Canadian Journal of Law & Jurisprudence XXXIV No.1 February 2021, 11-28
© The Author(s), 2021 doi: 10.1017/cjlj.2020.17

Humane Driving

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1. Introduction

The advent of fully autonomous vehicles (AVs) raises many questions. While some appear purely technical, others engage matters of public policy, sometimes with a prominent ethical component. Our expertise lies in law and applied ethics, and so our inquiry will focus heavily on legal or ethical issues arising from a widespread adoption of AVs and their response in emergency situations involving animals. By "animals" we do not mean all other animals than humans. We will concentrate on interest-bearing animals. These are animals who possess a welfare or wellbeing, animals whose lives can fare well or badly from their perspective.

In emergency situations where injury is unavoidable, or at least highly likely, AVs will have to make "decisions" that involve valuations of life, health, and perhaps property. We might wonder whether such determinations should ever be delegated to machines, however intelligent. Perhaps such choices regularly involve considerations that resist codification and so cannot be programmed or taught to robots, so that fully autonomous cars should not be permitted on the roads.[1] As we see it, the expected decrease in accidents and concomitant social benefits arising from the use of AVs is likely to incline many to think that such machines should be mandatory despite the risks of faulty decisions, at least if personal or public transportation vehicles are to be used at all. Some projections claim that wholesale adoption of AVs could result in a 90 percent reduction in automobile accidents, with a corresponding decrease in loss of life and limb.[2] Regardless, as changes in our climate and ecologies compel us to rethink how we live on this planet, the social and financial benefits of driverless vehicles—including increased mobility for the young, the elderly, disabled persons—may well outweigh permitting many humans to continue to pilot buses, cars, and trucks.

However, as we explain below, there are reasons to think that the reduction of deaths and injuries that adoption of AVs promises might not accrue to animals to

We thank Letitia Meynell and an anonymous reviewer for comments on a draft.
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1. A view explored in Duncan Purves, Ryan Jenkins & Bradley J Strawser, "Autonomous Machines, Moral Judgment and Acting for the Right Reasons" (2014) 18:4 Ethical Theory & Moral Practice 851.
2. See, e.g., "Automobile Insurance in the Age of Autonomous Vehicles" (2015), online (pdf) at KPMG https://www.kpmg.com/US/en/IssuesAndInsights/ArticlesPublications/Documents/automobile-insurance-in-the-era-of-autonomous-vehicles-survey-results-june-2015.pdf [perma.cc/Q45G-2F9X]; SA Beiker "Legal Aspects of Autonomous Driving" (2012) 52:4 Santa Clara L Rev 1145 at 1149-50; U Eberl, *Smarte Maschinen* (Carl Hanser Verlag, 2016) 174; US Department of Transportation: National Highway Traffic Safety Administration, *Critical Reasons for Crashes Investigated in the National Motor Vehicle Crash Causation Survey* (National Center for Statistics and Analysis, 2015); Leonard Evans, "The Dominant Role of Driver Behavior in Traffic Safety" (1996) 86:6 American J of Public Health 784.

https://doi.org/10.1017/cjlj.2020.17 Published online by Cambridge University Press

the same extent it will to humans. Indeed, it is not impossible that the carnage nonhumans currently suffer due to being run over by cars and trucks might even get worse when AVs come to dominate our roads.

The next section will provide an orientation to AVs and whom-to-harm scenarios. This will include considering some objections to focusing on such dilemmatic circumstances. Our purpose is not just to explain the importance of whom-to-harm scenarios when discussing the widespread use of AVs, but to suggest that those whose safety informs the relevant programming should not be limited to members of our own species. The third section will provide a discussion of how animals may be understood in whom-to-harm scenarios in the eyes of the law, at least as it currently stands. We will explain why we think that the law as it currently stands is not likely to offer much protection to animals. Our fourth section turns to ethics and why some very basic framing considerations can foreground the importance of attending to animal safety. We will not limit our discussion by espousing one moral theory. Given space limitations, this necessitates the lack of a deep engagement with any one moral theoretical approach. Instead, we will approach the discussion quite abstractly through a discussion of indirect and direct duty views.[3]

2. Some Orientation

Considerable scholarly attention in recent years deals with how AVs should be programmed to respond in emergencies when situations of inevitable accident arise. In emergency situations human drivers sometimes have to make decisions that engage ethical considerations; when AVs come to ply the roads similar choices will have to be pre-encoded in the vehicles' software. Our focus is on dilemmatic circumstances where harm or damage will occur no matter what course of action an AV adopts. Typical scenarios involve what a machine should do if a young child darts into the street in front of it, leaving it no time to brake. This presents a choice between staying the course and hitting the child or swerving into a tree or another vehicle, thus posing a threat to persons in the primary AV and in any other vehicles they may hit. Here, whose interests properly enjoy priority make this a particularly challenging scenario. When the stakes involve the lives of all of those involved, the appropriate solution may evade moral consensus.

Discussions of such dilemmatic circumstances in the emerging literature are partly informed by their resemblance to a thought experiment that has been a staple of academic philosophy for half a century: the trolley problem.[4] In one well-known version of this, the driver of a trolley whose brakes have failed is

3. We have no doubt that the inspiration for such an approach lies with Regan. Tom Regan, "The Case for Animal Rights" in Peter Singer, ed, *In Defense of Animals* (Harper & Row, 1985) 13 at 13-26.

4. Introduced in Philippa Foot, "The Problem of Abortion and the Doctrine of the Double Effect" (1967) 5 Ox Rev 5, the trolley problem gained greater prominence in Judith J Thomson, "Killing, Letting Die and the Trolley Problem" (1976) 59 The Monist 204.

https://doi.org/10.1017/cjlj.2020.17 Published online by Cambridge University Press

confronted with the choice between doing nothing and letting the trolley continue on its course, in which case it will hit and kill five persons on the tracks ahead, or taking action by switching it to a side track where only one person will be killed. The impending advent of AVs, and in particular the dilemma sketched above, has given new relevance to the trolley problem.

