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OPINION NOTE

Technological change and the evolution of the law of war*

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Abstract
Advances in military technology have led many, including the developers of such technology, to propose new regulation. International lawyers have extensively examined the adequacy of the existing law to address emerging technology, but they have devoted relatively little attention in these analyses to the prior development of the law as a result of, or despite, technological change. This essay highlights two challenges that those wishing to undertake such an exercise might encounter. The first of these is the general paucity of serious engagement with the history of international law applicable in armed conflicts and the perpetuation of a particular "origin myth" of international humanitarian law. The second challenge has to do with the controversies about the impact of technology on society in general, and the impact of military technology on warfare in particular. Nevertheless, the essay concludes by pointing towards some of the insight that might be gained from a more history-conscious analysis of the relationship between technology and law in the military context.

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Keywords: law of war, law of armed conflict, international humanitarian law, arms control, military technology, law and technology theory, legal history.

Introduction

Warfare has been upgraded. The past few decades have seen an extraordinary technological change in conflicts and in military capabilities generally. Reportedly more than 100 States have established dedicated cyber-warfare units within their armed forces or intelligence agencies.[1] These units help States fend off hostile cyber-operations targeting their national infrastructure and – though this might not be equally publicized – undertake such operations against an adversary. Nearly as many States are said to operate unmanned aerial vehicles (UAVs) for intelligence, surveillance and reconnaissance, and allegedly some 30 States already have or are developing armed UAVs.[2] Military applications of artificial intelligence, nanotechnology and biotechnology are being actively devised and implemented.

This technological shift has sparked an extensive debate about the adequacy of the applicable international law, yet past developments of the law as a result of, or despite, technological change have garnered surprisingly little attention in these analyses. This Opinion Note aims to highlight a few obstacles in the path of those inclined to undertake a more historically inquisitive inquiry. Also, it seeks to foreshadow some of the insights that might be gained from such an exercise. These aims are modest. This paper does not purport to impart "history lessons" to guide policy-makers or commentators in their analyses of the governance of some new technology. It merely attempts to encourage a discourse more mindful of history.

Before proceeding, some terminological clarifications are in order. They seem necessary given that "technology" is a deceptively simple term. To many participants in the debates about the regulation of military technology, the word means weapons or, perhaps more broadly, military equipment. On this account, technology means human-made physical objects, especially tools, instruments and devices. However, technology can be construed more broadly than just technological artefacts. Wilbert E. Moore, for example, has defined technology as "the application of knowledge to the achievement of particular goals or to the solution of particular problems."[3] Thus technology may be reasonably taken to

1 Fergus Hanson, "Waging War in Peacetime: Cyber Attacks and International Norms", *The Lowy Interpreter*, 20 October 2015, available at: www.lowyinterpreter.org/post/2015/10/20/Waging-war-in-peacetime-Cyber-attacks-and-international-norms.aspx (all internet references were accessed in October 2016).

2 Michael C. Horowitz and Matthew Fuhrmann, "Droning on: Explaining the Proliferation of Unmanned Aerial Vehicles", 1 October 2015, available at: ssrn.com/abstract=2514339.

3 Wilbert E. Moore, "Introduction", in Wilbert E. Moore (ed.), *Technology and Social Change*, Quadrangle Books, Chicago, 1972, p. 5.

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cover "skills, routines, and methods as well as the knowledge needed to operate devices"; in this sense technology refers to "technique, a way of doing things".[4] While there are further and even broader understandings of the notion of technology, for the purposes of this essay thinking of technology not just as an artefact (or even a set of interconnected artefacts) but also as technique appears adequate. From this point of view, both bullets and poison, for example, qualify as military technology. Even though a particular poison might not be a human-made object but, say, a toxin found in the natural environment, the extraction and the use of the poison to achieve a certain military aim (such as incapacitating an adversary) amounts to technology.

As for the law, the somewhat antiquated term "law of war" is used here. This is done advisedly in order to refer to all manner of international law rules and principles specifically meant to govern human conduct in war. This refers, first and foremost, to rules that restrict generally the choice of means and methods of warfare, and protect those not taking a direct part in hostilities. Such rules are collectively known as the "law of armed conflict" or "international humanitarian law". However, conceived broadly, the law of war also encompasses those rules of international law that restrict the use – and often also the development, acquisition, stockpiling, and so forth – of specific weapons, means or methods of warfare. These rules usually attract the moniker "arms control law".

While contemporary legal doctrine distinguishes rather sharply and consistently between these two branches of international law,[5] for present purposes they are best addressed together. For one, the distinction is of fairly recent vintage. Landmark documents from the 19th and early 20th century use the banner "laws of war" or "laws and customs of war" to refer to a range of international law rules and principles applicable in warfare. They do not distinguish neatly between rules pertaining to specific prohibited weapons, the conduct of hostilities, and the protection of certain persons and objects.[6] Remarkably, even the 7th edition of *Oppenheim's International Law*, published in 1952, deals with prohibited means of warfare purely as a matter of the conduct of hostilities, rather than as a discrete area of arms control.[7] Thus a rigorous adherence to the distinction between international humanitarian law and arms control law in a paper addressing the history of the law would amount to an anachronism. As such, it would distort rather than clarify the subject matter. Also, much of the current discussion among non-lawyers about the need to revise the law is not entirely clear about which branch of the law needs to be amended. This suggests that the entire fabric of the law needs to be considered.

4 Garth Massey, *Ways of Social Change: Making Sense of Modern Times*, 2nd ed., Sage, Los Angeles, 2015.
5 See e.g. US Department of Defense, *Law of War Manual*, Washington DC, June 2015, para. 1.6.2; Robert J. Mathews and Timothy L. H. McCormack, "The Influence of Humanitarian Principles in the Negotiation of Arms Control Treaties", *International Review of the Red Cross*, Vol. 81, No. 834, 1999, pp. 334–335.
6 See especially Institute of International Law, "The Laws of War on Land", Oxford, 9 September 1880; Hague Convention (IV) regarding the Laws and Customs of War on Land, 205 CTS 27, 18 October 1907 (entered into force 26 January 1910).
7 Lassa Oppenheim, *International Law: A Treatise*, 8th ed., edited by Hersch Lauterpacht, David McKay Company, New York, pp. 340–345.

