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AUTONOMY IS THE NEW BLACK – THE ETHICAL DEBATE SURROUNDING AUTONOMOUS VEHICLES AND LETHAL AUTONOMOUS WEAPON SYSTEMS

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JCSP 44

Exercise *Solo Flight*

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Introduction

Whether we like it or not autonomy is coming. Society's appetite for everything tech and possessing the next big thing that simplifies our lives, is voracious. Whether it's a smart phone that's essentially a personal secretary, a fitness coach worn on your wrist or a search engine that tells you what you want to look up before you even know you want it. Soon we may be sharing our pavements, offices, battlefields and even our homes with robots doing our dull or difficult tasks. If you are still wondering what the next big trend will be, it's autonomy; autonomy is the new black!

There is broad debate ongoing related to the ethics of autonomous system programming specifically regarding decision making which could harm humans. This paper will address two specific areas of this debate, firstly the use of artificial intelligence (AI) in the development of autonomous vehicles (AV) and secondly in the development of lethal autonomous weapon systems (LAWS).

The question this paper seeks to address is whether the ethical debate surrounding AV relates to that of LAWS. Although both fields of research relate to the morality of having robots make life or death decisions, the focus of ethical debate differs. In the commercial, private, AV sector the question centres on *how* to program AV to act ethically. Whereas, the state centred, public sector LAWS question seeks to address *whether* it is ethical to programme weapons to act autonomously.

In this paper, the core issues at the centre of each of these ongoing debates will be analysed to draw out the predominant theories. Potential reasons for the divergence in ethical focus will then be proposed. Additionally, any synergies and areas of overlap between these fields will be highlighted. It will be demonstrated that the underpinning reasons for the divergence in ethical debate between these two applications of autonomy are; potential for harm, consumerism and societal perception. Although the question of whether autonomous weapons are ethical or legal has yet to be resolved, technological pull, risk aversion to military casualties and the arms race push of leading military powers will likely drive proliferation. In the absence of regulation to govern the development of autonomous systems, consumer preference and profit maximisation will drive AI programming models not ethical ideals.

The Ethical Debate on Autonomous Vehicles

> *In the future, moral philosophy will be a key industry sector... You would want [robots] preloaded with a pretty good set of values… So presumably the robot companies will get their values loaded into the robot from a values company.*
>
> - Stuart Russel, *Why Moral Philosophy Will Be Big Business In Tech*

The first driverless car licence in the US was awarded to Google by the state of Nevada in 2012. Since then autonomous vehicle trials in Silicon Valley, Las Vegas and Europe have

become increasingly common as this intelligent mobility market projected to be worth 100 billion dollars US globally by 2025, gains pace.[1]

As the AV juggernaut careens down the highway towards us, the moral question, which is yet to be satisfactorily answered, is how to programme AI to think and act ethically in an unavoidable crash scenario. In the groundswell of public hype and political support, the question of *if* this technology should be allowed, appears to have been left eating the proverbial dust.

In 2014, the international Society of Automotive Engineers (SAE) proposed five levels of automation; five being full automation with no steering wheel. It is defined as, "The sustained and unconditional . . . performance by an automated driving system of the entire [driving task] . . . without any expectation that a user will respond to a request to intervene."[2] Using advanced sensors and radars, several autonomous capabilities are already integrated into current vehicles. These include automatic forward collision braking, lane-keep assist, automatic parking and the most advanced, Tesla's autopilot, which can drive the car but still requires human oversight.[3]

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[1] Mary Slosson, "Google Gets First Self-Driven Car License in Nevada," *Reuters,* 8 May 2012, last accessed 29 April 2018*, https://www.reuters.com/article/uk-usa-nevada-google/google-gets-first-self-driven-car-license-in-nevada-idUSLNE84701320120508*

[2] American National Standards Institute, "Defining Self-Driving Cars and Automated Systems in SAE J3016," *ANSI* (blog) last modified 3 November 2016, https://blog.ansi.org/2016/11/defining-automated-vehicle-system-sae-j-3016/. Most cars are between levels zero and two, with autopilot-enabled cars like Tesla at level three, known as "conditional automation," which requires the driver to monitor the road and take over when requested.[2] Level four, "high automation," is already being trialled by market leaders including Google.

[3] Autotrader, "7 Self-Driving Car Features You Can Buy Now," November 2016, last accessed 24 April 2018, https://www.autotrader.com/best-cars/7-self-driving-car-features-you-can-buy-now-and-so-259333. Currently available car automation includes; automatic forward collision braking detects imminent frontal collision, alerts the driver and applies the brakes; lane-keep assist automatically steers the car back into its lane should it start to drift out; road-sign recognition automatically captures sign information including speed limits and relays it to the driver; adaptive cruise control will slow down or speed up based on traffic, automatic parking detects an appropriately sized parking space and steers the car into it; steering assist can take over driving for a limited period usually seconds to minutes before handing control back to the driver, this is not as advanced as Tesla's autopilot which provides near-full autonomous driving (level 4) although it currently still requires human oversight.