Some have responded to this new literature by pointing out that there are disanalogies between the trolley problem and the ethical choices that will arise from adoption of AVs.[5] Others have pointed out that AVs will be so much safer than human-driven cars that situations like that set out above will seldom arise,[6] so the problem remains an arid academic one. A third reaction to the claim that literature on the trolley problem can help us in programming AVs is that society's response to the sort of dilemma set out above will not be derived from philosophy but rather from existing law, both criminal and civil.[7]

We adopt no position on the first of these objections. The dilemmata arising from the use of AVs may or may not amount to versions of the much-discussed trolley problem. However, they certainly constitute "whom-to-harm" problems, and that is our focus here. As for the second objection, we reject it. In an AV dominated world, even if a whom-to-harm (or whom-to-spare) decision of the sort set out above arises only once in every 10 billion miles driven, that will still amount to about 1,000 times per year.[8] That is sufficient to make the problem one that cannot be ignored and will have to be dealt with in AV software. Unavoidable questions of law and public policy arise here.

As for the third objection to thinking that scholarly writing on the trolley problem contains the solution to how to program AVs, it has some merit. Canadian responses to the AV whom-to-harm problem will be made against the background of both criminal responsibility and rules of civil liability, in particular the tort of negligence. This background includes as-yet unanswered questions about who bears legal responsibility for harms arising from crashes of AVs—the vehicle's owner,

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5. Sven Nyholm & Jilles Smids, "The Ethics of Accident-Algorithms for Self-Driving Cars: An Applied Trolley Problem?" (2016) 19 Ethical Theory & Moral Practice 1275. One of these is that in the trolley problem the choice must be made under the pressure of emergent circumstances, with no chance for deliberation. In contrast, in the AV situation the decision can be made in advance, and after wide consultation. A second difference is that in the trolley problem all the outcomes are distinctly specified in advance; they are known to the chooser. In the AV problem, there is uncertainty, incomplete information, and risk: swerving into the tree could possibly kill the AV's occupants, but might only injure them. This last point is explored in Björn Meder et al, "How Should Autonomous Cars Drive? A Preference for Defaults in Moral Judgments Under Risk and Uncertainty" (2019) 39:2 Risk Analysis 205.

6. Or that if they do arise, the AV will not have enough information to intelligently choose, so should just be programmed to brake and hope for the best: Rebecca Davnall, "Solving the Single-Vehicle Self-Driving Car Trolley Problem Using Risk Theory and Vehicle Dynamics" (2019) 25:2 Science & Engineering Ethics 431.

7. Bryan Casey, "Amoral Machines, or: How Roboticists Can Learn to Stop Worrying and Love the Law" (2017) 111 Nw UL Rev 231. For an argument that Casey is wrong, and that ethical thinking has a big role to play in this domain, see W Bradley Wendell, "Economic Rationality and Ethical Values in Design-Defect Analysis: The Trolley Problem and Autonomous Vehicles" (2018) 55:1 Cal W L Rev 129.

8. Samuel I Schwartz with Karen Kelly, *No One at the Wheel: Driverless Cars and the Road of the Future* (Public Affairs, 2018) at 168.

https://doi.org/10.1017/cjlj.2020.17 Published online by Cambridge University Press

its retailer, its manufacturer, its programmer, or the vehicle itself?[9] This legal framework may tend to push ethical analysis to the side. However, while existing legal structures, not to mention the input of the insurance industry, will provide important contributions to the resolution of the whom-to-harm problem posed by AVs, those seem unlikely to completely control the conversation. Some confirmation of this can be found in the response of the country that appears to have devoted the most thought to this subject to date, Germany. In 2016 the German Federal Minister of Transport and Digital Infrastructure appointed an ethics committee to come up with a draft code of responses to ethical questions presented by AVs. That committee comprised law professors, ethics professors, experts in various technical disciplines, a bishop, consumer groups, industry input, and a prosecutor.[10] We think that it would be unethical to deploy AVs on Canadian roads without resolving the question of how they should operate in whom-to-harm situations and that the Canadian debate leading to that resolution will involve participation at least as diverse as the German one.

Indeed—and here is where animals come in—we suggest it should be even wider. It should include animal advocates, or at least ethicists attuned to the animal problem. The shift to AVs will have a number of consequences for nonhumans, including a potential reduction in the rate of vehicular slaughter of wildlife along highways. AVs will be superior to human drivers in detecting and reacting to animals who venture onto roadways. Yet despite this possible reduction in car-caused animal slaughter, there will still be situations of unavoidable harm. Animals will be involved in whom-to-harm situations similar to those described above. Those setting the rules for AV software will have to decide where they fit in—if their interests matter at all.

Animals have so far played little part in discussions of AV whom-to-harm scenarios.[11] As was the case with academic discussion of the trolley problem over the last several decades, recent analysis of the whom-to-harm problem presented by AVs has generally avoided scenarios involving endangered nonhumans.

9. This last option is considered in Sabine Glass, Emily Silverman & Thomas Weigend, "If Robots Cause Harm Who is to Blame? Self-Driving Cars and Criminal Liability" (2016) 19 New Crim L Rev 412 and John Zipp, "The Road Will Never Be the Same: A Reexamination of Tort Liability for Autonomous Vehicles" (2016) 43 Transportation LJ 137. In the civil sphere it is more likely that the advent of AVs will cause more jurisdictions to adopt a no-fault regime for vehicle accidents. The operation of tort law in respect of personal injury and property damage caused by automobiles will be legislatively eliminated and replaced with a no-fault compensation scheme similar to that already in place in Quebec.

10. Christoph Luetge, "The German Ethics Code for Automated and Connected Driving" (2017) 30:4 Philosophy & Technology 547 at 548. They reported the following year. For an English translation see Germany, Federal Ministry of Transport and Digital Infrastructure, Ethics Commission, *Automated and Connected Driving* (2017), online (pdf) at https://www.bmvi.de/SharedDocs/EN/publications/report-ethics-commission-automated-and-connected-driving.pdf?__blob=publicationFile (German Ethics Commission) [perma.cc/TE7F-999Y].

11. A few writers note that the being who occasions a whom-to-harm scenario might be a nonhuman, but they do not pursue the consequences of this. E.g. Nick Belay, "Robot Ethics and Self-Driving Cars: How Ethical Determinations in Software Will Require a New Legal Framework" (2015) 40:1 J Legal Prof 119 at 121-22 and Hod Lipman & Melba Kurman, *Driverless: Intelligent Cars and the Road Ahead* (MIT Press, 2016) 252.

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Yet the creature who darts in front of an AV might not be a small child but rather a duck or a dog, particularly but not exclusively in urban environments. Depending on the ethical framing, this might give rise to the question of whether the AV should be programmed to forge ahead and kill the nonhuman, or instead swerve, posing some increased risk of harm to the vehicle's occupants, other drivers, nearby pedestrians, or valuable property.

