationships based upon control.[261]

In terms of AWS, the language used by the judges in the *Katanga and Chui* pre-trial decision suggests that the '*automatic'* following of orders by subordinates and the '*mechanised'* way in which the organisation worked may enable parallels to be drawn to the actual use of machines.[262] This would not be prohibited under Article 22(2) of the ICC statute which prevents extending the definition of crimes, but not an expansion of the understanding of perpetration.

We saw in Chapters 2 and 3 that the parallels between soldiers and machines are useful to show their common position in subordination to their commanders,[263] and that the subordinate position of an AWS is subject to far greater control as human soldiers can choose to disobey unlawful orders[264] whereas a machine cannot.[265] Thus the manifestation of a commander's (or operator's) actions is much more clearly shown through an AWS than it would with be through soldiers. As such,

[260] Situation in the Democratic Republic of the Congo in the Case of the Prosecutor v Germain Katanga (Trial Chamber 1) Separate Opinion of Judge Fulford, Case No: No ICC-01/04-01/06 [2012] ICC; Situation in the Democratic Republic of the Congo in the Case of the Prosecutor v Mathieu Ngudjolo Chui (Pre-Trial Chamber) Concurring Opinion of Judge Van der Wyngaert, Case No: ICC-01/04-02/12 [2012] ICC.
[261] Katanga and Chui (n.259) paras.511-518
[262] Katanga and Chui (n.259) paras.511-518; see also McFarland and McCormack (n.244).
[263] Ohlin (n.256) '[control theory] *also requires that the individual persons of the organization are essentiality fungible*' 9, also see 14-21.
[264] ICRC Study, Rule 154.
[265] '*contrary to what is suggested by science-fiction scenarios, the danger is not that robots begin to disobey. Quite the reverse: it is that they never disobey.*', See Gregoire Chamayou, Drone Theory (Penguin Books 2015) 217; note that Arkin seeks to develop an 'ethical governor' which would evaluate the morality and legality of all orders before enacting them. See Ronald Arkin, Governing Lethal Behaviour In Autonomous Robots (CRC Press, 2009) 127-153.

AWS should be seen as following programming/instructions in an '*automatic*' and '*mechanised*' manner, such that their controllers can be seen as acting through them for the purposes of individual criminal responsibly when an unlawful act is committed. This Chapter now discusses the particular issues of generating individual criminal responsibility for the exercise of technical, tactical, and procurement control, having already noted the responsibilities of states and non-state actors, and political leaders, for their political control.

### 11.3. International criminal responsibility of AWS developers

In terms of technical control, this Section considers three scenarios where AWS developers act unlawfully and could be held responsible. First, where a developer programmes an AWS to perform a criminal act. Second, where an individual unlawfully alters an AWS to assist, aid, or abet the commission of international crimes by others. Third, where the developers were reckless or negligent as to the programming of the system such that civilians are not protected. As the present Chapter noted above, developers could not be held responsible for the commission of war crimes that were not '*in the context of* […] *an* [armed conflict]'.[266]

Where a developer intentionally programmes an AWS to perform unlawful acts by altering the algorithmic understanding of a target to include civilians or enabling an algorithmic bias against a particular type of person,[267] for example, they would clearly have created a situation whereby they knew the unlawful acts would happen. Their intent and knowledge would fulfil the general mental elements for international crimes.[268] The presence of any necessary special intent would fulfil the mental requirements for genocide and certain crimes against humanity.[269] Should the AWS go on to

[266] See the penultimate paragraph of each crime under Art.8, Elements of the Crimes.
[267] Noel Sharkey, 'The Impact Of Gender And Race Bias In AI' (Humanitarian Law & Policy Blog, 2018) Archived:<https://web.archive.org/web/20190721041416/https://blogs.icrc.org/law-and-policy/2018/08/28/impact-gender-race-bias-ai/>.
[268] Art.30, ICC Statute.
[269] See Arts.6 and 7, Elements of the Crimes.

perform an international crime, the developer would be acting through the AWS and would fulfil the *actus reus* element. This completes the individual criminal responsibility that could be ascribed to a developer under Article 25(3)(a) of the ICC statute.

McCormack and McFarland argue that, in order for a developer to clearly be responsible, they may need to have programmed an AWS in such a way that the operator cannot intervene in their plan.[270] This would seem to be correct. Should a developer, for example, programme civilian objects into the target database of an AWS, then their direct responsibility for the unlawful act would seem to be in question if an operator knew this information and deployed the system anyway. In such a situation, the role of the developer would seem to be accessorial.

The second scenario of a developer altering AWS programming to assist, aid, or abet unlawful uses of AWS may seem outlandish but people have willingly assisted international crimes in similar circumstances.[271] It is possible to imagine an AWS developer who becomes aware of some AWS operators using their products with a desire to commit international crimes and alters the controlling architecture to 'unlock the door' and enable these crimes to occur.