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The call for new law

The idea that the law of war has become inadequate in light of technological developments has gained some traction recently. All manner of pundits have considered it advisable to increase the regulation of cyberspace, some quite specifically insisting on a "Geneva Convention on Cyber Warfare".[8] These proposals have a highly divergent degree of intelligibility: many of those publicly bemoaning the inadequacy of international law in relation to military operations in cyberspace do not explicate as to how, precisely, the existing law falls short. UAVs being a concrete set of devices, the suggestions for further regulations have been rather more specific. For one, civil society campaigns have advocated for a ban on all weaponized drones.[9] Somewhat more realistically, commentators have suggested reviewing existing regulatory mechanisms to reduce the likelihood of UAV-technology proliferation.[10]

The most organized and articulate have been the proponents of regulation of lethal autonomous weapon systems. Working under the auspices of organizations such as the International Committee for Robot Arms Control, they have sought to influence, for example, the ongoing discussion on such technology within the framework of the Conventional Weapons Convention. An open letter urging "a ban on offensive autonomous weapons beyond meaningful human control" has been signed by over 3000 researchers of robotics and artificial intelligence, as well as over 17,000 others (including prominent scholars and entrepreneurs).[11]

Some have gone one step further. Brad Allenby, in a jointly penned piece in *Slate* in 2012, claimed that new treaties addressing particular technologies, while having a degree of usefulness, "are mere attempts to update an already obsolete international regime".[12] The word "obsolete" can make many law of war specialists wince. It is reminiscent of Alberto Gonzales, White House Counsel under President George W. Bush, describing some aspects of Geneva Convention III as "quaint" and "obsolete".[13] However, to be fair, in his later, more academic writings, Allenby has been far more circumspect. He has noted, for example, that the law of war has "developed over a long period, with commentary and input

8 Chris Weigant, "We Need a Geneva Convention on Cyber Warfare", *Huffington Post: The Blog*, 28 October 2013, available at: www.huffingtonpost.com/chris-weigant/we-need-a-geneva-conventi_b_4171853.html; Karl Rauscher, "It's Time to Write the Rules of Cyberwar", *IEEE Spectrum*, 27 November 2013, available at: spectrum.ieee.org/telecom/security/its-time-to-write-the-rules-of-cyberwar.

9 See e.g. Drohnen-Kampagne, available at: drohnen-kampagne.de; Ban Weaponized Drones from the World, available at: act.rootsaction.org/p/dia/action/public/?action_KEY=6180.

10 Micah Zenko and Sarah Kreps, *Limiting Armed Drone Proliferation*, Council of Foreign Relations, Washington DC, 2014.

11 "Autonomous Weapons: An Open Letter from AI & Robotics Researchers", available at: futureoflife.org/open-letter-autonomous-weapons.

12 Braden R. Allenby and Carolyn S. Mattick, "Why We Need New 'Rules of War'", *Slate: Future Tense*, 12 November 2012, available at: www.slate.com/articles/technology/future_tense/2012/11/drones_cyberconflict_and_other_military_technologies_require_we_rewrite.html.

13 Alberto R. Gonzales, "Decision Re Application of the Geneva Convention on Prisoners of War to the Conflict with Al Qaeda and the Taliban", Memorandum for the President, 25 January 2002, reproduced in Karen J. Greenberg and Joshua L. Dratel (eds), *The Torture Papers: The Road to Abu Ghraib*, Cambridge University Press, New York, 2005, pp. 118–121.

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from many cultures", such that "[i]t is neither desirable nor likely that such a robust and developed framework should suddenly become totally obsolete".[14] In any event, the underlying point is an important one: concern about particular technologies only goes so far. Governance problems may well result from the totality of the technological change and the interaction of the various technologies with each other. In other words, technological change may well be a problem for the law of war as a whole.

The law and technology enterprise

Technologists, scientists, ethicists and other commentators calling for legal renewal have entered into a symbiotic relationship with international lawyers writing about such matters – one feeds the other. Unsurprisingly, then, a staggering amount of international law literature has emerged over the past decade dissecting the challenges generated by new technologies that have, or might have, military use.

When it comes to scholarly literature on law and technology generally, much of it falls into a particular pattern. Drawing on the discussions on the regulation of outer space, *in vitro* fertilization and virtual worlds, Kieran Tranter has described a scholarly template which he calls the "law and technology enterprise".[15] This template starts off with a technological crisis event – a specific technology that appears to have an uncertain future in that it promises both progress and peril.[16] This starting point, incidentally, meshes nicely with the (Western) mainstream consensus that technological developments have major impacts on society, and entail both problems and opportunities.[17] The law and technology enterprise then goes on to identify gaps in, or inadequacies of, the current law, to expound the need for legislative interventions and to outline the processes for law-making.[18] While doing all of this, the discussion shies away from engaging with the values that underlie the law and from expressing opinion on the substance of future regulation. As Tranter sums it up, "[l]aw is to be made, but the values and policies that inform this law-making should come from elsewhere."[19]

The reader of the literature on law and emerging military technology will recognize at least some of the features of the law and technology enterprise.[20]

14 Braden R. Allenby, "Are New Technologies Undermining the Laws of War?", *Bulletin of the Atomic Scientists*, Vol. 70, No. 1, 2014, p. 29.
15 Kieran Tranter, "The Law and Technology Enterprise: Uncovering the Template to Legal Scholarship on Technology", *Law, Innovation & Technology*, Vol. 3, No. 1, 2011.
16 *Ibid.*, p. 69.
17 Nick Bostrom, "Technological Revolutions: Ethics and Policy in the Dark", in Nigel M. de S. Cameron and M. Ellen Mitchell (eds), *Nanoscale: Issues and Perspectives for the Nano Century*, Wiley & Sons, Hoboken, 2007, p. 131; Roger Brownsword, *Rights, Regulation and the Technological Revolution*, Oxford University Press, Oxford, 2008, p. 25.
18 K. Tranter, above note 15, p. 69.
19 *Ibid.*, p. 70.
20 See, in relation to cyber-warfare, Samuli Haataja, "Technology, Violence and Law: Cyber Attacks and Uncertainty in International Law", in Rauno Kuusisto and Erkki Kurkinen (eds), *Proceedings of the*

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One such feature is the identification of, and a focus on, a particular disruptive technology, along with the challenges and opportunities that it appears to create. Most noticeably, this has generated separate discussions of the law as it pertains to cyber-warfare, UAVs, autonomous weapons, military nanotechnology and so on. The establishment of specialist journals on the law of cyber-warfare epitomises this siloing.[21]

Admittedly, the technology-specific approach cannot be easily avoided. The technologies in question are highly sophisticated and complex taken individually. As a result, overarching legal analyses prove challenging simply due to the scientific and technical knowledge required in order to make an informed contribution to the debate.[22] Thus the best strategy so far has been to make a link between the conversations about different technologies by conducting them alongside each other, as has been done in several edited volumes as well as symposium issues of journals, including this *Review*.[23]

Something sets this scholarship apart from the law and technology enterprise, though. Law of war experts readily talk about the substance of the rules and the values underlying the law, even though they often remain sceptical about the prospects of law-making. This preparedness to engage with values might have something to do with the widely accepted premise that the bulk of the law of war results from a balancing act between the contradictory considerations of military necessity and humanity – or, as Nobuo Hayashi has argued, from the joint satisfaction of those considerations.[24] While this leads to a seemingly endless debate about how best to reconcile military necessity and humanity, this is a debate about substance, not just form.

