ROBOT ETHICS AND SELF-DRIVING CARS: HOW ETHICAL DETERMINATIONS IN SOFTWARE WILL REQUIRE A NEW LEGAL FRAMEWORK

I. INTRODUCTION

Automated decision making in vehicles has played an increasing role in transportation as technology has yielded improvements to machine learning, sensing, and processing.[1] Today, cars perform complex tasks related to braking, steering, and object detection, often without the awareness of the driver.[2] Multiple major automotive companies already plan on releasing technologies that allow for hands-free driving assistance in the next couple model years.[3] Indeed, Google—one of the leading companies in self-driving cars—has publicly stated its intention to bring entirely autonomous cars to consumer markets within the next five years.[4]

Once considered science fiction, self-driving cars are becoming more of a reality every day.[5] However, along with the numerous benefits to convenience and safety,[6] these new technologies pose major ethical dilemmas.[7] Perhaps most notably, machines will have to make decisions regarding whom to save or protect in the event of a collision or unforeseen

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1. *See* Noah J. Goodall, *Machine Ethics and Automated Vehicles,* ROAD VEHICLE AUTOMATION 93, 93 (Gereon Meyer & Sven Beiker eds., Springer Int'l Publ'g 2014).

2. *See* Russ Heaps, *8 Great New Advances in Auto Technology*, BANKRATE (May 27, 2009), http://www.bankrate.com/finance/money-guides/8-great-new-advances-in-auto-technology-1.aspx.

3. *See, e.g.*, C.C. Weiss, *Cadillac to Introduce Automated Driving and Vehicle-to-Vehicle Tech in 2016*, GIZMAG (Sept. 12, 2014), *http://*www.gizmag.com/cadillac-super-cruise-v2v-2016/33769/.

4. Donna Tam, *Google's Sergey Brin: You'll Ride in Robot Cars Within 5 Years*, CNET (Sept. 25, 2012, 2:01 PM), http://www.cnet.com/news/googles-sergey-brin-youll-ride-in-robot-cars-within-5-years/.

5. *See Self-Driving Cars Coming to a Street Near You*, THE ECONOMIST (Sept. 18, 2014), http://www.economist.com/news/business-and-finance/21618531-making-autonomous-vehicles-reality-coming-street-near-you.

6. *See* Don Howard, *Robots on the Road: The Moral Imperative of the Driverless Car*, SCI. MATTERS (Nov. 13, 2014), http://donhoward-blog.nd.edu/2013/11/07/robots-on-the-road-the-moral-imperative-of-the-driverless-car/#.VGVY6FfF8QS; *See also* Christopher Mims, *The Potential Benefits of Driverless Cars are Stunning*, QUARTZ (Oct. 22, 2013), http://qz.com/138367/the-potential-benefits-of-driverless-cars-are-stunning/.

7. *See* Adam Gopnik, *A Point of View: The Ethics of the Driverless Car*, BBC NEWS MAG., http://www.bbc.com/news/magazine-25861214 (last updated Jan. 24, 2014).

obstacle.[8] Inseparable from these ethical considerations is the issue of legal liability,[9] for whoever dictates the car's behavior in these situations will also most likely be subject to the liability surrounding the outcome.[10] This article aims to survey the various approaches to the legal and ethical aspects of self-driving cars and offer the best strategy going forward to meet these considerations without deterring innovation in the market.

II. THE TROLLEY PROBLEM COMPARISON

Consider the following classic thought experiment in ethics: A runaway trolley is barreling down the tracks towards five unsuspecting railroad workers and will kill them if nothing is done.[11] Watching from a distance, you see a lever positioned next to you.[12] If you pull this lever, the trolley will switch to a separate set of tracks.[13] You notice, however, that the alternative tracks have a single railroad worker on them.[14] Your options are to either: 1) do nothing and allow the trolley to kill the five workers; or 2) pull the lever to divert the trolley and kill the one worker.[15] The experiment illustrates the difficult distinction between affirmative action that *causes* one death vs. "letting circumstance lie" and *allowing* five.[16]

A number of answers and justifications exist to this dilemma, known as "The Trolley Problem,"[17] dependent on one's personal moral values. According to a psychology study conducted at Michigan State University, roughly 90% of individuals would choose to kill the one worker instead of the five.[18] However, altering the scenario slightly (i.e. instead of switching the track, you would have to push a bystander in front of the train to save the five people) yields a far less confident response, despite the end result being the same.[19] This variability makes it difficult to determine a consistent ethically "correct" course of action. Certainly from a utilitarian

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8. Gopnik, *supra* note 7.

