The Road to Autonomy

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I. INTRODUCTION

On February 14, 2016, a self-driving vehicle sensed sandbags positioned around a storm drain and maneuvered to avoid them, crossing into the center

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lane and crashing into the side of a public transit bus.[1] This was the first crash caused by a self-driving vehicle, proving that even with all the cameras, lasers, radars, sonars, and global positioning systems (GPS), car accidents are inevitable.[2] This inevitability was magnified on May 7, 2016, when a tractor-trailer turned in front of a self-driving vehicle, and the vehicle failed to brake, resulting in the first self-driving vehicle fatality.[3] Currently, there are no standards for who should be held liable in situations such as these involving fully autonomous vehicles; this is because there is no *driver* at fault. Instead, artificial intelligence (AI) operates the vehicle. Society has progressed from the "horse and buggy" to trains, planes, and automobiles, and the creation of autonomous robots, such as the driverless car, is a new progression in this line of advancements. This Comment poses the question, "Should an autonomous robot possess a legal status in society?" and answers that question in the affirmative, thereby holding the autonomous vehicle liable.

Driverless cars are the first step in innovation to a fully autonomous future. But as technology evolves, the law must evolve with it. For instance, in 1905, all cases dealing with automobile tort liability could be summarized in a four-page article, whereas by 1936, it would "call for an encyclopedia."[4] This

1. DMV, REPORT OF TRAFFIC ACCIDENT INVOLVING AN AUTONOMOUS VEHICLE 2 (2016), https://www.dmv.ca.gov/portal/wcm/connect/3946fbb8-e04e-4d52-8f80-b33948df34b2/Google+Auto+LLC+02.14.16.pdf?MOD=AJPERES [https://perma.cc/7TP3-TAWQ].

2. *See* Alex Davies, *Google's Self-Driving Car Caused Its First Crash*, WIRED (Feb. 29, 2016, 2:04 PM), https://www.wired.com/2016/02/googles-self-driving-car-may-caused-first-crash/ [https://perma.cc/7456-GP7B].

3. The Tesla Team, *A Tragic Loss*, TESLA (June 30, 2016), https://www.tesla.com/blog/tragic-loss [https://perma.cc/E3NS-XPZ3]; *see also* Bill Vlasic & Neal E. Boudette, *Self-Driving Tesla Was Involved in Fatal Crash, U.S. Says*, N.Y. TIMES (June 30, 2016), http://www.nytimes.com/2016/07/01/business/self-driving-tesla-fatal-crash-investigation.html. Following the death of the vehicle operator, Joshua Brown, Tesla released a statement saying the car's Autopilot (semi-autonomous self-driving feature) was unable to see "the white side of the tractor trailer against a brightly lit sky." *A Tragic Loss*, *supra*. Tesla also noted that because it was a semi-autonomous system, the operator should have taken control of the vehicle. *Id.* The investigation into the crash revealed that there were no "defects in design or performance of the . . . Autopilot systems," clearing Tesla of fault. NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., INVESTIGATION PE 16-007, at 11 (2017), https://static.nhtsa.gov/odi/inv/2016/INCLA-PE16007-7876.PDF [https://perma.cc/YD5N-L7YL]. Tesla, however, did release an update that Elon Musk believed would have likely prevented the crash because it included revisions to the driver monitoring strategy. Neal E. Boudette, *Elon Musk Says Pending Tesla Updates Could Have Prevented Fatal Crash*, N.Y. TIMES (Sept. 11, 2016), https://www.nytimes.com/2016/09/12/business/elon-musk-says-pending-tesla-updates-could-have-prevented-fatal-crash.html. In a fully autonomous vehicle, this would not have been a straightforward investigation because the "driver" is the AI system, and the human passenger cannot take control of the vehicle. *See* FEDERAL AUTOMATED VEHICLES POLICY, *infra* note 54, at 9.