A further implicit feature of the law and technology enterprise, however, also characterizes the literature on new military technology. The law and the technology are seen as having a present and a future – a dangerously uncertain future at that – but no past. Relatively little attention has been paid to the development of the law of war in light of prior technological change. By and large, to borrow from Tranter, "[t]he lawyer trie[s] to save the future through a hybrid of speculation and description."[25] This seems rather curious. One would

12th European Conference on Information Warfare and Security, ACPI, Sonning Common, 2013, pp. 317–318.

21 See e.g. the *Journal of Law & Cyber Warfare*, the *Journal of Information Warfare*, and the *International Journal of Cyber Warfare & Terrorism*.

22 However, see, for a more integrative approach, Michael N. Schmitt, "War, Technology and the Law of Armed Conflict", in Anthony M. Helm (ed), *The Law of War in the 21st Century: Weaponry and the Use of Force*, US Naval War College, Newport, 2006.

23 See especially Dan Saxon (ed.), *International Humanitarian Law and the Changing Technology of War*, Martinus Nijhoff, Leiden, 2013; Hitoshi Nasu and Robert McLaughlin (eds), *New Technologies and the Law of Armed Conflict*, TMC Asser Press, The Hague, 2014; *International Review of the Red Cross*, Vol. 94, No. 866, 2012, pp. 457–817; *Utah Law Review*, No. 5, 2013, pp. 1215–1356; *International Law Studies*, Vol. 91, No. 1, 2014, pp. 468–516, 540–640, 699–728; *Case Western Reserve Journal of International Law*, Vol. 47, No. 1, 2015, pp. 1–238.

24 See Nobuo Hayashi, "Military Necessity as Normative Indifference", *Georgetown Journal of International Law*, Vol. 44, No. 2, 2013.

25 K. Tranter, above note 15, p. 69.

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think it interesting and potentially instructive to consider how the law has adapted or failed to adapt to technological breakthroughs of the past.

As promised in the introduction, the remainder of this essay seeks to do two things: to offer something by way of an explanation for this neglect of history, and to suggest that there are some benefits to a deeper engagement with the prior development of the law of war.

The development of the law of war

In works on military history, the law of war tends to make a fleeting appearance, often not even in a minor role but merely as an uncredited extra. Some historians refer selectively to arms control and disarmament measures.[26] The outlawing of the crossbow among Christians by the Catholic Church in 1139 seems to be a perennial favourite as the ostensibly first attempt at arms control.[27] Others briefly mention the Battle of Solferino and the 1864 Geneva Convention on the protection of the wounded and sick.[28] John Keegan, in his well-regarded *History of Warfare*, devotes a couple of pages to the law.[29] One of the most notable exceptions to this overall neglect of the regulation of warfare is the *Oxford History of Modern War*, which despite its compact size contains a whole chapter on the law of war by Sir Adam Roberts.[30]

The relative lack of attention to the law of war by (military) historians may be something of a reflection on the capacity of the law to restrain the conduct of belligerents – or at least how historians perceive that capacity. Little surprise, then, that the history of the law of war in its own right has not exactly flourished as a field of study either. The most significant contemporary book-length works can be easily listed. Maurice Keen wrote in some detail on the medieval law of war, as did Theodor Meron, but through a Shakespearean lens.[31] Geoffrey Best's duology probably ranks as the best-known (and certainly the most entertaining) work on the history of the law of war from the mid-19th century until the

26 Robert L. O'Connell, *Of Arms and Men: A History of War, Weapons and Aggression*, Oxford University Press, New York, 1989, pp. 95–96, 274–275; R. Ernest Dupuy and Trevor N. Dupuy, *The Harper Encyclopedia of Military History: From 3500 BC to the Present*, 4th ed., Harper Collins, New York, 1993, pp. 307–308, 1123–1125; 1369–1371, 1485–1486.

27 R. L. O'Connell, above note 26, pp. 95–96; R. E. Dupuy and T. N. Dupuy, above note 26, pp. 307–308 (also referring to the broader attempts by the Church to limit warfare through the notions of "peace of God" and "truce of God").

28 Christon I. Archer, John R. Ferris, Holger H. Herwig and Timothy H. E. Travers, *World History of Warfare*, University of Nebraska Press, Lincoln, 2002, pp. 422–423.

29 John Keegan, *A History of Warfare*, Alfred A. Knopf, New York, 1999, especially pp. 382–383.

30 Adam Roberts, "Against War", in Charles Townshend (ed.), *The Oxford History of Modern War*, new ed., Oxford University Press, Oxford, 2005.

31 Maurice Keen, *The Laws of War in the Late Middle Ages*, Routledge & Kegan Paul, London, 1965; Theodor Meron, "Shakespeare's Henry the Fifth and the Law of War", *American Journal of International Law*, Vol. 86, No. 1, 1992; Theodor Meron, *Bloody Constraint: War and Chivalry in Shakespeare*, Oxford University Press, New York, 1998.

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late-20th century.[32] Recently, John Witt has explored at length the role of the law of war in American history.[33]

In terms of universal histories of the law of war, one is largely left with two options: a slim book edited by Michael Howard, George Andreopoulos and Mark Shulman, which provides a highly readable but fairly cursory account,[34] and a three-volume opus by Alexander Gillespie, which supplies a wealth of historical data but little by way of analysis.[35] Overall, Stephen Neff's observation from a decade ago that "surprisingly little" attention has been devoted to the history of the law of war[36] still holds true today. This appears to be equally true for international humanitarian law as the most sizeable portion of the law of war as well as arms control law. As for the latter, Mark Moyar notes that "[n]o historian has as yet produced a broad history of arms control and disarmament that can be described as comprehensive."[37]

Law of war specialists, like other international lawyers, are not utterly disinterested in the past. They may be most interested inasmuch as the past reveals State practice. State practice, of course, constitutes one ingredient in the formation of customary rules of international law. Also, where the practice relates to a treaty, the practice may assist in the interpretation of the provisions of that treaty.[38] An examination of the preparatory work of the treaty and the circumstances of its conclusion – all a matter of historical record – amounts to a valid supplementary means of treaty interpretation.[39] However, such interest in history tends to be narrow: it attempts to elucidate the content of existing rules. As a result, international lawyers often have a good sense of how contemporary rules emerged and developed – for example, how the notorious mistreatment of prisoners of war during the Second World War influenced the drafting of Geneva Convention III.[40] The sense of the overall evolution of the law of war, however, tends to remain far sketchier.

