

## FROM GENEVA TO THE ALGORITHM: HUMANITARIAN PRINCIPLES AND DISARMAMENT IN THE FACE OF NEW TECHNOLOGIES OF WAR

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**Abstract** *The article examines the evolution, since 1945, of the cardinal principles of International Humanitarian Law (military necessity, distinction, proportionality, prohibition of unnecessary suffering and precautions in attack) and their articulation with the core principles of disarmament law (transparency, verifiability, irreversibility and non-discrimination). Through a qualitative, legal-dogmatic and historical-critical approach based on treaties, international jurisprudence, UN resolutions and specialized doctrine, it reconstructs how both sets of principles have progressively converged, forming a shared humanitarian framework to limit means and methods of warfare. The study shows that concerns inherent to IHL have driven major humanitarian disarmament processes, including the prohibition of chemical and biological weapons, anti-personnel landmines, cluster munitions and, more recently, nuclear weapons. It also analyzes the challenges posed by autonomous weapons systems, artificial intelligence in hostilities and offensive cyber operations, assessing whether existing IHL and disarmament principles provide adequate parameters for their regulation. It concludes that the interdependence between both branches is essential to guiding the governance of emerging technologies.*

**Keywords** *New Technologies: Principles and Disarmament; International law; autonomous weapons systems; artificial intelligence.*

### 1 Introduction

Since the end of the Second World War, International Law has been strained by two simultaneous and seemingly contradictory forces: on the one hand, the humanitarian drive to limit the methods and means of warfare through International Humanitarian Law (IHL); on the other, the strategic logic of States, which has fueled successive arms races and has made it necessary to develop an increasingly sophisticated Law of Disarmament and arms control. In this context, the principles of military necessity, distinction, proportionality, prohibition of unnecessary suffering and precautions in attack have been consolidated as the normative core of IHL, while the principles of transparency, verifiability, irreversibility and non-discrimination have acquired a central role in

disarmament and non-proliferation regimes. However, the emergence of new military technologies—such as autonomous weapons systems, the application of artificial intelligence to decision-making in warfare, and offensive cyber operations—reopens fundamental questions about the scope and effectiveness of these principles, both in times of armed conflict and in processes of arms limitation and prohibition. This article aims to reconstruct the historical evolution of these principles since 1945, to examine their points of convergence and mutual reinforcement between IHL and disarmament, and to explore the extent to which they offer a sufficient normative framework to guide the regulation of emerging technologies of warfare, thus contributing to the contemporary debate on the humanization of armed conflict in the digital age.

## **2 Methodology**

The research adopts a qualitative, legal-dogmatic and historical-critical approach, with a fundamentally theoretical and documentary design, aimed at reconstructing the evolution, since 1945, of the principles of military necessity, distinction, proportionality, prohibition of unnecessary suffering and precautions in attack in IHL (Aponte García et al., 2025; Romero-Sánchez et al., 2025), and their articulation with the principles of transparency, verifiability, irreversibility and non-discrimination characteristic of disarmament law. The study has an analytical and explanatory scope, and is based on a corpus of primary sources (IHL and disarmament treaties, United Nations resolutions and reports, international case law, military manuals and technical documents) and secondary sources (specialized doctrine, reports from international organizations and research centers on security, autonomous weapons, AI and cybersecurity), selected through systematic searches in academic databases and institutional repositories, using criteria of thematic relevance, academic quality and pertinence to the intersection between IHL, disarmament and new military technologies.

The analysis is organized into three complementary levels: (i) dogmatic-normative, in order to interpret treaties systematically, reconstruct the content and legal nature of the principles, and identify their formulation in international practice and case law (Victoria Ochoa et al., 2023); (ii) historical-critical, to trace chronologically the continuities, tensions and turning points in the relationship between security logics and humanitarian logics in the field of weapons; and (iii) relational and forward-looking, through the construction of a matrix of correspondences between IHL and disarmament principles, applied to the analysis of autonomous weapons systems, AI applications in the conduct of hostilities and offensive cyber operations. Rigor is ensured through the triangulation of sources, the explicit statement of the criteria for inclusion and exclusion of material, and transparency in the chain of argumentation, while acknowledging as main limitations the non-empirical nature of the study, the rapid technological evolution of the field, and the focus on literature available in Spanish and English (Romero and Aponte, 2024).

## **3 Research**

**Evolution of Legal Principles: From IHL to the Normative Framework of Disarmament**  
The end of the Second World War marked a turning point for International Law, as large-scale atrocities against civilians, the use of new devastating weapons including atomic weapons in Hiroshima and Nagasaki and indiscriminate destruction generated consensus within the international community on the need to strengthen humanitarian norms applicable in war and to prevent future arms races (Schroeder, 2018). In 1945, the United Nations was created with the aim of maintaining international peace and security, and its Charter recognized the importance of disarmament; Article 11 authorizes the General Assembly to “consider the general principles... for the maintenance of international peace and security, including the principles governing disarmament and the regulation of armaments,” enabling it to make recommendations in this regard (Evans, 2021).

Indeed, General Assembly Resolution 1 (I) of 1946, the first in its history, directly addressed the question of armaments by calling for “the elimination of atomic weapons and of all other weapons of mass destruction” (Meyer, 2016). In parallel, in the field of International Humanitarian Law (IHL), the law applicable in armed conflicts, efforts were made to update and develop rules to protect the victims of war and to limit the methods and means of combat. This effort crystallized, among other milestones, in the Four Geneva Conventions of 1949, aimed at the protection of the wounded, shipwrecked, prisoners of war and civilians (Perna, 2006). Later, the 1977 Additional Protocols expanded humanitarian protections, codifying key principles on the conduct of hostilities and civilian protection (Kosirnik, 1997).

Together, these developments marked a turning point in the codification of humanitarian law, establishing the foundations of modern IHL and linking disarmament to the broader goal of protecting humanity in war (Droege, 2025)

Since 1945, therefore, two parallel and complementary legal fields have evolved: on the one hand, International Humanitarian Law (IHL), which seeks to humanize armed conflicts by limiting their effects, and, on the other, Disarmament Law, which aims to control and reduce armaments, especially weapons of mass destruction, in order to prevent war or mitigate its ravages (Garcia, 2020). The following section examines the doctrinal and jurisprudential evolution of five essential principles of IHL—distinction, proportionality, prohibition of unnecessary suffering or superfluous injury, and precautions in attack—and their connection with four normative principles of disarmament: (i) transparency, (ii) verifiability, (iii) irreversibility and (iv) non-discrimination, in the period after 1945 (Greenwood, 2022a). The approach is historical-critical, considering the normative development of treaties and resolutions and their interpretation in international case law, especially that of the International Court of Justice, the ad hoc international criminal tribunals and the International Criminal Court, as well as the relevant doctrine.