We suggest that the discussion of how to program AVs to respond in whom-to-harm situations should not continue to ignore the problem of where nonhumans fit in. As mentioned earlier, we are moving into a time where we must rethink how we live on this planet. We face two global crises of our own making: climate change and what some have christened, however prematurely, the sixth extinction.[12] Our biosphere is under threat and it is in our interests, as well as the interests of animals whose habitats and lives we are endangering, to find a less destructive way to live on our land and in our territories. If this is to be a comprehensive re-envisioning of how we live in this world, we must address how we are to program AVs with animals in mind. This means that animal advocates should devote some thought to formulating positions on this question and ensuring that those views are advanced.

Of course, it is possible that those who have made no explicit mention of animals in recent analyses of whom-to-harm problems might nevertheless regard themselves as having addressed the animal question; they might have done so simply by proceeding as though animals were included in their consideration of property. That is, some discussions of how AVs should be programmed to respond in emergency situations have addressed the question of how harm to property fits in. Since most legal systems regard animals as property, or at least as being eligible to be turned into property, it is conceivable that these discussions of how AVs' emergency algorithms should regard property were intended to embrace the question of how they should regard animals.

This seems unlikely. Not all the animals whose interests should be present in such discussions are straightforwardly thought of as property, wildlife for instance. Moreover, these days some animals commonly bought and sold, or transferred as gifts, sometimes fit only uncomfortably into traditional notions of property. A recent instance of this is a decision of the Court of Appeal of Newfoundland and Labrador where, in the course of deciding which party should get possession of a couple's beloved dog following their break-up, one judge commented at length on the need for the law to treat animate property differently than inanimate things, at least for some purposes.[13] And a 2015 amendment to the *Civil Code of Québec* states: "Animals are not things. They are sentient beings

12. Sarah Zielinksi, "Climate Change Will Accelerate Earth's Sixth Mass Extinction" (2015), online at *Smithsonian Magazine* https://www.smithsonianmag.com/science-nature/climate-change-will-accelerate-earths-sixth-mass-extinction-180955138 [perma.cc/EY48-KW3E].

13. *Baker v Harmina*, 2018 NLCA 15 at paras 48-52, Hoegg JA, dissenting in part.

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and have biological needs."[14] We suspect that analyses of AV emergency algorithms, even those that expressly mentioned property, simply overlooked them.

Either way, we suggest that animals merit express and distinct consideration when these questions arise and that their treatment should be more nuanced than simply lumping them in with inanimate property. The lives and suffering of sentient nonhumans are considered important in other areas of law and policy as well as ethics. Indeed, as we will see in our ethics discussion, according animal interests equal consideration to relevantly similar human interests is a live debate and such a position is not easily dismissed merely on the grounds of species identity.[15] To seriously countenance such a position is to countenance something in deep tension with viewing the relevant animals as property. Even where animals are ranked as property, many areas of Canadian law recognize that some of them are a special class of property—one whose members have a moral status that dictates that they may not be subjected to suffering or distress without justification. With that in mind we offer some thoughts on how animals might be treated in AV whom-to-harm problems and AV software more generally.

3. How Animals Might Fare Under Law as it Currently Stands

In considering how animals' interests might figure in AVs' whom-to-harm software it will be useful to start by glancing at how those interests have been treated in Canadian law. In the past, whom-to-harm situations have arisen with human-driven vehicles, presenting drivers with agonizing decisions over whether to swerve to avoid a small creature in the road ahead—thus imposing increased risks on passengers and pedestrians—or maintain course and kill the animal. In cases where drivers have swerved to spare the animal they have sometimes harmed humans or their property. That has given rise to both criminal and civil court cases in which the legality of the drivers' evasive action had to be assessed. Those assessments, found in reported decisions, may be of some use in informing the design of AVs' pre-set algorithms for whom-to-harm situations.

We digress here to note that we presume that when driverless vehicles are deployed their whom-to-harm algorithms will be made mandatory—that is, not amenable to driver choice or modification but instead dictated by law. It might be thought that owners of AVs should be free to select their own software to deal with the whom-to-kill problem. One can imagine a world in which manufacturers and retailers of AVs offer purchasers a variety of software options for whom-to-harm scenarios: selfish ones for ethical egoists, which would opt never to harm the driver;[16] another for altruists; one for Kantians; another for

14. Art 898.1 CCQ.

15. Andrew Fenton, "Decisional Authority and Animal Research Subjects" in Kristin Andrews & Jacob Beck, eds, *The Routledge Handbook of Philosophy of Animal Minds* (Routledge, 2018) 475.

16. Belay, *supra* note 11 at 129 (advocating that all AVs be so programmed).

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Utilitarians;[17] perhaps even one for drivers who renounce human supremacy.[18] While this remains conceivable, it seems more likely that public policy will dictate a uniform solution, at least for most private vehicles.[19] Of course, currently human drivers do have choice. They elect how to respond in whom-to-harm situations. However, these choices sometimes result in litigation where the legality of those decisions is assessed *ex post facto*. In an AV world where considerations pertinent to such decisions can be set in advance, the legal system can impose its desired outcomes at the design stage. That suggests that there will at least be legal[20] constraints to manufacturer and owner choice in selecting AV whom-to-harm algorithms. A further reason for compulsory software is that both in emergency and non-emergency situations it will be advantageous if AVs know how *other* AVs are programmed. This would be difficult if there were owner choice in the matter.[21] Finally, even if such uniformity is not imposed by law, it may effectively be dictated by the insurance industry.

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17. Jean-François Bonnefon, Azim Shariff & Iyad Rahwan, "The Social Dilemma of Autonomous Vehicles" (2016), 35 Science 1573 offers the results of an empirical study that shows that most people would like others to buy AVs that had a Utilitarian algorithmic morality, but themselves would prefer to acquire AVs that protect their occupants at all costs. Against that there is some empirical evidence that when whom-to-harm situations do arise on the road human drivers make decisions that seem informed by a Utilitarian outlook: Anja K Faulhaber et al, "Human Decisions in Moral Dilemmas are Largely Described by Utilitarianism: Virtual Car Driving Study Provides Guidelines for Autonomous Driving Vehicles" (2019) 25 Science & Engineering Ethics 399. None of the hypotheticals employed in this study involved nonhumans.

