"Trust in the machine: the case of Autonomous vehicles"

Introduction

It has been argued that autonomous vehicles offer a wealth of social and economic advantages that could profoundly change our lives for the better.[1] They will arguably reduce emissions,[2] ease congestion, offer greater mobility to a wider range of people than ever before,[3] as well as allow them to be more productive by performing tasks other than driving (users of autonomous vehicles could, for example, read a book, send a text or sleep.) Improved road safety is a major incentive because human error is reportedly a causal factor in between 75%-95% of all road traffic accidents.[4] Autonomous vehicles, by contrast, will be programmed to avoid collision. By removing the human element, autonomous driving technology could dramatically improve road safety. By way of example, in 2016, the European Commission, in its "European strategy on Cooperative Intelligent Transport Systems," noted how, in the very near future, vehicles will interact directly with each other and road infrastructure, with such cooperation expected "to significantly improve road safety."[5] The terminology used by the European Commission is extremely pertinent here because the precise scale of the benefit that might accrue cannot be determined without further research[6] and hence presently "it is impossible to holistically quantify the positive ... impact of highly autonomous cars."[7]

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[1] Department for Transport, 'The Pathway to Driverless Cars (2015), 6, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401562/pathway-driverless-cars-summary.pdf, last accessed 23 January 2018.

[2] This is in keeping with the UK Government's clean air plan and its decision to ban the sale of all new diesel and petrol cars and vans from 2040. See A Asthana and M Taylor, 'Britain to ban sale of all diesel and petrol cars and vans from 2040' *Guardian* (London 25 July 2017) https://www.theguardian.com/politics/2017/jul/25/britain-to-ban-sale-of-all-diesel-and-petrol-cars-and-vans-from-2040, last accessed 23 January 2018.

[3] Department for Transport, 'The Pathway to Driverless Cars' (2015), 16, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401562/pathway-driverless-cars-summary.pdf, last accessed 23 January 2018.

[4] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 12, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

[5] Commission (EC), 'A European strategy on Cooperative Intelligent Transport Systems, a milestone towards cooperative, connected and automated mobility', COM(2016) 766 final, 30 November 2016, 3, available at http://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v5.pdf, last accessed 23 January 2018.

[6] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 26, available at

Nonetheless, due to the several perceived substantive benefits of autonomous vehicles, governmental support around the globe has been extensive. By way of example, in the U.S., several States, including California, Florida, Michigan and Nevada, have passed laws to enable the testing and operation of driverless cars.[8] In relation to the UK, in 2015, the Government set out a Code of Practice for the testing of autonomous vehicles, allocated £100 million in the budget for research into autonomous vehicle technology and established 'The Centre for Connected and Autonomous Vehicles' to co-ordinate its actions on autonomous vehicles.[9] The UK is reportedly one of the best countries to develop and test autonomous vehicles[10] and the Department for Transport has reiterated its aim to "maintain the UKs world-leading position for developing and testing … autonomous road vehicle technology."[11] Trials of autonomous cars have taken place in Bristol, Coventry, Milton Keynes and Greenwich.[12].

Greenwich has also recently been the location of autonomous bus trials and other trials are scheduled for completion in the region in 2017.[13] Additionally, a stretch of the M6 in Cumbria has been earmarked for the testing of autonomous trucks.[14] These initiatives arguably cement the UK Government's commitment to the development of autonomous

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https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

[7] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 62, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

[8] Allen and Overy, 'Autonomous and connected vehicles: navigating the legal issues', 2017, 6, available at http://www.allenovery.com/SiteCollectionDocuments/Autonomous-and-connected-vehicles.pdf, last accessed 23 January 2018.

[9] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 12, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

[10] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 12, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

[11] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 12, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

[12] https://www.gov.uk/government/news/driverless-cars-technology-receives-20-million-boost, last accessed 22 January 2018.