Fundamental Principles of International Humanitarian Law (IHL)

The cardinal principles of modern IHL have roots prior to 1945, but it is in the second half of the twentieth century that they are normatively consolidated and receive universal recognition. The International Court of Justice (ICJ), in its 1996 Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, emphasized that the principles of distinction and the prohibition of unnecessary suffering constitute the “core” of contemporary IHL, forming part of the fabric of this body of law as “cardinal” and “intransgressible” norms of customary law (Gaggioli & Melzer, 2020a). These principles, together with that of military necessity and that of humanity (Caballero-Pérez, 2020), inform all the rules on the conduct of hostilities, seeking a balance between military exigency and humanitarian considerations (Greenwood, 2022b). The evolution of each principle is detailed below (Arevalo-Ramírez, 2022).

Military necessity

The principle of military necessity authorizes only those measures of force that are necessary to achieve a legitimate military objective and does not prohibit the “inevitable” destruction required to weaken the enemy; in other words, military necessity is not a blank check: it sets the limits of permissible warfare, subordinating it to the attainment of a concrete military advantage. Any act of war that exceeds what is necessary to defeat the enemy is considered unlawful (Arief Fahmi Lubis, 2019). This concept finds its roots in doctrine and practice prior to 1945; for example, the Lieber Code (1863) of the U.S. Civil War had already established that no superfluous harm was justified. After the Second World War, however, it was reaffirmed in the trials of war criminals. The International Military Tribunal at Nuremberg (1945–46), in judging Nazi crimes, made it clear that

military necessity could not be invoked to justify violations of the laws of war that caused wanton destruction or atrocities against civilians (Lawless, 2020).

Likewise, instruments such as the 1907 Hague Convention IV (Annex, art. 23) restricted certain actions, establishing that “it is especially forbidden to destroy or seize the enemy’s property, unless such destruction or seizure be imperatively demanded by the necessities of war,” thus foreshadowing the rule of necessity (Kritsiotis, 2020). In the post-war period, military necessity was implicitly recognized and limited by key humanitarian treaties; the 1977 Additional Protocols do not expressly state “necessity” as such, but their provisions reflect the idea that it is only lawful to inflict the harm strictly indispensable to achieve military objectives (Hassanová, 2023a). Article 1(2) of Additional Protocol I (1977) incorporates the Martens Clause, recalling that even in cases not covered by written law, 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” (Ivanenko, 2022). This clause underscores that military necessity is never absolute; it always operates within the limits imposed by the principles of humanity.

Case law has highlighted this dialectic; for example, the International Criminal Tribunal for the former Yugoslavia (ICTY) noted that the customary law of armed conflict imposes a balance between military necessity and humanitarian considerations, such that purely vindictive or destructive actions without a concrete military advantage violate IHL (European Constitutional Law Association & Kwon, 2023). Thus, after 1945, the principle of military necessity evolved from being a generic permission to a strictly delimiting criterion: what is not militarily necessary is prohibited, thereby laying the groundwork for more specific rules on distinction, proportionality and the prohibition of cruel means (Hassanová, 2023b).

On the distinction between civilians and combatants

The principle of distinction is one of the oldest and most fundamental in IHL, essential for the protection of the civilian population in war; it establishes the obligation to distinguish at all times between combatants and civilians, and between military objectives and civilian objects, so that operations are directed only against legitimate military objectives (Sutton, 2021). This principle dates back to the earliest customs of war; for example, the notion of not attacking non-combatants has existed since classical wars and was incorporated into twentieth-century treaties such as the Hague Rules (Gaggioli & Melzer, 2020b). However, during the Second World War, distinction was frequently ignored, as evidenced by the massive aerial bombings of cities, which led the international community to strengthen this rule in legal terms after 1945 (Chitadze, 2023a).

Explicit codification came with Additional Protocol I of 1977, whose Article 48 proclaims the “basic rule” of distinction: The Parties to the conflict shall at all times distinguish between the civilian population and combatants, as well as between civilian objects and military objectives, and accordingly shall direct their operations only against military objectives (Mantilla, 2024; Von Bernstorff & Mensching, 2023).

In turn, Article 51 of that Protocol prohibits attacks against the civilian population and indiscriminate attacks, defining the latter in terms that violate distinction, for example, those that treat military objectives and civilians alike (Von Bernstorff & Mensching, 2023b). Although major military powers such as the United States, for example, did not ratify Protocol I, they recognize most of these provisions as reflecting customary international law (Moir, 2024). In fact, in 1996 the ICJ affirmed that the principle of distinction obliges parties never to make the civilian population the object of attack and not to employ weapons that are incapable of distinguishing between civilian and military objectives (Hood & Cormier, 2024). The Court characterized this norm as

“intransgressible,” even for States that are not parties to the relevant treaties, highlighting its universal nature and possibly its status as *ius cogens* (Halimurka & Zeman, 2019). In the same vein, the International Committee of the Red Cross (ICRC) has recognized it as a “cornerstone” of IHL (“The ICRC’s Legal and Policy Position on Nuclear Weapons,” 2022).

In post-1945 practice, this principle has been reaffirmed by numerous forums. The International Criminal Tribunal for the former Yugoslavia (ICTY) systematically convicted deliberate attacks against civilians as war crimes, as in *Prosecutor v. Galić* (2003) concerning the siege of Sarajevo (Gurda et al., 2021). Likewise, the Rome Statute of the International Criminal Court (1998) classifies as war crimes “intentionally directing attacks against the civilian population as such” and attacks against civilian objects (Art. 8.2.b.i and ii) (Chitadze, 2023b). These developments confirm that the obligation of distinction, outlined in the post-war period and incorporated into the 1977 treaties, has been consolidated, both in doctrine and in contemporary international jurisprudence, as an inviolable principle (Kapelańska-Pręgowska, 2020).

#### Proportionality

The principle of proportionality complements that of distinction and seeks to balance the incidental harm caused to civilians with the concrete military advantage obtained in an attack. It recognizes that, even when complying with distinction by targeting only military objectives, operations may cause civilian casualties or damage to civilian objects. Proportionality prohibits such “incidental” harm from being excessive in relation to the anticipated concrete and direct military advantage (Cohen & Zlotogorski, 2021a). In other words, although some collateral damage may occur, it must not be disproportionate to the military objective achieved. This principle, which has long been implicit in the practice of warfare, was expressly formalized in 1977: Article 51(5)(b) of Additional Protocol I characterizes as an indiscriminate attack one that may be expected to cause civilian losses “which would be excessive in relation to the concrete and direct military advantage anticipated” (Farah, 2019). This rule of proportionality, now an undisputed part of customary law, acts as a humanitarian brake: even when a legitimate target is attacked, one must refrain if the cost in civilian lives or property is too high (Van Den Boogaard, 2023a).

