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LETHAL AUTONOMOUS WEAPON SYSTEMS UNDER IHL: RETHINKING HUMAN CONTROL, ACCOUNTABILITY, AND REGULATION

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Abstract: *Weapons that can select and engage targets without further human intervention unsettle a premise on which international humanitarian law (IHL) rests: that a human being makes, controls, and answers for each decision to use force. Debate on lethal autonomous weapon systems (LAWS) remains divided between defenders of existing IHL and advocates of a ban. This article examines whether LAWS can comply with the principles of distinction, military necessity, proportionality, and humanity and with the requirements of accountability, and whether existing law suffices to govern them. Using doctrinal legal research with analytical and conceptual approaches, it analyzes Additional Protocol I, customary IHL, the Rome Statute, and the work of the Group of Governmental Experts under the Convention on Certain Conventional Weapons. It argues that autonomy as such is not the decisive legal threshold. Under controlled conditions, autonomous functions can improve targeting precision, but in dynamic environments they strain the qualitative judgements that distinction and proportionality require and open a gap in individual criminal responsibility that superior responsibility cannot close. The article proposes a legally binding instrument that grades prohibitions and restrictions according to a system's degree of autonomy, predictability, and operational context, anchored in a requirement of meaningful human control.*

Keywords: Accountability; Artificial Intelligence; International Humanitarian Law; Lethal Autonomous Weapon Systems; Meaningful Human Control

1. Introduction

The development of autonomous weapon systems challenges a foundational assumption of the contemporary law of armed conflict: that human actors remain capable of making, controlling, and assuming responsibility for decisions concerning the use of force. Advances in artificial intelligence and autonomous systems have enabled weapons to perform functions that previously required direct human intervention. Autonomous capabilities are not entirely new in military technology, but contemporary developments have widened the range of functions that weapons can perform independently, particularly target selection and engagement (McFarland, 2020; Sharkey, 2008). The prospect of weapons that select and engage targets without further human intervention has turned autonomous weapons from a technological issue into a significant question of international humanitarian law (IHL).

The term "lethal autonomous weapon systems" (LAWS) does not denote a technologically uniform category. No universally agreed definition exists, and autonomy is better understood as a spectrum than as a binary distinction between human-controlled and machine-controlled weapons (Ekelhof, 2017). The International

Committee of the Red Cross (ICRC) defines autonomous weapon systems, for the purposes of its legal analysis, as weapon systems that, once activated, can select and engage one or more targets without further human intervention (International Committee of the Red Cross [ICRC], 2026). This functional approach matters because the principal legal concern lies in the extent to which a system can independently determine the targets against which force will be applied and the circumstances in which it will be delivered, rather than in the mere presence of artificial intelligence or automated functions in a weapon.

LAWS do not emerge in a legal vacuum. Existing IHL applies to weapons irrespective of their technological sophistication. Article 35 of Additional Protocol I sets fundamental limits on the means and methods of warfare, including the prohibition of weapons of a nature to cause superfluous injury or unnecessary suffering, while Article 36 requires each High Contracting Party, in the study, development, acquisition, or adoption of a new weapon, to determine whether its employment would be prohibited by the Protocol or by any other applicable rule of international law (Protocol I, 1977). The legal question is therefore whether the characteristics of autonomous weapons permit the requirements of existing IHL to be met in the circumstances in which they are developed and used, and not whether their novelty places them outside existing law.

The principal difficulty arises from the transfer of certain combat functions from human decision-makers to autonomous systems. The rules of distinction, proportionality, and precautions require context-dependent judgements about the status of persons and objects, anticipated civilian harm, the expected military advantage, and feasible measures to avoid or minimise civilian casualties (Protocol I, 1977; ICRC, 2026). These judgements become problematic when an autonomous system responds to sensor inputs and environmental conditions in ways that are difficult to predict or control in advance. The question is whether a system's behaviour is predictable and controllable enough to enable the humans responsible for its use to fulfil their obligations under IHL, which is a narrower and harder question than whether the system can be programmed to follow legal rules. Recent scholarship identifies a possible minimum requirement of human intervention arising from the legal obligations of commanders and operators, while recognising that the required degree of intervention may vary with circumstances (McFarland, 2022).