[13] House of Commons Briefing Paper, 'Connected and autonomous road vehicles', CBP 7965, 12 June 2017, 16, available at http://researchbriefings.files.parliament.uk/documents/CBP-7965/CBP-7965.pdf, last accessed 24 January 2018. See also D Thomas, 'Driverless shuttle bus to be tested by public in London' *BBC* (5 April 2017) http://www.bbc.co.uk/news/technology-39495915, last accessed 24 January 2018.

[14] Press Association, 'Driverless lorries to be tested on UK motorways' *Guardian* (6 March 2016) https://www.theguardian.com/uk-news/2016/mar/06/driverless-lorries-tested-on-uk-motorways, last accessed 23 January 2018.

vehicle technology, which is considered "a natural progression" given that cars with some level of autonomy are already available and it is predicted that fully autonomous vehicles could be widespread by late 2020s.[15] Reports suggest that there will be 21 million autonomous vehicles on the world's roads by 2035.[16]

However, the technology is not risk-free. With the new possibilities offered by autonomous vehicles, comes the potential for risks. Therefore, what are some of the risks associated with the inevitable arrival of autonomous vehicles? Driverless cars raise interesting questions that governments and lawyers will need to address. This piece evaluates the privacy implications and liability issues of autonomous vehicles, with particular emphasis on the evolving UK legal and regulatory environment.

Privacy implications

Gavison[17] conceives of privacy as "limited accessibility", consisting of three components: secrecy, anonymity and solitude.[18] These, in turn, are shorthand for "the extent to which an individual is known, the extent to which an individual is the subject of attention and the extent to which others have physical access to an individual."[19] Consequently, a loss of privacy occurs when others obtain information about an individual, pay attention to him, or gain access to him.[20] On this basis, it is straightforward to argue that autonomous vehicles raise privacy issues,[21] predominantly because the ability of individuals to retain control over their private information as it flows through autonomous vehicles is a privacy and data protection challenge. The vehicle itself would be a repository of personal information about

[15] Department for Transport, 'The Pathway to Driverless Cars' (2015), 16, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/401565/pathway-driverless-cars-main.pdf, last accessed 24 July 2017.
[16] Allen and Overy, 'Autonomous and connected vehicles: navigating the legal issues', 2017, 2, available at http://www.allenovery.com/SiteCollectionDocuments/Autonomous-and-connected-vehicles.pdf, last accessed 23 January 2018.
[17] Gavison R, 'Privacy and the limits of the law', (1980) 89 *Yale Law Journal* 421, in Schoeman, F (ed), *Philosophical Dimensions of Privacy : An Anthology* (Cambridge University Press, 1984).
[18] ibid 351.
[19] ibid 386.
[20] ibid 351.
[21] L Collingwood, 'Privacy implications and liability issues of autonomous vehicles' (2017) 26(1) *Information & Communications Technology Law* 32, available at http://www.tandfonline.com/doi/abs/10.1080/13600834.2017.1269871?journalCode=cict20, last accessed 23 January 2018. See also House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 11, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

where and how its user had travelled[22] - effectively a data centre on wheels, collecting and storing a vast amount of data - and the use of this data raises a number of issues around privacy and data protection if the collected data is processed inappropriately.[23] Therefore, it will be important to achieve privacy for individuals, while using the collected data to achieve efficiency and safety in autonomous vehicle operations.[24] Approaches might include encrypting or anonymising personal information from autonomous vehicles (now accepted as default[25]) and ensuring that autonomous vehicles and the data they produce complies with the relevant privacy and data protection legislation, including the requirements of the incoming European General Data Protection Regulation (GDPR, effective from 25 May 2018[26]) as well as current Data Protection regulations.

This is problematic because the very meaning of "personal" in the context of the collected data is unclear. In the UK, for example, certain data generated by autonomous vehicles will constitute 'personal data' for the purposes of the prevailing Data Protection Act 1988 (DPA) and, since personal data must be processed in accordance with the DPA, including that where personal information is required to perform a particular function, the information can be kept for no longer than is necessary once that purpose has been accomplished.[27] However, there will be some data, such as that relating to an individual's position, speed and performance on the road, which arguably cannot be regarded as entirely personal. Good data governance will therefore be needed to secure appropriate protection of personal information while safely using and linking this other, non-personal data, which is needed if an autonomous system is to operate as a whole.