Historically, the notion of proportionality is linked to the principle of humanity. As early as the 1868 Saint Petersburg Declaration, it was suggested that the only legitimate objective of war is to weaken the enemy forces, and that employing means that uselessly aggravate suffering runs counter to that objective, which anticipates a form of proportional analysis: harm vs. objective (Garibian, 2022a). After 1945, war crimes trials also applied a rudimentary proportionality assessment when weighing the military necessity of certain devastations against the harm caused; for example, the destruction of villages without clear military necessity was condemned (Van Den Boogaard, 2023b). But it is with Protocol I that the legal obligation to weigh means and ends in each attack is clearly established (Cohen & Zlotogorski, 2021b).

International jurisprudence has given concrete content to this principle. The ICJ, in its 1996 opinion, stressed that, when assessing the lawfulness of the use of any weapon, including nuclear weapons, respect for the environment must be taken into account as part of determining what is “necessary and proportionate” to achieve military objectives, thereby integrating environmental considerations into the proportionality analysis. Criminal tribunals have had the opportunity to apply it on a case-by-case basis: for example, the ICTY in *Prosecutor v. Kupreškić* suggested that launching an attack in the knowledge that it will cause “excessive” civilian deaths constitutes a serious violation of IHL, even if there is a military objective (Díaz Galán & Bertot Triana, 2018), anticipating

the criminal provision later codified in the ICC Statute (Agi, 2022). Indeed, the ICC classifies as a war crime “intentionally launching an attack in the knowledge that such attack will cause incidental loss of life or injury to civilians ... which would be clearly excessive in relation to the concrete and direct overall military advantage anticipated” (Art. 8.2.b.iv of the Rome Statute). This criminalization since 1998 reflects the maturity of the principle (Beatty, 2020)

Doctrinally, proportionality in International Humanitarian Law (IHL) is understood as a corollary of distinction and as a way of balancing military necessity with humanity (Hassanová, 2023c). Thus, a commander must always assess whether the expected civilian harm does not exceed what is required to achieve the objective; and if it does, he or she must cancel or suspend the attack (Cohen & Zlotogorski, 2021c). Protocol I reinforces this through the principle of precautions (Article 57), imposing the obligation to do everything feasible to obtain prior information about the target and its surroundings, so as to avoid disproportionate attacks by mistake. Since 1945, proportionality has evolved from being an implicit tactical principle to an explicit and enforceable legal rule, currently regarded as part of the core of humanitarian law applicable to any armed conflict (Van Den Boogaard, 2023c).

Prohibition of unnecessary suffering or cruel weapons

International Humanitarian Law (IHL) proscribes the use of means and methods of warfare that cause “superfluous injury” or “unnecessary suffering” to enemy combatants. This principle, with a deeply humanitarian content, was one of the first to be codified: the 1868 Saint Petersburg Declaration affirmed that the only legitimate aim of war is to weaken the enemy, and therefore it is contrary to humanity to employ weapons that uselessly aggravate suffering (Garibian, 2022b). That idea was taken up by the 1907 Hague Regulations, whose Article 23(e) prohibits the use of weapons “calculated to cause unnecessary suffering” (Bothe et al., 2021). After 1945, this rule remained fully in force and served as a basis for the development of treaties restricting specific armaments. In 1996, the International Court of Justice (ICJ) identified it as the second cardinal principle of IHL, declaring: “It is prohibited to cause unnecessary suffering to combatants; consequently, it is prohibited to use weapons that cause such harm or uselessly aggravate their suffering” (Heintze, 2019). It added that, in applying this principle, “States do not have unlimited freedom of choice of means of warfare.” In other words, sovereignty in the selection of weaponry is constrained by considerations of humanity.

In the immediate post-war period, the Tokyo and Nuremberg trials classified certain particularly cruel atrocities as crimes, which indirectly reinforced this prohibition, although they focused more on acts against civilians than on weapons as such (Petukhov & Ryabtseva, 2024). Nonetheless, the international community soon addressed weapons that cause particularly horrific suffering. For example, the 1925 Geneva Protocol already prohibited the use of chemical and biological weapons because they asphyxiate, poison and cause intense agony, and although it predated 1945, its importance was revitalized after the war as it achieved near-universal adherence. In 1972 the Biological Weapons Convention (BWC) was adopted, and in 1993 the Chemical Weapons Convention (CWC), which not only prohibit the use but also the development, stockpiling and possession of these weapons, precisely because of the indiscriminate and unnecessary suffering they cause (Mika, 2025). These humanitarian disarmament conventions are directly connected to the IHL principle of unnecessary suffering.

For its part, Additional Protocol I (Article 35(2)) provides that “it is prohibited to employ weapons, projectiles, materials and methods of warfare of a nature to cause superfluous injury or unnecessary suffering” (Comité Internacional de la Cruz Roja (CICR), 2006, p.11). This article reiterated in 1977, with binding force for its States Parties, what was

already an ancient customary principle. Since then, treaties have been adopted that implement this rule for conventional weapons: the 1980 Convention on Certain Conventional Weapons (CCW) and its Protocols prohibit or restrict weapons considered excessively injurious, such as incendiary weapons against civilians, anti-personnel mines (Protocol II and its amendments, and later the 1997 Ottawa Convention, which completely bans anti-personnel landmines) (Al- Anzi, 2024), or blinding lasers (1995 Protocol IV to the CCW, which prohibits laser weapons designed to cause permanent blindness, as they are deemed to cause superfluous suffering) (Steinvall, 2023). All these instruments are explicitly based on the premise that certain armaments wound in a manner disproportionate to the military purpose they serve, thus violating the principle of humanity (Liivoja, 2020).

International criminal jurisprudence has reaffirmed the prohibition on employing weapons that cause superfluous injury or unnecessary suffering. In this regard, the Statute of the International Criminal Court classifies the use of such weapons as a war crime, provided that they are expressly prohibited and listed in the relevant annex (Art. 8.2.b.xx of the Rome Statute) (Tsilonis, 2019). Although that annex has not yet incorporated specific armaments, due to political and diplomatic considerations, in practice the Court may prosecute the use of expanding bullets, chemical weapons or other means prohibited by international treaties, on the grounds that they produce unnecessary suffering, in line with precedents established by ad hoc tribunals (Sanchez-Mera, 2019). Thus, the International Criminal Tribunal for the former Yugoslavia, in *Prosecutor v. Tadić* (1995), recognized that the use of inherently indiscriminate weapons or those that cause disproportionate harm constitutes a war crime under customary international law (Ambos, 2021). More recently, charges have been brought against individuals in the conflicts in Syria and Iraq for the use of chemical weapons against the civilian population, invoking this fundamental norm of international humanitarian law (Prakoso, 2019).