The anticipated benefits of AV include enhanced safety, reduced congestion, reduced emissions, better mobility options for the disabled or elderly and enhanced commuter productivity.[4]

In 1967, philosopher Philippa Foot proposed an ethical thought experiment known as the trolley problem. This invited readers to choose who lived and who died, a group of five or just one, in a runaway trolley scenario.[5] Ninety percent of participants surveyed opted for a utilitarian approach and saved the five.[6] Utilitarian ethics advocates pursuing the course that offers the greatest good for the greatest number, or does the least harm.[7] Further studies, adding contextual information about the potential victims, found that participants' responses varied dramatically.[8] What constitutes least harm and who is most worthy of saving is subjective; what if the five are all pensioners and the one is a child. This point highlights the evolving, socially constructed beliefs that inform human judgment. The conundrum for AV programmers is replicating that complexity in code to enable a robot to *act* ethically. Various derivations of the trolley problem have been proposed to frame the evolving "machine ethics" discussion.[9]

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[4] Todd Litman, *Autonomous Vehicle Implementation Predictions: Implications for Transport Planning*, Victoria Transport Policy Institute, 27 February 2017, 1, last accessed 24 April 2018, http://leempo.com/wp-content/uploads/2017/03/M09.pdf)

[5] Philippa Foot, "The Problem of Abortion and the Doctrine of Double Effect, " *Oxford Review* Number 5, (1967). A runaway trolley is heading down a track towards five people. An observer is standing next to a switch, which could divert the trolley onto another track where one person is standing. The only way to save the group is to divert the trolley killing the one. Should the driver take an action to change tracks and sacrifice one person to save the five on the trolley's present course?

[6] Bryan Casey, "Amoral Machines, or How Roboticists Can Learn to Stop Worrying and Love The Law," North Western University Law Review 111, no. 5 (2017): 1353.

[7] David Copp, *The Oxford Handbook of Ethical Theory*, Oxford University Press 2006, 428.

[8] Iyad Rahwan, "What Moral Decisions Should Driverless Cars Make?" TEDx video, Cambridge, September 2016, last accessed 29 April 2018, https://www.ted.com/talks/iyad_rahwan_what_moral_decisions_should_driverless_cars_make

[9] Casey, "Amoral Machines . . ., 1356.

Social scientist Iyad Rahwan coauthored a study in 2016 with 2000 participants to explore AV ethics.[10] The study proposed six thought experiments including one involving an AV approaching a pedestrian crossing when the brakes malfunction. The car has the options of hitting 10 pedestrians on the crossing, or swerving into a wall and sacrificing the passenger. The results revealed that 76 percent of participants favoured the utilitarian view that it was more ethical to sacrifice the one passenger than the many pedestrians, and that this was the AV they wanted society to adopt.[11] However when asked whether they would buy a car such a car, the answer was overwhelmingly, no. They wanted to drive a car that prioritized their safety at all costs, but everyone else to drive the utilitarian variant that would minimize harm.[12] Herein lies the problem for ensuring ethical behaviour in an AV market that will be driven by consumer choice. This example highlights two perspectives that form a central argument in the AV ethical debate; should they be programmed to minimize total harm (utilitarian) or to prioritize client safety. This self-preservation perspective, which does not follow any specific ethical theory, could ultimately be self-defeating. Immanuel Kant's theory of categorical imperative could portend the potential consequences of a universal adoption of this approach. Kant's theory states: "Act only on that maxim through which you can at the same time will that it should become a universal law."[13] If all road users are acting in their own self-interest, in willing violation of the categorical imperative, the result is self-defeating; our roads ultimately become safe for no one.[14]

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[10] Jean-François Bonnefon, Azim Shariff, and Iyad Rahwan, "Autonomous Vehicles Need Experimental Ethics: Are We Ready for Utilitarian Cars?" *Computing Research Repository* (2015): 1.

[11] *Ibid.*

[12] Rahwan, What Moral Decisions Should Driverless Cars Make . . .,video.

[13] Copp, *The Oxford Handbook of Ethical Theory* . . ., 28. Kant classed the Categorical Imperative as the fundamental principle of morality; it consists of several formulations of which this is one.

[14] Hardin Garrett, "Tragedy of the Commons," *The Concise Encyclopedia of Economics*, last accessed 7 May 2018, http://www.econlib.org/library/Enc/TragedyoftheCommons.html. This social dilemma can also be likened to William Forster Lloyd's "Tragedy of the Commons," which refers to a shared-resource system within

Rahwan *et al*. highlight the formidable challenge of defining algorithms to guide AV faced with these moral dilemmas. They propose that these algorithms must meet three likely incompatible objectives, ". . . [consistency], not causing public outrage and not discouraging buyers."[15] They also call for developers and regulators to engage with philosophers in developing this field of experimental ethics.

Brian Casey proposes that it is not ethics but law that should be used as a framework to program driverless car AI, invoking Justice Oliver Wendell Holmes' "bad man" theory.[16] Casey asserts that philosophical concepts like the trolley problem are a poor means of understanding robotics-engineering problems as profit-seeking firms will be incentivized to operate within legal constraints versus ethical ones. Holmes described the legal system's ability to give a "bad man . . . as much reason as a good one" to behave morally. Observing that the "bad man . . . who cares nothing for . . . ethical ideals. . . is likely nevertheless to care a good deal to avoid being made to pay money, and will want to keep out of jail if he can."[17] Through legal incentives therefore even amoral actors, in this case robots could be made to behave indistinguishably from moral ones.[18]

Santoni de Sio offers the US legal "doctrine of necessity" as a guideline for AI programming regulation. This doctrine regulates emergency cases in which "human agents have intentionally caused damages to life and property in order to avoid other damages . . . when avoiding all evils is deemed to be impossible."[19] He cautions against using simple utilitarian

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which individual users act according to their own self-interest, contrary to the common good, spoiling the resource for all.

[15] Bonnefon, Shariff, and Rahwan, Autonomous Vehicles Need Experimental Ethics . . ., 1.

[16] Casey, "Amoral Machines . . ., 1356.

[17] Oliver Wendell Holmes, The Path of Law, *Harvard Law Review* 10 (1897): 457, 459.

[18] Casey, "Amoral Machines . . ., 1362.