Consistently with a highly pragmatic approach that focuses on the origins of current rules, broader views of history mostly focus on what has been called the "modern" law of war. According to a widely shared narrative – a kind of "origin myth" – the modern law was born in the 1860s with the promulgation of the

32 Geoffrey Best, *Humanity in Warfare*, Columbia University Press, New York, 1980; Geoffrey Best, *War and Law since 1945*, Clarendon, Oxford, 1994.
33 John Fabian Witt, *Lincoln's Code: The Laws of War in American History*, Free Press, New York, 2012.
34 Michael Howard, George J. Andreopoulos and Mark R. Shulman (eds), *The Laws of War: Constraints on Warfare in the Western World*, Yale University Press, New Haven, 1994.
35 Alexander Gillespie, *A History of the Laws of War*, 3 vols, Hart, Oxford, 2011.
36 Stephen C. Neff, *War and the Law of Nations: A General History*, Cambridge University Press, Cambridge, 2005, p. 1.
37 Mark Moyar, Arms Control and Disarmament, *Oxford Bibliographies*, 19 April 2015, available at: www.oxfordbibliographies.com/view/document/obo-9780199791279/obo-9780199791279-0002.xml.
38 See Vienna Convention on the Law of Treaties, 1155 UNTS 331, 23 May 1969 (entered into force 27 January 1980), Art. 31(3)(b) (providing that "any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation" must be taken into account in the interpretation of the treaty).
39 *Ibid*., Art. 32.
40 See e.g. G. Best, *War and Law*, above note 32, pp. 135–136.

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Lieber Code, and the adoption of the first Geneva Convention and the St Petersburg Declaration.[41] Earlier developments are seldom discussed in any detail and often appear as vignettes – historical curiosities of the sort preserved in glass jars.[42] Howard Levie once dismissed pre-1860 practices altogether because in that period "humanity played no part, or a very small and almost accidental part, in … warfare".[43] This widely (if implicitly) supported view links the genesis of the law of war exclusively to the advance of the ideals of humanity. In other words, the development of the law of war is seen as the process of placing on the conduct of hostilities ever-more elaborate restrictions, deriving from considerations of humanity. This approach is problematic for at least four reasons.

First, the interaction between the consideration of humanity and military necessity that nowadays characterizes the law is not the only way to construct a regulatory framework for warfare. For a long time, the law was largely encapsulated by military necessity. As Neff has put it, "[o]n the whole, the jealous lordship of the principle of necessity was very nearly unchallenged in the Middle Ages".[44] This remained true for several centuries thereafter.[45] Military necessity is, admittedly, an elastic notion, perhaps capable of ruling out only the most obvious of excesses. However, even a law based on military necessity, imperfect as it may appear to the contemporary observer, had a role to play. As Martti Koskenniemi has noted, the significance of military necessity

> was less to provide a criterion for measuring the permissibility of an act than to direct combatants – in practice, superior officers – to examine their conscience even in the midst of fighting and to suppress their desire to engage in "irrational" violence ….[46]

On this account, the notion of military necessity had, at the very least, an important enculturing and educational function: it compelled combatants to reflect upon the propriety of their own conduct.

Second, the developments from the 1860s onwards have been considered a "codification" of pre-existing military customs[47] and a "compilation" of principles articulated by publicists.[48] It is difficult to see how a codification or a compilation,

41 Instructions for the Government of Armies of the United States in the Field, General Order No. 100, 24 April 1863; Geneva Convention for the Amelioration of the Condition of the Wounded in Armies in the Field, 129 CTS 361, 22 August 1864 (entered into force 22 June 1865); Declaration Renouncing the Use, in Time of War, of Explosive Projectiles under 400 Grammes Weight, 138 CTS 297, 11 December 1868 (entered into force upon signature).

42 As always, there are exceptions: for example, Leslie Green and Gerald Draper gave a lot of thought to the pre-modern development on the law of war.

43 Howard S. Levie, "History of the Law of War on Land", *International Review of the Red Cross*, Vol. 82, No. 838, 2000.

44 S. C. Neff, above note 36, p. 65.

45 *Ibid.*, pp. 112–113.

46 Martti Koskenniemi, *The Gentle Civilizer of Nations: The Rise and Fall of International Law 1870–1960*, Cambridge University Press, Cambridge, 2002, p. 88.

47 H. S. Levie, above note 43, p. 340; S. C. Neff, above note 36, p. 113.

48 M. Koskenniemi, above note 46, p. 87 (describing the Lieber code as "a compilation of humanitarian principles taken from publicists from Grotius onwards").

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resulting in a law guided by the ideal of humanity, could have been possible if the earlier law had been completely devoid of humanitarian sentiments.

Third, if one treats the notion of humanity very strictly, not even all post-1860s law would qualify as humanitarian. Amanda Alexander has argued that the law truly embraced humanitarian values only towards the end of the 20th century, with the acceptance of the principles contained in the 1977 Additional Protocols.[49] While that may be an extreme view, the law certainly underwent a process of "humanization", as Meron noted, as a result of the influence of human rights law and a greater weight being given to considerations of humanity.[50] Also, the term "international humanitarian law" appears to be a child of the 1970s.[51]

Fourth, the exclusive focus on the notion of humanity overlooks the role that honour – including its medieval incarnation, chivalry – has played in the development of the law of war. This neglect is problematic inasmuch as some notion of warrior honour seems to have a timeless and universal character.[52] Indeed, a nod to chivalry can be seen even in the contemporary law, which otherwise appears to be driven by humanitarian concerns.[53]

In short, a sharp distinction between the pre-modern and modern law, common though it may be, conceals more than it reveals. Significantly, it suggests a greater break with the past in the 1860s than warranted. Richer and subtler historical accounts of the development of the law of war have, moreover, been offered. Sometimes they have come about almost by accident. Perhaps the most thoughtful conceptual history of the law of war that extends beyond the modern period may be found in Stephen Neff's *War and the Law of Nations*.[54] Yet, by his own admission, Neff did not set out to write a history of the law of war but rather a "history of ideas about the legal nature and character of war as such".[55] His account nonetheless provides important insights into the overall evolutionary trajectory of the law of war, and identifies key ideas and periods in its development. It provides a valuable springboard into more detailed histories of the law of war.

Technology-specific and technology-neutral law of war

Having overcome the aversion for the history of the law, anyone undertaking an enquiry into the role of technology in that history must clear a further hurdle. What is the impact of technology on law?

49 Amanda Alexander, "A Short History of International Humanitarian Law", *European Journal of International Law*, Vol. 26, No. 1, 2015.

50 Theodor Meron, "The Humanization of Humanitarian Law", *American Journal of International Law*, Vol. 94, No. 2, 2000.

51 At least *Google Books Ngram Viewer*, available at: books.google.com/ngrams, suggests that the phrase "humanitarian law" entered the corpus of books in the 1970s.

52 See e.g. Paul Robinson, *Military Honour and the Conduct of War: From Ancient Greece to Iraq*, Routledge, London, 2006.

53 On the impact of chivalry on the contemporary law of war, see, e.g., Rain Liivoja, "Chivalry without a Horse: Military Honour and the Modern Law of Armed Conflict", in Rain Liivoja and Saumets (eds), *The Law of Armed Conflict: Historical and Contemporary Perspectives*, Tartu University Press, Tartu, 2012.

54 S. C. Neff, above note 36.

55 *Ibid.*, p. 2.