Accordingly, the prohibition on causing unnecessary suffering has guided the development of numerous disarmament norms after 1945: whenever the international community identifies a weapon whose effects cause harm greater than the military necessity of neutralizing combatants (for example, chemical, biological or certain explosive munitions), its prohibition or restriction is promoted (Hameed et al., 2024). This principle thus directly links classical international humanitarian law with contemporary disarmament law, as will be seen below (Dunworth, 2020b).

#### Precautions in attack

The principle of precautions in attack imposes on the parties to the conflict the obligation to plan and conduct military operations in accordance with a duty of due care, seeking to avoid or, failing that, to minimize incidental harm to the civilian population and to civilian objects. Although the notion of adopting precautionary measures, such as issuing prior warnings before bombardments, had isolated manifestations, for example during the Second World War, the systematic codification of this principle was consolidated in Additional Protocol I of 1977. In particular, Article 57 provides that constant care must be taken to spare civilians and civilian objects, setting out concrete obligations such as verifying the military nature of the target, selecting means and methods that reduce the effects on civilians, prohibiting attacks that may be expected to cause excessive damage in relation to the anticipated military advantage, and suspending or cancelling operations if disproportionate risks become apparent (Fitriliani & Sujatmoko, 2024; John, 2024b). Thus, the principle of precaution emerges as a practical mechanism for operationalizing the principles of distinction and proportionality, strengthening preventive control over the risks inherent in the conduct of hostilities.

After 1977, although not all States ratified Protocol I, the duty to take precautions in armed conflicts has been recognized as a customary norm of international humanitarian law [(ICRC, 2005, Rules 15–21)]. This principle has been invoked in recent conflicts; for example, the Rules of Engagement of NATO and UN forces include guidelines to minimize collateral damage (Hosang, 2020), and practices such as the “roof-knocking” strikes carried out by the Israeli Air Force before attacking buildings in Gaza reflect the spirit of Article 57, although the effectiveness of these actions remains the subject of debate (Chiu Kuan-Yu, 2024). As for jurisprudence, the International Court of Justice (ICJ) reaffirmed in the case *Congo v. Uganda* (2005) that Uganda, as an occupying power, had the obligation to take all necessary precautions to protect civilians (Ventura, 2023), although it did not elaborate on the specific criteria for doing so. Likewise, reports prepared by commissions of inquiry and non-governmental organizations, following conflicts such as the Gulf War (1991) and NATO’s intervention in Yugoslavia (1999), examined whether the parties to the conflict had properly complied with this duty, particularly criticizing attacks on densely populated areas without apparent attempts to reduce the harm (Ponomareva & Frolov, 2019).

Doctrine emphasizes that the principle of precaution operationalizes the other principles: it imposes a standard of conduct on the responsible combatant, requiring anticipation and constant assessment of the risk to civilians. This is related to technological and procedural advances in post-1945 armed forces: improved intelligence and surveillance systems allow for more accurate target selection (Voss, 2025), and legal training for commanders seeks to instill in them the need to weigh less harmful options. In this sense, a weapon of lower yield should be chosen if it suffices to neutralize the objective, or attacks should be carried out at night when fewer civilians are present, among other measures, all of which are considered precautions (Goździewicz, 2024). Indeed, the very principle of proportionality requires precautions: without sufficient information and adequate operational care, it is not possible to correctly assess the proportionality of an attack (Marchant, 2020).

With regard to subsequent codification, the principle of precaution has not only been reiterated in military manuals worldwide, but has also inspired specific legal instruments. Protocol III to the 1980 Convention on Certain Conventional Weapons (CCW), for example, establishes the obligation to take precautions when using incendiary weapons, prohibiting their use in air strikes against objectives located in densely populated areas, unless such objectives are clearly separated (Kapliuk et al., 2023). This instrument reflects how disarmament treaties or treaties regulating conventional weapons directly incorporate the principle of the protection of civilians. Likewise, the 2008 Convention on Cluster Munitions broadly prohibits the use of cluster bombs due to their indiscriminate nature and the continuing dangers they pose, given the high number of unexploded submunitions that function as mines (Docherty & Sanders-Zakre, 2023b). This implies an acknowledgment that there is no effective precaution capable of making their use safe, the only viable precautionary measure being their total prohibition (Bradley & Dudziak, 2021).

After 1945, there was a shift from isolated precautionary practices to an articulated set of rules in 1977, which has been widely accepted as binding. The adoption of this principle completed the fundamental triptych of International Humanitarian Law (IHL) on methods of warfare distinction, proportionality and precaution, consolidating a higher humanitarian standard and also serving as a bridge toward disarmament considerations, since recognizing that certain means do not allow sufficient precautions leads to their legal elimination (Cohen & Zlotogorski, 2021d; Garcia, 2020).

Normative principles of disarmament law

The evolution of International Humanitarian Law (IHL), focused on regulating the conduct of hostilities, has taken place in parallel with the development of international disarmament and arms control law, whose purpose is to determine the categories of weapons whose possession and use are lawful for States, as well as to establish the legal conditions for their limitation or elimination. Following the conclusion of the Second World War, the international community recognized that the accumulation of arsenals, especially nuclear weapons, represented an existential threat to humanity. This recognition prompted the adoption of fundamental legal instruments, such as the Treaty on the Non-Proliferation of Nuclear Weapons (TNP, 1968), whose Article VI enshrines the commitment of the Parties to negotiate in good faith effective measures to put an end to the nuclear arms race and to achieve general and complete disarmament under strict and effective international control (Hayashi, 2020a).

Within this normative framework, various multilateral treaties, such as the Convention on the Prohibition of Chemical Weapons (OPAQ, 1993) and the Convention on Cluster Munitions (CCM, 2008), have codified binding legal obligations on disarmament and the restriction of certain types of armaments (Casey-Maslen & Vestner, 2020). From these instruments, guiding principles have emerged that steer negotiations and the implementation of agreements, among which stand out transparency in the declaration of capabilities and stockpiles, verifiability through international inspection mechanisms, the irreversibility of disarmament measures, and non-discrimination among States. These principles, reaffirmed in forums such as the United Nations Conference on Disarmament and in various resolutions of the General Assembly, constitute the essential pillars of an effective, credible and sustainable international disarmament regime (Bowen et al., 2018). It should be noted that disarmament law has materialized mainly in specific areas, such as nuclear, chemical and biological weapons and certain conventional weapons, rather than in a unified code (UNODA, 2022). Nevertheless, the aforementioned normative principles have a cross-cutting character: they apply as criteria of good faith and effectiveness in any process of arms reduction (Kütt, 2019). The UN Disarmament Agenda and the documents adopted at the Review Conferences of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) reiterate these principles as necessary conditions for progress toward general disarmament (Hayashi, 2020b). The following section examines each principle and its historical-doctrinal development after 1945.