This issue lies at the centre of the international debate. One position holds that existing IHL is flexible and technologically neutral enough to regulate LAWS, with weapons reviews under Article 36 providing a key mechanism for assessing their legality (McFarland, 2020; Copeland et al., 2023). Another position argues that existing rules, although applicable, do not specify the limits of autonomy, particularly where systems operate unpredictably, target persons, or function for extended periods and across wide areas without effective human supervision (ICRC, 2021, 2026). The ICRC has increasingly adopted the latter position, holding that IHL applies to LAWS but that existing rules do not resolve all the humanitarian, legal, and ethical questions raised by autonomy, and it advocates new legally binding rules establishing specific prohibitions and restrictions complementary to existing IHL (ICRC, 2026).

The regulatory debate has therefore moved beyond the binary question of whether LAWS should be banned or permitted. Within the framework of the *Convention on Certain Conventional Weapons* (CCW), States have continued to consider prohibitions and restrictions, human judgement and control, critical functions, accountability, and other elements of a possible normative and operational framework (United Nations Office for Disarmament Affairs [UNODA], 2025a, 2025b). The UN General Assembly has likewise recognised the humanitarian, legal, security, technological, and ethical concerns raised by autonomous weapons and called for continued consideration of their implications (United Nations General Assembly, 2024). The central regulatory question has thus become one of identifying the circumstances in which autonomy becomes legally unacceptable.

This article argues that autonomy *per se* should not be the decisive threshold for determining the compatibility of LAWS with IHL. Legality should instead be assessed through the interaction of four factors: *the degree of autonomy*, *the predictability of system behaviour*, *the operational context in which autonomy is employed*, and *the extent of human control and responsibility retained in the use of LAWS*. Predictability matters because it links technological autonomy to the practical capacity to comply with IHL. A predictable system operating within narrow parameters in a controlled environment raises different legal questions from an unpredictable system that independently selects human targets in a dynamic and densely populated environment.

The article therefore proposes a context-sensitive regulatory approach that subjects autonomy to graduated prohibitions and restrictions instead of an undifferentiated prohibition of all autonomous weapons. Existing IHL remains indispensable, but it should be complemented by legally binding rules addressing the specific risks created by autonomy, including requirements concerning predictability, human control, weapons review, operational limitations, and accountability. The article asks: *under what conditions can autonomy remain legally controllable under IHL, and to what extent is new international regulation necessary to ensure that it does?*

2. Method

This study employs normative, or doctrinal, legal research to examine the compatibility of LAWS with IHL and to assess the need for, and possible contours of, new international regulation. Doctrinal research suits the inquiry because it concerns the interpretation, systematisation, and critical evaluation of legal norms, principles, and doctrines rather than the empirical observation of their implementation (Irwansyah & Yunus, 2021; Qamar & Rezah, 2020).

The research adopts an analytical and a conceptual approach. The analytical approach examines the relationship between the rules governing the conduct of hostilities and the technological characteristics of LAWS, particularly autonomy, predictability, and human control. The conceptual approach clarifies the legal meaning and interrelationship of concepts relevant to autonomous warfare, including distinction, proportionality, precautions, military necessity, human control, and accountability (Kadarudin, 2021; Bhat, 2020). The legal materials comprise treaty law, customary IHL, decisions and advisory opinions of international courts and tribunals, United Nations

instruments and documents, and materials generated within the CCW process. Secondary materials include scholarly literature and authoritative analyses of autonomous weapons and IHL. These materials are examined through systematic interpretation, doctrinal synthesis, and critical normative analysis in order to determine how far existing IHL can regulate autonomous weapons and to formulate a context-sensitive regulatory framework based on the degree of autonomy, predictability, operational context, and human control (Bhat, 2020).