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[22] D Glancy, 'Privacy In Autonomous Vehicles' (2012) 52 Santa Clara L. Rev. 1171, 1180.
[23] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 42, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[24] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 8, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[25] Allen and Overy, Autonomous and connected vehicles: navigating the legal issues, 2017, page 11, available at http://www.allenovery.com/SiteCollectionDocuments/Autonomous-and-connected-vehicles.pdf, last accessed 23 January 2018
[26] The EU General Data Protection Regulation (EU) 2016/679. The GDPR replaces the Data Protection Directive 95/46/EC. See http://www.eugdpr.org/, last accessed 23 January 2018.
[27] Data Protection Act 1998, Schedule 1, Part I.

In the UK, the development of appropriate privacy and data protection regulations for autonomous vehicles is reportedly "at an early stage."[28] It will be very important for regulators to clearly set out what the technology will and will not do with the collected user data because this will be an essential element for take-up of the technology. Put simply, better data retention policies are necessary to reassure users over their privacy concerns, otherwise take up of the technology could be curtailed.

In summary, autonomous vehicles generate personal information about the people who use them and the debate concerning the control over, ownership and misuse of this information necessitates an appropriate regulatory response. There is a strong argument to suggest that the emerging technology can be seen as a threat to user privacy and, as Glancy notes, ultimately, the future success of autonomous vehicles will depend in part on how well privacy interests and autonomous vehicles can work together.[29] The importance of appropriate data protection and privacy regulations are, at least, acknowledged by the UK Government[30] and the issues raised in this context should not be underestimated. Given that assuring respect for user privacy is one of the best ways to foster trust and confidence in new technologies such as autonomous vehicles, this issue could be a real barrier to adoption of the technology if not properly addressed.[31]

Another matter that must be addressed with this technology is how accidents involving autonomous vehicles will be treated at law and how blame will be apportioned between a (human) driver and a car's automated system, as discussed below.

Issues of Liability

Accidents involving autonomous vehicles have occurred. By way of example, in March 2017, *Uber* removed its autonomous cars from public roads in Arizona after an accident left

[28] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 43, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[29] D Glancy, 'Privacy In Autonomous Vehicles' (2012) 52 Santa Clara L. Rev. 1171, 1225.
[30] Centre for Connected and Autonomous Vehicles, 'Pathway to driverless cars: Consultation on proposals to support Advanced Driver Assistance Systems and Automated Vehicles : Government Response', January 2017, 15, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/581577/pathway-to-driverless-cars-consultation-response.pdf, last accessed 23 January 2018.
[31] D Glancy, 'Privacy In Autonomous Vehicles' (2012) 52 Santa Clara L. Rev. 1171, 1225-6.

one of the vehicles on its side (however, the fleet was reportedly back after 3 days[32]). The first accident involving an autonomous vehicle was reported on February 2016 when an autonomous vehicle hit the side of a passing bus.[33] Though a relatively minor accident, it effectively highlighted that the safety of autonomous vehicles cannot be taken for granted. Later in 2016, a man was killed when his *Tesla*'s Autopilot system failed to recognise a truck turning in front of his car. Therefore, even with safety features, the possibility of accidents, whilst considerably lowered, remains. In particular there have been concerns raised during the medium term (estimated to be 15-20 years[34]) when there will be mixed fleets of autonomous vehicles (the level of autonomy in which will vary) and traditional vehicles, the management of which will be very complex. How will liability be apportioned in this period in which vehicles with several different levels of autonomy[35] penetrate the market while traditional cars, fully operated by humans, remain on the roads?[36] In the longer term (20-50 years), manual driving will be restricted, making this period easier to forecast and manage.[37]