#### Transparency

In this regard, transparency in the field of armaments is conceived as informational openness and the fostering of mutual confidence among States with respect to their arsenals, strategic doctrines and military plans. Its essential purpose is to reduce strategic uncertainty and perceptions of threat which, if they persist, could encourage arms races or lead to conflict through miscalculation (Casey-Maslen, 2021a). In line with post-war State practice, especially in the context of the Cold War, a high degree of military secrecy prevailed; nevertheless, it should be noted that even during that period initiatives were undertaken to enhance transparency as an instrument of *détente*. An early example of this were the “open skies” agreement proposals put forward in the 1950s which, although not brought to fruition at that time, reflected an incipient willingness to exchange information (Suwara, 2022). Likewise, certain bilateral arms control agreements between the United States and the Soviet Union introduced limited mechanisms for information exchange. However, it was mainly after the conclusion of the Cold War that transparency acquired a central dimension, embodied in legal instruments such as the START I Treaty (1991), which incorporated obligations of periodic notification, comprehensive data exchanges regarding nuclear warheads and delivery vehicles, as well as on-site verification

mechanisms, raising transparency to unprecedented levels between the former superpowers (Maksymenko & Matuyzo, 2021).

In the multilateral sphere, the United Nations General Assembly established in 1991 the Register of Conventional Arms, a voluntary transparency mechanism intended to have States report annually on their exports and imports of heavy weaponry, with the aim of preventing accumulations of arms that could prove destabilizing (Wezeman et al., 2024). Complementarily, within the framework of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT, 1968), the Review Conferences of the States Parties have reiterated appeals addressed to the nuclear-weapon States, urging them to increase transparency regarding the size of their arsenals and their stockpiles of fissile materials, as a concrete manifestation of the duty to act in good faith in fulfilling their nuclear disarmament obligations (Kadelbach, 2020).

It should be noted that these multilateral practices, although initially of a voluntary or political nature, are laying the groundwork for the consolidation of transparency as an emerging principle of customary international law in the field of armaments. The progressive development of information, verification and reporting mechanisms tends to shape a standard of expected behavior among States, especially in sensitive areas such as the control of conventional and nuclear weapons. In this sense, transparency is emerging not only as an instrument of mutual confidence, but also as an essential normative component for international stability and security in the twenty-first century.

The Action Plan adopted in the Final Document of the 2010 Review Conference of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) underlined that progress towards a world free of nuclear weapons requires not only openness and cooperation, but also the strengthening of confidence through greater transparency and effective verification mechanisms (Hayashi, 2020c). In this vein, various non-nuclear-weapon States have consistently promoted the incorporation of the principles of transparency, verifiability and irreversibility as essential elements for consolidating an effective and sustainable legal regime for nuclear disarmament (Meyer, 2020).

The materialization of the principle of transparency can be observed in contemporary practice: States such as the United States and the Russian Federation, in compliance with international commitments undertaken in treaties such as START, have proceeded to disclose previously classified data relating to the number of deployed and stockpiled nuclear weapons (Meyer, 2020). Similarly, France and the United Kingdom have made public announcements regarding the reductions carried out in their arsenals and the adoption of self-imposed maximum limits, consolidating an unprecedented precedent of openness in the field of strategic deterrence. This trend reflects the growing recognition that transparency not only increases strategic predictability, but also constitutes an essential mechanism for minimizing the risks of armed conflict arising from misperceptions or miscalculations.

Nevertheless, the possibility of absolute transparency faces limitations arising from the inherent sensitivity of military information; even those States that adopt policies of openness retain reservations about certain aspects, invoking reasons of national security. Hence, the international debate has turned toward the search for an “appropriate balance between transparency and secrecy,” with the aim of sharing sufficient information to strengthen confidence without undermining essential defensive capabilities (Iwan, 2022). In this context, transparency has been consolidated as a basic condition for a successful nuclear disarmament process and, more broadly, as an indispensable element of any effective arms control regime (Casey-Maslen, 2021b).

A paradigmatic example of this evolution is the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their

Destruction (1993), which imposes on States Parties the obligation to provide detailed declarations of all their chemical agents, production facilities and stockpiles, under the verification of the Organisation for the Prohibition of Chemical Weapons (OPCW) (Sossai, 2021a). There has been a shift from the opacity that characterized the immediate post-war period toward the establishment of a culture of increasing transparency in matters of disarmament, recognized both at the normative level and in the practice of multiple international instruments in order to ensure its effectiveness.

#### Verifiability

Closely linked to the principle of transparency is verifiability, understood as the ability to independently confirm that States are effectively complying with the commitments they have undertaken in the field of disarmament or arms limitation. A disarmament agreement lacking robust verification mechanisms runs the risk of becoming an ineffective instrument, insofar as mistrust between the parties and the absence of means to detect non-compliance can erode its credibility (Glaser & Jie, 2020). After 1945, international verification gradually came to be consolidated as a central element of disarmament regimes. The first ambitious efforts to establish intrusive verification mechanisms, such as the unsuccessful 1946 Baruch Plan, which proposed placing control of atomic energy under an international authority, failed due to deep East–West tensions (Musto, 2019). Nevertheless, subsequent treaties introduced limited but significant verification measures: the 1959 Antarctic Treaty authorized inspections on Antarctic territory to prevent covert military activities, while the 1967 Treaty of Tlatelolco established the first nuclear-weapon-free zone in Latin America and the Caribbean, complementing the safeguards system of the International Atomic Energy Agency (IAEA) (Puga Álvarez, 2022).

The major leap in terms of verifiability occurred with the nuclear arms control agreements of the 1960s, 1970s and especially the 1980s; the SALT I Treaty (1972) and subsequent agreements allowed the use of National Technical Means of Verification (NTM), such as spy satellites, under the principle of non-interference, thereby de facto legalizing remote verification (Bateman, 2023). Subsequently, the Intermediate-Range Nuclear Forces Treaty (INF, 1987) and the Strategic Arms Reduction Treaty (START I, 1991) incorporated on-site inspections, sensor-based monitoring, telemetry exchange and other advanced forms of verification, inaugurating a highly robust bilateral verification regime (Maurer, 2024).