9. *See* Alexis C. Madrigal, *If a Self-Driving Car Gets in an Accident, Who – or What – is Liable?*, THE ATLANTIC (Aug. 13, 2014), http://www.theatlantic.com/technology/archive/2014/08/if-a-self-driving-car-gets-in-an-accident-who-is-legally-liable/375569/ [hereinafter *If a Self-Driving Car Gets in an Accident*].

10. *If a Self-Driving Car Gets in an Accident, supra* note 9.

11. Judith J. Thomson, *The Trolley Problem*, 94 YALE L.J. 1395, 1395-96 (1985).

12. Thomson, *supra* note 11.

13. *Id.*

14. *Id.*

15. *Id.*

16. *Id.* at 1396-97.

17. Thomson, *supra* note 11, at 1395.

18. David C. Navarrete et al., *Virtual Morality: Emotion and Action in a Simulated Three Dimensional "Trolley Problem"*, 12 EMOTION 364, 367 (2012).

19. *See* Thomson, *supra* note 11, at 1409-10.

perspective, saving five people outweighs the cost of losing one.[20] However, what if, for example, the one is a child and the others are adults?[21] Five adults might provide a higher net utility than one child, but western society often places a high moral value on saving the latter.[22] Moreover, at what point does general welfare impede on notions of personal liberty? The deaths of the five men can be characterized as a product of external factors (the trolley);[23] pulling the lever, however, would directly cause a person to die where he otherwise would not have.[24]

These are the sorts of considerations that both companies developing self-driving cars and their stakeholders will have to solve in order to curb liability and remain ethically sound. In fact, manufacturers of self-driving cars may even face a more difficult situation than that of the Trolley Problem due to the decision being pre-meditated.[25] In the case of a human, tort law provides a malleable scale of accountability for negligence cases (the Reasonable Person Standard)[26] to determine whether an individual fell short of his duty to others.[27] This test takes into account limitations in a human's ability to make the best decision given the specific circumstances (e.g. stress, time to react, etc.).[28] In the case of self-driving cars, however, the machine makes decisions based on the algorithms coded into its software.[29] Which is to say, the car will react in accordance to how the manufacturer pre-determined it should react in those circumstances.[30]

Imagine a scenario where a child runs in front of a car approaching a tunnel.[31] The options are to either hit and kill the child or swerve into the wall and kill the driver.[32] Or perhaps there is a scenario where a dog runs in front of the car.[33] To what degree should the car attempt to swerve (and

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20. *Id.* at 1408.

21. *Id.* at 1405.

22. *See generally* VIVIANA A. ZELIZER, PRICING THE PRICELESS CHILD: THE CHANGING SOCIAL VALUE OF CHILDREN 22-58 (Princeton U. Press 1994) (1985).

23. *See* Thomson, *supra* note 110, at 1397.

24. *Id.* at 1395-96.

25. *See* Patrick Lin, *The Ethics of Autonomous Cars*, THE ATLANTIC (Oct. 8, 2013, 12:23 PM), http://www.theatlantic.com/technology/archive/2013/10/the-ethics-of-autonomous-cars/280360/?single_page=true.

26. RESTATEMENT (SECOND) OF TORTS §283 (1965).

27. *See* RESTATEMENT (THIRD) OF TORTS §7 (2010).

28. *See* RESTATEMENT (SECOND) OF TORTS §283 (1965).

29. Alexis C. Madrigal, *The Trick That Makes Google's Self-Driving Cars Work*, THE ATLANTIC (May 15, 2014, 12:25 PM), http://www.theatlantic.com/technology/archive/2014/05/all-the-world-a-track-the-trick-that-makes-googles-self-driving-cars-work/370871/ [hereinafter *The Trick*].

30. *See The Trick*, *supra* note 29.