Moreover, autonomous vehicles could have negative implications for drivers' competence, making drivers and other road users complacent and overly reliant on the technology working,[38] which could lead to accidents. Research has found that drivers of automated vehicles, due to their reliance on the robustness of the technology, were generally not as effective in emergencies as drivers of manual vehicles. In simulated emergencies, up to a third of drivers of automated vehicles did not recover the situation, whereas almost all drivers of manual vehicles in the same situation were able to do so. In addition, research showed that drivers of automated vehicles took, on average, six times longer to respond to emergency

[32] https://www.theverge.com/2017/3/27/15077154/uber-reactivating-self-driving-car-pilot-tempe-pittsburgh-crash, last accessed 22 January 2018.
[33] M Robbins, 'Statistically, self-driving cars are about to kill someone. What happens next?' *Guardian* (14 June 2016).
[34] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 63, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[35] In partial and conditional automation, the driver will need to remain alert at all times despite the vehicle performing most of the manoeuvres independently.
[36] R Graham, 'Getting a handle on driverless cars' (2015), 159 (12) Supp (Personal Injury Focus), SJ 13, 15.
[37] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 63, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[38] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 7, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

braking of other vehicles compared to manual drivers.[39] The House of Lords Science and Technology Committee has recommended that better understanding is needed of how autonomous vehicles will affect the behaviour of road users, an area recognised as being under-researched,[40] but it is at least arguable that, whilst accidents overall might decrease, new types of accidents not currently contemplated could present with the introduction of autonomous vehicles (road users overly relying on the technology working and purposely stepping out in front of a vehicle, for example).

Certainly, it will not be possible to avoid all accidents and this raises both ethical issues and matters of liability. In relation to the former, with autonomous vehicles, there will be situations where the vehicle will have to determine what course of action to take in the event of a collision.[41] How the vehicle reacts will be governed by its pre-programmed algorithms and its in-built ethical solutions.[42] Though very rare, situations will arise in which there is sufficient time for an autonomous vehicle to decide upon a course of action which harms one person, or group of people, instead of another. In some (necessity) situations, they will have to decide whether to harm their passengers or people in other vehicles, or other road users and pedestrians.[43] Deciding on the correct algorithm to adopt in this situation is not only a challenge, but it also raises a question as to whether it would even be lawful to sell (or drive) a vehicle that's actually programmed to effectively create risks to pedestrians and other drivers on the road.[44] In any event, who would wish to drive such a vehicle and would individuals perceive these vehicles as being potentially unsafe because of the lack of a human driver? The Department of Transport in the UK has recently acknowledged that issues such

[39] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 35, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[40] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 34, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[41] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 44, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[42] See, on this point, J-F Bonnefon, A Shari and I Rahwan, 'Autonomous Vehicles Need Experimental Ethics: Are We Ready for Utilitarian Cars?' Toulouse School of Economics, University of Oregon and Massachusetts Institute of Technology, 12 Oct 2015, which explores how to build "moral algorithms" in to autonomous vehicles.
[43] House of Commons Briefing Paper, 'Connected and autonomous road vehicles', CBP 7965, 12 June 2017, 10, available at http://researchbriefings.files.parliament.uk/documents/CBP-7965/CBP-7965.pdf, last accessed 24 January 2018.
[44] However, this argument must be balanced against the understanding that it is almost impossible to conceive of any transport system with a 100% safety record.

as these are likely to impact public perception and attitudes towards autonomous technologies are will therefore be important factors in the level and pace of adoption.[45] Research further suggests that the public morally agree with a utilitarian autonomous vehicle designed to sacrifice the owner to save individuals on the road, but would not feel comfortable travelling in one.[46] There are clearly several areas of concern. For example, what would be the outcome if the vehicle decides a course of action that the driver would never have chosen; should the driver be responsible for any resultant damage or not; would the automated decision-making response always be presumed to be superior over human decision-making[47] and, hence, could fault actually be attributed at all or would this represent a no-fault system begging its own bespoke set of principles and restrictions (an option not currently considered in governmental proposals – see below)?