At the multilateral level, the Treaty on the Non-Proliferation of Nuclear Weapons (TNP, 1968) established from its inception a verification system based on the International Atomic Energy Agency (IAEA); its Article III obliges non-nuclear-weapon States to accept international safeguards to ensure that their nuclear materials are not diverted to military purposes (Bytchkov, 2022). This regime was strengthened with the adoption of the Additional Protocol in 1997, which expanded the IAEA's authority to detect undeclared nuclear activities. Likewise, the Convention on the Prohibition of Chemical Weapons (1993) implemented what is probably the most intrusive verification regime currently in force: States Parties must exhaustively declare their chemical arsenals and allow regular inspections carried out by the Organisation for the Prohibition of Chemical Weapons (OPCW), which oversees the destruction of stockpiles with the support of advanced monitoring technologies (Sossai, 2021b).

The importance of verifiability in disarmament has been explicitly recognized in diplomatic forums. Thus, the Final Document of the 2000 NPT Review Conference reaffirmed the principle that disarmament efforts must be underpinned by effective verification mechanisms (Garcia, 2020a). Similarly, United Nations Security Council Resolution 1540 underscored the need for robust national controls to prevent the

proliferation of weapons of mass destruction to non-State actors (Punzi, 2024). Without verification, disarmament commitments lack credibility, and the possibility of non-compliance undermines international cooperation. The case of the 1972 Biological Weapons Convention (BWC) is paradigmatic: by not providing for verification mechanisms, it allowed the USSR to develop a clandestine biological programme for years, eroding confidence in the treaty. This experience spurred subsequent attempts to equip the BWC with a verification protocol. Likewise, unilateral disarmament pledges without monitoring mechanisms generate scepticism, showing that, in disarmament, transparency and verification are not luxuries but essential conditions for building trust among nations.

Today, verifiability is recognized as an indispensable pillar of any serious disarmament treaty. Initiatives such as the International Partnership for Nuclear Disarmament Verification (IPNDV), launched in 2015, bring together experts from numerous countries to develop techniques that make it possible to confirm the destruction of nuclear warheads without compromising sensitive information (Martínez-Lliso, 2020). This need for technological innovation reflects a fundamental challenge: how to validate irreversibly that a warhead has been dismantled, a key question for sustaining deep and genuine disarmament. Since 1945, the international community has evolved from relying on the traditional principle of *pacta sunt servanda* toward the construction of legal regimes based on transparency, oversight and robust verification (Sieber-Gasser, 2021). Only through these robust mechanisms can the confidence necessary to move toward a world free of nuclear weapons be ensured.

#### Irreversibility

The principle of irreversibility in disarmament aims to ensure that reductions in armaments are, insofar as possible, permanent, avoiding scenarios in which a State can rapidly reverse disarmament steps and rebuild eliminated military capabilities. This concern arose from the realization that cooperation could be betrayed if an actor decided to rearm in secret. Although bilateral treaties such as SALT I (1972) and SALT II (1979) did not explicitly mention irreversibility, some material developments pointed in that direction. Later, agreements such as the INF Treaty (1987) required the physical destruction of missiles, and START I (1991) imposed the elimination of strategic bombers and submarines, measures that seriously hindered a rapid reversal (Woolf, 2024). This evolution reflects a fundamental lesson: for disarmament to inspire genuine confidence, it is not enough to limit arsenals on paper; it is essential to dismantle physical capabilities, sending a tangible signal of commitment to peace (García, 2020).

At the multilateral level, the principle of irreversibility in disarmament began to take explicit shape in the 1990s, and was consolidated at the 2000 NPT Review Conference, which adopted the “13 Practical Steps” toward nuclear disarmament. In particular, Step 5 enshrined the idea that all progress in arms reductions must be designed in such a way that it cannot easily be reversed (Elbahtimy, 2023a). Among the initiatives praised at that conference, the “Megatons to Megawatts” programme stands out, through which the United States and Russia converted highly enriched uranium from nuclear warheads into fuel for reactors, providing a tangible example of technical irreversibility (Pretorius, 2024). These efforts reflect a fundamental evolution in the architecture of disarmament: it is not enough to disarm; it is essential to ensure that the path toward a safer world cannot easily be undone.

Nevertheless, ensuring absolute irreversibility is difficult. As the Group of Governmental Experts on nuclear disarmament verification has pointed out, “all nuclear disarmament steps are, in principle, reversible” (United Nations, 2019, p. 3), since it will never be physically impossible for a State that has dismantled weapons to rearm, even using new

materials. Complete irreversibility is an ideal, but measures can be taken to make reversal more difficult and to detect at an early stage any attempt at reconstitution. For this reason, irreversibility goes hand in hand with verifiability: disarmament is more irreversible where verification is in place to ensure the prompt detection of non-compliance. It is also complemented by transparency, as openness provides greater confidence that there are no hidden stockpiles that could be used to reverse reductions. The UN has indicated that irreversibility, verification and transparency are closely interrelated (United Nations, 2022).

Post-1945 international practice has shown a constant effort to incorporate the principle of irreversibility into disarmament treaties. The Chemical Weapons Convention (CWC) requires the destruction of all chemical weapons production facilities, or their conversion to peaceful purposes under international supervision, with the aim of preventing their military re-use (Organisation for the Prohibition of Chemical Weapons, 1993). Similarly, the 2017 Treaty on the Prohibition of Nuclear Weapons (TPNW) provides, in its Article 4, that nuclear-armed States joining it must eliminate their arsenals in a verifiable and permanent manner and in accordance with a multilateral plan (International Committee of the Red Cross, 2024). Although the nuclear-weapon States are not yet parties to the TPNW, this treaty represents a shift whereby irreversibility is no longer merely an ethical aspiration, but a legal standard that defines contemporary expectations in the field of disarmament.

#### Non-discrimination

The principle of non-discrimination in disarmament law holds that the obligations and benefits arising from arms control agreements must be applied equitably among States, without unjustified privileges. This requirement emerged in response to criticism of the regime of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which temporarily recognizes five States as possessors of nuclear weapons while prohibiting their acquisition by all others (Caballero-Pérez, 2020b). Although the NPT was accepted by most as a necessary evil to curb proliferation, numerous non-aligned countries have insisted that nuclear disarmament must ultimately be genuinely non-discriminatory, that is, without perpetuating hierarchical distinctions among States. This demand reflects a broader principle of equity in the contemporary architecture of international security (Dunlap, 2021).