[19] Filippo Santoni de Sio, "Killing by Autonomous vehicles and The Legal Doctrine of Necessity," *Ethical Theory Moral Practice* 20 (2017): 413.

calculi to inform AI decision-making, citing the problem of incommensurability. This concerns the inherently flawed concept of attempting to assign comparative value to lives.[20] Subjective at best, in emergency circumstances, there may not be the time or information available to make a proper evaluation and assess long-term "less visible harms" or consequences of an action.[21] Although robots may be better than humans at evaluating visible factors of "value" in terms of age, sex and wealth, de Sio is concerned with the long-term (negative) societal effects of rules and policies permitting or encouraging certain unforeseen behaviours. He does however propose that simple utilitarian calculi could be useful for AV reasoning in property versus life sacrifice scenarios.[22]

The trolley problem is black and white, one or another group will die; however, decisions are rarely that clear-cut. A human driver might make a course change in good faith, with "right intention," having some reasonable expectation that the person in the way of the new course could escape harm.[23] The concept of right intention could come into effect in apportioning liability or culpability.[24] The complication with AV is how to program right intention reasoning and, how to determine whether a robot acted with right intention. It can be assumed that AI machine learning would be necessary, however, how can programmers be certain that the lessons being learned are ethically sound? Microsoft's Tay chatbot launched onto twitter as an AI

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[20] *Ibid*., 419.
[21] *Ibid*., 418.
[22] *Ibid*., 419
[23] Uwe Steinhoff, "Just Cause and Right Intention," Journal of Military Ethics 13, no. 1 (Winter 2014): 32.
[24] Peter Cane, *Responsibility in Law and Morality,* (Oxford :Hart, 2002), 102.

learning experiment in 2016. Tay evolved from tweeting "humans are super cool" to being a racist, misogynist anti-Semite in under 24 hours.[25]

A benefit frequently highlighted by AV supporters is the expected reduction in road traffic accidents (RTA). Following the fatal crash in March 2018 involving a Tesla car operating in autopilot mode, Elon Musk stated that although Tesla's Autopilot "will never be perfect," in the long term is it expected to "reduce accidents by a factor of 10."[26] Rahwan has also asserted this, highlighting that AVs could eliminate up to 90 percent of accidents - that proportion attributed to driver error - which kills 1.2 million people worldwide annually.[27] He proceeds to ask that if an AV solution that eliminates 99 percent of accidents could be established in the next 10 years but it is not ethically ideal, should it be used? If achieving the final one percent takes 60 years, should we wait and sacrifice the 60 million people worldwide that are predicted to die in accidents between now and then?[28] This argument has been used to suggest that even in the absence of a fully resolved ethical programming model, it would be unethical not to adopt the technology early, when so many lives are at stake.[29] Developers and lawmakers, have extended the utilitarian argument of minimizing harm as justification for expediting AV development and amending traffic law to accommodate AV road trials.[30] In the face of such inalienable logic,

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[25] Ian Johnston, "AI Robots Learning Racism, Sexism and Other Prejudices from Humans, Study Finds," *The Independent*, last modified 13April 2017, https://www.independent.co.uk/life-style/gadgets-and-tech/news/ai-robots-artificial-intelligence-racism-sexism-prejudice-bias-language-learn-from-humans-a7683161.html

[26] Elon Musk, interview by Gale King, 13 April 2018, "Tesla CEO Elon Musk Addresses Autopilot System Safety Concerns," CBC News, last accessed 24 April 2018, https://www.cbsnews.com/news/tesla-ceo-elon-musk-addresses-autopilot-safety-concerns/

[27] Rahwan, What Moral Decisions Should Driverless Cars Make . . .,video.

[28] Rahwan, What Moral Decisions Should Driverless Cars Make . . .,video.

[29] *Ibid*., video.

[30] Andrew J. Hawkins, "California Green Lights Fully Driverless Cars For Testing on Public Roads," The Verge, last modified 26 February 2018, https://www.theverge.com/2018/2/26/17054000/self-driving-car-california-dmv-regulations.

ethical solution or no, it is impossible to ignore the influence and growing momentum of the AV juggernaut.

The Ethical Debate on Lethal Autonomous Weapon Systems

> *. . . the tendency to destroy the adversary which lies at the bottom of the conception of War is in no way changed or modified through the progress of civilization.*
>
> - Carl von Clausewitz, On War

The ongoing ethical debate pertaining to LAWS focuses on *whether* it is ethical to program robots to autonomously select and engage human targets. The ethical arguments related to LAWS are extensive, therefore this paper will provide a summary of the principle arguments only.

As with AV, some semi-autonomous military capabilities already exist, such as the Phalanx ship-borne anti-aircraft guns and Brimstone fire and forget missiles.[31] There is ongoing lively debate surrounding what constitutes autonomy and some claim that LAWS are no ethically different to cruise missiles.[32] The focus here will be on fully autonomous weapon systems, for which there has been extensive debate regarding a definition.

In an attempt to exclude the class of semi-autonomous weapons described, philosopher Robert Sparrow offers the following definition:

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[31] Robert Sparrow, "Robots and Respect: Assessing the Case Against Autonomous Weapon Systems," *Ethics & International Affairs* 30, no. 1 (2016), 95.

[32] Ryan Jenkins and Duncan Purves, "Robots and Respect: A Response to Robert Sparrow," *Ethics & International Affairs* 30, no. 3 (Fall, 2016), 392,393.