18. The title of a recent article suggests yet another variation: Derek Leben, "A Rawlsian Algorithm for Autonomous Vehicles" (2017) 19:2 Ethics & Information Technology 107. Driving behind a veil of ignorance strikes us as problematic. In an even lighter vein Adam Gopnik speculates about a Nietzschean version which would drive right over anything, and also software inspired by Albert Camus "which would stall and pause in the middle of the highway while the traffic backs up behind—and then suddenly shoot off, bang, because the existential leap must be made, and some pedal struck." A Gopnik, "A Point of View: The Ethics of the Driverless Car" (2014), online at *BBC News online* https://www.bbc.com/news/magazine-25861214 [perma.cc/2H7F-DWFS].

19. Presumably police cars, fire engines and ambulances will have software that differs from that mandated for private vehicles—for example, by permitting breach of speed limits and some other traffic regulations.

20. We sidestep the question here of whether the legal response to this question will or should be imposed at the national level or provincially. That will depend on as-yet unresolved questions of constitutional law. Present laws governing vehicles in Canada exist at both the federal and provincial levels, and questions relating to the advent of AVs are being discussed at both levels. While a uniform national response seems simpler, provincial variation is possible. AVs equipped with GPS can tell when a provincial border has been crossed and adjust accordingly. Indeed, these will be necessary, since traffic laws already differ provincially—e.g., whether a right turn is permitted on a red light. So AVs' software will already have to respond to legal differences arising from crossing provincial borders. That being so, there could be software that responds differently in a whom-to-harm situation depending on the law on that matter applicable in the place where the vehicle happens to be at the time.

21. The view that the software for whom-to-harm problems will not be left to individual manufacturers or AV owners is broadly accepted: Ivó Coca-Vila, "Self-Driving Cars in Dilemmatic Situations: An Approach Based on the Theory of Justification in Criminal Law" (2018) 12:1 Crim L & Philosophy 59 at 61-63; Jan Gogoll & Julian Müller, "Autonomous Cars: In Favour of a Mandatory Ethics Setting" (2017) 23:3 Science & Engineering Ethics 681; Belay, *supra* note 11 at 129.

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In designing such software what lessons, then, might be gleaned from judicial decisions in whom-to-harm cases involving human drivers and nonhumans—in particular, from cases where drivers swerve or panic brake to avoid hitting and killing a small animal in the roadway and injury to humans ensues? From our review of the reported cases the first thing to note is that drivers often do take evasive action to avoid colliding with small animals, even when doing so increases risks to themselves and other humans. Presented with a small animal appearing in the road before them—an animal they could opt to hit with minimal consequence to themselves or their vehicle—they often either swerve to avoid a collision or jam on the brakes.[22] When harm to humans has resulted the law has generally been unforgiving: it has regarded swerving to be unreasonable, giving rise to liability under the tort of negligence. Indeed, steering to avoid a collision with a small animal has even been adjudged *presumptively* negligent, on a par with driving on the wrong side of the centre line.[23] In the words of the Chief Justice of British Columbia in a case where the driver had swerved to avoid a dog, "If the choice is between an animal and human safety then … there is no real choice and the animal must suffer."[24]

Where the driver's alternative is between death to the animal and *non-fatal* injury to humans, the harm to humans is the greater wrong.[25] A nice illustration of this appears in a case where a bus driver was held to have erred in successfully braking hard to avoid killing a dog but at the cost of relatively minor injury to a standing passenger who fell over.[26]

The holdings in these cases, and others, is especially notable in light of the fact that courts typically exercise a measure of leniency with respect to decisions made in emergency circumstances. For example, in exonerating the driver in *Canadian Pacific Ltd. v. Gill* (not an animals case) the Supreme Court of Canada noted that it is "trite law that faced with a sudden emergency for the creation of which the driver is not responsible he cannot be held to a standard of

22. We suspect that they swerve less frequently for animals than for humans. A study that asked American college students whether, as drivers, they would swerve to avoid killing a pedestrian, even at the risk of injury to themselves, elicited the following responses: 94% would swerve to avoid hitting a human child, 84% would swerve for an adult, and 27% for an (unspecified) animal: Katherine Brunk, "The Pedestrian Safety Problem and the Ethical Implications in the Age of Autonomous Vehicles" (2019), online at *All Theses 3131, Clemson University* https://tigerprints.clemson.edu/cgi/viewcontent.cgi?article=4138&context=all_theses [perma.cc/L4GB-6AJF] at 41-42.

23. *Olsen v Barrett*, 2002 BCSC 877 at para 52.

24. *Molson v Squamish Transfer Ltd* (1969), 70 WWR 113 (BCSC) at 114.

25. Drivers can even be liable for property damage caused when they swerve to avoid killing a cat that runs in front of their car: *Falkenham v Zwicker* (1978), 32 NSR (2d) 199, 93 DLR (3d) 289 (SC).

26. *Sutherland v Glasgow Corp*, 1949 SLT 388 (2nd Div). There, the court was quite clear in articulating the choice as being between the life of the animal and mere minor injury to a human. Although the court found that the driver's actions did save the dog's life, it still held that he had made the wrong choice. He should have pursued the option that involved killing the dog but not bruising his human passenger. For a Canadian case where braking (not swerving) and coming to a stop to avoid killing a small animal was held to be negligent, see *Gill v Bains*, [1985] BCJ No 510, Vancouver Registry No B831070 (SC).

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conduct which one sitting in the calmness of a courtroom later might determine was not the best course."[27]

Tort law has a name for this: the "agony of the moment" doctrine. Here is a description from a leading Canadian text:

> The sudden emergency, "agony of collision" or "agony of the moment" doctrine illustrates the basic proposition that the standard of care is that degree of care which would have been taken by the reasonable person *in like circumstances* . . . The significance of the sudden emergency doctrine is that it will permit a person who is faced with a sudden emergency to make a choice which would not have been acceptable in a non-emergency situation . . .[28]

So, for example, in a case where a driver caused personal injury to humans by swerving to avoid a harmless inanimate object that suddenly appeared in the road in front of her the court found her action reasonable in the circumstance: "The average motorist will flinch from driving over a cardboard box or even a large sheet of paper; there is something in all of us that prompts reaction, by braking or swerving, to avoid any unnatural material in the road."[29]

However, the doctrine does not seem to get applied in animal cases. The fact that drivers who harm humans by swerving to avoid inanimate objects are accorded greater forgiveness than those who do so when swerving to avoid killing animals gives rise to a suspicion that courts are anxious to avoid ever being seen as valuing animal life as in any way comparable to human life, or even human health.