4. Richard M. Nixon, Comment, *Changing Rules of Liability in Automobile Accident Litigation*, 3 LAW & CONTEMP. PROBS. 476, 476 (1936). This 1936 law review article was authored by former United States President Richard M. Nixon while he studied law at

was due to the courts' insistence on extending old laws "developed in the days of the horse and buggy" to modern automobile cases.[5] However, some courts were willing to establish new doctrines by "stretch[ing] the legal formulas . . . to reach desired results."[6] These "stretches" created products liability law; however, the law developed slowly, while the rigid horse and buggy rules continued to govern automobile liability for decades.[7] As such, the law was essentially outpaced by technology. Likewise, the adoption of the driverless car will place society at a similar crossroads. Current state and federal laws assume human beings make all the decisions.[8] Yet, as autonomy advances, it will demand changes to these laws because the AI will have a role in making every day driving decisions. As a result, autonomous robots will no longer be considered *products* used by society, instead they will become part of society. For the law and driverless cars to develop in tandem, lawmakers need to be proactive in addressing autonomous liability.

The National Highway Traffic Safety Administration (NHTSA) took a groundbreaking step in February 2016 by recognizing the AI system

Duke University. *Id.* After law school, Nixon served in World War II as a Navy lieutenant commander in the Pacific, and after leaving the Navy, he was elected to Congress. FRANK FREIDEL & HUGH SIDEY, THE PRESIDENTS OF THE UNITED STATES OF AMERICA 79 (16th ed. 2001). Two years later, General Eisenhower selected Nixon as his running mate. *Id.* Following Nixon's vice presidency in the Eisenhower administration, and one unsuccessful run for president in 1969, Nixon was elected as the 37th President of the United States. *Id.* However, when faced with the prospect of impeachment after the Watergate scandal, Nixon became the only president in American history to resign from office. *Id.*; *cf.* Nixon v. United States, 418 U.S. 683, 713, 715–16 (1974) (holding that the president does not have absolute immunity in a criminal proceeding for official executive communications).

5. Nixon, *supra* note 4, at 476.

6. *Id.* at 485. An example of this is courts' refusal to "classify the automobile as a dangerous instrumentality," thereby refusing to "hold the owner liable." *Id.* However, by applying more conventional formulas, courts have recognized that an automobile "may become dangerous unless carefully driven. Therefore, the owner may subject himself to liability if he knowingly entrusts his car to a driver who is incompetent for want of age or experience, or who has a reputation for recklessness." *Id.* (footnotes omitted) (first citing Allen v. Bland, 168 S.W. 35 (Tex. Civ. App. 1914); then citing Jones v. Harris, 210 P. 22 (Wash. 1922)).

7. DAVID G. OWEN, PRODUCTS LIABILITY LAW 249 (3d ed. 2015) ("Over the first half of the twentieth century, tort law moved slowly in expanding a manufacturer's responsibility for product-caused harm to remote consumers."); *see* Nixon, *supra* note 4, at 476.

8. JOHN FRANK WEAVER, ROBOTS ARE PEOPLE TOO: HOW SIRI, GOOGLE CAR, AND ARTIFICIAL INTELLIGENCE WILL FORCE US TO CHANGE OUR LAWS 4 (2014).

piloting Google's self-driving cars as the *driver*.[9] This recognition once again stretches legal formulas, paving the way to a category of law that is willing to recognize this fully autonomous robot as a legal entity—an artificial person.

Part II of this Comment discusses the background of AI and robotics, the technology behind the autonomous vehicle, and the evolution of products liability laws. Part III examines current regulations, the benefits of autonomous technology, and the need for a definitive liability framework. Part IV discusses why current tort liability laws will be ineffective in governing autonomous vehicle liability by examining the shift in liability from the driver to the owner and manufacturer. Part V proposes a short-term solution by attributing liability to the programmer, while software is still hard-coded. Finally, Part VI explores legal personhood, and proposes that the autonomous vehicle be held liable through a similar legal structure to that of a corporation.

II. BACKGROUND

A. Understanding the Technology: AI and Robotics

In 1950, Alan Turing proposed the question, "Can machines think?"[10] Turing, widely regarded as the father of AI, replaced this question with a practical test, which he termed the "Imitation Game."[11] The test requires

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9. Letter from Paul A. Hemmersbaugh, Chief Counsel, Nat'l Highway Traffic Safety Admin., to Chris Urmson, Dir. of the Self-Driving Car Project, Google (Feb. 4, 2016), http://tiny.cc/ke8pjy [https://perma.cc/J4N9-2Z8Q].