> . . . one that is capable of being tasked with identifying possible targets and choosing which to attack without human oversight, and that is sufficiently complex such that, even when it is functioning perfectly, there remains some uncertainty about which objects and/or persons it will attack and why.[33]

LAWS as defined do not yet exist, however several military powers including the UK, US, Russia and China have ongoing billion-dollar development programs.[34] The most ambitious of these are future pilotless fast jets that could be engaging in air-to-air and air-to-ground combat by 2030.[35] The US DoD describe three categories of automation; fully autonomous weapon systems are captured by the third category:

> **Human-in-the-Loop Weapons**: Robots that can select targets and deliver force only with a human command [e.g. Reaper drones];
>
> **Human-on-the-Loop Weapons**: Robots that can select targets and deliver force under the oversight of a human operator who can override the robots' actions; [e.g. Korean border sentry SGR-A1][36] and
>
> **Human-out-of-the-Loop Weapons**: Robots that are capable of selecting targets and delivering force without any human input or interaction.[37]

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[33] Sparrow, Robots and Respect . . ., 95.The first part of Sparrow's definition derives from that of the US DoD however his second part attempts to capture the future class of machines programmed using artificial intelligence and machine learning, to mimic human decision-making and reasoning.

[34] Daniel Cebul, "Do We Need New International Law For Autonomous Weapons?" *Defense News*, last modified 10 April 2018, https://www.defensenews.com/unmanned/2018/04/10/do-we-need-new-international-law-for-autonomous-weapons/.

[35] Unmanned Combat Air Craft (UCAV) have been in development for over 10 years by leading military nations with prototype autonomous flight trials already underway.

[36] The SGR-A1 is a South Korean automated border sentry installed in the Korean demilitarized zone, it can detect, track and engage targets autonomously although currently, a human must give it permission to fire.

Just war theory is central to the argument on the ethical use of LAWS. In outline, just war theory is the principle ethical framework for regulating the conduct of armed conflict. It has two main regulatory frameworks, *just ad bellum* "justice in declaration of war" and *jus in bello* "justice in the conduct of war."[38] The three main criteria for *jus in bello* are distinction, proportionality of means and military necessity.[39] Some opponents of autonomous weapons offer the consequentialist perspective that the ease of deployment of automated weapons, increases the risk of both *jus ad bellum and jus in bello* violations.[40] If states can wage war without the risk of troop sacrifice it dramatically simplifies the cost calculation in terms of "blood and treasure."[41] The concern is that this could lower the bar for resorting to war. It is however with *jus in bello* where the main criticisms lie, these will be explored further in this section.

Supporters of LAWS argue from a consequentialist standpoint that robots will be capable of greater ethical discrimination on the battlefield than human soldiers, which will have the consequence of minimizing total harm.[42] There are also advocates that present a non-consequentialist argument referring to robots' putative superior ability to follow rules or laws, which should minimize non-combatant casualties.[43] Purves, Jenkins and Strawser argue that the deontological principle of not violating the rights of non-combatants under any circumstances

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[37] Human Rights Watch, "Losing Humanity: The Case Against Killer Robots," Human Rights Watch, Nov 2012, last accessed 22 April 2018, https://www.hrw.org/sites/default/files/reports/arms1112_ForUpload.pdf

[38] Alex Leveringhaus, *Ethics and Autonomous Weapons* (London: Macmillan, 2016), 10,12.

[39] *Ibid*., 12.

[40] *Ibid*., 14; Daniele Amoroso and Guglielmo Tamburrini, "The Ethical and Legal Case Against Autonomy in Weapons Systems." *Global Jurist* 17, no. 3 (2017), 2.

[41] Jonathan Swift, *Authors WorksVolume VI - The Publick Spirit of the Whigs*, (Dublin: 1712), 24. Jonathan Swift referred to blood and treasure to describe the human and financial investment a given actor is willing to spend to achieve their goals through armed conflict.

[42] Ronald C. Arkin, "The Case for Ethical Autonomy in Unmanned Systems." *Journal Of Military Ethics* 9, no. 4 (December 2010): 332.

[43] Sparrow, Robots and Respect . . ., 102.

represents a strong moral reason to use LAWS. Presuming that so doing would reduce *jus in bello* violations and "predictably minimize civilian casualties."[44]

Leading LAWS advocate, Professor Ronald Arkin presents both consequentialist and deontological arguments, contending that robots will be capable, of "better-than-human" ethical performance on the battlefield.[45] He asserts that machine superiority in targeting precision, consistency of decision-making and adherence to rules such as the Laws of War; will result in fewer non-combatant casualties and collateral damage.[46] Arkin argues that LAWS will be capable of better battlefield ethical *judgment,* precisely because they are not hampered by human frailties including emotion.[47] Arkin bases his assertion of "better-than-human" ethical performance in part, on human soldiers' historically poor *jus in bello* ethical record.[48] Rosa Brooks, a former US Under Secretary of Defense counselor agrees. She is "fond of killer robots" believing that rights advocates and ethicists are "far too generous" in their assessment of human judgment, and that it is "killer humans" that should be feared.[49]

Arkin's critics, including Sparrow, assert that his expectation of robots possessing the level of discrimination necessary to meet the criteria of *jus in bello* in the near term is over exaggerated. Sparrow claims that, "Arkin systematically underestimates the extent of the

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[44] Purves, Jenkins, and Strawser, Autonomous Machines, Moral Judgment . . ., 398.

[45] Arkin, The Case for Ethical Autonomy . . ., 332.

[46] *Ibid*. The Laws of War are a collective name for internationally agreed laws which govern the conduct of warfare including the Geneva Conventions, International Humanitarian Law and Human Rights Law.

[47] Arkin cites the reasons for robot superiority in coping with the fog of war as, reduced need for self-preservation enabling more risk to be taken in accurate target identification, absence of judgment impairing emotions including fear, sorrow and frustration, resistance to cognitive biases that impair decision-making and; their superior ability to fuse and interpret sensory data to inform decisions on resorting to lethal force. as.