31. *See* Jason Millar, *Should Your Robot Driver Kill You to Save a Child's Life?*, THE CONVERSATION (Aug. 1, 2014, 6:00 AM), http://theconversation.com/should-your-robot-driver-kill-you-to-save-a-childs-life-29926.

32. Millar, *supra* note 31.

33. *See* Gopnik, *supra* note 7.

potentially endanger the driver or others) in order to avoid the dog? Does it make a difference if it is a squirrel?[34] Or perhaps there is a scenario where a human driver would ethically be justified in breaking the law, like a husband rushing his wife who is in labor to the hospital.[35] Should the car take such situations into account when determining its behavior? It may be tempting to conclude that self-driving cars will encounter these situations so infrequently that they hardly pose an issue.[36] However, by nature of operating in imperfect systems filled with human drivers, pedestrians, and animals that behave unpredictably, autonomous vehicles encountering these ethical calculations is all but guaranteed.[37] Thus, as long as there exists even the slightest possibility that a self-driving car will have to make an ethical decision, programmers will have to account for the various choices and moral reasoning in the car's software.[38]

On a systemic level, this raises the question of who exactly should have the power to determine who lives and who dies or else who will suffer injury to self or property. Should it lie in the legislature in the form of laws and policy that detail whom exactly to save? Should it be left up to the manufacturer of the machine in question? Should it minimize damage from an insurer's point of view? Or, ultimately, perhaps it should rest with the individual. While laws regarding automated cars are currently scarce[39], an application of legal ethics from established areas of law, like tort law, provide a framework to guide early law and policy as we move into the inevitable future of AI/Human interaction.

III. EXAMINING THE ASSIGNMENT OF RESPONSIBILITY (LEGAL AND ETHICAL) FOR THE DECISIONS MADE BY MACHINES

A. The Manufacturer

Perhaps the most obvious choice to determine the behavior of self-driving cars in ethical situations is the manufacturer. This designation would be consistent under traditional product liability notions where the manufacturer is "ultimately responsible for the final product."[40] That is, if there is a design defect within the control of the manufacturer that leads to

34. *See id.*

35. Dave Dickinson, *5 Issues Concerning Driverless Cars*, LISTOSAUR (Nov. 27, 2014), http://listosaur.com/science-a-technology/5-issues-concerning-driverless-cars/.

36. *See* Goodall, *supra* note 1, at 94-98.

37. *See id.*

38. *See id.*

39. *See id.* at 97.

40. Gary E. Marchant & Rachel A. Lindor, *The Coming Collision Between Autonomous Vehicles and the Liability System*, 52 SANTA CLARA L. REV. 1321, 1329 (2012).

some sort of harm, and the manufacturer knew or should have known of the defect, then they are going to be liable for the harm.[41] This raises the issue, however, as to whether an ethical determination that very well could have been made by a human driver in the same situation can be considered a "defect" so as to impose product liability. While tort law varies by state,[42] a majority of courts follow a similar two-part test for design defects as laid out by the California Supreme Court:[43]

> First, a product may be found defective in design if the plaintiff establishes that the product failed to perform as safely as an ordinary consumer would expect when used in an intended or reasonably foreseeable manner. Second, a product may alternatively be found defective in design if the plaintiff demonstrates that the product's design proximately caused his injury and the defendant fails to establish, in light of the relevant factors, that, on balance the benefits of the challenged design outweigh the risk of danger inherent in such design.[44]

Under this reasoning, a plaintiff would have a difficult time proving the second test given the benefits detailed previously in this article;[45] however, a plaintiff could have a case for the first test depending on the circumstances. For example, if the manufacturer programmed the car to minimize overall damage, which resulted in the car injuring the driver instead of multiple pedestrians, this result might be contrary to an ordinary consumer's expectation that a product would protect the owner first and foremost. In fact, according to a survey conducted by the Open Roboethics Initiative,[46] roughly 64% of people polled would prefer the car to protect their lives and those of their passengers before a pedestrian's.[47]

From an ethical standpoint, a manufacturer would likely have to apply a one-size-fits-all set of behaviors that may be inconsistent with those of the user.[48] For example, the manufacturer might program the car to always

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41. *See* Marchant & Lindor, *supra* note 40, at 1329.