The aiding and abetting of an international crime requires that such conduct is '*for the purpose of facilitating the commission of such a crime.*'[272] Thus, a developer would need to be acting with the specific intention of facilitating the criminality, with knowledge that the ultimate perpetrator intended to do so, and that their actions would contribute to the unlawful activity.[273] However, the ultimate perpetrator (the AWS operator) need not know that there has been any assisting, aiding, or abetting

[270] McFarland and McCormack (n.244) 375-376.
[271] Case No.9 (Trial of Bruno Teesch and Two Others 'The Zyklon B case') British Military Court, Hamburg, 1st-8th March 1946. Law Reports of Trials of War Criminals 93, 101-102.
[272] Art.25(3)(c), ICC Statute; Blaškić (Appeal)(n.246) para.46.
[273] McFarland and McCormack (n.244) 380.

to their crimes,[274] nor need there be a common plan between them.[275] Indeed, the aider or abettor need not be present with the ultimate perpetrator during the crime.[276]

As ICL Courts have considered aiding and abetting behaviour for international crimes to exist before, during, and after the principal acts,[277] the actions of an AWS developed prior to the acts of the ultimate perpetrator should still be seen as criminal. Yet, ICL case law has not yet needed to consider accessorial acts taking place at advanced temporal distance from the principal acts, such as that between weapons manufacture in peacetime and criminal acts years later,[278] and so jurisprudence displays no indication as to a limit of acceptable advanced *temporal* distance for aiding and abetting in terms of genocide or crimes against humanity. As such, a court may decide that long time gaps between AWS manufacture and their unlawful use may be too far removed to be included. Yet, where the intent of the ultimate perpetrator and the developer's accessorial intent exist at the same time during the manufacture of the AWS, this would seem to meet the threshold. Here, the developer would not necessarily be unlawfully acting through the AWS but using their technical control to enable the operator to act unlawfully through the AWS. They, would, therefore, be an accessory to the crimes.

Should the relationship between nefarious developers and operators become so close that they are "*acting pursuant to a common design,* [and] *possess the same criminal intent*',[279] it may be possible to characterise their behaviour as a joint criminal enterprise. The ICC Statute allows for this,[280] and the use of AWS does not cause novel problems.

In the third scenario, developers could programme an AWS so poorly that civilians are not protected, and they are reckless or negligent as to the harm that would come to the civilians. ICL case law has differing practice on whether these mental states are sufficient for *mens rea*. It has accepted

[274] Tadić (Interlocutory Appeal)(n.116) para.229.
[275] Tadić (Interlocutory Appeal)(n.116) para.229.
[276] Blaškić (Appeal)(n.246) para.48.
[277] Blaškić (Appeal)(n.246) para.48.
[278] McFarland and McCormack (n.244) 379-380.
[279] Tadić (Appeal)(n.75) para.196.
[280] Art.25(3)(a), ICC Statute.

both recklessness,[281] meaning that the offender knows it is probable that their acts will cause unlawful harm,[282] and gross negligence,[283] meaning that a person does not act to avert a risk of harm they know will come about due to their conduct being blatantly at odds with the required standard,[284] as sufficient for fulfilling the *mens rea* element of international crimes. Yet, neither of these mental states are included in the ICC Statute, which requires intent and knowledge to fulfil *mens rea* '[u]*nless otherwise provided*'.[285] As such, the Statute allows for negligence and recklessness to fulfil the *mens rea* elements where a '*should have known*' threshold is used (conscripting children[286] and command responsibility).[287] As this threshold is not applicable to the circumstances of weapons developers, they are unlikely to be held responsible at the ICC for acts of recklessness or negligence. However, domestic jurisdictions commonly apply both standards to *mens rea*; where ICL is incorporated into domestic law, developers could be held responsible for their unlawfully reckless or negligent acts.

### 11.4. International criminal responsibility of AWS users

This Section considers the responsibility for AWS where they are firmly under the tactical control of operators. Where an operator specifically instructs an AWS to perform an internationally criminal act, they would commit the *actus reus* elements by acting through the AWS. They would possess the *mens rea* elements by intentionally instructing an AWS to perform the unlawful act and knowing that it would occur as a consequence of those instructions.[288] For genocide and certain crimes against humanity, this would also need additional special intent.[289]

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[281] Prosecutor v Strugar (Trial Judgement) Case No: IT-01-42 [2005] ICTY para.235.
[282] Prosecutor v Delić (Trial Judgement) Case No: IT-04-83 [2008] ICTY para.48.
[283] See Stenger and Crusius, and Hinselmann and Other in Cassese's Companion (n.76) 725-726, 935-936
[284] Antonio Cassese, 'The Elements of International Crimes' in Antonio Cassese and Paola Gaeta (eds.), Cassese's International Criminal Law (3rd edn, OUP, 2013) 52-53.
[285] Art.30, ICC Statute.
[286] Art.8(2)(b)(xxvi), ICC Statute.
[287] Art.28(a)(i), ICC Statute.
[288] Art.30, ICC Statute.
[289] Arts.6 and 7, Elements of the Crimes.

For example, an operator could use an AWS for *ad hoc* targeting against a field hospital.[290] Or, they could inflate the acceptable level of incidental harm during an *autonomous* mission such that the same medical personnel and hospital would be incidentally damaged.[291] The effect of each nefarious act would be the same: protected persons would be unlawfully harmed. The operator could be held responsible in either case, as they would display both intent and knowledge that their actions would result in unlawful conduct.

In terms of aiding and abetting, it is not inconceivable that an operator might allow an AWS that they know has been unlawfully programmed by a developer to be used for missions. The responsibility framework would be the same as outlined in the previous Section. But, as the operator would need to be directly involved with the developer's plan, the relationship between a nefarious developer and a nefarious operator would need to be quite close. This could, therefore go beyond a mere accessorial relationship and into a joint criminal enterprise quite easily.