3. Analysis and Discussion

3.1. Conceptualising Autonomous Weapon Systems

Various definitions of LAWS are in use, and no consensus on a common definition has emerged (Schmitt, 2017; Solis, 2016; UNODA, 2025b). The ICRC, as the authoritative body in IHL, has defined LAWS as "any weapon system with autonomy in its critical functions – that is, a weapon system that can select (search for, detect, identify, track or select) and attack (use force against, neutralize, damage or destroy) targets without human intervention" (Davison, 2017). Others have defined LAWS as "weapons or weapons system that have the capability to identify, select and engage targets without intervention by humans in that decision making-process" (Blank & Noone, 2019), and as "a special class of weapon systems that use sensor suites and computer algorithms to independently identify a target and employ an on-board weapon system to engage and destroy the target without manual human control of the system" (Sayler, 2020).

Experts and institutions consistently emphasise the term "autonomy" in describing LAWS. Derived from the Greek *autos* (self) and *nomos* (law), autonomy in relation to LAWS has been defined as "an entity operating under its own laws" (Wallach, 2017), which implies that LAWS operate independently of external intervention and rules. The United States Department of Defense (DoD) rejects this interpretation and holds that autonomous systems remain subject to external limits in the form of human control and supervision and of the rules embedded in their software. In the DoD's formulation, autonomy is "a capability (or set of capabilities) that enables a particular action of a system to be automatic or, within programmed boundaries, 'self-governing'" (Solis, 2016). On this view, LAWS may act without outside command, but their operation still follows predetermined rules embedded in their programming, a position shared by the roboticist Noel Sharkey (Foy, 2014).

LAWS are commonly perceived as products of advanced technology, yet the category may also include conventional weapons whose functions are performed without human control or intervention. Mines are an example, since they can explode and cause harm without human control (ICRC, 2022).

Autonomous weapon systems are commonly classified according to the extent of human involvement in their operation. In semi-autonomous, or "human-in-the-loop", systems, a human must select and authorise the attack on a specific target. In human-supervised autonomous, or "human-on-the-loop", systems, the system selects and attacks targets under the supervision of a human operator who can intervene. In fully autonomous, or "human-out-of-the-loop", systems, the system can select targets and

conduct attacks without any human intervention (Docherty, 2012; Blank & Noone, 2019). The first two categories retain human involvement, while in the third the power of decision rests entirely with the system. Human Rights Watch defines a "fully autonomous weapon" to include both human-out-of-the-loop systems and systems in which the human capacity to intervene is so limited that they are effectively out of the loop (Docherty, 2012).

It is generally understood that weapon systems able to operate entirely without human intervention do not yet exist, but human-controlled and human-supervised autonomous systems have been in use by various states for years. The Aegis Combat System, an integrated naval weapons system developed in the United States and used by several navies, combines radar and computation to track and guide missiles automatically against threats to naval vessels (Kimmel, 2009; Rollins, 2022). Other examples include the SGR-A1, a ground-based security and surveillance robot developed by Samsung with a reported capability to deliver lethal force without human command, deployed along the border between North and South Korea; the US land-based Patriot missile system; and Israel's Iron Dome air defence system (Solis, 2016).

The development of LAWS has so far been oriented mainly toward technologies that augment and support human soldiers on the battlefield. The idea is gaining traction, however, that future LAWS should do more than act as auxiliary tools or extensions of the human hand and should instead replace human soldiers on the ground (Foy, 2014).

The concept of meaningful human control has emerged as the most influential attempt to translate these distinctions into a legal standard. Santoni de Sio and van den Hoven (2018) give the concept a philosophical foundation built on two conditions. The "tracking" condition requires that the system's behaviour respond to the relevant moral and legal reasons of the humans who design and deploy it, and the "tracing" condition requires that the outcomes of the system can be traced to at least one human who understands its capabilities and accepts responsibility for its use. Their account explains why the loop-based classification, although useful, does not settle the legal question: a human may formally remain on the loop while lacking the time, information, or understanding needed to influence the system, in which case control is nominal rather than meaningful. The four factors proposed in this article, namely autonomy, predictability, operational context, and retained human control, can be read as an attempt to make the tracking and tracing conditions assessable in the review and use of particular weapons.