42. *See* Thomson Reuters, *50 State Statutory Surveys: Civil Laws: Torts*, 0020 SURVEYS 29 (Westlaw)(2015).

43. *See* Thomas Reuters, *supra* note 42.

44. Barker v. Lull Eng'g Co., 573 P.2d 443, 455-56 (1978).

45. *See Self-Driving Cars Coming to a Street Near You*, *supra* note 5.

46. OPEN ROBOETHICS INITIATIVE, http://robohub.org/author/ori/ (last visited Nov. 13, 2014).

47. OPEN ROBOETHICS INITIATIVE, *If Death by Autonomous Car is Unavoidable, Who Should Die? Reader Poll Results*, ROBOHUB (June 23, 2014), http://robohub.org/if-a-death-by-an-autonomous-car-is-unavoidable-who-should-die-results-from-our-reader-poll/.

48. *See* Millar, *supra* note 31.

try to protect the driver seat,[49] but one can imagine a scenario where the driver would rather protect their significant other or child in the passenger seat. Or alternatively, the car might be programmed to save a pedestrian over a passenger when a human might value the opposite.[50] Such a system would subject the user to the values of the manufacturer, creating a situation where "cars [would] not respect drivers' autonomous preferences in . . . deeply personal moral situations."[51]

Ultimately, however, the reasoning against making the manufacturer responsible might be much more grounded: if the manufacturer were responsible for all the ethical decisions of a self-driving car, "the liability burden on the manufacturer may be prohibitive of further development."[52] This would potentially deter manufacturers from developing the autonomous vehicle altogether—a socially undesirable result.[53]

B. The Individual

If not the manufacturer, perhaps the next most intuitive party to hold responsibility over the vehicle's actions is the individual owner/user.[54] This designation would be consistent with the already well-established concept of liability resting with the driver.[55] However, as the "driver" in self-driving cars will have theoretically no role in the decision making process,[56] assigning liability will surpass the traditional negligence standard associated with vehicles in favor of strict liability.[57] Such a system would remove significant ambiguity from the legal side, but is it too much to ask a driver to potentially face full liability for the moral decisions of the car?

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49. *See* Kyle Stock, *The Problem With Self-Driving Cars: They Don't Cry*, BLOOMBERG BUSINESS WEEK (April 03, 2014), http://www.businessweek.com/articles/2014-04-03/the-problem-with-self-driving-cars-they-dont-cry.

50. *See* Stock, *supra* note 49.

51. Millar, *supra* note 31.

52. Marchant & Lindor, *supra* note 40, at 1334.

53. *See id.*

54. Alexander Hevelke & Julian Nida-Rümelin, *Responsibility for Crashes of Autonomous Vehicles: An Ethical Analysis*, SCIENCE AND ENGINEERING ETHICS 620, 623-627 (June 11, 2014), *available at* http://link.springer.com/article/10.1007%2Fs11948-014-9565-5.

55. Tim Worstall, *When Should Your Driverless Car From Google Be Allowed to Kill You?*, FORBES (June 18, 2014, 8:27 AM), http://www.forbes.com/sites/timworstall/2014/06/18/when-should-your-driverless-car-from-google-be-allowed-to-kill-you/.

56. *See* Samuel Gibbs, *Google's Self-Driving Car: How Does it Work and When Can We Drive One?*, THE GUARDIAN (May 29, 2014), http://www.theguardian.com/technology/2014/may/28/google-self-driving-car-how-does-it-work.

57. *See generally* Hans-Bernd Schäfer & Andreas Shönenberger, *Strict Liability Versus Negligence* (Munich Pers. RePEc Archive, Working Paper No. 5, 2008), *available at* http://mpra.ub.uni-muenchen.de/40195/1/MPRA_paper_40195.pdf.