10. A.M. Turing, *Computing Machinery and Intelligence*, 59 MIND 433, 433 (1950).

11. *Id.* Turing's life story was adapted into the Oscar-winning screenplay, *The Imitation Game*, by Graham Moore. *The Imitation Game*, CUMBERBATCHWEB, http://www.benedictcumberbatch.co.uk/film/the-imitation-game/ [https://perma.cc/96PV-54TP]. The film, starring Benedict Cumberbatch, was released theatrically in 2014. *Id.* It follows Turing from his school days through to World War II, where he helped to end the war by building the first computer to crack the Nazi enigma codes, ending with his prosecution in 1952 under Britain's "gross indecency" law for homosexuality. *The Imitation Game*, GRAHAM MOORE, https://mrgrahammoore.com/film-tv/the-imitation-game/ [https://perma.cc/8389-K2EU]. The press surrounding the film encouraged the posthumous pardoning of Alan Turing in 2013 by Queen Elizabeth II and the creation of a worldwide petition requesting the pardoning of the other 49,000 men prosecuted under this law. Steven Swinford, *Alan Turing Granted Royal Pardon by the Queen*, TELEGRAPH (Dec. 24, 2013, 11:00 AM), http://www.telegraph.co.uk/history/world-war-two/10536246/Alan-Turing-granted-Royal-pardon-by-the-Queen.html; Sarah Kaplan, *Inspired by 'Imitation Game,' Petition Calls for Pardon of 49,000 British Men Prosecuted for Being Gay*, WASHINGTON POST (Feb. 23, 2015), https://www.washingtonpost.com/news/morning-mix/wp/2015/02/23/inspired-by-imitation-game-petition-calls-for-pardon-of-49000-british-men-prosecuted-for-being-gay/?utm_term=.985536b7f57c [https://perma.cc/77MZ-GC2S]. In 2017, *Turing's Law* was enacted to posthumously pardon all the men convicted under British homosexuality laws. Kate McCann, *Turing's Law: Oscar Wilde Among 50,000 Convicted Gay Men Granted Posthumous Pardons*,

that a human interrogator ask a series of questions, via text, to a human participant and to a computer designed to generate human-like responses, with the goal of determining which of the participants is the computer and which is the human.[12] The test ultimately assesses whether a machine can be smart enough to fool a person into thinking that they are communicating with another person.[13] These natural language conversations were one of the first steps in testing whether machines can exhibit intelligent behavior.[14]

Nowadays, this intelligent behavior is commonly referred to as *AI*.[15] The term AI was first used by John McCarthy in his 1955 proposal for the Dartmouth Summer Research Project to define the "science and engineering of making intelligent machines."[16] Although the term created a unified

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TELEGRAPH (Jan. 31, 2017, 8:16 PM), http://www.telegraph.co.uk/news/2017/01/31/turings-law-thousands-convicted-gay-bisexual-men-receive-posthumous/ [https://perma.cc/QD2M- LZ6R].

12. *See* Turing, *supra* note 10, at 433–35. Turing begins by describing a party game where player A is male, player B is female, and player C is the interrogator whose goal is to determine the gender of player A and B. *Id.* Turing then modifies that game by posing the question, "[w]hat will happen when a machine takes the part of A in this game?" *Id.*

13. *See id.* Different versions of this test have developed through the years, including a version where a jury asks questions of a computer, and the computer must make a significant portion of the jury believe that it is a human. MICHAEL RYAN, THE DIGITAL MIND: AN EXPLORATION OF ARTIFICIAL INTELLIGENCE 131 (2014). These intelligence tests are widely referred to as the "Turing Test." *Id.*