In terms of recklessness and negligence, we have already seen that these standards are not always applicable at the ICC, despite precedents for their use in ICL. Such claims could be heard in domestic courts applying ICL rules, however. Negligence is particularly relevant to the use of highly complex machines. These systems could be so complex that they are beyond human understanding.[292] This raises the issue of how a threshold of negligence can be decided when it may be impossible to fully comprehend the workings of these systems. Sassóli articulates that operators need not comprehend the complex mechanisms of AWS, but must understand the capabilities of the system.[293] In much the same way, all people who drive cars understand the capabilities of the vehicle to move

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[290] For more on the intentional targeting of medical personnel during the Syrian conflict, see Derek Gregory, ''Your Turn, Doctor'' (Geographical Imaginations, 2018) Archived:<https://web.archive.org/web/20190520085930/https://geographicalimaginations.com/2016/11/30/your-turn-doctor/>.
[291] See Carrie McDougall, 'Autonomous Weapon Systems and Accountability: Putting the Cart Before the Horse' (2019) 20 Melbourne Journal of International Law 58, 69.
[292] See Hughes (n.187).
[293] Marco Sassóli, 'Autonomous Weapons And International Humanitarian Law: Advantages, Open Technical Questions And Legal Issues To Be Clarified' (2014) 90 International Law Studies, 307, 324.

but many do not understand the precise nature of an internal combustion engine. Thus, adequate training would need to bring operators up to an appropriate level of understanding.[294] Consequently, any claim of negligence against an operator could only be levelled on the basis that they did not give adequate thought to the capabilities of the system. A negligence claim could not be made because the operator did not consider the complex technical workings of the robot. Following the same logic in terms of claiming recklessness, an operator could not be thought of as reckless if an unlawful act occurred and an advanced level of understanding, beyond that which would be reasonable for an operator to have, was required to foresee that the acts would probably happen.

### 11.5. Superior orders that are (not) manifestly unlawful

The notion of leaders, or commanders, ordering subordinates to use an AWS for criminal acts is something we saw earlier in relation to policies of using sexual violence as a 'weapon'. Should a superior order a subordinate to commit a crime using an AWS, they themselves would be individually criminally responsible under Article 25(3)(b) of the ICC statute.

In normal circumstances, an operator being ordered to use an AWS for criminality would not prevent their individual responsibility. However, Article 33 of the ICC statute provides that the defence of superior orders can be activated where a criminal act has occurred and a subordinate is under a legal duty to follow orders, the subordinate did not know the order was unlawful, and the order was not manifestly unlawful.[295] For an order to be manifestly unlawful, it must be obviously illegal to a reasonable combatant (orders to commit genocide or crimes against humanity are always manifestly unlawful).[296]

[294] Training operators to an appropriate level of understanding is already US policy, see US UNOG delegation, cited in Chengeta (n.3) 24.
[295] Art.33(2), ICC Statute.
[296] Mark W.S. Hobel, '"So Vast An Area Of Legal Responsibility"? The Superior Orders Defense And Good Faith Reliance On Advice Of Counsel' (2011) 111 Colombia Law Review, 574, 587-590.

It is possible to imagine a situation where a commander orders an AWS operator to use the system in an attack that does not seem manifestly unlawful. As this thesis has discussed at length, target identification by AWS is based on recognising characteristics associated with adversaries. The legality of an attack, therefore, can hinge upon whether the characteristic is lawful in terms of distinguishing a target. There are many motifs displayed by those actively fighting for a cause, and some are shared with those peacefully supporting such a cause.[297] An order to target individuals based upon them displaying such a motif would only be manifestly unlawful if the operator is aware that the symbol was displayed by both legitimate targets and civilians. Where an operator is unaware of such facts, they could rely upon a defence of superior orders and the commander issuing an unlawful command would be held responsible.

It is problematic that this defence only applies to cases of war crimes with superior orders not being a defence to genocide and crimes against humanity. Still, other defences may be available, and superior orders could potentially be extended to genocide and crimes against humanity under Article 31(3) which allows grounds for excluding criminal responsibility other than those specifically listed under Article 31(1) to be considered (mental disease, intoxication, self-defence, duress).

### 11.6. Modes of liability: command responsibility

Having discussed AWS operators, the Chapter now moves to consider their commanders who will oversee AWS operations. The standard for command responsibility in the ICC Statute states that a commander shall be held responsible for the crimes of their subordinates under their effective control where they knew or, owing to the circumstances, should have known that their forces were

[297] See, for example, the Easter Lily motif, a symbol of Irish republicanism displayed both by peaceful and violent organisations, see Ireland Calling, 'Easter Lily - Irish Symbol Of Peace' (Ireland Calling, 2018) Archived:<https://web.archive.org/web/20180626105121/http://ireland-calling.com/easter-lily/>. This is provided only as an example and is not meant to suggest that 'The Troubles' were legally an armed conflict.

committing (or were about to commit) international crimes, and failed to take all necessary and reasonable measures to prevent or punish such criminality.[298]

Where the commander is a civilian superior (a political leader, for example), the standard is altered such that they must consciously disregard information clearly indicating that their subordinates were committing or were about to commit international crimes, rather than that they should have known; the crimes concerned must also be under the effective control and authority of the civilian commander.[299]

The superior-subordinate relationship may be *de jure*, or *de facto*.[300] The ICC Trial Chamber in *Bemba* elucidated various factors that may indicate the existence of command authority and effective control in a military context,[301] and the SCSL Trial Chamber did so in relation to the ANSA context.[302] A similar degree of control is required in civilian superior-subordinate relationships for the purposes of command responsibility.[303] Essentially, anybody with the ability to order a subordinate operator to use an AWS to act in a particular way would have the required level of control over the subordinate and the system to establish command responsibility, whatever their position in the command hierarchy.[304]