All of this suggests that if law is to be the chief guideline for AV whom-to-harm algorithms then animals, or at least small ones, will be losers. On the roads most evasive action or emergency braking poses some increased risk to humans, even if only minimally, but running over a cat or squirrel does not. A whom-to-harm algorithm requiring that AVs treat harm to animals' lives as lesser than *any* risk of injury to humans would effectively require AVs to run over a lot of animals, even where the risk (to humans) of trying to avoid doing so was small.[30] This may not be shocking given how other aspects of Canadian law view animals' lives. For instance, it subordinates those lives to humans' gustatory interests. To offer another example, the regime that regulates biomedical

27. *Canadian Pacific Ltd v Gill*, [1973] SCR 654 at 665, Spence J.

28. Lewis Klar & Cameron Jefferies, *Tort Law* 6th ed (Thomson Reuters, 2017). For a sample of cases where this has been applied, see *Ferguson Estate v MacLeod*, [2000] PEIJ No 11, 2000 PESCTD 9; *Butler v O'Brien*, [1954] ILR at para 85, [1954] 34 MPR 121, 1954 CarswellNfld 16 (NS); *Morton (Next friend of) v Sykes,* [1951] OJ No 250, [1951] OWN 687, 1951 CarswellOnt 293 (High Ct); *Wood v Paget*, [1938] 3 WWR 33, [1938] 4 DLR 325 (BCCA).

29. *Sturm et al v Gagne Gravel Co Ltd et al*, (1966) 57 WWR 344 (Man QB) at para 16.

30. Something like this was the conclusion of the German Ethics Commission, *supra* note 10. Recommendation 7 states that AVs "must be programmed to accept damage to animals . . . if this means that personal injury [to humans] can be prevented." One scholar who anticipated our fear that AVs might make things worse for nonhumans is Oliver Bendell. See Oliver Bendell, "Considerations About the Relationship between Animals and Machine Ethics" (2016) 31:1 AI & Society 103. But his reasoning (at 107) was that AVs aligned to economic interests would avoid swerving because they would prefer to damage animals rather than the car.

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experimentation in Canada regards the lives of laboratory animals as worth less than the slim chance of finding improved treatments for human afflictions, and this goes not only for fatal diseases like cancer and Alzheimer's but for less serious conditions such as male pattern baldness or tattoo removal. That being the case, some persons may regard the AV whom-to-harm algorithms just described as entirely appropriate.

However, the possibility that a new technology which makes the world safer for humans might simultaneously make it less so for animals should at least give us pause. Currently, human drivers frequently brake or swerve in an attempt to avoid running over, say, a cat or a duck—often succeeding and preserving an animal's life without harming any humans. In replacing humans with technology, it is important not to make the relevant decision space less humane. To do otherwise is to abandon what amounts to a rather conservative and basic moral orientation governing human-animal relations. If we are to support the view that AV whom-to-harm algorithms should reflect a greater regard for the impulse not to drive cars over small animals, we need to look beyond the law as it is currently understood and applied.

4. A Turn to Ethics

If we are right about the law as it currently stands, perhaps ethics provides a more fruitful domain in which to interrogate and trouble the kinds of values and evaluations that support or legitimize prioritizing the interests of humans to the exclusion of other animals. Though ethical judgments are not straight-forwardly relevant to law (except, perhaps, criminal law), they can be relevant to those creating laws or those, in liberal democracies like Canada, voting for others who, at their best, represent their constituencies within institutions where laws are created. Engaging ethics well does not require a commitment to foundational moral judgments or agreeing with socially prominent or dominant value commitments that support prioritizing some to the exclusion of others. Ethics need not be anthropocentric, unlike much of law, and so can provide a space for careful reflection that challenges the status quo.

Two fundamental approaches to our treatment of other animals that will concern us here talk in terms of either indirect or direct duties. Indirect duty views do not consider unnecessary harms to be morally wronging the animals concerned. Rather, who is wronged is either the agent themselves or others enjoying moral status (usually other agents taken to be relevantly similar to the agent acting wrongly).[31] Direct duty views do consider unnecessary harms to be morally wronging the animals concerned, even where the animals do not enjoy equal moral status.[32] Where animals do not enjoy equal status, human interests can take

31. Christine Korsgaard, "Interacting with Animals: A Kantian Account" in Tom L Beauchamp & RG Frey, eds, *The Oxford Handbook of Animal Ethics* (Oxford University Press, 2011) 91.
32. Tom L Beauchamp, "Rights Theory and Animal Rights" in Beauchamp & Frey, *ibid*, 198.

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priority and so can reflect an anthropocentrism familiar to law.[33] Greater specificity about direct duty views complicates such a claim. Direct duty views which index moral status to the capacities of those who can be morally wronged are unlikely to hold that all humans enjoy a moral status that exceeds that which is accorded other animals (e.g., human embryos or first trimester human fetuses).[34] Even here, however, there will be humans who enjoy greater regard than both some other humans and other animals. We submit that the inclusion of animals in discussions of the future use and position of AVs in whom-to-harm scenarios can be defended using either fundamental approach, though one approach is much less likely to require a significant rethinking of how animals are regarded in law. Let us take each in turn.

Perhaps the best-known advocate of indirect duties to other animals in the modern era is Immanuel Kant.[35] For Kant, animals lack moral status because they are not rational agents who purposefully act in ways that cohere with their values, desires, and reasons and who can subject their decisions to act to logical and ethical scrutiny. To use language adapted from Kant, animals are not ends-in-themselves.[36] Again for Kant, animals cannot be wronged by being unnecessarily harmed, but rational agents can harm themselves and others if they act in ways that ignore relevant similarities between themselves and animals, similarities that support particular duties to fellow rational agents and require a cultivated sensitivity and responsiveness to such grounds to adequately fulfill those duties to fellow rational agents. This last part was put in terms of an avoidance of an insensitivity that negatively affected one's moral agency or ability to act morally in the world, and could harm others in the process.[37,38]

So, Kant is not indifferent to what we take to be the mistreatment of animals, though for anthropocentric reasons. To mistreat relevantly similar animals risks developing a comfort with mistreating fellow humans (understood as fellow

33. David DeGrazia, *Animal Rights: A Very Short Introduction* (Oxford University Press, 2002).

34. The Utilitarian RG Frey accepted both that we have direct duties to other animals and that some humans did not enjoy a higher moral status than some other animals. See RG Frey, "Animals and Their Medical Use" in Andrew I Cohen & Christopher Heath Wellman, eds, *Contemporary Debates in Applied Ethics* (Blackwell Publishing Ltd, 2005) 91.