The apprehensions over automated or algorithm based decision-making are well documented. Mittelstadt et al., for example, suggest that the ethical concerns raised by algorithms might include, inter alia, inscrutable evidence leading to opacity, unfair outcomes and transformative effects due to over-reliance on the technology itself[48] and Keats Citron has evaluated the prevalence of automation bias (stemming essentially from a predisposition to presume a computer system's infallibility) and the propensity to forget that automated systems are fallible.[49] Nonetheless, whilst the issues and concerns inherent in so-called, "algorithmic morality"[50] show no signs of reducing, the formulation of a coherent plan for allocating regulatory responsibility for autonomous vehicles, in general, and the moral algorithms that govern their behaviour, in particular, has yet to materialise. The UK Government has not thus far adequately addressed this issue in its domestic regulatory

[45] House of Commons Briefing Paper, "Connected and autonomous road vehicles", Number CBP 7965, 12 June 2017, 9, available at http://researchbriefings.files.parliament.uk/documents/CBP-7965/CBP-7965.pdf, last accessed 24 January 2018. See also http://www.bbc.co.uk/news/technology-39495915, last accessed 24 January 2018.
[46] J-F Bonnefon et al (2015) 'Autonomous Vehicles Need Experimental Ethics: Are We Ready for Utilitarian Cars?' Research Gate. Available at https://arxiv.org/abs/1510.03346, last accessed 16 June 2017.
[47] See, further, Danielle Keats Citron, 'Technological Due Process', 85 Wash UL Rev. 1249 (2008) 85:1249-1313, available http://heinonline.org/HOL/Page?handle=hein.journals/walq85&collection=journals&id=1255&startid=1255&enddid=1320, last accessed 10 January 2018
[48] Brent Daniel Mittelstadt, Patrick Allo, Mariarosaria Taddeo, Sandra Wachter and Luciano Floridi 'The ethics of algorithms: Mapping the debate' Big Data & Society, July – December 2016, 1-21.
[49] Danielle Keats Citron, 'Technological Due Process', 85 Wash UL Rev. 1249 (2008) 85:1249-1313, available http://heinonline.org/HOL/Page?handle=hein.journals/walq85&collection=journals&id=1255&startid=1255&enddid=1320, last accessed 10 January 2018
[50] House of Commons Briefing Paper, 'Connected and autonomous road vehicles', CBP 7965, 12 June 2017, 10, available at http://researchbriefings.files.parliament.uk/documents/CBP-7965/CBP-7965.pdf, last accessed 24 January 2018.

approach. Instead, the House of Lords Science and Technology Committee has urged the Government to "keep them in mind" during its programme of regulatory reform accepting that the ethical discussion surrounding autonomous vehicles was over-emphasised and artificial and, overall, required more research into what human drivers actually do in an emergency before judging algorithms.[51]

This is arguably a short-sighted approach, because matters of liability in relation to accidents involving autonomous vehicles require complex analysis and a bespoke regulatory solution. On the one hand, with the increase in data collection in autonomous vehicles, it will arguably become easier to determine exactly what the cause of an accident was (subject to privacy implications).[52] However, fault for the accident will arguably still need to be attributed[53]. Issues of liability are complicated because who would be held responsible in an accident involving an autonomous vehicle is uncertain due to the lack of an active human driver. By way of example, for the offence of causing death by dangerous driving under the Road Traffic Act 1988, it must be considered whether a person meets the standard of a "competent and careful driver". This raises a wealth of, as yet, unanswered questions (and arguably necessitates amendments in the law) in the context of autonomous vehicles: How does the law judge a machine's decision making? What standard of competency will be applied to autonomous "driving"? Might it be necessary for there to be a higher standard in autonomous vehicles than would be expected of a conventional driver and is requiring a higher standard even possible? Should these vehicles be prevented from driving faster than a speed that enables them to stop for or avoid an obstacle in the road – so-called "defensive driving"?[54]

Moreover, the idea of a "driver" (i.e the person controlling the vehicle: see below) will change and this has its own challenges. Part of the attraction of autonomous vehicles is likely to be the opportunity for a user, who would otherwise need to be fully engaged in driving, to do something else or nothing at all. This is likely to affect in-vehicle behaviour because car