The ICC requires an element of causation to confirm the applicability of command responsibility, unlike the ICTY and ICTR.[305] Whilst command failures need not have enabled the commission of the crimes, the crimes (or an increased risk of the crimes occurring)[306] must have occurred as a result of the superior's failure to exercise control over their subordinates at the relevant

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[298] Art.28(a), ICC Statute; note that this is a less strict interpretation than in Yamashita (n.64).
[299] Art.28(b), ICC Statute.
[300] Delalić and others (Trial)(n.196) para.370.
[301] Bemba (n.306) para.417.
[302] Prosecutor v Brima and Others (Trial Judgement) Case No: SCSL-04-16-T [2007] SCSL, para.788.
[303] Prosecutor v Nahimara and others (Appeal Judgement) Case No: ICTR-99-52-A [2007] ICTR, paras.606-609.
[304] Blaškić (Trial)(n.221) para.301.
[305] Baig (n.64) 187.
[306] Decision Pursuant to Article 61(7)(a) and (b) of the Rome Statute on the Charges of the Prosecutor Against Jean-Pierre Bemba Gombo (Pre-Trial Chamber II) Case No: ICC-01/05-01/08-424 [2009] ICC, para.425.

time.[307] This need not entail knowledge of a specific unlawful plan by subordinates but may be general information to make the commander aware that unlawful acts could occur. The ICTY Appeals Chamber suggests knowledge that subordinates are violent, unstable, or inebriated, would be enough general information to put the commander on notice that unlawful acts might be committed by their subordinates.[308] Thus, where an AWS commander is aware that their subordinates operating AWS present a risk of unlawful conduct, they are under a duty to prevent such offences. Where a commander should have known of such happenings, they could also be held responsible as a form of negligence.[309] It also seems possible to extend command responsibility to the AWS as a subordinate. So, as with violent, unstable, or inebriated human subordinates, a commander would also be on notice of the potential for unlawful acts if they knew that the ability of an AWS under their command to be used in compliance with the law could not be assured.[310]

Preventing subordinate criminality must entail the superior taking all necessary measurers within their material ability,[311] which may potentially go beyond their formal powers.[312] The ICC Pre-Trial Chamber took both ICTY and ICTR jurisprudence to create a non-exhaustive list as to what would constitute discharging the duty to prevent:

> *'(i) to ensure that superior's forces are adequately trained in* [LoAC]*; (ii) to secure reports that military actions were carried out in accordance with international law; (iii) to issue orders aiming at bringing the relevant practices into accord with the rules of war; (iv) to take disciplinary measures to prevent the commission of atrocities by the troops under the superior's command.'*[313]

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[307] Bemba (n.306) para.418.
[308] Prosecutor v Delalić and others (Appeal Judgement) Case No: IT-96-21-A [2001] ICTY, para.238.
[309] Bemba (n.306) para.429.
[310] Christopher M. Ford, 'Autonomous Weapons And International Law' (2017) 69 South Carolina Law Review, 413, 474.
[311] Blaškić (Appeal)(n.246) para.438
[312] Prosecutor v Kayishema and Ruzindana (Appeal Judgement) Case No: ICTR-95-1-A [2001] ICTR, para.302; Prosecutor v Krajišnik (Appeal Judgement) Case No:IT-00-39-A [2009] ICTY, para.193-194.
[313] Bemba (n.306) para.438

In terms of AWS, a commander may be required to ensure that in addition to their human forces being adequately trained under part (i), that their robotic forces are adequately capable of performing the tasks asked of them in accordance with international law.[314] However, whilst a commander should have the same degree of knowledge as a reasonable commander at a comparable level of command and in a comparable operational context,[315] this does not require deep technical knowledge of the AWS nor each operation. Nor does this justify a wilful or negligent lack of knowledge about either the technical aspects of the system or operations. Thus, if a commander were to fail to ensure that AWS under their command were programmed to enable lawful use, that would seem to constitute a failure of command responsibly (part (i)).[316] Another failure might be not ensuring that AWS are used in such a way as to be legally compliant (part (iii)), for example, not monitoring that AWS operators were taking adequate care of civilians or placing sufficient restrictions on *autonomous* functioning.

In terms of the duty to repress, and punish, subordinate criminality, the ICC Statute only extends to knowledge about acts that subordinates are '*committing or* [are] *about to commit'*.[317] This implies that the duty to punish subordinates does not extend to commanders who are informed about such criminality *ex post facto*.[318] However, the Pre-Trial Chamber has extended the meaning of this duty to include both ongoing crimes, and that which have occurred.[319] Thus, where an AWS commander becomes aware that these systems are being used for criminality, whether it is happening at the time, or has already finished, they would be legally required to punish the operators who engaged in unlawful acts. This may be fulfilled using disciplinary measures immediately available to the commander, or through enabling investigation by competent authorities.[320] Of course, an AWS

[314] Ford, (n.310) 474.
[315] Tallinn Manual, Rule 85 commentary para.10.
[316] See Section 12 for more on issues created by highly complex systems.
[317] Art.28, ICC Statute.
[318] Baig (n.64) 187.
[319] Bemba (n.306) para.439.
[320] Blaškić (Appeal)(n.246) para.68.

commander could not punish an AWS when it is used in a criminal act and so the duty to repress could only apply to human subordinates.

### 11.7. Modes of liability: procurement responsibility

Corn suggests a new mode of liability for persons involved in the testing and procurement of AWS which shares a conceptual basis with command responsibility. This is a *lex ferenda* suggestion. But, unlike others, such as Crootof's War Torts concept,[321] it a comparatively modest proposal to recognise that both commanders and procurers exert control over AWS and apply similar rules to that command, rather than creating a whole new body of law. As we saw in Chapter 3, procurement responsibility is the basis of the conception of procurement control used in this thesis.[322] The weapons testing process (Chapter 4) is a key moment for exercising such control. It is also a significant opportunity to correct, or cancel, the development of an AWS that is unlikely to produce a lawful system. Further, the guidance resulting from a review can shape the use of AWS as discussed in Chapter 5.