14. In 2014, the first computer program, named Eugene Goostman, passed the Turing Test. *Turing Test Success Marks Milestone in Computing History*, U. READING (June 8, 2014), http://www.reading.ac.uk/news-and-events/releases/PR583836.aspx [https://perma.cc/SA9D-EDNC]. To pass the test, the interrogator must mistake the computer for a human more than 30% of the time. *Id.* Eugene, simulating a thirteen-year-old boy, convinced 33% of the interrogators that it was human. *Id.*

15. Tim Urban, *The AI Revolution: The Road to Superintelligence*, WAIT BUT WHY (Jan. 22, 2015), http://waitbutwhy.com/2015/01/artificial-intelligence-revolution-1.html [https://perma.cc/F5LA-47W9]. AI is depicted throughout novels, comic books, movies, and television shows. Examples of some of the most famous AI include: HAL 9000 from *2001: A Space Odyssey*; Agent Smith from *The Matrix Trilogy*; C-3PO and R2-D2 from *Star Wars*; Data from *Star Trek*; Skynet from *The Terminator*; Wall-E and Auto from Pixar's *Wall-E*; Rosey from *The Jetsons*; and the most recent additions, Dolores and Maeve from *Westworld*, to name a few. *See* 2001: A SPACE ODYSSEY (Metro–Goldwyn–Mayer 1968); *Star Trek: The Next Generation: Encounter at Farpoint* (CBS television broadcast Sept. 28, 1987); STAR WARS: EPISODE IV – A NEW HOPE (Lucasfilm Ltd. 1977); *The Jetsons: Rosey the Robot* (ABC broadcast Sept. 23, 1962); THE MATRIX (Warner Bros. 1999); THE TERMINATOR (Hemdale Film Corp. 1984); WALL-E (Walt Disney Pictures & Pixar Animation Studios 2008); *Westworld: The Original* (HBO broadcast Oct. 2, 2016).

16. *What Is Artificial Intelligence*, AISB, http://www.aisb.org.uk/public-engagement/what-is-ai [https://perma.cc/J6EJ-2J93]; *see also* John McCarthy et al., *A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence*, AI MAG., Aug. 31, 1955, at 13, http://www.aaai.org/ojs/index.php/aimagazine/article/view/1904/1802 (displaying

identity for AI, three categories have emerged to define the level of machine intelligence: (1) Artificial Narrow Intelligence, (2) Artificial General Intelligence, and (3) Artificial Superintelligence.[17] While the primary goal in artificial intelligence research is to develop Artificial General Intelligence, which is human-level intelligence, the world is currently made up of Artificial Narrow Intelligence.[18] This is AI that specializes in one area, focusing on a narrow

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the first page of the original Dartmouth proposal, which introduces the term "Artificial Intelligence"). In 1958, McCarthy created Lisp, "which became the standard AI programming language and continues to be used today, not only in robotics and other scientific applications but in a plethora of internet-based services, from credit-card fraud detection to airline scheduling; it also paved the way for voice recognition technology, including Siri." Martin Childs, *John McCarthy: Computer Scientist Known as the Father of AI*, INDEP. (Nov. 1, 2011), http://www.independent.co.uk/news/obituaries/john-mccarthy-computer-scientist-known-as-the-father-of-ai-6255307.html [https://perma.cc/ZX9Y-YZ34]. McCarthy won the Turing Award in 1971 for his contributions to the field of AI. *A.M. Turing Award: John McCarthy*, ASS'N FOR COMPUTING MACHINERY, http://amturing.acm.org/award_winners/mccarthy_1118322.cfm [https://perma.cc/7T8M-AYSN].