[48] Arkin cites a US Surgeon General Ethics and Mental Health Report (2006) on the behaviour of US Service personnel during Operation Iraqi Freedom, which showed strong correlation between high emotion (anger), mental health and unethical behaviour, including the mistreatment of non-combatants. *Ibid.,* 333.

[49] Rosa Brooks, *How Everything Became War and the Military Became Everything*, (New York : Simon & Shuster, 2016), 135-139.

challenges involved in designing robots that can reliably distinguish legitimate from illegitimate targets in war."[50] He offers that to meet the *jus in bello* criteria of discrimination between, for example a civilian holding an umbrella and a combatant holding a gun or a prone combatant lying in ambush and an injured one now *hors de combat* requires, "agents to reason at a high level of abstraction to be able to make complex contextual judgements."[51] Sparrow is just one of several critics who believe that developers are considerably short of solving this "hard engineering" problem any time soon.[52]

Opponents of LAWS argue that having a robot make decisions on whether to kill humans is morally wrong, and respect for the sanctity of life demands that a human pass that judgment. One argument is that LAWS use would dehumanize victims and, as all human life has intrinsic value, a machine selecting them for execution violates fundamental human dignity.[53] Yale ethicist Wendell Wallach proposes that these weapons under just war theory are *mala in se*, or evil in themselves, violating the *jus in bello* requirement of respect for the humanity of our enemies.[54] This groups them with chemical weapons, mass rape and anti-personal mines, considered evil weapons of war and thus outlawed by numerous states.[55] On these grounds, various organizations including the UN Disarmament Office (UNDO), Human Rights Watch and

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[50] Sparrow, Robots and Respect . . ., 97.

[51] *Ibid*., 101; Cambridge Dictionary, "Hors de Combat," *Cambridge Dictionary Online*, last accessed 1 May 18. https://dictionary.cambridge.org/dictionary/english/hors-de-combat. *Hors de combat* refers literally to "out of combat." In the Laws of War, it refers to a combatant who is no longer taking part in hostilities.

[52] Sparrow, Robots and Respect . . ., 97.

[53] Michael C. Horowitz, "The Ethics & Morality of Robotic Warfare: Assessing the Debate Over Autonomous Weapons." *Daedalus* 145, no. 4 (2016), p31-32.

[54] Wendell Wallach, "Terminating the Terminator: What to Do About Autonomous Weapons," Science Progress, 29 January 2013, last accessed 29 April 2018. https://scienceprogress.org/2013/01/terminating-the-terminator-what-to-do-about-autonomous-weapons/

[55] Morten Dige, "Explaining the Principle of *Mala In Se," Journal of Military Ethics, Vol 11, no.4 2012, 318-332.*

Nobel Peace Laureate**,** Jody Williams through the "Campaign to Stop Killer Robots"**,** have been lobbying for the preemptive prohibition of LAWS.[56]

Political Scientist Michael Horowitz, outlines one of the principle arguments against; that LAWS lack "meaningful human control" which results in a legal and moral accountability gap."[57] If the machine should malfunction and commit a war crime there is no one who can *justly* be held accountable, undermining *jus post bellum*.[58] Sparrow contends that according to International Humanitarian Law it is therefore impermissible to wage war using LAWS, as to do so would "treat our enemy like vermin, as though they may be exterminated without moral regard at all."[59]

A further argument against LAWS cites the virtue ethics perspective on the "anti-codifiability" of morality, in that it is not possible to capture or codify true moral theory in a set of universal rules for anyone, including intelligent thinking robots, to follow. This view originates from John McDowell's 1979 paper in which he references Aristotle's Nicomachean Ethics:

> As Aristotle consistently says, the best generalizations about how one should behave hold only for the most part. If one attempted to reduce one's conception of what virtue requires to a set of rules, then, however subtle and thoughtful one was

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[56] UN, "UN Pathways to Banning Fully Autonomous Weapons," UN Office for Disarmament Affairs, 23 Oct 2017, last accessed 22 April 2018, https://www.un.org/disarmament/update/pathways-to-banning-fully-autonomous-weapons/.

[57] Horowitz, The Ethics & Morality of Robotic Warfare . . ., 30. The term "meaningful human control" is gaining popularity due to the complexities of achieving a widely accepted definition for autonomous weapons.

[58] Leveringhaus, *Ethics and Autonomous Weapons* . . ., 13, 18. *Jus post bellum,* justice in the aftermath of war is a more recent third framework of just war theory.

[59] Robert Sparrow, "Killer Robots," *Journal of Applied Philosophy* 24, no.1, (2007): 62.

> in drawing up the code, cases would inevitably turn up in which a mechanical application of the rules would strike one as wrong . . . [60]

Prominent ethical theorists including the deontologist Kant, also recognize the vital role of moral judgement in moral decision-making.[61] Purves *et al.* argue that AI decision making will be informed through a discrete set of rules provided by humans and as such there is no way for them to reproduce contextual human judgement in the way that Arkin anticipates.[62] The just war theory of right intention, asserts that it is not morally sufficient just to do the right thing, the act must be for the right reasons.[63] Purves *et al.* believe that even if robots could eventually closely mimic human judgement, they would be incapable of possessing human agent beliefs or desires to be "motivated to act morally" such as through human compassion. If they cannot be compelled to act for *reasons* other than programming, then they are incapable of "acting for the right reasons."[64] At best Purves *et al.* claim robots could represent a morally deficient replication of human judgement.[65] At worst, as Professor Paul Saffo stated when addressing the risk of AI exceeding human intelligence, "If we're lucky, they'll treat us as pets . . . and if we're very unlucky, they'll treat us as food."[66]

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[60] John McDowell. "Virtue and Reason." The Monist 62, no. 3 (01 July 1979): 331.
[61] Purves, Jenkins, and Strawser, Autonomous Machines, Moral Judgment . . ., 857.
[62] *Ibid.*
[63] *Ibid*., 860, 863.
[64] *Ibid*., 861.
[65] *Ibid.*
[66] Rhodri Marsden, "Mark Zuckerberg and Elon Musk's Debate Over Artificial Intelligence: Will Robots Go Rogue," *The National*, last modified 3 August 2017, https://www.thenational.ae/arts-culture/mark-zuckerberg-and-elon-musk-s-debate-over-artificial-intelligence-will-robots-go-rogue-1.616530. Paul Saffo is a technology forecaster based in Silicon Valley and a consulting Professor in the School of Engineering at Stanford University.