As Corn suggests, the current conception of command responsibility is not flexible enough to accommodate a shift of focus to procurement responsibility.[323] But, Corn's concept is based upon the same foundation as command responsibility (accomplice liability and negligence).[324] Considering the similar conceptual basis, and the importance of weapons reviewers in terms of AWS being used in compliance with international law, it is worth considering procurement responsibility. Following Corn, it is possible to reconceptualise and then apply command responsibility as procurement responsibility.[325] So the argument goes, where weapons reviewers knew of issues with AWS and did

[321] Crootof (n.8).
[322] Art.28, ICC Statute.
[323] Corn (n.168) 232.
[324] Corn (n.168) 233.
[325] Corn (n.168) 232.

nothing, or should have known about issues and did nothing, they would be held responsible for those issues.[326]

As we have already seen, if this type of control is exercised properly, it makes wrongful actions unforeseeable.[327] Indeed, where an AWS creates a violation of international law, and the reason for this is found to be an inadequate procurement process, then the official who carried out the relevant parts of the procurement process should be held responsible.[328]

Applying the standard of ignoring known issues to weapons testers and reviewers is not overly problematic. However, applying a 'should-have-known' standard does create an issue. With human soldiers, a commander is responsible for their training, and would, therefore, be aware of any gaps, or personal issues, that may become problematic during combat.[329] Yet, weapons reviewers are not directly involved in the programming of AWS. Thus, even if they have a considerable technical understanding of the system through testing,[330] that would not necessarily allow them to understand the nuances of how the system will work in all contexts. Where such a level of technical knowledge is reasonable, a should-have-known standard could be implemented and persons who are not aware of required information could be held responsible if the system acts unlawfully and this is avoidable.

Yet, where knowledge of the reviewer is at a reasonable level, and that is still insufficient, for example, if the AWS was very highly complex, a should-have-known standard should not be used because the level of knowledge required is unreasonable to expect. As such, this reinforces the argument that despite the complexity of these systems, they need to be understandable by humans in order for many legal and policy duties to be performed.[331]

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[326] Art.28, ICC Statute.
[327] Corn (n.168) 233.
[328] Corn (n.168) 235.
[329] Corn (n.168) 234.
[330] Corn (n.168) 228-238.
[331] See Samek, Wiegand and Muller (n.188); Hughes (n.187).

In summary, Corn's argument for a new mode of liability is convincing in relation to weapons reviewers who know of issues and disregard them, and in relation to issues that they reasonably should-have-known about. But, it comes unstuck where the complexity of a system is beyond reasonably expected knowledge. Thus, in addition to having a mode of liability dependent upon the complexity of the system, a more preferable solution would be to ensure that all systems are manufactured in such a way that they are understandable to human beings of reasonable experience and knowledge.

Still, as the concept of procurement responsibility is still only a suggestion, it is more likely that any failure to adequately review a weapon would be dealt with under service law, or with administrative means in the domestic setting.[332] For such failures to become unlawful on the international level, some changes would be needed.

12. Remaining issues

Having started this Chapter by discussing the possibility that a responsibility gap might exist in relation to AWS, it is clear from the foregoing discussion that there are several entities that can be held responsible for the internationally wrongful, or criminal, acts of an AWS. However, the present Chapter has also noted areas where these gaps are not completely closed, and issues remain.

Responsibility gaps still exist in relation to: AWS developers who fulfil the *actus reus* and *mens rea* of war crimes during peace-time manufacturing, and yet because of the temporal distance from an armed conflict cannot be held to have committed a war crime under international law; AWS manufacturing companies cannot be held responsible on the international level due to not having

[332] For example, see Armed Forces Act 2006; Dickinson (n.21); UK MoD (n.21); McNeal (n.21).

legal personality under ICL;[333] the multi-national nature of modern weapon production[334] may create issues for any victims of manufacturer wrongdoing as a multi-jurisdictional investigation may simply be too difficult to create (note that multi-agency investigations across jurisdictions can fulfil the duty to investigate under IHRL). [335]

As we saw in Section 2, domestic law may be capable of filling some gaps where individuals and manufacturers involved in developing and using AWS have committed acts that are unlawful under domestic criminal law. Further, tort law could allow for AWS manufacturers to be held responsible under a product liability regime, or where a company fails to provide required information or training for their products,[336] for example.

The closure of several responsibility gaps is dependent upon certain premises. This first requires states to change their policies to accept that arms manufacturers can be responsible for their products following delivery. Second is to understand that those exercising control over AWS act through them such that the actions of an AWS are the manifestation of their control. Where these arguments are not accepted, responsibility gaps would exist as the most obvious fall-back position would be the current paradigm that has been shown to be insufficient.