[51] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 45, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.
[52] Allen and Overy, 'Autonomous and connected vehicles: navigating the legal issues', 2017, 9, available at http://www.allenovery.com/SiteCollectionDocuments/Autonomous-and-connected-vehicles.pdf, last accessed 23 January 2018.
[53] Whilst no fault liability may be applicable, this has yet to be evaluated – see above
[54] House of Lords Science and Technology Committee, 'Connected and Autonomous Vehicles : The future?, HL (2016-17) 115, 44, available at https://www.publications.parliament.uk/pa/ld201617/ldselect/ldsctech/115/115.pdf, last accessed 22 January 2018.

users would effectively be legally permitted to be distracted from driving. They might be intoxicated, for example. But, could they be liable in the event of an accident? Would the law require that such a person had sufficient training[55] in relation to the particular operating system and at all times retains the capability to so intervene (thereby significantly reducing the attraction of the technology itself)? By extension, if they failed to so intervene, would their actions be considered negligent, thereby satisfying the legal basis for liability in road accidents, which will generally be negligence? In this situation, the user would effectively become the driver, but is this appropriate? Arguably, it may be that such legal responsibilities will only be avoided if the user does not have the ability to intervene. At this point, notions of driving or operating a car would become irrelevant; all those travelling in such cars would simply be passengers.[56] It is very difficult to argue that any persons being carried in the vehicle could be described as physically driving it, the legal definition from *R v MacDonagh*[57] being whether he or she is "in a substantial sense controlling the movement and direction of the car." However, if the car's computer has complete control of the vehicle, would the law consider that to represent the driver? Based on the principles of current legislation, it would seem that strict liability of the operator and tortious liability of the manufacturer of the autonomous system will be applied[58] where the ground for the operator's liability is that the operator uses the autonomous system and bears an overriding overall responsibility.[59] However, what about in the event of a cyber attack? Should the software manufacturer be strictly liable for defective software security that allowed third parties to hack into the car? Or should the owner be liable if, for example, they had failed to download software security updates? Should MOTs be extended to include the compulsory checking of the software technology contained in autonomous vehicles or should network providers be held liable if accidents are a result of a defect in connectivity causing the incidents?[60] Additionally, what would be the outcome where an occupant of the vehicle embarked upon a

[55] Requiring a change to driving tests.
[56] R Draper, 'Uber's pilot and driverless cars: will the law need to be more hands on before driving can be hands off?' *Kingsley Napley blog* (24 November 2016) https://www.kingsleynapley.co.uk/insights/blogs/corporate-and-commercial-law-blog/ubers-pilot-and-driverless-cars-will-the-law-need-to-be-more-hands-on-before-driving-can-be-hands-off, last accessed 22 June 2017.
[57] *R v MacDonagh* [1974] 1 QB 448.
[58] See, for the full list of driving legislation in the UK: https://www.gov.uk/browse/driving/highway-code-road-safety, last accessed 23 January 2018.
[59] G Wisskirchen, et al, 'Artificial Intelligence and Robotics and Their Impact on the Workplace', IBA Global Employment Institute, April 2017, 61, available at www.ibanet.org/Article/NewDetail.aspx?ArticleUid=012a3473-007f-4519-827c-7da56d7e3509, last accessed 24 July 2017.
[60] Allen and Overy, 'Autonomous and connected vehicles: navigating the legal issues', 2017, 9, available at http://www.allenovery.com/SiteCollectionDocuments/Autonomous-and-connected-vehicles.pdf, last accessed 23 January 2018.

deliberate destruction of the hardware? All of these issues combine to suggest that there will need to be regulated co-operation between various sector participants because, ultimately, there are several parties who will be involved in the event of an accident. Legislators, courts and other commentators will face a considerable challenge in determining where liability between these parties will lie. Given the several interconnected elements of the autonomous vehicle conundrum[61] and the fact that there are clearly differences between the principles attaching to human driving and autonomous driving, it is arguable that regulatory decisions need to be taken, and they need to be taken soon. Certainly, it will be interesting to see how liability will be apportioned in the future, as there clearly needs to be a complete overhaul in light of technology where the driver is completely out of the loop. Current governmental proposals, which effectively supplement compulsory motor insurance to include autonomous vehicles, are given below, but because these effectively replicate what has been proposed before, it is likely that they will fail to go far enough to plicate those who doubt the integrity of the system.