3.2. Autonomous Weapon Systems under Existing IHL

No binding rule of IHL currently addresses LAWS specifically. IHL does, however, regulate new types of weapons. Article 36 of Additional Protocol I to the 1949 Geneva Conventions (Protocol I) provides:

> "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" (Protocol I, 1977).

The article obliges every State Party to ascertain whether new weapons, means, or methods of warfare under its possession or command are compatible with IHL and other relevant international law. The Protocol does not regulate how this duty is to be performed and leaves the matter to each State, largely because many States resisted an international review mechanism out of concern for national security (Bothe et al., 2013). The ICRC has nonetheless sought to harmonise practice and provide a common standard, among other things by issuing a guide that sets out the scope, framework, and procedure of the review (Lawand et al., 2006).

Article 36 does not specify what constitutes a "new weapon, means or method of warfare", but the ICRC holds that "weapon" should be interpreted in the widest sense, irrespective of the type and nature of the weapon (Lawand et al., 2006). LAWS therefore fall within the scope of the provision, and existing interpretations of Article 36 and of the status of LAWS under IHL agree that LAWS qualify as "new weapons" subject to review (Gill & Fleck, 2017).

The weapons review is also the point at which predictability becomes a legal requirement rather than an engineering preference. A State can determine whether a weapon's employment would be unlawful "in some or all circumstances" only if it can anticipate how the weapon will behave in those circumstances. Copeland et al. (2023) show that weapons reviews can address many of the concerns raised by autonomous systems, provided that reviewers test systems across the range of environments in which they will be used and that reviews are repeated when systems learn or are updated. Their analysis also shows the limits of the mechanism: reviews are national, rarely published, and dependent on the reviewing State's own technical capacity and good faith. The review can therefore filter out systems whose behaviour cannot be predicted, but it cannot by itself ensure that States apply a common standard of predictability.

The *Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May Be Deemed to Be Excessively Injurious or to Have Indiscriminate Effects* (CCW) and its protocols do not mention LAWS, but States Parties to the CCW have discussed them continuously. In 2016 they agreed to establish a Group of Governmental Experts on LAWS within the CCW to discuss legal parameters for LAWS and to consider the possibility of a specific international instrument on them (Sassòli & Nagler, 2019).

3.3. Compatibility with the Fundamental Principles of IHL

IHL rests on several principles that are universally recognised as its core values. The principles most relevant to the use of LAWS in armed conflict are distinction, which includes the duty of precaution and the special protection of certain persons and objects; military necessity and proportionality, which include the prohibition of superfluous injury and unnecessary suffering; and humanity, as a consideration in actions and policies in armed conflict. The requirement of accountability, which gives these principles their force, is examined alongside them.

3.3.1. Distinction

The principle of distinction, between combatants and civilians and between civilian objects and military objectives, is among the most essential principles of IHL. Article 48 of Protocol I provides:

> "*In order to ensure respect for and protection of the civilian population and civilian objects, the 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*" (Protocol I, 1977).

To give effect to this principle, IHL requires the parties to take precautions in military operations (Protocol I, 1977). Under Protocol I, the parties must take all feasible measures to verify that the intended target is not a civilian person or object protected under IHL, and they must refrain from attacking when it becomes clear that the target is not a legitimate military objective (Protocol I, 1977).

The principle of distinction applies in both international and non-international armed conflicts (Henckaerts & Doswald-Beck, 2005). Its importance was affirmed during the adoption of Additional Protocol I (Henckaerts & Doswald-Beck, 2005) and in the advisory opinion of the International Court of Justice (ICJ) in the *Nuclear Weapons* case (International Court of Justice [ICJ], 1996), which described it as a "cardinal principle" and an "intransgressible" principle of customary international law.