The principle arguments for and against the development of LAWS originate from across the normative ethical fields of utilitarianism, deontology and virtue ethics, in addition to those from just war theorists. The most compelling arguments in favour stem from the utilitarian perspective of minimizing total harm. A key point of overlap pertinent to both sides of the LAWS debate is whether robots will be capable of the level of discrimination necessary to identify only legitimate targets consistently. Deontologists and virtue ethicists offer the most compelling counter argument; robots, no matter how well programmed will still represent at best, a morally deficient replication of human moral judgement and even if they do the right thing, it could not be for the right reasons.[67]

Reasons for the Diverging Ethical Debate on Private Versus Public Sector Autonomy Applications

The ethical positions related to AV and LAWS summarized above demonstrate some commonalities in terms of seeking to minimize harm, however it also highlights their divergent focus. How one manifestation of AI technology has progressed seemingly unhampered by the question on whether it should be permitted, and the other is the focus of international debate, will be explored in this section.

The most obvious difference is that although both applications involve the use of autonomy, AV will be designed to try to avoid causing harm whilst carrying out its function, whereas LAWS will be designed with the intent of inflicting harm. It is therefore understandable that development of robots for the purpose of killing humans would be highly contested and

meet greater resistance than the use of autonomy in vehicles, even though the latter will affect more people.

The complexity of programming robots to mimic drivers versus highly trained military professionals may be a factor in the diverging ethical debate. For example, driving is easy, billions of people worldwide drive whereas only a relative handful are trained to fly fast jets. As such developing robots to replicate a skill that takes four years of training and costs millions to acquire will be much more complex than designing them to drive, something many could achieve with one week's training. The fact that military professionals are highly trained to make life or death decisions under highly stressful, dynamic conditions, through the fog of war could explain why there remains unease over entrusting this task to a robot.

State support or tacit agreement has also smoothed the path for the introduction of AV technology. Several states have already amended automotive legislation, built model cities for developer trials and testing, permitted trials on public roads and upgraded to smart road furniture, despite the absence of defined AI ethical programming regulations.[68] Governments' rush to get involved could be attributed to the expectation of lower RTA casualty rates, revenues, job creation, taxation or enabling market share capture by national industry. This approach further indicates the powerful influence of market forces. Some of these fiscal motivations could also be true of the global LAWS industry, in terms of national revenue generation. However, it is unlikely to be to the same degree as the AV market, as any arms sales would be largely interstate rather than private consumer generated and therefore a significantly smaller market from which to derive taxation revenues. Moreover, LAWS technology, though it may generate financial

[68] Dino Grandoni, "Among the States, Self-Driving Cars Have Ignited a Gold Rush," *New York Times*, 6 August 2015, last accessed 28 April 2018.

savings for state militaries and armed conflict long term will still come at extraordinarily high cost in terms of Defence budget upfront investment.

Securitization is another factor which could account for the divergent focus in ethical debates. In international relations, this refers to transformation of an issue into a security or existential matter, thereby attracting disproportionate attention.[69] Scholars from both debates, have in fact securitized both AV and LAWS in subtly different ways. As shown in section one, scholars like Rahwad argue we are morally compelled to pursue AV or risk millions more needless RTA deaths.[70] Section two highlighted how scholars lobbying for the prohibition of LAWS such as the UN, have seized upon the risk to humanity's ethical integrity should robots be lawfully permitted to kill humans.[71] Over time however, the LAWS securitization focus may swing in favour of the technology, given society's aversion to friendly troop casualties. Currently, western militaries are experiencing a relatively quiet period in terms of deployments, compared with during the Iraq and Afghan wars (2001 – 2014) when numerous troops were dying or returning with life altering injuries.[72] The political motivation to act to save troop lives and maintain public support for expeditionary operations is therefore currently low. However, scores continue to die on the roads now, lending strong support to the AV case.[73]

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[69] Rens van Munster, " Securitization," Oxford Bibliographies, 26 June 2012, last accessed 28 April 2018. http://www.oxfordbibliographies.com/view/document/obo-9780199743292/obo-9780199743292-0091.xml. Terrorism is a threat routinely securitized by states, despite road traffic accidents or communicable disease accounting for a greater number of deaths.

[70] Rahwan, What Moral Decisions Should Driverless Cars Make . . .,video.

[71] Horowitz, The Ethics & Morality of Robotic Warfare . . .,31-32: UN, UN Pathways to Banning Fully Autonomous Weapons . . .

[72] The Iraq war, Operation Iraqi Freedom 2003-20111; the Afghan war, Operation Enduring Freedom 2001-2014.