The complexity of AWS can cause problems for investigators of wrongdoing. Much like with operators,[337] commanders,[338] and reviewers,[339] the performance of investigative duties require such

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[333] Note this jurisdiction in other areas of international law: Barcelona Traction (n.128) para.56; Case Concerning Ahmadou Sadio Diallo (Republic of Guinea v Democratic Republic of the Congo) Preliminary Objections [2007] ICJ Reports, p.582, para.61; Ralph G. Steinhardt, 'Responsibilities of Multinational Corporations' in Stuart Casey-Maslen (ed.), Weapons Under International Human Rights Law (CUP, 2015).
[334] See the large number of contributing companies from different countries: BAE Systems, 'Taranis' (BAE Systems, 2016) Archived:<https://web.archive.org/web/20190812060713/https://www.baesystems.com/en-uk/product/taranis1>; Dassault, 'Neuron, The European Combat Drone Demonstrator: Introduction' (Dassault Aviation, 2018) Archived:<https://web.archive.org/web/20190727165638/https://www.dassault-aviation.com/en/defense/neuron/introduction/>.
[335] Pearson v United Kingdom, App no:40957/07 (ECtHR, 13 December 2011) para.71; Maktouf and Damjanović, App nos: 2312/08 and 34179/08 (ECtHR, 18 July 2013) para.82.
[336] See: Turner et al.; Heston et al.; Rosa (n.23).
[337] Sassóli (n.293) 324.
[338] Tallinn Manual, Rule 85 commentary para.10.
[339] Hughes (n.187).

persons to understand the system they are examining. Where a system is complex, this may require a technical expert to be available where necessary to carry out these duties. This is not a significant leap beyond current doctrine, which already allows for advisers across the development and use of weapons,[340] and is encouraged in relation to cyber-operations.[341] A similar solution could be employed with AWS.

Yet, some cutting-edge algorithms are so complex as to be beyond the understanding of experts.[342] The use of explainable algorithms, which provide evidence for their decisions, might be the only way for humans to understand these systems at the necessary level. As such, they may be legally required in order to fulfil the obligations of operators, commanders, procurers, and investigators.[343]

## 13. Conclusion

Having considered many aspects of accountability, responsibly, and liability as they relate to AWS and the different entities that control them, this Chapter has sketched out a new paradigm of responsibility for AWS. It argues that those who control the unlawful actions of the system should be held responsible, no matter their position. This argument has been reinforced by applying current international law rules and precedents from ICL trials. Thus, this Chapter has demonstrated how a sufficient responsibility paradigm could be applied to the use of AWS and over all entities exercising political, procurement, technical, or tactical control. Thus, the exercising of control has clear links to being held responsible for wrongdoing that results from such control. In conformity with the layers of control outlined in Chapter 3, the holding of each entity responsible for their controlling acts can be

[340] Development, Concepts and Doctrine Centre, JDP 3-00 Campaign Execution (3rd edn, UK Ministry of Defence 2009), 1-9; UK Ministry of Defence, 'Legal Review Of Newly Acquired Or Developed Weapons Or Associated Equipment (2009DIN04-217)' (Development, Concepts and Doctrine Centre, 2009) para.11.
[341] Tallinn Manual, Rule 114 commentary para.6.
[342] Boulanin and Verbruggen (n.178) 17.
[343] Hughes (n.187).

seen in parallel; if multiple controlling entities have engaged in wrongdoing, then each wrongdoer should be held responsible separately.

This Chapter also noted that in order for sufficient investigations, reviews, the exercise of command responsibility, and the fulfilment of operator duties to be enabled, that explainable algorithms be used in AWS or technical experts be present during AWS use. Essentially, this also adds additional regulation to the use of AWS.

The highly technical nature of AWS does not, therefore, create a responsibility gap so large that AWS should never be lawfully used as some have claimed.[344] But, all persons involved in the production and use of AWS can be held responsible in some way. This should be based on the level of control that an entity has over an AWS, which should be reflected in the applicable responsibility paradigm. Still, the proposed paradigm hinges upon its main points being accepted. Where they are not accepted, wide responsibility gaps could be created, and this could hamper the fulfilment of any victim's right to a remedy. However, the proposed paradigm does not solve all issues and some small responsibility gaps may not be possible to fill in international law but could be filled under domestic law. Consequently, it can be said that, in terms of responsibility, international law is capable of sufficiently regulating AWS in most cases. But, there some instances where domestic law must fill gaps.

[344] HRW (n.2); Chengeta (n.3); Sparrow (n.3).

Chapter 7: Conclusion

1. Layers of control and technological management

Considering autonomous weapon systems (AWS) from the layers of control approach has allowed us to see that, on the whole, current international law can sufficiently regulate AWS. We have observed through each substantive Chapter that legal duties are placed upon the human beings who exercise political, procurement, technical, and tactical control over AWS, and they must ensure that the deployment, development, manufacture, and use of AWS are in conformity with the law, respectively, as AWS are their legal agents. Consequently, failures in their exercise of control also entail their responsibility if legal obligations are violated by AWS. Taking this view of AWS was necessary as they are subject to the control over their programming and instructions by their very nature. Each entity exercises their control in parallel; as such, there is no competition between entities which means that responsibility can be attributed discretely to multiple parties if necessary.

The use of technological management has also been discussed as a method by which some breaches of legal rules can be made impossible. There are moral issues raised by this,[1] but the continual narrowing of possible behaviours that an AWS could perform into only allowing those that are desirable would seem to be a positive outcome in legal terms. However, as we saw through Chapters 4, 5, and 6, the actual lawful use of these systems is fundamentally dependent upon developers building, and commanders using, these systems in lawful ways, as authorised by reviewers. As such, whilst a nefarious AWS user could choose to use a system unlawfully, as with other weapons, they should have fewer opportunities to do so with an AWS due to having fewer 'doors' open for abuse.

[1] Roger Brownsword, 'Technological Management And The Rule Of Law' (2016) 8 Law, Innovation and Technology, 100, 129-131.