For LAWS, the issue concerns their ability to distinguish combatants from civilians and military objectives from civilian objects. Distinction poses few problems where hostilities occur in areas with few civilians or civilian objects, such as deserts or the high seas. Most modern conflicts, however, take place in areas with dense civilian populations and infrastructure, and given the advantages that LAWS offer to the parties, a restriction of their use to particular localities appears unlikely (Saxon, 2022; Foy, 2014). Compliance with the principle of distinction therefore becomes crucial.

Distinguishing combatants from civilians poses the greatest challenge. Identification technologies, including facial and physical recognition, have advanced rapidly, but many experts agree that the capabilities of artificial intelligence remain inadequate for reliable judgements about the status of persons in armed conflict (Solis, 2016; Brenneke, 2018). As armed conflict becomes more dynamic and complex, identifying combatants also becomes harder. In guerrilla warfare or insurgency, combatants blend into the surrounding environment and population, which often occurs in protracted conflicts and wars of national liberation. Civilians or other protected persons may also take part in the conflict in various ways, such as assisting one of the parties, harbouring fleeing combatants, showing hostility toward adversary forces, disseminating propaganda, or engaging in sabotage or underground resistance, conduct that IHL addresses under the concept of direct participation in hostilities (DPH) (Crawford, 2015). Civilians who directly participate in hostilities may lose their protection for such time as they do so (Hague Convention IV, 1907), but the determination depends on the nature and circumstances of each case.

In these situations, LAWS risk failing to distinguish combatants from civilians, because the differences between them are blurred in practice. This difficulty also affects the system's capacity to respond appropriately to an apparent threat. A robotic soldier pelted with stones by a group of hostile juveniles, for example, may register their apparent hostility and aggression as a threat and use lethal force against them, a plausible outcome given the real risk to the system.

Whether a human soldier would react better in the same situation remains an open question. A soldier facing such harassment might withdraw or fire a warning shot, but might equally lose control and shoot at the juveniles; human emotion and impulse make that outcome impossible to exclude. The relevant comparison is thus between the likely response of an imperfect machine and the likely response of an imperfect human.

With proper programming, LAWS could also improve distinction. Because a system embedded with artificial intelligence can access and process large amounts of information algorithmically, it might detect combatants hidden among civilians more reliably than humans. Realising this potential would require major further progress in recognition and identification technology and in computational processing and analysis, and it remains doubtful whether current technology can perform the task reliably.

The same assessment applies to the distinction between civilian objects and military objectives, where LAWS may either improve distinction or fail to make it, depending on the situation and the system's capability. Distinguishing objects is considerably easier than distinguishing persons, but LAWS may still err, particularly with dual-use or camouflaged objects.

3.3.2. Military Necessity and Proportionality

Like distinction, military necessity and proportionality are recognised as fundamental principles of IHL, and they are closely linked, since respect for military necessity depends on respect for proportionality.

The principle of military necessity permits belligerents to adopt the means and methods they consider necessary to achieve legitimate military purposes, provided that these do not exceed what is necessary to secure the submission of the enemy and do not violate IHL (Blank & Noone, 2019; Crowe & Weston-Scheuber, 2013; Crawford & Pert, 2015). The principle is embedded in the 1907 Hague Convention, the Geneva Conventions, and the 1977 Additional Protocols (Hague Convention IV, 1907; Fourth Geneva Convention, 1949; Protocol I, 1977), and it has been affirmed in the decisions of international tribunals and in national practice (Solis, 2016).

The principle of proportionality requires that the parties refrain from an attack when the incidental harm it may be expected to cause to civilians and civilian objects would be excessive in relation to the concrete and direct military advantage anticipated (Protocol I, 1977). A corollary of military necessity and proportionality is the prohibition of weapons and methods of warfare of a nature to cause superfluous injury or unnecessary suffering (Protocol I, 1977).

For LAWS, the issue is whether they can confine their actions within the bounds of military necessity and proportionality. Determining necessity and proportionality is

difficult because many factors bear on it. The assessment requires case-by-case judgement and a comprehensive evaluation of the overall situation in which competing factors and interests must be balanced (Foy, 2014), and the dynamic character of modern armed conflict, in which situations change rapidly and constantly, makes the task harder still.