[73] Department For Transport, "Road Casualties in Great Britain: Quarterly Provisional Estimates Year Ending June 2017," last modified 26 October 2017, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/654962/quarterly-

LAWS, if successfully developed, will ultimately involve the state application of armed force and as such draws in state agency as a factor. State representatives and public bodies face greater scrutiny than do commercial actors and will be expected to engage in establishing accountability mechanisms to control the evolution and potential deployment of this technology. These accountability mechanisms must be in place before LAWS can be lawfully fielded; this is proving to be less of a constraint on AV. States in the US have passed laws enabling AV trials on their public roads. Regulation of military activity, however, is a national or federal matter and as such is likely to necessitate broader consultation for the amendment of law. Should LAWS be deployed in a future conflict and violate *jus in bello* by failing to apply lethal force in a proportionate or discriminatory manner, or malfunction and kill a number of non-combatants, the political fallout would be devastating. Whereas an automaker facing a comparative catastrophe with AV could rebrand to protect shareholders and profit margins, state institutions cannot. This could impact the public sector autonomy debate in that lawmakers may be reticent to encourage the proliferation of LAWS where the stakes of catastrophic fallout may be perceived to be higher.

In addition to the anticipated profits, the lack of current AV legislation could explain the incentivization for the rapid development of autonomous technological applications in the private versus the public sector. In a cost-benefit analysis, transnational automakers and tech giants might consider it financially preferable to weather a lawsuit downstream, than to miss out on the considerable gains to be made from being first to market. This risk, as exposed by Rahwan *et al*'s study regarding AV consumer preference, underscores the concern that profit-

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estimates-april-to-june-2017.pdf. In the year ending June 2017 there were 176,500 road casualties and 1710 deaths in Great Britain alone.

seeking firms could subvert the ethical debate in favour of product sales.[74] It also supports Casey's argument for pursuing a legally constrained governance model for AI to compel good behaviour.[75]

A seemingly frivolous, though potentially significant contributory factor could be the powerful influence of Hollywood and its sensitizing effect. From an early age, Hollywood has made us yearn for an artificially intelligent car friend like Herbie, or a sophisticated ally like Knight Rider's Kit.[76] At the same time it has taught us to fear the menacing rogue killer robots in Terminator or the 2004 movie iRobot where artificially intelligent robots *learn* to ignore human input in order to protect us from our own destructive nature.[77] Whether conscious or subconscious, what we see in the media and on film is likely to have an influence on broader society's perception of the threats and opportunities presented by autonomy and machine AI. Hollywood portrayal bias could feed into the ethical debate on the use of AI, creating greater reticence to allow its use for war fighting than for commercial applications.

Desensitization through the steady addition of automated features to our vehicles over the last decade may also have influenced the AV debate. Automakers have been exposing us to increasingly indispensable technological features, for example who doesn't appreciate rear cameras or sensors that simplify the vexing task of parking? Through these un-alarming incremental steps, drivers are becoming desensitized and conditioned to accept greater

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[74] Rahwan, What Moral Decisions Should Driverless Cars Make . . .,video.

[75] Casey, "Amoral Machines . . ., 1356.

[76] Oliver Joy, "Driverless Cars: From Hollywood To Real World," *CNN*, last modified 22 November 2013, http://edition.cnn.com/2013/11/21/business/renault-nissan-ceo-wants-driverless/index.html

[77] IMDb, "IRobot Synopsis," *IMDb* (blog), last accessed 7 May 2018, https://www.imdb.com/title/tt0343818/plotsummary.

automation and the steady erosion of human control. Constructivists describe our reality as a social construct, continuously reshaped by evolving ideas rather than fixed by hard laws of nature.[78] It could be argued that tech developers have irrevocably changed our socially constructed environment. Eroding our tech boundaries and building a subtle consumer demand, normatively constituted through our happy existence, has paved the way to usher in a driving experience devoid of human control. This public exposure in the military sphere has begun, but less successfully, through reporting on bomb disposal robots and Remotely Piloted Air Systems (RPAS), described by the media as armed *drones*.[79] The Reaper RPAS, which was used heavily in the Iraq and Afghan conflicts and has been used increasingly outside of the confines of official war fighting.[80] Particularly its prolific use by the CIA in Pakistan and Yemen in pursuit of so-called ISIS (Islamic State in Iraq and Syria) high value individuals has attracted much negative press.[81] If societal sentiment towards machine AI use in war fighting has been impacted by the views expressed in the media it is more likely to have been adverse, which could negatively impact the LAWS debate.

Although the ethical debate on using LAWS is still heavily contested, its development by leading military nations continues at a rapid pace.[82] When these weapons reach sufficient technological maturity, the incentives for global leaders to field them will be significant.

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[78] Copp, *The Oxford Handbook of Ethical Theory* . . ., 41.

[79] EDA, "Remotely Piloted Aircraft Systems – RPAS," European Defence Agency, last modified 24 April 2018, https://www.eda.europa.eu/what-we-do/activities/activities-search/remotely-piloted-aircraft-systems---rpas.

[80] Chris Woods, "CIA's Pakistan Drone Strikes Carried Out by Regular US Air Force Personnel," *The Guardian,* last modified 14 April 2014, https://www.theguardian.com/world/2014/apr/14/cia-drones-pakistan-us-air-force-documentary.

[81] Spencer Ackerman, "41 Men Targeted But 1147 People Killed: US Drone Strikes – The Facts On the Ground," *The Guardian*, last modified 24 November 2014, https://www.theguardian.com/us-news/2014/nov/24/-sp-us-drone-strikes-kill-1147.

[82] Daniel Cebul, "Do We Need New International Law For Autonomous Weapons?" Defense News, last modified, 10 April 2018, https://www.defensenews.com/unmanned/2018/04/10/do-we-need-new-international-law-for-autonomous-weapons/.