2. Is current law sufficient to regulate AWS?

This thesis suggested that the ideal solution for how international law should deal with AWS would be a comprehensive regulatory treaty covering their development, manufacture, use, proliferation, and responsibility.[2] However, as we have seen, there is little likelihood that any international instrument can be agreed to deal with AWS, whether regulatory or prohibitive. As such, this thesis is left to examine present-day international law and its ability to deal with AWS. It has shown that the best way to understand the lawfully compliant use of AWS is through layers of control. This returns the discussion to the research question of the thesis: Can international law as it currently stands sufficiently regulate autonomous weapon systems, or is new law required?

We have seen over three analytical chapters, that, broadly, international law does have the tools to deal with AWS, although some specific areas where the law is, at best, sub-optimal have been noted. It has also been shown how legal rules are applied through exercises of control. For example, in the discussion of weapons law, we saw that, in order to effectively deal with the *autonomous* nature of these systems, reviewers, when exercising procurement control, need to consider the ability of an AWS to recognise potential targets as distinct from non-targets, and that this is different from the normal consideration of accuracy when evaluating whether a weapon is inherently indiscriminate.

A reviewer's ability to consider this is due to the inherent flexibility of the legal framework of weapons reviews. Article 36 of Additional Protocol I, which creates the treaty obligation to carry out weapons reviews, and the customary rules which create implied duties to evaluate weapons,[3] do not state how a weapons review should be carried out. As such, this allows them to be used flexibly so as to be comprehensive enough to sufficiently regulate AWS and their novelty as weapons. Decisions to use this flexibility would also form part of procurement control.

[2] Rebecca Crootof, 'The Killer Robots Are Here: Legality And Policy Implications' (2015) 36 Cardozo Law Review, 1837, 1897; Kenneth Anderson, Daniel Reisner and Mathew Waxman, 'Adapting The Law Of Armed Conflict To Autonomous Weapon Systems' (2014) 90 International Law Studies, 335, 406-408.
[3] Jean-Marie Henckaerts and Louise Doswald-Beck, Customary International Humanitarian Law, Volume I: Rules (CUP, 2005), Rule 71.

Technical control is also key here as it is the ability of weapons developers to produce a system that can be used in compliance with the law is also crucial. This thesis has shown that technical control does not just revolve around creating AWS so as to be lawfully usable by commanders/operators, but also that the programming of AWS for use in combat results in them partaking in the targeting cycle.[4] Thus, their control over AWS, and their responsibility for how AWS work, extends into deployment of these system more significantly than for any other weapon system. It was important for this thesis to evaluate the enduing influence of AWS developers in order to determine how legal rules apply to them so as to be able to show that current legal regimes can sufficiently regulate their actions in relation to AWS.

The application of targeting law is like weapons law in that it does not prescribe how particular tasks should take place. On a basic level, if the required tasks are performed, the law is complied with. As we saw throughout the thesis, *autonomous* systems using artificial intelligence are incapable of assessing qualitative values. Thus, they cannot be used for those legally required tasks that need innate qualitative judgement. This is not necessarily fatal to the lawfulness of using AWS, it merely means that humans must perform these tasks and have an ongoing engagement with each mission AWS are used for. However, *autonomous* systems can assess quantitative data and so could lawfully perform tasks involving quantitative analysis. Therefore, through dividing these tasks between human and machine, compliance with the law whilst using these systems can be enabled. Consequently, it can be said that the targeting law regime can regulate AWS sufficiently.

The human engagement, and the key decisions it involves, across this human-machine division of labour is the crux of tactical control as commanders are determining how attacks using AWS should take place. This includes not only the targets, time and location of attack, and weapons to be used (or effects to be caused), but also how targets and civilians should be recognised and how the AWS should

[4] US Department of Defense, DOD Dictionary Of Military And Associated Terms (US DOD, 2018)(Hereafter: DoD Dictionary) see ‘Targeting’.

deal with this information, and all of this in terms of whether targeting by the AWS will take place in a *fully-autonomous*, *semi-autonomous*, or remote-controlled mode.

Regarding responsibility, we saw in the previous Chapter that international law, and international criminal law in particular, does have the tools to deal with the use of AWS in most cases. However, making use of these tools would require a paradigm shift to reflect an understanding of the different controlling relationships the thesis has explained: to change national policies so that manufacturers can be seen as responsible for their products after delivery; to change the view of control theory such that it includes perpetrators 'acting through' an AWS as an innocent agent.

However, the biggest gap in this responsibility paradigm is that related to weapons developers who make an AWS in peacetime that goes on to perform a war crime, as such crimes under the Rome Statute of the International Criminal Court require the *actus reus* to take place '*in the context of*' an armed conflict.[5] Whilst the definitions of crimes in the ICC Statute are strictly construed,[6] other courts could follow precedents that include an understanding that some war crimes begin before an armed conflict breaks out.[7]

Closing such gaps would enable those who exert control over AWS to be responsible for their actions in exerting that control, whichever layer their control comes from. In most cases, this should allow international legal rules on responsibility to be applied to each controlling entity as necessary. By following the approach that the exercise of control leads to responsibility for that control, we can see that current international legal rules are generally capable of regulating responsibility for AWS at a sufficient level in theory.

[5] See the last two requirements for each crime under Art.8, International Criminal Court, Elements Of Crimes (International Criminal Court, 2011).
[6] Art.22(2), Rome Statue Of The International Criminal Court 1998 (adopted 17 July 1998, entered into force 1 July 2002) 2187 UNTS 3.
[7] Prosecutor v Blaškić (Appeal Judgment) Case No: IT-95-14-A [2004] ICTY, para.48; Prosecutor v Taylor (Trial Judgement) Case No: SCSL-03-01-T [2012] SCSL, para.484.