As experts such as Marco Sassòli and Bill Boothby have emphasised, combatants assessing the anticipated military advantage and the degree of proportionality required to secure it with the least collateral risk must remain continuously informed of developments and capable of making appropriate decisions (Solis, 2016). A system embedded with artificial intelligence may process information about a developing situation faster than humans, yet it remains doubtful whether LAWS could adapt and react appropriately in the field, particularly since with current technology such processing may take considerable time.

Decision-makers often face a dilemma between achieving objectives dictated by military necessity and minimising the effects of an attack in accordance with proportionality. The concern is that LAWS, lacking the human judgement that brings qualitative assessment to bear on a situation, may prioritise military necessity at the expense of proportionality, particularly if they are not programmed with limits that must not be crossed in their decision-making during hostilities. Asaro (2012) presses this concern further. He argues that IHL implicitly requires human judgement in each decision to take life, because proportionality involves a moral and legal evaluation that cannot be reduced to the calculation of probabilities, and that delegating it to machines would dehumanise lethal decision-making. Schmitt and Thurnher (2013) answer that IHL regulates the effects of attacks rather than the identity of the decision-maker, and that a system able to meet the standard of a reasonable commander would comply with the law. The disagreement is significant for the design of regulation. If Asaro is right, certain uses of autonomy are unlawful in principle; if Schmitt and Thurnher are right, they are unlawful only when the system fails in practice. The graduated approach proposed in this article accepts part of each position: it treats the qualitative proportionality judgement in dynamic environments as a function that must remain with humans, while permitting autonomy in contexts, such as the defence of a ship against incoming missiles, where the relevant judgements can be made by humans in advance and encoded in narrow parameters.

3.3.3. Humanity

IHL requires the parties to maintain humanitarian values in armed conflict and to give priority to humanitarian considerations in all their actions, including the obligation to confine violence within the limits of necessity as far as reasonably possible, to refrain from employing weapons, means, and methods that cause superfluous destruction or unnecessary suffering, and to treat non-combatants and combatants humanely in accordance with IHL (Blank & Noone, 2019; Solis, 2016; Wallach, 2017). Originating in the Hague Conventions, the principle forms part of customary international law. In modern IHL it is expressed chiefly in Article 1(2) of Protocol I, the Martens Clause, which provides that in cases not covered by the Protocol or by other international agreements,

civilians and combatants remain under the protection of the principles of humanity and the dictates of public conscience.

For LAWS, the issue is whether a non-human entity can bring humanitarian considerations to bear on its decisions and actions in armed conflict. The issue is most acute for out-of-the-loop systems, in which human involvement is almost nil, unlike in-the-loop and on-the-loop systems. Human Rights Watch, for example, has warned that LAWS, unrestrained by the emotion and compassion that often check atrocities, may cause greater harm to humanity in pursuing their objectives, particularly in the hands of parties with little respect for IHL (Docherty, 2012).

The use of LAWS may also encourage the proliferation of conflict. Concern about human casualties and the backlash they provoke has historically shaped decisions on whether to enter armed conflict. With LAWS, this concern may lose much of its influence, so that States and non-State actors may resort more readily to armed force to resolve disputes or pursue their goals.

The use of LAWS could, on the other hand, strengthen the principle of humanity, particularly in the protection of non-combatants. Human emotion can check atrocities, but it is just as often their cause. History shows that in fierce conflicts with high casualties, combatants are prone to commit violations such as rape, pillage, or the murder of enemy-affiliated civilians and persons *hors de combat*, whether under orders, on their own initiative, or both. LAWS, lacking emotion, would be less likely to commit such atrocities, particularly where such acts have no bearing on the effective conduct of hostilities in their calculations.

3.3.4. Responsibility

Under international law, serious violations of IHL committed in international or non-international armed conflict constitute war crimes for which States and individuals may be held responsible (Henckaerts & Doswald-Beck, 2005; Fleck & Bothe, 2010; Gill & Fleck, 2017). Responsibility is indispensable to ensuring respect for and the implementation of IHL (Practical Guide to Humanitarian Law, 2026).