35. It may seem odd to use Kant here, particularly as his view is quite a dated one. We have two reasons for our choice: (1) As noted above, Kant provides a clear and well-known indirect duty view of animals. (2) Unlike contemporaries like Carruthers (Peter Carruthers, *The Animals Issue: Moral theory in practice* (Cambridge University Press, 1992)), he also evidences some surprising sensitivities to other animals despite their lack of moral standing. Of course, Kant is also a giant in theoretical ethics and so, despite the fact that Kant is long dead, his influence continues unabated.

36. Korsgaard, *supra* note 31.

37. Immanuel Kant, *Lectures on Ethics*, translated by Louis Infield (Hackett, 1963).

38. There is a risk of using the *Lectures on Ethics* as a source of Kant's thought. These are not, on the whole, notes taken during his lectures. They also do not reflect his mature thought. (On this point see Alice Pinheiro Walla, *Review of Kant's Lectures on Ethics: A Critical Guide*, Lara Denis & Oliver Sensen, eds, (2016), online at Notre Dame Philosophical Rev https://ndpr.nd.edu/news/kants-lectures-on-ethics-a-critical-guide [perma.cc/SEM6-3HSU]. Nevertheless, the position on our indirect obligations to animals, taken in those notes (and we will limit our use of primary sources for Kant's view on animals to *Lectures on Ethics*), is useful for our discussion as they reflect a reasonable view taken from that vantage point.

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rational agents). Without good reason to act cruelly, or without regard for the relevant animal's possible stress or distress, we should not so act. To do otherwise risks harming our own humanity; it is in our own self-interests not to do that and, to top it off, it is required by moral law.[39] This commitment of Kant's will be put to use momentarily, but first let us get some other self-interested reasons out of the way that can nevertheless impact how other animals fare in a world dominated by AVs.

The size of animals will matter when considering whether an AV should avoid or run them over. The bigger the animal the more clearly prudential it is to for the AV to avoid collision. A moose or deer is best avoided; to do otherwise risks human life and limb.[40] But, depending on the size, a domestic pig is also best avoided. Presumably, AVs will come in various sizes, so even a pig can do enough damage to a vehicle to warrant avoiding them on roadways. We can rehearse this point where horses are used as transport, in or outside of the city (think of police horses versus recreational riding), though other humans now enter the decisional context. We can go a little deeper.

Religious practitioners are not impervious to demands to regard how other animals fare when they act in the world. Though this can be an other-regarding element of the relevant religion, it need not. Certain cosmologies attach negative significance to harming animals or positive significance to benefiting them (e.g., Buddhism and Hinduism). Where either significance involves lengthy residence in unpleasant or pleasant locales after death (e.g., hells or heavens), or unpleasant or pleasant future consequences for the actor, the self-interest is unmistakable. Even if only during a period of transition from current vehicles to AVs, depending on how responsibility for animal harm is understood in situations where machines make the decisions, religious practitioners may well be advised, or morally required, to attend to how AVs are programmed to avoid harming animals and weigh-in on those discussions before market or other forces become decisive.

Returning to Kant's approach to animals, we now know that the connection between cruelty to animals and mistreatment of humans is complicated and not quite as Kant understood it. There is a growing consensus, for example, that animal cruelty can be a precursor to mistreating humans when the cruelty is not socially sanctioned or tolerated. Where it is socially sanctioned or tolerated, the connection is much less clear.[41] If true, this is an important discovery because what qualifies as "risky cruelty"[42] will differ, even if only slightly, across the world. In other words, even if only rarely, "risky cruelty" may be different depending on where you are in the world and so some forms of cruelty avoid

39. Kant, *supra* note 37.
40. Patrick Lin, "Why Ethics Matters for Autonomous Cars" in Markus Maurer et al, eds, *Autonomous Driving: Technical, Legal and Social Aspects* (Springer, 2016) at 69.
41. Eleonora Gullone, *Animal Cruelty, Antisocial Behaviour, and Aggression: More than a Link* (Palgrave Macmillan, 2012).
42. By "risky cruelty" we mean animal cruelty that significantly increases the risk of the relevant actor mistreating humans.

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being inescapably risky. Regardless, applying this approach to our current focus will be difficult. Unless the running down of animals on roadways qualifies as a socially proscribed expression of animal cruelty, programming AVs to do so will not clearly connect to Kant's view of our indirect duties to animals. Kant's position may remain relevant in other ways, however. There is increasing evidence that work in abattoirs can have a significant adverse effect on the mental health of abattoir labourers.[43] For those labourers, then, it would be better to avoid work that involves the slaughter and butchering of animals. This may be enough to connect back to Kant's view,[44] as such work can negatively impact the humanity we are all under obligation to cultivate if mental health issues experienced by some abattoir workers negatively impact their ability in the future to act autonomously or morally. Perhaps, then, the intentional killing of animals on roadways can enjoy proscription should such killing adversely affect those in the vehicles.

An obligation to avoid small-mindedness, mentioned by Kant when talking about our obligations to animals, does not seem to be reducible to cruelty and so can apply even where cruelty is not an issue. He states, "[a] master who turns out his ass or his dog because the animal can no longer earn its keep manifests a small mind."[45] Earlier in the same lecture he states, "if a dog has served his master long and faithfully, his service, on the analogy of human service, deserves reward, and when the dog has grown too old to serve, his master ought to keep him until he dies."[46]

For Kant, small-mindedness harms the humanity of the actor, encouraging them not to universalize certain caring or respectful responses that should be universalized. The kind of caring or respectful response motivated by long and faithful service surely affects the steps taken to protect the relevant animals from unnecessary death. For example, Kant does not think that it is appropriate to simply "euthanize" the dog after their service is over. As long as those animals live among us, we have reasons to program AVs so as to avoid harming them, at least at first glance. This can include more than faithful dogs. We can talk of faithful horses, cats, birds, and even rats, so long as the companionship these animals provided their guardians can be reasonably construed as a service, as we think it can. More formal service animals can include more than dogs, and, when they are there for mental health support, relevantly resemble companion animals in socially bonded, interspecific family units. Besides, service animals provide a clear service and should be rewarded for it.