Particularly if traditional adversaries also possess the technology, this could spur an arms race akin to the nuclear one. Even if those nations that ascribe to the Laws of War exercise restraint in the use of LAWS, it does not mean that all states will.[83] Fighting a LAWS equipped adversary with conventional means could put that party at a considerable disadvantage. Particularly in aerial combat where an ability to outmaneuver your adversary through faster decision-making could mean the difference between defeat and victory. With this is mind, could any leading military nations seeking to maintain or increase their global power afford not to invest in LAWS? The apparent inevitability of LAWS proliferation signals the importance of establishing meaningful international debate and regulation of these weapons now. That luminaries such as Stephen Hawking and tech field leaders Steve Wozniak and Elon Musk signed a petition to ban military robots capable of AI should signal a cautionary note.[84]

The challenges for public acceptance of AV and LAWS are worlds apart. Most people use some aspect of advanced or intelligent technology in their daily lives like smart phones, smart cars or robot vacuum cleaners. Handing over the reasoning and thinking to a machine for daily chores is less of a mental leap than handing over control of lethal weapons, which few people have any real experience of. Even fewer have experience of war fighting except what Hollywood or the media tells them. Risk of harm, consumerism and perception or fear of the unknown, emerge as the three underpinning drivers in the divergence of the AV and LAWS ethical debates.

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[83] Wallach, Terminating the Terminator: What to Do About Autonomous Weapons," Science Progress, 29 January 2013, last accessed 29 April 2018. https://scienceprogress.org/2013/01/terminating-the-terminator-what-to-do-about-autonomous-weapons/

[84] Joseph Libunao, "Majority Join Musk and Hawking in Call to Ban Autonomous Weapons," Futurism, last modified 12 November 2015, https://futurism.com/majority-join-musk-and-hawking-in-call-to-ban-military-robots-capable-of-artificial-intelligence/.

Conclusion

This paper has illuminated several common areas in the AV and LAWS ethical debates. As yet, no consensus has been reached on what type of ethical model AV or LAWS should be programmed with to inform decision making when confronted with an ethical dilemma. There is a strong case for a utilitarian model of minimizing harm, which in a human life versus property decision would be uncontentious; however, using AI to determine greatest value between lives becomes distinctly problematic. The risk is that, without government regulation, consumer preference for self-preservation and automaker profit, versus ethical ideals will drive AV programming. With the use of LAWS, necessity due to a realist perception of threat from technological overmatch by traditional adversaries may drive their use despite ethical objections. A key point of overlap to both autonomy applications relates to robots' capacity for the discrimination necessary to identify least harm in the case of AV and, with LAWS, only legitimate targets meeting *jus in bello* criteria. Also common to both areas is the purported potential for the superior rule following ability of robots such as with the Highway Code and Laws of War to dramatically reduce casualty rates. This argument may become a compelling driver for the use of autonomy in LAWS as well as AV in the future.

In both applications, scholars have raised the issue of the accountability gap. Should human casualties result from the use of AV or LAWS, the question of who would be legally accountable has not been satisfactorily addressed. There is a need for regulation in both cases, however with BMW and Uber signaling that driverless cars will be ready for consumer use by

2021, there is a pressing need to resolve this issue for AV now.[85] If fully autonomous vehicles should be cleared for use on public roads in the near future, then whatever model of legal accountability is established could prove useful as a template for LAWS. Certainly it would weaken the argument for LAWS prohibition on the grounds of the accountability gap considerably. There are some fundamental differences in autonomous applications between AV and LAWS, which have created the ethical divergence in scholarly debate. It is proposed that the three underpinning reasons are harm, consumerism and perspective. Firstly although both applications seek to minimise harm, fundamentally, one technology is designed to save life and the other to take it. Secondly, the consumerism and market forces associated with possessing the latest technological advancement aids the AV cause, but is lacking with LAWS. Lastly perception: here our socially constructed norms and ideas play a significant role. It is easy to form a positive mental picture of a cautious, alert robotic car driving down a residential street unhindered by tiredness, drink, drugs or cellular phone distractions. It is however impossible to form a mental image of a robotic soldier without imagining killer robots from the Terminator movie. Although there are several other factors affecting the differing focus of these debates, it is proposed that the three summarised are the most influential.

Some interesting areas of future study emerged during this research. The question of whether robots can be classed as lawful combatants under the Laws of War when there is no one that can justly be held accountable for the deaths they might cause, has not been conclusively addressed. A further area of study could be to consider what a common international standards framework for autonomous trade goods, specifically cars, might look like. The European Union

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[85] Eric Adams, "How Long, Really, Until Self-Driving Cars Hit the Streets?" *The Drive*, last modified 7 December 2017, http://www.thedrive.com/tech/16768/how-long-really-until-self-driving-cars-hit-the-streets.

has an opportunity to set global standards in this area given that a number of the leading AV developers are based in Europe and it is the world's largest car exporter.[86]

Autonomy is coming and humanity stands at risk from the pace of technological advancement outstripping our ability to regulate and govern it in any meaningful way. If this is not addressed as a matter of urgency, it will be transnational corporations not world leaders dictating the legal and ethical agenda that will shape our society for future generations. Autonomy is undoubtedly the new black, but the law must push back.

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[86] European Community, "International Trade in Motor Vehicles," *Eurostat*, last modified June 2017, http://ec.europa.eu/eurostat/statistics-explained/index.php/International_trade_in_motor_vehicles. The EUs new General Data Protection Regulation that comes into effect from 25 May 2018 is designed to harmonize data privacy laws and the way they are approached across Europe. It also aims to assist Europe in developing a capacity for AI governance, which could provide the basis of a regulatory framework for autonomous vehicles. EU, "The General Data Protection Regulation GDPR)," *EUGDPR*, last accessed 7 May 18, https://www.eugdpr.org.

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