For LAWS, the question is to whom responsibility for violations committed in operations involving LAWS can be attributed. State responsibility poses little difficulty, since responsibility is attributed to the State that deployed the system. A question may arise as to which State bears responsibility when LAWS of different parties engage one another, but this differs little from the ordinary problem of determining responsibility for violations in any war, regardless of whether the combatant is human or machine.

Individual responsibility poses a harder problem. Only entities with international legal personality can be held accountable for violations of international law (Gill & Fleck, 2017). LAWS have no legal personality and thus cannot bear criminal responsibility. As technology develops and fully autonomous systems become a realistic prospect, the question of responsibility for IHL violations committed by such systems without human intervention will become unavoidable.

Sparrow (2007) gave this problem its classic formulation as a “responsibility gap”. He argued that it would be unfair to hold the programmer or the commander responsible

for the actions of a system whose behaviour neither could fully foresee or control, while the system itself cannot be punished in any meaningful sense. Since IHL requires that someone be accountable for deaths caused in war, the deployment of systems that create such a gap is, on his account, unethical. The literature has identified four candidates for responsibility (Docherty, 2012; Solis, 2016). The developer or manufacturer may be held liable when a violation results from a defect in the system's hardware or software. A military commander may be held responsible for violations by LAWS operating under his or her command under the doctrine of superior responsibility in international criminal law (Rome Statute, 1998). The "handler" of the system, whether the operator of an in-the-loop or on-the-loop system or the supervisor of an out-of-the-loop system, may be held liable for allowing violations under his or her watch. Finally, the system itself might, under the principle of individual responsibility, be held directly responsible.

Each proposition has drawbacks. Attributing responsibility to developers and manufacturers is logical where a link between the violation and the design of the software or hardware can be established beyond doubt, but it is doubtful whether they can be prosecuted for an IHL violation, since conduct constitutes such a violation only when committed in the context of an armed conflict (Solis, 2016; *Prosecutor v. Haradinaj et al.*, 2008). Weapons are usually designed and manufactured before a conflict begins, which raises the question whether international criminal law applies at all. Because development and manufacture are typically the work of teams or corporations, it is also unclear whether responsibility should rest with the individuals most responsible or with the entire team or corporation.

Attributing liability to a military commander under the doctrine of superior responsibility is equally problematic, because the doctrine requires effective control over subordinates. As Human Rights Watch has pointed out, it is doubtful that a commander could take effective action to intervene against a fully autonomous system or to punish it for a violation (Docherty, 2012). The same applies to the handler of a fully autonomous system, who in the absence of any human control mechanism would have little control over its actions.

The final proposition, attributing responsibility directly to the system, is the most problematic. LAWS cannot be held responsible because they lack legal personality, and with current technology it is doubtful that they understand the nature and consequences of their actions sufficiently to be subject to liability. It may become possible in the future, when LAWS have reached a very high level of sophistication, to regard them as legal persons capable of responsibility. Even then, the question would remain whether punishment could be meaningfully applied to them and whether it would deter them, since, as discussed above, such systems lack the subjective emotions central to human beings.

The responsibility gap thus confirms the central argument of this article. Accountability can be preserved only where humans retain enough control over a system to satisfy the tracing condition identified by Santoni de Sio and van den Hoven (2018), that is, where the outcomes of its use can be traced to a person who understood its capabilities and accepted the decision to deploy it in a given context. A regulatory regime that requires

such control for systems used against persons, or in environments where their behaviour cannot be predicted, closes the gap by preventing its emergence rather than by stretching doctrines of criminal liability beyond their foundations.

3.4. Special Regulation for LAWS

The question of whether LAWS require special rules is highly contested, and States, international organisations, and other actors hold divergent views. Some argue that a dedicated convention or instrument is unnecessary because existing rules in the Hague Conventions, the Geneva Conventions, the Additional Protocols, and the CCW suffice to regulate LAWS (Wareham, 2020; Solis, 2016). Others, such as France and Germany, have encouraged a non-binding instrument as an alternative to a binding convention in view of the differing positions of the parties (Wareham, 2020).