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Considering this rather thorny issue requires some preliminary conceptual housekeeping. The law can deal with technology on different levels of abstraction. This is by no means a unique feature of the law of war: the distinction between "technology-specific" and "technology-neutral" law, as well as the question about the desirability of the latter, have been extensively discussed in other contexts.[56]

Technology-specific law, as the term itself suggests, addresses a particular type of technology. The most obvious examples of technology-specific rules pertaining to warfare are those that either ban completely, or restrict in some way, the use of certain means of warfare, that is, particular weapons and projectiles. The prohibition of the use of poison and poisoned weapons constitutes one of the most long-standing examples.[57] The more recently introduced ban on weapons "the primary effect of which is to injure by fragments which in the human body escape detection by X-rays" provides another example.[58] There are, however, other technology-specific rules of the law of war, especially when it comes to the more technology-dependent naval and air warfare. For example, certain aspects of the protection of medical aircraft are provided for separately from the protection of other medical transports. For one, there are rules concerning the marking and identifying signals of medical transports that are specific to aircraft.[59] Also, medical aircraft are subject to detailed rules concerning flight plans and possible interception.[60]

Law can be considered technology-neutral "as long as it does not favour one specific technology over another", even though it "might be closely related to or intertwined with technology".[61] There are rules of the law of war that are quite fixated on technology, yet seem manifestly "technology-neutral". In particular, this includes rules that address weapons by focusing on the effects of means of warfare generally rather than on a particular weapons technology. Such rules prohibit the use of inherently indiscriminate means of warfare,[62] as well as means of warfare of a nature to cause unnecessary suffering.[63] Similarly, there are rules banning the use of means of warfare with environmental effects above a certain threshold[64] and particularly egregious uses of the environment as a means of

56 See, in particular, Bert-Jaap Koops, "Should ICT Regulation Be Technology-Neutral?", in Bert-Jaap Koops *et al.* (eds), *Starting Points for ICT Regulation: Deconstructing Prevalent Policy One-liners*, Asser, The Hague, 2006.

57 Hague Convention (IV) regarding the Laws and Customs of War on Land, 205 CTS 277, 18 October 1907 (entered into force 26 January 1910), Annex: Regulations concerning the Laws and Customs of War on Land ("Hague Regulations"), Art. 23(a).

58 Protocol on Non-Detectable Fragments, annexed to 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, 1342 UNTS 168, 10 October 1980 (entered into force 2 December 1983).

59 See especially Geneva Convention I, Art. 36(2); Additional Protocol I, Annex I, Arts 7(1) and 9(1).

60 See especially Geneva Convention I, Art. 36(3)–(4); Additional Protocol I, Arts 29–30; Additional Protocol I, Annex I, Arts 13–14.

61 B.-J. Koops, above note 56.

62 Protocol Additional (I) to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts, 1125 UNTS 3, 8 June 1977 (entered into force 7 December 1978) ("Additional Protocol I"), Art. 35(1).

63 Hague Regulations, Art. 23(e); Additional Protocol I, Art. 35(2).

64 Additional Protocol I, Art. 35(2).

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warfare.[65] Indeed, the systematic use of the generic term "means of warfare" in the formulation of these prohibitions emphasizes their technology-neutral quality. The auxiliary obligation to determine *ex ante* whether the employment of "a new weapon, means or method of warfare" would be prohibited by international law is clearly also technology-neutral.[66]

Some rules "abstract completely away from technology"[67] such that "they apply to behaviour of the actors involved and the effects of that behaviour and not to the means through which the actors behave or by which those effects come about".[68] Thus it becomes possible to speak of "technology-indifferent" law. The bulk of the law of war is technology-indifferent. The law of war governs the conduct of hostilities and offers protection to persons not taking part in hostilities – all quite irrespective of the means and methods of warfare the belligerents adopt and other technology that they use. As these rules seek to achieve certain (humanitarian) ends, all manner of technology may be involved in either breaching these rules or, conversely, securing compliance with them. It might in fact be the same technology depending on the circumstances: for example, various pharmacological agents and medical devices could be used to treat people (as required by the law) or to torture them (contrary to the law).

From technological change to legal change

The different types of rules just mentioned have developed along somewhat different vectors. This is partly due to diverging ideologies. Fundamentally, the highly technology-specific rules of arms control law are not necessarily based on the same considerations as the more technology-neutral or technology-indifferent rules of international humanitarian law. While humanitarian concerns certainly inform the making of arms control law,[69] and probably increasingly so, restrictions on a particular weapon are often determined by strategic considerations (such as the cost of acquiring the weapon, its utility and so on).[70] Owing to the different ideological outlook, arms control treaties have been negotiated – ever since the First Word War – in fora different from those where the protection of war victims has been considered.

On a very basic level, correlating the development of technology-specific rules with technological change is straightforward. The adoption of a treaty restricting the use of incendiary weapons must have something to do with the development of incendiary

65 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, 1108 UNTS 151, 18 May 1977 (entered into force 5 October 1978).
66 Additional Protocol I, Art. 36.
67 B.-J. Koops, above note 56.
68 Chris Reed, "Taking Sides on Technology Neutrality", *SCRIPT-ed*, Vol. 4, No. 3, 2007, p. 269.
69 See R. J. Mathews and T. L. H. McCormack, above note 5.
70 For a particularly bleak view, see Chris af Jochnick and Roger Normand, "The Legitimation of Violence: A Critical History of the Laws of War," *Harvard International Law Journal*, Vol. 35, No. 1, 1994, especially pp. 66–68 (regarding exploding bullets) and pp. 73–74 (balloons). See also R. Liivoja, above note 53, pp. 84–86 (concerning poison and crossbows).

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weapons. Where such technology-specific law-making does take place, there can be little doubt that the technology has had some impact on the law. However, the simplicity stops there. The question as to why a particular legislative approach has been taken, or why there was no legislative reaction, defies an easy answer. A comprehensive response will likely identify a combination of strategic, economic, humanitarian and other factors. Moreover, where law-making does take place, it may happen at different stages of technological development. Mostly it occurs reactively, that is, after the introduction of a technology. Infrequently, law-making is proactive, anticipating (and possibly preventing) the introduction of a new technology: the ban on permanently blinding laser weapons serves as a rare example.[71]

As concerns technology-neutral and technology-indifferent rules, the link between technological change and the evolution of the law becomes weaker. One cannot presuppose that these rules would undergo change simply in response to technological change alone. Indeed, the abstract nature of technology-neutral and technology-indifferent rules should protect them against technological change, which is the reason why the use of such rules has been advocated. For technology to have an impact on technology-neutral or technology-indifferent rules, that impact would need to be indirect – mediated by a more general transformation of society. In relation to the law of war, the process would need to have two parts: technological change affecting the character of warfare in general and, in turn, the change in the character of warfare precipitating a change in the law.