Accordingly, it is likely that the outstanding liability issues will remain a major obstacle to the introduction of fully automated driving, predominantly because uncertainty as to the regulation of autonomous fleet will stifle demand for such vehicles. By way of response, on 22 February 2017, the UK Government introduced a Vehicle Technology and Aviation Bill[62] to the House of Commons, Part 1 of which addressed liability and insurance issues in relation to self-driving vehicles - specifically provisions relating to insurance for automated vehicles and the protection of victims where an autonomous vehicle is involved in a crash while in automated mode. However, following dissolution of Parliament prior to the June 2017 UK general election, the Bill was superseded by the Automated and Electric Vehicles Bill,[63] which is currently being debated in the House of Commons and will likely evolve considerably as it passes through Parliament towards Royal Assent. Under the new Bill, an Autonomous Vehicle is defined by reference to a definitive list of vehicles capable of operating in a self-driving mode and the list is both set and administered by the Secretary of

[61] J Boeglin 'The Costs Of Self-Driving Cars: Reconciling Freedom And Privacy With Tort Liability In Autonomous Vehicle Regulation' (2015)17 Yale J.L. & Tech. 171, 175.
[62] Vehicle Technology and Aviation HC Bill (2016-17) [143]. See https://publications.parliament.uk/pa/bills/cbill/2016-2017/0143/17143.pdf, last accessed 23 January 2018.
[63] Automated and Electric Vehicles HC Bill (2017-19) [112]. See https://services.parliament.uk/bills/2017-19/automatedandelectricvehicles.html, last accessed 9 January 2018.

State[64]). As regards insurance, the new Bill largely mirrors the proposals from its predecessor, The Vehicle Technology and Aviation Bill. The approach remains to extend product liability. Under Part 1 of the Bill,[65] a single insurer model is proposed, where a motor insurer covers both the driver's use of the vehicle and the autonomous vehicle technology. Under current proposals, an insurer could, therefore, face liability if an insured Autonomous Vehicle drives in self-driving mode and causes an accident resulting in damage or injury[66] (if the vehicle is uninsured, the liability shifts to the owner of the Autonomous Vehicle.[67]) Compensation can be claimed by the injured party from the insurer, although insurance companies would be able to recover costs from the manufacturer if it is found that the product was at fault (either software or/and vehicle). However, possible exceptions to this include situations where the insured failed to install (safety) critical software updates[68] or made modifications in a way prohibited under the insurance policy.[69] Liability could be also excluded if the owner negligently allowed the vehicle to drive itself where it wasn't appropriate to do so.[70]

Additionally, whilst regulatory change is presently being contemplated, this is arguably piecemeal. It has been reported that the Government will "… make the minimum changes required … to create a framework fit for the arrival of Autonomous Vehicles"[71] and that there would be no fundamental revisions to the regulatory infrastructure at this stage.[72] Instead, the UK Government supports a rolling programme of reform[73] and this seems to be supported in