Holding the driver responsible creates two major issues that could cripple the self-driving car from ever taking hold. First, a strict liability standard would create a strong disincentive against individuals adopting the new technology. How many people would consistently agree to be at the mercy of liability they do not control, especially when said liability could potentially deal with significant damages to life or property? Strict liability operates best as a deterrent against a specific behavior,[58] whereas negligence encourages a greater level of care when conducting that behavior.[59] Assuming that self-driving cars are a societally desirable change, as this article does, strict liability would not make sense as the controlling standard. Moreover, strict liability for the driver would (at least in part) remove incentives for the manufacturer to program smart decisions, as the manufacturer would share none of the risk associated with those decisions.[60]

One counterargument might be that driving is already essentially a strict liability activity.[61] Statistically, the average driver is likely to have a collision roughly once every 17.9 years.[62] Thus, just by engaging in the activity a driver is agreeing to be liable at some point. Under this rationale, the assignment of liability would not be based on the end result but rather the risk created merely by entering a car (driverless or otherwise).[63] Under such a model, owners of self-driving cars would share the responsibility of the risks the car creates.[64] This result could be achieved through some sort of tax or mandatory insurance.[65] The problem with this position, however, is that it ignores the idea of being morally "blameworthy" currently attributed to driving liability.[66] Even if a traditional driver's fault in an accident is inevitable,[67] the reprehensible conduct that lead to that specific accident still would exist.[68]

The other issue is that the driver would be liable for the decisions of the manufacturer but share no role in determining the ethical values of those decisions.[69] One possible solution would be to allow the driver to determine

58. *See* Schäfer & Shönenberger, *supra* note 57, at 6-8.
59. *See id.* at 6.
60. *See* Lin, *supra* note 25.
61. *See* Worstall, *supra* note 55.
62. Des Toups, *How Many Times Will You Crash Your Car*, FORBES (July 27, 2011, 6:50 PM), http://www.forbes.com/sites/moneybuilder/2011/07/27/how-many-times-will-you-crash-your-car/.
63. Hevelke & Nida-Rümelin, *supra* note 54, at 626-627.
64. *Id.* at 626.
65. *Id.* at 626-627.
66. *Id.* at 627.
67. *See* Toups, *supra* note 62.
68. Hevelke & Nida-Rümelin, *supra* note 54, at 627.
69. *See id.* at 626-627.

the ethical priorities of the car through a system of adjustable ethics.[70] Thus, the users of self-driving cars would be able to customize their car to reflect their own personal moral values.[71] In a poll by the Open Roboethics Initiative, 44% of respondents said the passengers in the vehicle should control how it responds in ethical situations.[72] Moreover, adjustable ethics might carry the added bonus of making consumers feel more comfortable holding end liability. Still, such a system would not be without drawbacks: it would create a level of unpredictability among self-driving cars, as each would behave uniquely depending on the specific ethics of the user. This might mirror more traditional driving today, but would potentially lessen the safety and efficiency benefits that come with self-driving cars being predictable to both other cars and the environment.[73]

The simplest solution to both the ethical and legal side of individual responsibility might be to require that a driver always be behind the wheel and ready to take over in emergency situations.[74] Under this "duty to intervene" model, the liability would be based on the driver's failure to pay attention and take over when necessary.[75] This model would mirror the traditional decision making process made currently by drivers, thus both making liability clear and removing the need for machines to make ethical determinations in place of a human driver.[76] In fact, such a requirement is already consistent with current legislation regarding self-driving cars requiring an operator present in the driver's seat.[77]

However, this model poses multiple practical issues. First, requiring an operator would eliminate much of the consumer appeal of a self-driving car.[78] Not only would this make impossible the comfortable notion of reading or browsing the internet while your car drives you to a destination,[79] but it would also prevent self-driving cars from performing one of their largest selling points: being controlled remotely.[80] For

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70. David Tuffley, *Self-Driving Cars Need 'Adjustable Ethics' Set by Owners*, THE CONVERSATION (Aug. 24, 2014, 4:43 PM), http://theconversation.com/self-driving-cars-need-adjustable-ethics-set-by-owners-30656.

71. Tuffley, *supra* note 70.

72. Open Roboethics Initiative, *supra* note 46.

73. *See* Howard, *supra* note 6.

74. *See* Hevelke & Nida-Rümelin, *supra* note 54, at 623-624.

75. *Id.*

76. *See id.*

77. CAL. VEH. CODE § 38750(b)(2) (West 2015).

78. Hevelke & Nida-Rümelin, *supra* note 54, at 624.

79. *See* Sherry Stokes, *Consumers Expect to Use Mobile Devices, Read and Eat in Self-Driving Cars of Tomorrow*, CARNEGIE MELLON U. (Jan. 22, 2015), http://engineering.cmu.edu/media/press/2015/01_22_autonomous_vehicle_survey.html.