Perhaps we can continue to broaden the sense of service we are drawing from here to include the maintenance of our environment (including the health of our

43. Jean Lian, "Silence on the Floor" (2013), online at *OHS Canada* https://www.ohscanada.com/features/silence-on-the-floor [perma.cc/AEB8-A9LA] and Jessica H Leibler, Patricia A Janulewicz & Melissa J Perry, "Prevalence of Serious Psychological Distress among Slaughterhouse Workers at a United States Beef Packing Plant" (2017) 57:1 Work 105.

44. Kant himself seemed to believe that butchering adversely affected the humanity of butchers. Kant, *supra* note 37.

45. *Ibid* at 241.

46. *Ibid* at 239-40.

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biosphere), the facilitation of our food production, and even the health benefits we reap from periodically exploring national parks, protected areas, or wilderness. If we can, the indirect duty view that we have been outlining can be used to motivate programming our AVs with a sensitivity to the presence of many more animals than might otherwise be the case.

There is another avenue which perhaps we could take, using Kant as our guide. In his *Grounding for the Metaphysics of Morals,* Kant provides one argument against the morality of suicide that foregrounds the contradictory nature of a universal law of nature that leads those obeying it to destroy life.[47] Though this may be pressing Kant's point too far, the growing concern to stay the decline of global free-living animal populations, to conserve wilderness, animal habitats, and rainforests, and maintain a to-be-specified level of biodiversity can all be understood in terms of human self-interest. Indeed, this is often how these considerations are put in public media.[48] To universalize maxims that threaten the stability or survival of our biosphere, and so ourselves, seems to violate the kind of ethical analysis that Kant would bring to bear. If something like this move is right, it could once again motivate programming our AVs with a broad sensitivity to what they are free or not free to run over.

Of course, there are limits to this line of reasoning. Considerations of whom-to-harm scenarios will not, on indirect duty views, favour other animals over humans. But all is not lost. The considerations we have canvassed would warrant making significant efforts to rethink how we move about in our world. Arguably, trivial reasons for travel would be critically scrutinized, we should redesign various spaces through which we travel to minimize lethal or harmful encounters with other animals, and perhaps prohibit the use of vehicular transport in ecologically sensitive areas.

However, this is not likely to satisfy those who would defend according greater moral significance to the animals who might be seriously injured or killed by AVs. It is to direct duty views of our obligations to animals that we now turn.

As we mentioned earlier, direct duty views can come in two versions. Under one version animals can be directly wronged by our actions, but the animals do not enjoy equal moral status with ourselves (broadly construed to include all humans who enjoy high moral status). The other version also holds that animals can be directly wronged by our actions but, in contrast to the first version, holds that a to-be-specified number of these animals enjoy equal moral status with ourselves.[49]

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47. Immanuel Kant, *Grounding for the Metaphysics of Morals*, translated by James W Ellington (Hackett, 1993) (original work published 1785).

48. Jonathon Gatehouse, "Human Activity Pushing Earth towards 'Sixth Mass Species Extinction,' Report Warns" (2018), online at *CBC News* https://www.cbc.ca/news/thenational/national-today-newsletter-russia-diplomats-biodiversity-1.4592950 [perma.cc/3JWQ-4NL4] and Isabelle Garretsen, "One Million Species Threatened with Extinction because of Humans" (2019), online at *CNN* https://www.cnn.com/2019/05/06/world/one-million-species-threatened-extinction-humans-scn-intl/index.html [perma.cc/3GA2-QTZD].

49. DeGrazia, *supra* note 33.

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Direct duty views where other animals are not moral equals to ourselves (direct duty unequal views) can reflect what some have called a sliding scale of moral status. A sliding-scale approach holds that

> [o]ne animal enjoys greater moral status (or is due greater moral regard) than another based, at least partially, on their morally significant psychological capacities: thus a chimpanzee or dog enjoys a higher moral status (or is due greater moral regard) than a zebrafish or roundworm.[50]

It is possible that direct duty unequal views do not hold a sliding scale of moral status (e.g., perhaps all sentient animals who are not persons, or who cannot form and prioritize higher-order desires, goals or preferences, are both all equal to each other but not equal to persons or those who can form and prioritize high-order desires, goals, or preferences),[51] but we will not discuss them here for several reasons. First, where moral views hold that we have direct duties to animals but resist proscribing the use of animals in the food, research, or testing industries, they tend to reflect a sliding-scale approach.[52] We think it is safe to claim that such views outnumber either indirect duty views, direct duty unequal views which hold that all other animals enjoy a moral status equal to each other, or direct duty views where other animals are our moral equals. Second, policies governing the use of animals in, say, the research or testing industry tend to offer special protections to some animals based on their greater social importance (e.g., cats, dogs, horses, and nonhuman primates).[53] These can be readily understood as reflecting direct duty unequal views committed to a sliding scale of moral status, though such a scale is informed by the social significance of animals, not just their morally significant psychological capacities. A third reason arises out of a very common view in applied ethics that interests reflect the capacities of animals who possess them, so that we can reasonably talk of differing interests across taxa relative to differing capacities among members of these taxa.[54] It is possible that animals with interests in, say, liberty of movement, liberty of social choice, and control over their immediate environments will enjoy protections that for various reasons incline those using animals to use those who either lack those interests or lack them to a lesser or greater degree. This effectively supports a sliding scale where the use of animals lacking or possessing "burdensome" interests to a lesser or greater degree is consistently favoured and normalized as animals first-to-be-used.[55]

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50. Andrew Fenton, "On the Need to Redress an Inadequacy in Animal Welfare Science: Toward an Internally Coherent Framework" (2012) 27:1 Biology & Philosophy 74.
51. David DeGrazia, "Moral Status As a Matter of Degree?" (2008) 46:2 Southern J Philosophy 181.
52. For evidence of this in the scientific use of animals see *ibid*.
53. E.g., EC, *Commission Directive 2010/63/EU of 22 September 2010 on the protection of animals used for scientific purposes*, [2010] OJ L 276/33.
54. Beauchamp, *supra* note 32 and Martha Nussbaum, "The Capabilities Approach and Animal Entitlements" in Beauchamp & Frey, *supra* note 31 at 228.
55. We are not suggesting that such an attitudinal change about first-to-be-used animals would be defensible.