Already in 1961, the General Assembly, through Resolution 1653 (XVI), affirmed that the use of nuclear weapons would be contrary to “the laws of humanity,” reinforcing an egalitarian moral view: no nation should be considered legitimately entitled to employ them (Caballero-Pérez, 2020). This principle began to take concrete shape in the disarmament negotiations of the 1970s and 1980s. During the discussions on a treaty prohibiting chemical weapons, numerous States demanded a non-discriminatory regime that would not perpetuate privileged clubs. The Chemical Weapons Convention (CWC) gave effect to this by imposing equal obligations on all States, requiring the total destruction of chemical arsenals and the permanent renunciation of their possession. Unlike the nuclear regime, the chemical regime succeeded, at least legally, in overcoming the division between possessors and non-possessors (Carlson, 2020).

The practical application of the principle of non-discrimination in disarmament law is clearly reflected in treaties such as the Chemical Weapons Convention (CWC) and the Biological Weapons Convention (BWC), where all States Parties, regardless of their size or power, are subject to the same inspection criteria and obligations (Elbahtimy, 2023). Another notable example is the 2017 Treaty on the Prohibition of Nuclear Weapons (TPNW) which, unlike the NPT, does not distinguish between nuclear-weapon and non-nuclear-weapon States; under the TPNW, no State may possess nuclear weapons (Diaz,

2019), thereby reaffirming a fundamental legal equality. Although nuclear-weapon States have not acceded to the TPNW and criticize it for failing to recognize differentiated security realities, its proponents see precisely in that legal equality a virtue and a reaffirmation of the principle of equity that should govern the global nuclear order.

The principle of non-discrimination in nuclear disarmament does not require identical operational treatment for all States, but rather fair treatment in accordance with their specific situations. As explained in the UN report on nuclear verification, this principle recognizes that a State that has never possessed certain weapons will not have to destroy them, whereas one that has possessed them must eliminate them (Garcia, 2020). This legitimate differentiation does not contradict equity; what would be discriminatory would be to allow unjustified privileges, such as some nuclear-weapon States retaining exclusive rights, thereby perpetuating structural inequalities. There is therefore consensus that any future framework for complete nuclear disarmament must remove these temporary distinctions: all nuclear weapons must be destroyed under the same standards, and all States subjected to a rigorous verification regime (Torres Sandoval, 2021b). Only in this way can the ideal of a just and universal nuclear order be fully realized.

The principle of non-discrimination, articulated together with those of transparency, verification and irreversibility, is consolidated as an essential normative pillar that requires disarmament regimes to be fair, balanced and universal, an indispensable condition for ensuring the sustained adherence of the majority of States and the lasting effectiveness of international agreements.

Connections between the principles of IHL and the principles of disarmament

Although the principles of International Humanitarian Law (IHL), such as necessity, distinction, proportionality, prohibition of unnecessary suffering and precaution, apply to the conduct of armed conflicts (*jus in bello*), while the principles of disarmament, such as transparency, verification, irreversibility and non-discrimination, regulate the means of warfare in times of peace or demobilization (*jus ad pacem*), there is a profound relationship of mutual reinforcement between them. Historically, many disarmament initiatives have been driven by humanitarian concerns inherent in IHL, seeking to limit or eliminate particularly inhumane means of warfare (Bermejo-García & Cocchini, 2020). In turn, effective respect for IHL is facilitated when certain types of weapons, by virtue of their indiscriminate nature or their capacity to inflict disproportionate suffering, are restricted or eliminated through disarmament agreements.

The principles of International Humanitarian Law (IHL), such as distinction, proportionality and precaution, have driven specific prohibitions of weapons that, by their very nature, violate those principles, thereby contributing to humanitarian disarmament. The recognition that biological and chemical weapons affect combatants and civilians indiscriminately led to their total prohibition through the BWC (1972) and the CWC (1993), reinforcing the need to protect humanity in armed conflicts (Borrett et al., 2019). Similarly, the devastating impact of anti-personnel mines on civilians, even years after hostilities have ended, prompted the 1997 Ottawa Convention, prohibiting their use and seeking to avoid unnecessary suffering (Koorey & Persi Vicentic, 2021). Comparable concerns about the lack of distinction and the disproportionate harm to civilians spurred the adoption of treaties such as the Convention on Cluster Munitions, approved by 100 States in 2008 (International Committee of the Red Cross, 2017), and the 1995 Protocol IV on Blinding Laser Weapons, adopted within the framework of the Convention on Certain Conventional Weapons. Thus, the rules of IHL not only humanize war, but also guide disarmament processes by eliminating weapons that are incompatible with human dignity, as embodied in 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” (International Committee of the Red Cross, 2014, p. 1). The principle prohibiting unnecessary suffering has historically guided the development of disarmament norms, assessing each new weapons technology in light of its humanitarian effects. In 1996, the International Court of Justice stressed that the use of nuclear weapons, given their capacity for massive destruction and uncontrollable effects, would hardly be compatible with the requirements of International Humanitarian Law (IHL) (Caballero-Pérez, 2020c). Although the Court did not declare them absolutely illegal, its analysis reinforced the notion that these weapons are in tension with humanitarian foundations. This concern drove the Humanitarian Initiative and, subsequently, the adoption of the 2017 Treaty on the Prohibition of Nuclear Weapons (TPNW), which is explicitly based on IHL principles and prohibits the possession and use of nuclear armaments (Garcia, 2020a). Thus, the TPNW constitutes a milestone in the convergence between disarmament and legal humanitarianism: it not only eliminates a category of weapons, but also reaffirms the ethical commitment to protect humanity from their catastrophic consequences.

One of the most powerful links between International Humanitarian Law (IHL) and disarmament is found in the principle of precaution: if the use of a weapon, by its very nature, cannot avoid causing disproportionate or indiscriminate harm to civilians, its elimination becomes the only course consistent with humanitarian values. Likewise, disarmament principles such as verification and transparency make it possible to identify when certain weapons, once openly assessed, reveal unacceptable effects; this occurred with incendiary weapons and undetectable fragments, whose regulation in Protocols III and I to the Convention on Certain Conventional Weapons (CCW) responded to accumulated evidence of their impact on civilians (Bermejo-García & Cocchini, 2020). In such cases, science, technical verification and the moral imperative converge: when harm cannot be mitigated through precautions, the law responds with prohibition. For their part, the principles of transparency, verification and irreversibility contribute to compliance with IHL in armed conflicts. A more transparent world in terms of armaments reduces the likelihood of surprise or error that could trigger wars, which ultimately protects civilian populations from suffering their effects. Verification and transparency also play a role in exposing violations of IHL; for example, OPCW mechanisms have documented the use of chemical weapons (Syria, 2013–2018), facilitating the attribution and sanctioning of those acts contrary to IHL (Organisation for the Prohibition of Chemical Weapons, 2020). Conversely, armed conflicts provide lessons that feed into disarmament regimes; after the Gulf War (1991), the use of depleted uranium weapons and the massive fires in oil wells generated environmental and health concerns that have led to calls for new restrictive norms.