The first part of this process is, of course, not a legal matter at all. Rather it pertains more generally to the relationship between technological change and social change. Put very simply, there has been considerable debate about whether technology provides tools that people can use as they see fit (the "instrumental" view of technology) or whether technology actually drives social change (the "deterministic" view of technology).[72]

This debate has also occurred in the context of warfare and military affairs. What appears to be widely recognized is that technology plays a significant role in warfare and that there is a strong correlation between the overall state of technology and the character of warfare. Many historians dealing with military technology have emphasized the significant role played by technology in warfare, while being at pains to avoid falling back on a purely deterministic position. For example, Martin van Creveld argues that "war is completely permeated by technology and governed by it" but goes on to note that "[m]erely because technology plays a very important part in war, it does not follow that it alone can dictate the conduct of a war or lead to a victory".[73] Similarly, Alex Roland notes that

71 See Protocol on Blinding Laser Weapons, annexed to 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, 1380 UNTS 370, 13 October 1995 (entered into force 30 July 1998).

72 The question whether technology embodies a set of values or is, rather, value-neutral, adds a further dimension to the problem. See, e.g., Andrew Feenberg, "What Is Philosophy of Technology?", in John R. Dakers (ed.), *Defining Technological Literacy*, Palgrave Macmillan, New York, 2006.

73 Martin van Creveld, *Technology and War: From 2000 BC to the Present*, revised ed., The Free Press, New York, 1991, pp. 1 and 3.

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> Technology has been the primary source of military innovation throughout history. It drives changes in warfare more than any other factor. … However much technology may change warfare, it never determines warfare – neither how it will be conducted nor how it will turn out. Technology presides in warfare, but it does not rule.[74]

In Roland's view, technology opens doors, though it is another matter whether societies pass through them. In relation to military technology in particular, there have been marked differences in the readiness of different societies, often due to cultural factors, to walk through particular doors. The initial development of gunpowder in China, but its rapid adaptation for military purposes in Europe, is perhaps one of the most prominent examples. Thus when assessing the impact of technology on warfare one must consider it alongside political, economic, cultural and other factors. This is by no means a simple exercise.

What complicates matters further is the associated dispute about the continuity of change in warfare. In the 1990s, the notion of "revolutions in military affairs" (RMAs) gained currency, suggesting that changes in military affairs happen, as it were, in bursts – that they are concentrated over relatively short periods of time rather than taking place at a steady pace. The original concept of RMAs related quite specifically to technological change, though later iterations regarded technological change as only one of the factors facilitating changes in warfare.

The notion of RMAs – later rebranded "military transformations" – became the subject of enormous controversy.[75] However, as historian Jeremy Black has noted, RMA is "at once description, analysis, prospectus and mission; and much of the confusion surrounding the use of the term reflects a failure to distinguish between these aspects of the situation."[76] The concept has proven particularly contentious when used as a "prospectus and mission" to advocate for a change in military technology, tactics or something else in order to gain the upper hand in an apparent RMA, and that change has failed to yield the anticipated advantages. The concept has been put to a better use when, rather than in an attempt to predict the future, it has been applied descriptively and analytically to developments in warfare with some hindsight. This is, for example, what Max Boot did in his excellent *War Made New: Technology, Warfare, and the Course of History*.[77]

The difficulties of assessing changes in the law of war in light of technological change are formidable, especially when it comes to changes in the technology-neutral and technology-indifferent rules that characterize international humanitarian law.

74 Alex Roland, "War and Technology", *FPRI FootNotes*, Vol. 14, No. 2, 2009, available at: www.fpri.org/articles/2009/02/war-and-technology.

75 For a recent discussion, see Jeffrey Collins and Andrew Futter (eds), *Reassessing the Revolution in Military Affairs: Transformation, Evolution and Lessons Learnt*, Palgrave Macmillan, New York, 2015.

76 Jeremy Black, "The Revolution in Military Affairs: The Historian's Perspective", *The RUSI Journal*, Vol. 154, No. 2, 2009, p. 98.

77 Max Boot, *War Made New: Technology, Warfare and the Course of History, 1500 to Today*, Gotham, New York, 2006.

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Not only does one have to rely on a sketchy legal history, but one also gets drawn into highly polarizing debates about the impact of technology on warfare. That said, two major innovations in weapons technology could be mentioned that arguably had a completely different impact on the law.

The first of these was gunpowder. Along with knightly warfare of the European Middle Ages, there had developed a "law of arms" which encompassed codes of chivalry and some ancient customs, such as the protected status of heralds. This law of arms only applied between knights – the wealthy, cosmopolitan and Christian warrior elite. Lowly foot soldiers and other common folk, not to mention non-Christians during the Crusades, could expect little benefit from chivalric ideals. The so-called "gunpowder revolution" (*circa* 1500–1700) dealt a decisive blow to the mounted combatants of the Middle Ages, supplanting them with "infantrymen armed with missile weapons, first the longbow, then arquebuses and muskets".[78] Whatever may have been the practical effect of chivalric ideals – by most accounts it was rather limited – a regulatory system based on class could not survive into the gunpowder era. The chivalric law of arms was shadowed and subsequently overtaken by codes of conduct promulgated for particular military operations.[79] These became the predecessors of contemporary codes of military discipline. In short, the technological change impacted on the conduct of warfare, which led to a change in the regulatory framework. Technology contributed to the development of a law of war that was more equal and universal in its application than the law of arms.

The innovation that ought to be mentioned in comparison is the "atom bomb". There is no doubt that nuclear weapons represented an enormous technological change in the warfighting capabilities of States. Appropriately, nuclear weapons were subsequently caught in an elaborate, if incomplete, net of technology-specific disarmament and non-proliferation measures.[80] In parallel with these developments, some issues arose concerning the application of the law of war.

First, a number of States expressed their understanding that Additional Protocol I was not intended to govern nuclear weapons.[81] In the *Nuclear Weapons* Advisory Opinion, however, the International Court of Justice confirmed that the use of nuclear weapons would have to be "compatible with the requirements of the international law applicable in armed conflict, particularly those of the principles and rules of international humanitarian law".[82] What this means is that those progressive rules of Additional Protocol I that have

78 *Ibid.*, pp. 17–105.
79 S. C. Neff, above note 36, pp. 74–75.
80 For an overview, see e.g. Dieter Fleck, "Nuclear Weapons", in Rain Liivoja and Tim McCormack (eds), *Routledge Handbook of the Law of Armed Conflict*, Routledge, Abingdon, 2016.
81 See declarations made on signature by the United Kingdom and the United States, and on ratification by Belgium, Canada, France, Germany, Ireland, Italy, the Netherlands, Spain and the United Kingdom.
82 International Court of Justice, *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, *ICJ Reports 1996*, para. 105(2)(D).