In considering these legal areas together, we can see that, overall, AWS can be sufficiently regulated by current international law. But, in order to appropriately reflect the layers of control approach that this thesis has shown to be optimal for understanding AWS, sufficient regulation requires legal rules to be used flexibly in terms of weapons law, to be applied across a human-machine division of labour with regard to targeting law, and used with an altered perspective when dealing with responsibility. As such, the legal framework that has been outlined through the thesis stretches current interpretations of international law, as it applies to AWS, further than ever before. Yet, the efficacy of this framework is dependent upon it being accepted. This is not guaranteed. Rejection would lead to inadequate regulation of AWS.

3. Further issues to discuss

The most obvious issue that needs further discussion is how to ensure that legal frameworks that do sufficiently regulate AWS are assured and implemented. Considering that the process of developing a specific international instrument to regulate AWS is unlikely to succeed, soft law can be considered. Creation of soft law regulation to cement this framework, and the layers of control approach, in a way that appeals to many states, with the hope that it would become part of customary international law and national military manuals, seems to be the best way forward.[8]

Another issue that requires further discussion is the use of highly complex programming in systems such as AWS. The last Chapter noted that if people reviewing,[9] using,[10] or investigating[11] AWS

[8] Note that part of the forthcoming Oslo Manual considers AWS.
[9] Joshua G. Hughes, 'The Law Of Armed Conflict Issues Created By Programming Automatic Target Recognition System Using Deep Learning Methods' (2018) 21 Yearbook of International Humanitarian Law, 99.
[10] Marco Sassóli, 'Autonomous Weapons And International Humanitarian Law: Advantages, Open Technical Questions And Legal Issues To Be Clarified' (2014) 90 International Law Studies, 308, 324; Michael N Schmitt and Liis Vihul, Tallinn Manual 2.0 On The International Law Applicable To Cyber Operations (2nd edn, CUP, 2017), Rule 86 commentary para.6.
[11] Art.91, Protocol Additional to the Geneva Conventions of 12 August 1949, and relating to the Protection of Victims of International Armed Conflicts (adopted 8 June 1977, entered into force 7 December 1978) 1125 UNTS 3 (Hereafter: API); Basic Principles and Guidelines on the Right to a Remedy and Reparation for Victims of Gross Violations of International Human Rights Law and Serious Violations of International Humanitarian Law (60th session, 21 March 2006) UN Doc. A/RES/60/147.

cannot understand how they work, then this impairs their ability to fulfil their legal obligations. Solutions to this are either to provide technical advice to these decision-makers or develop explainable algorithms.[12] In order that the law is complied with, it is imperative that the practicalities of how these solutions could be implemented are worked out. It has a particular impact upon whether the complexity of these systems could impair the understanding of AWS to such a degree that it becomes impossible to fulfil these duties. Consequently, whilst we have seen in the previous chapters that AWS are not unlawful, and can be regulated, if some AWS in the future are so complicated that obligations cannot be fulfilled, then those particular systems could not be said to be sufficiently regulated and could, therefore, be thought of as unlawful. Thus, enabling these obligations to be complied with is essential to the lawful use and regulation of AWS in the future.

4. Continuing moral issues

Returning to the discussion from Chapter 2 on distance and technology being driving trends behind the development of AWS, we can see that these systems are pushing both concepts further than ever before. Although this thesis has noted the significant layers of control that humans will retain over these systems, a lack of direct human control is still unnerving. Indeed, this would seem to be the basis of concerns about the use of these systems. The discussion in Chapter 2 noted that many of the moral arguments made about AWS do not seem to stand up to close scrutiny. To this author, the intrinsic revulsion that many people have at the idea of AWS operating without direct human control does not fit neatly into common understandings of morality. Considering many bases for ethical frameworks were developed in the ancient world, the difficulties of applying moral standards to modern machines is not surprising. Still, using the best moral and ethical analysis available, Chapter

[12] DARPA, 'Explainable Artificial Intelligence' (Darpa.mil, n.d.) Archived:<https://web.archive.org/web/20190813202802/https://www.darpa.mil/program/explainable-artificial-intelligence>; Wojciech Samek, Thomas Wiegand and Klaus-Robert Muller, 'Explainable Artificial Intelligence: Understanding, Visualising And Interpreting Deep Learning Models' [2017] arXiv Archived:<https://web.archive.org/web/20190924160742/https://arxiv.org/pdf/1708.08296.pdf>.

2 managed to build a moral framework that would allow AWS to be used *in extremis* where they reduce risks in comparison to other systems, or they are needed to avoid defeat.[13]

However, this also requires humans to make decisions about how the system will be used.[14] As such, human beings must take a role in closely controlling AWS in order for their use to be morally compliant. This is similar to the legal framework that this thesis has discussed in detail. The difference between these two frameworks is that if, one day, an AWS capable of qualitative analysis could be developed to a legally compliant standard, the human role could lawfully become more distant. Morally, however, the position would not change. Humans must always take a close role to AWS in order for their use to be ethically and morally acceptable.

[13] Alex Leveringhaus, Ethics And Autonomous Weapons (Palgrave Macmillan, 2016) 82-86.

[14] This is because the machines cannot make decisions '*for the right reasons*', see Duncan Purves, Ryan Jenkins and Bradley J. Strawser, 'Autonomous Machines, Moral Judgment, And Acting For The Right Reasons' (2015) 18 Ethical Theory and Moral Practice, 851.

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