[64] Automated and Electric Vehicles Bill, Part 1, Section 1(1). See also https://www.clydeco.com/blog/insurance-hub/article/automated-and-electric-vehicles-bill-published, last accessed 24 January 2018.
[65] Automated and Electric Vehicles Bill, Part 1, available at https://publications.parliament.uk/pa/bills/cbill/2017-2019/0112/18112.pdf, last accessed 24 January 2018
[66] Automated and Electric Vehicles Bill, Part 1, section 2(1)
[67] Automated and Electric Vehicles Bill, Part 1, section 2(2)
[68] Automated and Electric Vehicles Bill, Part 1 section 4.
[69] https://www.out-law.com/en/articles/2017/october/uk-legislates-for-a-future-of-driverless-and-electric-cars/, last accessed 24 January 2018.
[70] Further clarification on the meaning and scope of "negligence" in this context is expected. See https://www.clydeco.com/blog/insurance-hub/article/automated-and-electric-vehicles-bill-published, last accessed 24 January 2018.
[71] Centre for Connected and Autonomous Vehicles, 'Pathway to driverless cars: Consultation on proposals to support Advanced Driver Assistance Systems and Automated Vehicles : Government Response', January 2017, 14, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/581577/pathway-to-driverless-cars-consultation-response.pdf, last accessed 23 January 2018.
[72] Centre for Connected and Autonomous Vehicles, 'Pathway to driverless cars: Consultation on proposals to support Advanced Driver Assistance Systems and Automated Vehicles : Government Response', January 2017, 7, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/581577/pathway-to-driverless-cars-consultation-response.pdf, last accessed 23 January 2018.
[73] Centre for Connected and Autonomous Vehicles, 'Pathway to driverless cars: Consultation on proposals to support Advanced Driver Assistance Systems and Automated Vehicles : Government Response', January 2017,

the new Bill. Given the wealth of questions raised in this article alone, this piecemeal governmental approach will arguably do little to reassure those worried about the profusion of liability concerns associated with the introduction of autonomous vehicle technology.

Conclusion

As suggested above, autonomous vehicles have the potential for a variety of societal benefits. However, whether these vehicles can fully be trusted and what the future might look like with them on our roads is open to debate. The likely impact they will have is vast, including improvements in, inter alia, road safety, mobility, congestion and emissions, but there are negative considerations too, not least those concerning privacy and liability. Accordingly, this piece has considered a variety of scenarios in which these issues might materialise at different junctures of autonomous vehicle technology development and deployment and has sought to show that, in relation to both issues, a number of complicated questions arise. Given that the legal and regulatory landscape has yet to be drawn out, the future is uncertain. In particular, uncertainty remains as to the way in which the raised privacy issues will be addressed so as to provide adequate redress for concerned groups and how liability in the event of an accident involving autonomous vehicles will be apportioned amongst the various parties involved. These uncertainties have the capability to curtail the adoption of autonomous vehicle technology. Despite the several benefits of these vehicles, it is eminently possible that people will be hesitant about embracing technology which potentially compromises their privacy and exposes them to liability issues not previously prevalent in traditional driving. The UK's Department for Transport has acknowledged this and has commented that the capability of autonomous vehicles "is likely to be dependent, at least in part, on user preference."[74] Given that it will take time before most people are able to trust autonomous vehicles entirely,[75] the future legal response must, therefore, be robust enough to allay the concerns raised above because otherwise negative perceptions of the technology itself could mean that take-up rates are less than those predicted. This would be unfortunate for those, governments, the disabled, elderly, or young people and road users alike, who

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10, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/581577/pathway-to-driverless-cars-consultation-response.pdf, last accessed 23 January 2018.

[74] Atkins for Department for Transport, 'Research on the Impacts of Connected and Autonomous Vehicles on Traffic Flow: Summary Report', May 2016, available at https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/530091/impacts-of-connected-and-autonomous-vehicles-on-traffic-flow-summary-report.pdf, last accessed 24 January 2018.

[75] M Taylor and P Maynard, 'Self-driving cars' (2015) 21(5), CTLR 133, 134.

perceive the arrival of significant benefits from automated vehicle technologies. Accordingly, the law may need to be more hands on before driving can be hands off.[76]

[76] R Draper, 'Uber's pilot and driverless cars: will the law need to be more hands on before driving can be hands off?' *Kingsley Napley blog* (24 November 2016) https://www.kingsleynapley.co.uk/insights/blogs/corporate-and-commercial-law-blog/ubers-pilot-and-driverless-cars-will-the-law-need-to-be-more-hands-on-before-driving-can-be-hands-off, last accessed 24 January 2018.