80. *See* Kevin Maney, *Google Has Shown That Self-Driving Cars Are Inevitable – and the Possibilities Are Endless*, THE INDEPENDENT (June 18, 2014), http://www.independent.co.uk/life-

example, a consumer would not be able to use the car for tasks like sending it to pick up a child from school[81] or bringing someone home from a bar.[82] Second, a duty to intervene assumes the capability of humans to properly recognize dangers and react in time—something that may not be possible given the split-second in which a collision can present itself.[83] Further, even if a person could react in time, there would be no guarantee that the reaction would be desirable.[84] After all, approximately 90% of all accidents are caused by human error.[85] Moreover, users may overreact to avoid liability and create risk where there otherwise would have been none;[86] for example, if an operator mistakenly believes the car to be nearing a collision and swerves into traffic in response. For these reasons, requiring a duty to intervene may serve as a functional legal tool while the technology behind self-driving cars is still being explored but does not offer a long-term solution.

C. The Insurer

If the aim is to maximize total welfare for society, then attributing responsibility to the insurer of a self-driving car seems to effectively produce that prima facie result. One of the fundamental tenants of an insurance provider is to pool risk and minimize loss.[87] This goal falls in line with traditional utilitarian theory,[88] which finds that actions that increase total utility are morally justified.[89] Thus, a self-driving car under an insurer's influence will always choose the "lesser of two evils" from an economic standpoint. Moreover, strong statistical evidence and a repeat

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style/motoring/features/google-has-shown-that-selfdriving-cars-are-inevitable--and-the-possibilities-are-endless-9547231.html.

81. Hevelke & Nida-Rümelin, supra note 54, at 624.

82. *Id.*

83. *Id.*

84. *See* Bryant W. Smith, *Human Error as a Cause of Vehicle Crashes*, THE CTR. FOR INTERNET AND SOC'Y (Dec. 18, 2013, 3:15 PM), http://cyberlaw.stanford.edu/blog/2013/12/human-error-cause-vehicle-crashes.

85. Smith, *supra* note 84, at 624.

86. *See* Hevelke & Nida-Rümelin, *supra* note 54, at 625.

87. Brian Boone, *How Auto Insurance Companies Work*, HOWSTUFFWORKS (May 30, 2012), http://money.howstuffworks.com/personal-finance/auto-insurance/auto-insurance-company2.htm.

88. "Utilitarianism." *BusinessDictionary.com.* WebFinance, Inc., http://www.businessdictionary.com/definition/utilitarianism.html (last visited Nov. 13, 2014) [defined as "[a]n ethical philosophy in which the happiness of the greatest number of people in the society is considered the greatest good. According to this philosophy, an action is morally right if its consequences lead to happiness (absence of pain), and wrong if it ends in unhappiness (pain)"].

89 *See generally* John C. Harsanyi, *Morality and the Theory of Rational Behavior*, *in* UTILITARIANISM AND BEYOND 39, 62 (Amartya Sen & Bernard Williams, Cambridge U. Press 1982).

presence place insurance providers in an advantageous position to justify a car's behavior from a liability standpoint.[90]

Two main issues, however, surround the insurer as the responsible party—one moral and one practical. The moral issue remains the same as previously discussed: why should the owner of a vehicle be subject to the ethical values of some other entity when there exists no morally "right" answer?[91] Or from a pedestrian's perspective, why should a working class individual be targeted over a corporate executive in the event the car has to hit one? Certainly, the latter provides greater overall economic utility, but does this not infringe upon the rights of the individual?[92]

One does not have to entirely rely on the moralistic argument, for there is a practical reason a utilitarian perspective does not work for self-driving cars. Namely, it would create improper incentives.[93] An automated car that aims to minimize overall damage will target people and objects that are less likely to suffer costly injuries. Thus, the self-driving car would choose to swerve into a car with high safety ratings rather than one with low safety ratings. Or the car would choose to hit the cyclist wearing a helmet over one without. In effect, this would create an environment where people were placed at greater risk of personal or economic harm because they took more responsible safety measures—the opposite of a societally desired effect.