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We can expect that direct duty unequal views will favour AV programming that is sensitive to the presence of socially significant animals, be they companion animals, primates, or working animals. Presuming that the visual acuity of these vehicles is less than ours, and/or programmers are (required to be) responsive to the variety of animals who can qualify as companion animals, such programming sensitivity should favour a number of animals living among us.[56]

The environmental and ecological considerations, mentioned earlier in relation to indirect duty views, can re-enter our discussion here, as there will be many environmental advocates who take direct duty unequal views of our obligations to other animals quite seriously.[57] Arguably, direct duty unequal views can provide support for stronger constraints on travellers who would risk seriously injuring or killing animals of great ecological or conservation significance. After all, on top of considerations of human self-interest there would be the interests of the relevant animals themselves, however they are weighted or ranked. Much the same could be said for religious constraints on harming other animals, where those constraints are understood to reflect other-regarding, species-inclusive considerations.

As with indirect duty views, however, direct duty unequal views are unlikely to favour animals over humans in whom-to-harm scenarios. They would offer greater support for even more changes in the way we travel than indirect duty views, but they are still likely to resemble attitudes of some of the judges mentioned in our earlier discussion of law.

For those yet to be satisfied by this discussion of the promise of ethics to substantively inform AV programming in animal friendly ways, there is still hope. Though direct duty unequal views are, we think, very popular, they come under increasing strain when they hold that no other animals can enjoy a moral status equal to ourselves (that is, those humans who enjoy high moral status). As one of us has argued elsewhere, the more we learn about the psychological capacities of other animals on this planet, the more a number of animals seem to enjoy a relevantly similar range of interests as ourselves. Chimpanzees quickly come to mind, but so do domestic dogs, dolphins, elephants, and crows.[58]

Some think that our species identity gives us special moral importance, but this has not survived critical philosophical analysis. Consider, personhood is often taken to be a marker of high moral status of the kind we commonly accord ourselves. But there is no definitive account of personhood in the philosophical literature,[59] or to the best of our knowledge anywhere else, and no plausible

56. Alastair Bland, "Will Driverless Cars Mean Less Roadkill?" (2015), online at *Smithsonian Magazine* https://www.smithsonianmag.com/innovation/will-driverless-cars-mean-less-roadkill-180957103 [perma.cc/2TUX-YV5E]. See also Candice Gaukel Andrews, "Self-Driving Vehicles Could Save Animal Lives" (2018), online at *Good Nature Travel* https://www.nathab.com/blog/self-driving-vehicles-could-save-animal-lives [perma.cc/FVK4-AD2E].

57. E.g., Gary Varner, "Environmental Ethics, Hunting, and the Place of Animals" in Tom L Beauchamp & RG Frey, eds, *The Oxford Handbook of Animal Ethics* (Oxford University Press, 2011).

58. Fenton, *supra* note 50.

59. Fenton, *supra* note 15.

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account treats being a member of our species as a necessary condition.[60] There are some simple reasons for this. First, such a restrictive account would not reflect its common historical use. Many religious stories and teachings are populated by nonhuman persons.[61] Even if some, many, or all of these stories and teachings stretch credulity, it is not on the grounds that only humans can be persons. Second, should there be sapient life on other planets whom we can detect or encounter, some will likely be persons in the sense we commonly use to describe ourselves.[62] At least, this is not an unreasonable view, but it could not be otherwise if only humans are persons. Third, there was a time in our species' past when we co-existed with other members of our genus. There is even suggestive evidence that some early members of our species interbred with Homo neanderthalensis and Homo altai.[63] Despite their off-spring not being fully members of our species, it does stretch credulity to hold that they were lesser (or 'half'-) persons because of it. Indeed, it stretches credulity to think that their mates were lesser or non-persons too.

Once being a member of our species is ruled out as a necessary condition, we face the very real prospect that some other animals are persons. We are not going to offer an account of personhood that clearly includes other animals, as we do not have to for our discussion to trouble direct duty unequal views. The more inclusive your views of personhood are, the more animals are likely to qualify (e.g., chimpanzees, dolphins, domestic dogs, macaques). The less inclusive your views, the less likely that all humans, between birth and death, are persons. Even in such a scenario, formal justice considerations—that like should be regarded alike—will favour animals whose psychological and behavioural profiles evince a range of interests relevantly similar to those seen among protected humans, whether they are persons or not.[64]

An ethical framework that would continue to resist allowing that some animals are our moral equals, despite what we now know of their psychological or behavioural capacities and the kinds of critical considerations that can be brought to bear on views of human supremacy (see our quick discussion of personhood, above), looks so self-interested as to undermine its credibility. Important for our discussion here, none of us needs to admit that many animals enjoy moral equality with ourselves for that admission to require some radical constraints on how we program AVs. We can be as conservative as we like, as long as we are consistent. Any animals who are our moral equals (or the moral equals of humans between birth and death, whether they are persons or not) should enjoy the same kind of consideration as ourselves when thinking about whom-to-harm

60. Kristin Andrews et al, *Chimpanzee Rights: The Philosophers' Brief* (Routledge, 2019).
61. Andrew Fenton & Syd Johnson, "Philosophers' Brief on Chimpanzee Personhood" (2018), online at *Impact Ethics* https://impactethics.ca/2018/03/04/philosophers-brief-on-chimpanzee-personhood [perma.cc/S3Y7-79US].
62. Kristin Andrews, "The Psychological Concept of 'Person'" (2016) 10:17 *Animal Sentience* 1.
63. Rasmus Nielsen et al, "Tracing the Peopling of the World through Genomics" (2017) 541 Nature 302 and Viviane Slon et al (2018) "The Genome of the Offspring of a Neanderthal Mother and a Denisovan Father" 561 Nature 113.
64. Fenton, *supra* note 15.

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scenarios. They are no more properly sacrificed than a child or grandfather on a pedestrian crossing. To the best of our knowledge, no efforts have been made to develop programming with this constraint in mind. If we are right here, there is much work that needs to be done.

5. Conclusions

Although we do not think that the law as it currently stands offers much hope of protecting animals from AVs in whom-to-harm scenarios, we have defended the view that a scientifically-literate, non-arbitrary ethical framework favours AV programming that considers at least some other animals on par with members of our own species. We have as yet to offer any views on how to resolve any of the various whom-to-harm scenarios that inform current discussions of safe AVs. That was not our purpose here. Rather, we want to highlight a lacuna in current discussions of safe AVs and have offered strong ethical considerations for why we need to do better. We hope we have at least made a case for why, when bioethicists are selected to contribute to the official policy discussions that will precede the formulation of Canada's laws dictating how AVs should respond to whom-to-harm scenarios, those persons should be attentive to the relationship between humans and animals and the relevance (or irrelevance) of species distinctions to questions of whom to harm.

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