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not entered the body of customary international law remain inapplicable to nuclear weapons.[83]

Second, the ambiguity of the *Nuclear Weapons* Advisory Opinion generated enormous controversy. As is well known, the Court opined that the use of nuclear weapons "would generally be contrary" to the rules of international law applicable in armed conflict.[84] Yet the Court felt unable to "conclude definitively whether the … use of nuclear weapons would be lawful or unlawful in an extreme circumstance of self-defence, in which the very survival of a State would be at stake".[85] This could be read as suggesting that "extreme circumstances of self-defence" would permit the law of war restrictions to be set aside, a proposition wholly inconsistent with the basic tenets of the law of war. Such a reading was, however, not put before the Court by States and, in any event, has been roundly rejected in subsequent writings.[86]

These issues notwithstanding, nuclear weapons did not lead to a substantive change in the law of war. Why? One possible explanation is that, despite changing the strategic landscape, nuclear weapons did little to alter the mundane – indeed, "conventional" – form of warfare. As Andrew Ross has noted, "[t]he nuclear revolution had greater strategic than operational or tactical war-fighting implications. It has been about deterrence and how we think about deterrence rather than war-fighting."[87]

The significance of history

Gregory Mandel has noted that "[s]tudying how prior law and technology issues were handled, and particularly how they were sometimes mishandled, provides valuable lessons for responding to current and future law and technology issues as they arise".[88] This rings true for the law and war and military technology as well. So what could be learned? Given the range of military technologies, both past and present, it would be audacious for a short paper such as this to proclaim definitive "lessons" that should be learned from history, or even to outline a

83 For a discussion and further reference, see Julie Gaudreau, "The Reservations to the Protocols Additional to the Geneva Conventions for the Protection of War Victims", *International Review of the Red Cross*, Vol. 84, No. 849, 2003.

84 International Court of Justice, *Legality of the Threat or Use of Nuclear Weapons*, Advisory Opinion, *ICJ Reports 1996*, para. 105(2)(E).

85 *Ibid.*

86 See e.g. Timothy L. H. McCormack, "A *non liquet* on Nuclear Weapons: The ICJ Avoids the Application of General Principles of International Humanitarian Law", *International Review of the Red Cross*, No. 316, 1997; Dapo Akande, "Nuclear Weapons, Unclear Law? Deciphering the Nuclear Weapons Advisory Opinion of the International Court", *British Yearbook of International Law*, Vol. 68, 1997, pp. 208–210.

87 Andrew L. Ross, "The Role of Nuclear Weapons in International Politics: A Strategic Perspective", *FPRI FootNotes*, March 2009, available at: www.fpri.org/article/2009/03/the-role-of-nuclear-weapons-in-international-politics-a-strategic-perspective.

88 Gregory N. Mandel, "History Lessons for a General Theory of Law and Technology", *Minnesota Journal of Law, Science & Technology*, Vol. 8, No. 2, 2007, p. 552.

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methodology for figuring out such lessons. However, there are a few general observations that can be made with relative safety.

Regularity of technological shocks

The law of war has been challenged by new technologies over and over again. Many technologies – especially weapons – have been perceived, at least initially, to be somehow at variance with the existing law. According to Best,

> [t]he history of warfare has been repeatedly punctuated by allegations that certain new weapons are "unlawful", because in some way "unfair" by the prevailing criteria of honour, fairness and so on, or because nastier their action than they need be.[89]

Best suggested that "[i]t is more often [the] unaccustomedness and immediate effectiveness [of a new weapon] that draws obloquy rather than objectively measurable nastiness."[90] He concluded rather glumly that "whatever the nature and strength of the objections at first encountered, [new weapons] slip into common use as soon as the objectors can acquire them for themselves, whereupon the law adapts accordingly".[91]

Whether Best was indeed correct about the adaptation of the law is really beside the point. What matters is that technological change is not a new type of challenge for the law of war. The allegedly precarious situation that the law currently finds itself in is not novel. What might well be true, however, is that technological change is occurring much faster now than previously, thereby exacerbating the problem that law tends to lag behind technology.

Effectiveness of regulation

Previous encounters between law and technology give some indication about the resilience of the law in the face of new technologies and the effectiveness of legal solutions adopted in relation to such technologies.

In a domestic law context, there has been much talk about the desirability of technology-neutral law to help withstand technological change.[92] This is also an important issue for the law of war. In some instances, the law has been so specific as to be easily rendered inapplicable. The obvious example is the prohibition of gas warfare. The first prohibition on the use of gas in warfare was in the 1899 Hague Declaration where the contracting States agreed "to abstain from the use of projectiles the sole object of which is the diffusion of asphyxiating or deleterious gases".[93] During the First Word War this undertaking was plainly

89 G. Best, *Humanity in Warfare*, above note 32, p. 62.
90 G. Best, *War and Law*, above note 32, p. 23.
91 *Ibid.*, p. 24.
92 For a discussion, see e.g. B.-J. Koops, above note 56; C. Reed, above note 68.
93 Hague Declaration (IV, 2) on the Use of Projectiles the Object of Which is the Diffusion of Asphyxiating or Deleterious Gases, 187 CTS 453, 29 July 1899 (entered into force 4 September 1900).

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breached by the use of gas-filled artillery and mortar shells.[94] However, belligerents also sought ways to circumvent the prohibition. The Germans devised "a gas shell … that also contained an explosive charge for producing a shrapnel effect" such that it was not the shell's *sole* object to diffuse gas.[95] The belligerents also gassed each other (and occasionally themselves) by releasing chlorine and phosgene gas from cylinders, rather than by means of gas-dispersing *projectiles*.[96] It is no coincidence that the 1925 Geneva Protocol introduced a more comprehensive prohibition: it banned the "the use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices".[97]

At the same time, highly technology-neutral law might not work well on the international plane. Institutional deficiencies of international law may well make it easier to ensure compliance with technology-specific law. In particular, the more technology-specific the rules on weapons or other means of warfare, the easier it might be to design effective disarmament verification and non-proliferation measures. For example, it is difficult to envisage a workable international verification regime for all indiscriminate or superfluously injurious weapons. Verification measures would likely bog down as a result of disputes about what weapons are covered by the prohibition.

That being the case, there arises an important question about the most effective balance between technology-neutral and technology-specific rules. The Chemical Weapons Convention provides the most elaborate example of one workable model. On the one hand, the Convention contains a comprehensive prohibition on the development, production, stockpiling and use of "chemical weapons".[98] Such weapons are, in turn, defined by reference to "toxic chemicals", which encompass substances that through "chemical action on life processes can cause death, temporary incapacitation or permanent harm to humans or animals".[99] Verification measures, on the other hand, apply to chemicals that have been listed in an annex to the Convention.[100] Thus the Chemical Weapons Convention marries rules that have different degrees of technology-specificity in order to create a broad but workable regime.

Weapons, weapon systems and military technology

Focus on weapons can be misleading. Admittedly, as suggested above, the adoption of projectile weapons and particularly gunpowder played a role in bringing to an end

94 See e.g. Kim Coleman, *A History of Chemical Warfare*, Springer, Berlin, 2005, pp. 27ff.
95 *Ibid*., p. 14; see also Ulrich Trumpener, "The Road to Ypres: The Beginning of Gas Warfare in World War I", *Journal of Modern History*, Vol. 47, 1975, p. 468.
96 K. Coleman, above note 95, pp. 16ff; see also U. Trumpener, above note 96, p. 468.
97 Protocol for the Prohibition of the Use of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare, 94 LNTS 65, 17 June 1925 (entered into force 8 February).
98 Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction, 1974 UNTS 45, 13 January 1993 (entered into force 29 April 1997), Art. I.
99 See *ibid*., Arts II(1) and (2).
100 See *ibid*., Annex on Chemicals.