D. The Legislature

Ultimately, the legislature may be in the best position to meet the legal and ethical demands of self-driving cars. Indeed, self-driving cars are not entirely unique in posing new issues on these fronts. The shift from horse and buggy to cars, for example, posed its own set of legal and ethical challenges.[94] Without transitionary laws, liability would have been too great for automobiles to take hold,[95] thus highlighting an additional consideration when assigning responsibility: the existence of a *transitional* period.[96] Much of the ethical and legal issues surrounding self-driving cars will become significantly less pressing as more and more people adopt self-

90. *Self-Driving Cars and Insurance*, INSURANCE INFORMATION INSTITUTE (Feb. 2015), http://www.iii.org/issue-update/self-driving-cars-and-insurance.

91. *See* Tuffley, *supra* note 70.

92. *See id.*

93. *See id.*

94. *See generally* Eric Morris, From Horse to Horsepower: The External Costs of Transportation in the 19th Century City (2006) (M.A. Thesis, UCLA), *available at* http://www.uctc.net/access/30/Access%2030%20-%2002%20-%20Horse%20Power.pdf.

95. Morris, *supra* note 94.

96. *See id.*

driving cars.[97] According to the Eno Center for Transportation,[98] as many as 4.2 million accidents could be avoided if 90% of vehicles in the U.S. were self-driving.[99] Moreover, roughly $450 billion could be saved in related costs.[100] While unpredictable behavior from pedestrians and animals would still exist, accidents among passenger vehicles (estimated at 65% of all automobile related deaths)[101] pose the largest issue to safety going forward.[102] Therefore, the focus in the present should be on minimizing liability for manufactures and consumers to incentivize early adopters and allow the market to grow to the amount ideal for safety and utility.

IV. FRAMING A LEGISLATIVE SOLUTION

The key to accomplishing these goals will be consistency in behavior, so the legislature needs to determine a consistent code by which all self-driving cars abide. The idea being that uniformity will relieve the manufacturer and consumer from large lawsuits contingent on how their one car in particular behaved.[103] In line with this reasoning, the legislature should determine that all self-driving cars must act in the *interest of their passengers* over anything else. The idea of self-preservation is both ethically neutral and societally accepted.[104] Moreover, it is consistent with current tort law that does not favor an affirmative duty to risk one's own wellbeing for others.[105] Further, the legislatures should consider the application of a "reasonableness standard" to machines making decisions. While certainly people's expectations of machines is to act perfectly according to programming, it is unrealistic given the current limitations in computer science and sensory hardware to expect a self-driving car to always execute the best decision in a complex environment.[106] The application of a reasonableness standard will allow for situational flexibility as a way of limiting liability as the technology improves.

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97. Phil LeBeau, *Take the Wheel Please, I'm Done Driving*, CNBC (Aug. 18, 2014, 11:15 AM), http://www.cnbc.com/id/101913796#.

98. ENO CENTER FOR TRANSPORTATION, https://www.enotrans.org/ (last visited Nov. 13, 2014).

99. *Preparing a Nation for Autonomous Vehicles*, ENO CENTER FOR TRANSPORTATION 8 (Oct.2013), https://www.enotrans.org/wp-content/uploads/wpsc/downloadables/AV-paper.pdf.

100. *Preparing a Nation for Autonomous Vehicles, supra* note 99, at 17.

101. NHTSA, *2012 Motor Vehicle Crashes: Overview*, U.S. DEPT. OF TRANS. (2012), http://www-nrd.nhtsa.dot.gov/Pubs/811856.pdf.

102. NHTSA, *supra* note 101, at 8.

103. *See* Hevelke & Nida-Rümelin, *supra* note 54, at 629.

104. *See* Erich Fromm, MAN FOR HIMSELF: AN INQUIRY INTO THE PSYCHOLOGY OF ETHICS 19 (Open Road Media, 2013).

105. RESTATEMENT (THIRD) OF TORTS §7 (2010).

106. *See* Lin, *supra* note 24; *See also* Stock, *supra* note 49.

Overall, an ideal painless solution to the ethical and legal issues posed by self-driving cars may not exist. If we are to see this future become a reality, however, consistent behavior and limited liability is a necessity as we transition away from human-controlled vehicles.

Nick Belay