The principle of non-discrimination finds a clear conceptual parallel in International Humanitarian Law (IHL): just as the latter imposes the obligation to protect the entire civilian population without any distinction, whether on the basis of nationality, ethnicity or legal status, in accordance with the 1949 Geneva Conventions and their Additional Protocols, the international disarmament legal regime seeks to avoid arbitrary distinctions between States. From this perspective, all States, regardless of their military or nuclear status, share the legal and political responsibility to contribute to the common goal of global disarmament. This aspiration to sovereign equality is normatively embodied in Article VI of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), which establishes the obligation of all Parties to negotiate in good faith effective measures aimed at the cessation of the nuclear arms race and at nuclear disarmament and general and complete disarmament under strict and effective international control (Hayashi, 2020c).

For decades, non-nuclear-weapon States have maintained that the effective implementation of this provision constitutes an indispensable condition for preserving both the legitimacy of the non-proliferation regime and the balance between rights and obligations within it (Pantoliano, 2022). In this vein, the International Court of Justice, in its 1996 Advisory Opinion on the Legality of the Threat or Use of Nuclear Weapons, declared that there exists a legal obligation to negotiate and conclude a treaty leading to nuclear disarmament, thereby reinforcing the principle that no State may indefinitely claim a privileged status in the field of nuclear armament (Les, 2024). This interpretation has been repeatedly endorsed by legal scholarship and by multilateral forums, consolidating itself as an essential normative component in efforts to shape a more equitable, secure and demilitarized international order.

From a historical perspective, a progressive convergence can be observed between International Humanitarian Law (IHL) and the international disarmament regime after 1945. In their initial stages, both branches evolved in a relatively independent manner: while IHL focused on regulating the conduct of hostilities during armed conflicts, disarmament concentrated on the limitation of arsenals in times of peace. Over time, however, the international community has recognized that both processes are indispensable and complementary for preventing human suffering in wartime contexts (Garcia, 2020c). However strict its provisions may be, IHL faces difficulties in effectively protecting the civilian population when certain types of weapons with devastating effects remain available for use. Consequently, disarmament measures that prohibit or restrict such armaments strengthen compliance with IHL by eliminating in advance means and methods of warfare that are incompatible with its fundamental principles (Benjamin-Britton et al., 2020).

Conversely, disarmament can only be sustainable if it is framed within a normative framework based on mutual trust and on the principles of transparency, verifiability and non-discrimination (Sossai, 2021c). These essential elements are closely linked to the notion of humanitarian collective security: a process through which all States commit to disarm jointly and under reciprocal guarantees, minimizing the risks of non-compliance or of gaining unilateral strategic advantages that could undermine international stability and lead to the resumption of armed conflicts.

The normative principles of disarmament and the fundamental principles of IHL share the ultimate goal of reducing the brutality of war and protecting humanity from the worst ravages of modern weaponry. Since 1945, lived experience and legal developments have made their interdependence clear: disarmament treaties are grounded in humanitarian considerations, and full respect for IHL in future armed conflicts depends in part on whether the international community has succeeded in controlling or eliminating the most dangerous weapons. As the ICJ has stated, essential humanitarian norms constitute intransgressible principles of customary law (Teferra, 2023).

Accordingly, a post-1945 historical-critical development shows a gradual merging of the humanitarian agenda and the disarmament agenda: legal instruments such as treaties on “inhumane” conventional weapons, conventions on weapons of mass destruction, and more recently the TPNW (United Nations, 2017), are achievements built on the foundations of IHL principles. At the same time, disarmament initiatives, in order to be effective, have had to incorporate normative principles (transparency, verification, irreversibility, non-discrimination) that guarantee their implementation—principles that reflect universal values of the UN and of general international law such as cooperation, good faith and sovereign equality. Contemporary doctrine emphasizes that general and complete disarmament, proclaimed utopically since 1945, will only be achievable if both the humanitarian imperative—to spare humanity useless suffering through the

elimination of the most horrendous weapons—and the imperative of collective security are rigorously observed.

In the words of a UN report, “the three fundamental notions—irreversibility, verification and transparency—are closely interlinked” (United Nations General Assembly, 2024) and are essential for implementing any nuclear disarmament treaty and maintaining a world without nuclear weapons. It may be added that such implementation will ultimately be guided by the humanitarian principles of IHL, which embody the “elementary considerations of humanity” common to all of international law.

#### **4 Conclusions**

The reflections developed in this article support the conclusion that the cardinal principles of International Humanitarian Law and the guiding principles of disarmament have not evolved as isolated compartments, but rather as parts of a single humanitarian grammar constructed after 1945. Military necessity, distinction, proportionality, the prohibition of unnecessary suffering and precautions in attack find a functional counterpart in transparency, verifiability, irreversibility and non-discrimination, such that IHL guides the “what” and “how” of the use of force, while disarmament defines the “with what” and “to what extent” of the arsenals available. The experience of the conventions on chemical and biological weapons, anti-personnel mines, cluster munitions and, more recently, nuclear weapons illustrates the consolidation of a humanitarian-inspired disarmament that translates the classical concerns of IHL into obligations to prohibit, limit and control armaments.

When this normative framework is projected onto emerging technologies—autonomous weapons systems, applications of artificial intelligence in the conduct of hostilities, and offensive cyber operations—it becomes apparent that the existing principles are not obsolete, but are insufficient if interpreted in a purely formal or technocratic manner. The requirements of distinction and proportionality call for heightened levels of transparency, explainability, and meaningful human control over algorithmic systems; the prohibition of unnecessary suffering and the precautions in attack demand a re-examination of the acceptability of delegating lethal decisions to opaque artefacts; and the principles of verifiability, irreversibility and non-discrimination require us to consider robust mechanisms for inspection, code traceability, capability limitations and the equitable distribution of risks. Accordingly, the main normative conclusion of this study is that the interdependence between International Humanitarian Law (IHL) and disarmament must be explicitly embraced as an integrated framework for the governance of new military technologies, combining an evolutionary interpretation of existing law with the development of new conventional instruments and practices of cooperative transparency. Future research should deepen empirical studies on State practice, incorporate voices from the Global South, and explore concrete institutional designs to render these principles operational in the digital age.

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