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the era of medieval warfare, but in other instances, a single weapon technology has not had that impact. As Schmitt notes, "fully understanding combat operations requires consideration of *all* the technologies having a direct causal relationship to weapons employment".[101] In other words, one needs to consider weapon systems. This is certainly true in a historical perspective. Thus the adoption of the stirrup – not in itself a weapon – led to the development of what was effectively a weapon system – a mounted knight with a forward-pointing lance – and the beginning of the era of medieval warfare.

One might even need to take a step further. The technological shifts that have shaped warfare from 1800 onwards have been characterized by broader changes in technology. Thus for example, the "first industrial revolution" in warfare (1856–1914), as described by Boot, notably led to the development of rifled artillery and automatic firearms.[102] However, perhaps an even greater impact was made by the introduction of the steam engine, which facilitated the building of railroads and factories, which in turn made it possible to move and equip large conscription-based armies. More obviously, perhaps, digital computing has impacted on military affairs in a myriad of ways, not only in relation to weapons or even weapon systems.

Newness of technology

The novelty of particular technology must inevitably be assessed within a historical frame of reference. After all, things are new only in relation to things that are old. However, it is easy to overestimate the newness of technology without adopting a sufficiently broad frame of reference. (A related difficulty has to do with the danger of being blinded by technological achievements, especially when scientific and technical experts are all testifying to new abilities.[103]) Perhaps the debate around UAVs has so far most benefitted from the adoption of a more historical perspective. Commentators have noted the continuity between UAVs and pre-existing technologies,[104] and drawn attention to earlier controversies about increasing distance between the adversaries in conflict.[105] This approach has highlighted that UAV technology is novel only to a degree. Arguably, the novelty of the currently ongoing technological change – ranging from robotics to biotechnology – has to do with the unique combination of multiple technologies, rather than the development of any single technology. However, something similar can be found in previous technological shifts. The first industrial revolution mentioned earlier also involved a range of technologies.

101 M. N. Schmitt, above note 22, p. 142.
102 M. Boot, above note 77, pp. 107–201.
103 G. N. Mandel, above note 88, pp. 559–563.
104 See e.g. P. W. Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century*, Penguin Press, New York, 2009, p. 46ff; Sarah E. Kreps, *Drones: What Everyone Needs to Know*, Oxford University Press, Oxford, 2016, pp. 9–12; see also Rain Liivoja, Kobi Leins and Tim McCormack, "Emerging Technologies of Warfare" in R. Liivoja and T. McCormack (eds), above note 80.
105 Stephanie Carvin, "Getting Drones Wrong", *International Journal of Human Rights*, Vol. 19, No. 2, 2015.

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A related issue is that of "newly controversial" as opposed to "new" technology.[106] In the context of military technology, landmines provide an example. Non-explosive forerunners of landmines – nasty contraptions involving hidden pits with stakes in them – were used several millennia ago.[107] A closer predecessor of the modern landmine, a pressure-operated explosive device, was introduced in the 1700s and became widely used during the American Civil War.[108] Yet it was only in the 1970s that sufficient consensus appeared as to the need to restrict their use, leading to the adoption of Protocol II to the Conventional Weapons Convention.[109] It took another 17 years for a comprehensive ban on anti-personnel mines to be agreed upon in the form of the Ottawa Convention.[110]

The factors leading up to this development cannot be fully explored here. Suffice it to say that the desirability of limiting the use of landmines came about as a consequence of the large numbers of civilians being wounded or killed by landmines. That in turn may be attributed to two factors: the development of compact landmines that could be dropped from aircraft to create large mine fields, and the increased presence of civilians in or near battlespaces. Thus a combination of technological factors and overall changes in the character of warfare created a humanitarian catastrophe, which made the landmine "newly controversial".

Concluding remarks

In his recent book *Future War*, Christopher Coker makes a compelling case for future-gazing through science fiction. Science fiction writers tend to analyse contemporary trends and stretch them beyond the present, thus offering, as Coker puts it, "a line of sight into the future".[111] Furthermore, science fiction can become a "self-fulfilling prophecy" such that its authors not so much predict the future but actually shape it.[112] Importantly, as Coker also points out, "science

106 This notion derives from Thérèse Murphy, "Repetition, Revolution and Resonance", in Thérèse Murphy (ed.), *New Technologies and Human Rights*, Oxford University Press, Oxford, 2010, p. 8.
107 See Mike Croll, *The History of Landmines*, Pen & Sword, Barnsley, 1998, pp. 4–5.
108 *Ibid*., pp. 10 and 15.
109 Protocol on Prohibitions or Restrictions on the Use of Mines, Booby Traps and Other Devices annexed to 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, 1342 UNTS 168, 10 October 1980 (entered into force 2 December 1983).
110 Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personal Mines and on the Destruction, 2056 UNTS 211, 18 September 1997 (entered into force 1 March 1999). See also Protocol on Prohibitions or Restrictions on the Use of Mines, Booby-Traps and Other Devices as amended on 3 May 1996 (Protocol II, as amended on 3 May 1996), annexed to 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, 2048 UNTS 93, 3 May 1996 (entered into force 3 December 1998) (distinguishing between anti-tank and anti-personnel landmines, and placing further restrictions on the use of the latter).
111 Christopher Coker, *Future War*, Polity, Cambridge, 2015, p. 15.
112 *Ibid*., p. 29.

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fiction in particular penetrates the social imaginaries of the military".[113] As a result, one can ill afford to dismiss science fiction when considering possible emerging military technologies and the regulatory challenges that they may create.

Likewise, one cannot neglect history books. The literature on past advances in military technology, and the role of this technological change in shaping warfare, is rich and fascinating.[114] Regrettably, this is not matched by the history of the law of war, which remains dominated by a very particular evolutionary tale that opens with the feats of Messrs Lieber and Dunant, and fixates on the notion of "humanity". While this can make a historically informed examination of the interaction between military technology and the law of war difficult, this enquiry appears to hold considerable promise.

This paper has consciously avoided passing judgement on whether a Geneva Convention on cyber-warfare or a Hague Convention on remotely controlled weapons systems would be desirable. To do so in such a short paper would be presumptuous and disrespectful to the vast number of commentators who have given careful thought to the regulation of emerging military technologies. It is submitted, however, that only by having regard to the continuous evolution of military technology and the law of war can one properly evaluate the seriousness of new challenges and the adaptability of the law.

113 *Ibid.*, p. 28.
114 See in particular, R. L. O'Connell, above note 26; M. van Creveld, above note 73; M. Boot, above note 77.

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