Those who support a special instrument are themselves divided on its nature. Many, convinced that LAWS are morally repugnant and politically unacceptable, that they can never meet the threshold required by IHL, and that their harm to humanity will always outweigh their benefits, advocate a complete ban on the development and use of LAWS, particularly systems that operate without human control (Wareham, 2020; Docherty, 2012; ICRC, 2023). Others oppose a complete ban but support special regulation that would keep LAWS compatible with the rules and principles of IHL (Wareham, 2020).

Each of these positions has strengths and weaknesses. A complete ban on fully autonomous LAWS would offer the strongest guarantee of compliance with IHL. Schmitt and Thurnher, however, have described an outright ban as “insupportable as a matter of law, policy and operational good sense” (Schmitt & Thurnher, 2013; Solis, 2016), and it is doubtful that States able to produce and use LAWS would voluntarily abandon weapons that offer them significant advantages in armed conflict, including the reduction of their own casualties.

At the other end of the spectrum, reliance on existing law or on non-binding instruments would not solve the problem. Foy identifies four conditions for a successful legal regime governing LAWS: clearly defined and articulated expectations that identify the problem precisely; realistic and implementable solutions; a holistic and inclusive character that engages all relevant stakeholders; and a capacity for assessment that allows the regime to improve over time (Foy, 2014). Meeting these conditions requires a comprehensive and effective legal framework that general IHL and non-binding instruments cannot provide, given the evolving and increasingly complex nature of LAWS.

The most appropriate path for the governance of LAWS is therefore a dedicated international legal instrument. Such an instrument could define acceptable categories and criteria of LAWS; set standards and limits for their development and use; establish a common system of weapons review to ensure compatibility with international law; create a clear system of accountability for violations related to the development and use of LAWS; and provide mechanisms for implementation and enforcement. It could also anticipate future developments, including systems capable of functioning entirely without human involvement or control. Organised around the four factors identified in this article, the instrument would prohibit systems whose behaviour cannot be

sufficiently predicted, or that target persons without meaningful human control, and would restrict other systems by reference to the operational context, the duration and area of their operation, and the human control retained.

The instrument can only be effective if it gains wide acceptance: ratification by most States, adherence by the major powers, particularly those currently sceptical of or opposed to international regulation of LAWS, and recognition of its essential rules as reflecting customary international law.

4. Conclusion

The analysis answers the first part of the research question by showing that autonomy becomes legally uncontrollable at an identifiable point: where the behaviour of a system can no longer be predicted with sufficient confidence for its users to make, in advance, the qualitative judgements that distinction and proportionality require, and where the outcomes of its use can no longer be traced to a human who understood and accepted them. Below that point, autonomy is compatible with IHL and may even improve compliance, as the use of defensive systems in controlled environments shows and as the absence of fear and anger in machines may suggest. Beyond it, LAWS strain the identification of combatants and of civilians who directly participate in hostilities, displace the context-dependent balancing of military advantage against civilian harm, and open a responsibility gap that neither the liability of manufacturers nor the doctrine of superior responsibility can close.

On the second part of the question, existing IHL applies fully to LAWS, but it does not specify where that point lies. Article 36 reviews are national, rarely published, and uneven, while the CCW process has produced valuable discussion but no binding standard. The article's contribution lies in joining the doctrinal analysis of distinction, proportionality, humanity, and responsibility with the philosophical account of meaningful human control, so that the threshold of legal acceptability can be specified through four assessable factors: the degree of autonomy, the predictability of behaviour, the operational context, and the human control retained. On this basis, the article supports a legally binding instrument with graduated prohibitions and restrictions in preference to either a complete ban or reliance on general rules and soft law. The effectiveness of such an instrument will depend on its acceptance by the States that develop these systems, and further research should examine how the factors proposed here can be translated into technical standards for weapons review that States are willing to share.

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