17. Urban, *supra* note 15.

18. RYAN, *supra* note 13, at 7–8. Traits associated with Artificial General Intelligence include "consciousness, sentience, sapience, and [the] self-awareness observed in living beings." *Id.* at 9. Although the creation of Artificial General Intelligence remains a common theme in science fiction films, it inevitably morphs into the villainous Artificial Superintelligence. *See, e.g.*, 2001: A SPACE ODYSSEY, *supra* note 15 (introducing HAL 9000). This is the type of intelligence that surpasses the smartest human minds, inciting the fear that humans will one day be superseded by their creations. *See* Nick Bostrom, *How Long Before Superintelligence?*, NICK BOSTROM: BLOG (Mar. 12, 2008), http://www.nickbostrom.com/superintelligence.html [https://perma.cc/WYX9-X7DB]. One of the ultimate AI villains is HAL 9000, whose unnerving phrase, "I'm sorry Dave, I'm afraid I can't do that," perfectly encapsulates the fear that humans will one day have no control over their creations. *See* 2001: A SPACE ODYSSEY, *supra* note 15. Leaders in the field of AI have postulated that once we have Artificial General Intelligence, superintelligence is not far behind, because the AIs with general intelligence will construct better AIs, which in turn will build even better AIs; this cycle will result in an "intelligence explosion." Irving John Good, *Speculations Concerning the First Ultraintelligent Machine*, *in* 6 ADVANCES IN COMPUTERS 31, 33 (Franz L. Alt & Morris Rubinoff eds., 1965). Futurist Ray Kurzweil refers to this as the "Singularity," and predicts it will occur by 2045. RAY KURZWEIL, THE SINGULARITY IS NEAR: WHEN HUMANS TRANSCEND BIOLOGY 136 (2005). If Kurzweil's prediction is correct, Artificial General Intelligence is anticipated within the next thirty years. *See id.* However, there are differing opinions as to whether machines will ever truly gain consciousness. *See, e.g.*, Bobby Azarian, *The Myth of Sentient Machines*, PSYCHOL. TODAY (June 1, 2016), https://www.psychologytoday.com/blog/mind-in-the-machine/201606/the-myth-sentient-machines [https://perma.cc/X3P7-WBFZ]. Although Singularity advocates, like Kurzweil, believe it is possible to reverse engineer the human brain, critics like neuroscientist Miguel Nicolelis differentiate between *intelligence* and *consciousness*, believing that intelligence can be replicated but consciousness cannot. *See* RAY KURZWEIL, HOW TO CREATE A MIND: THE SECRET OF HUMAN THOUGHT REVEALED 280 (2012); Antonio Regalado, *The Brain Is Not Computable*, MIT TECH. REV. (Feb. 18, 2013), https://www.technologyreview.com/s/511421/the-brain-is-not-computable/ [https://perma.cc/A99X-2LQ8]. This is because, from an engineering standpoint, "[a]ll digital computers are binary systems" that function using ones and zeroes to represent things like "numbers, letters, colors, shapes,

task.[19] For example, Apple's Siri and Microsoft's Cortana are essentially virtual personal assistants that can answer questions through their ability to process large amounts of data.[20] These AI systems are highly intelligent, but they operate in a predefined manner and are unable to complete tasks outside of their field of intelligence.[21]

Another area of AI research is *robotics*.[22] Although the terms *AI* and *robot* are often used interchangeably, there is a difference. AI is software that can learn and self-improve, whereas a robot is a machine that can be semi-

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images, and even audio." Azarian, *supra*. Therefore, "[e]verything a computer does involves manipulating [these] two symbols in some way." *Id.* However, computers, unlike the human brain, "only recognize [the] symbols and not the *meaning* of those symbols." *Id.* (emphasis added). By attaching no meaning to an image or a sound, computers cannot "experience the world subjectively," and thus, critics believe they will never be conscious. *Id.*

19. *See* Urban, *supra* note 15.

20. *See* Tom Warren, *The Story of Cortana, Microsoft's Siri Killer*, VERGE (Apr. 2, 2014, 2:00 PM), http://www.theverge.com/2014/4/2/5570866/cortana-windows-phone-8-1-digital-assistant [https://perma.cc/HD6V-WJEZ]. Microsoft named the AI in its windows phone after "Cortana," the AI character in its video game *Halo*. Ray Kurzweil, *Windows Phone Digital Assistant Cortana, Based on Popular AI Character from* Halo *Video Game*, KURZWEIL ACCELERATING INTELLIGENCE (Apr. 3, 2014), http://www.kurzweilai.net/microsoft-windows-phone-digital-assistant-cortana-based-on-popular-smart-ai-character-from-halo-video-game [https://perma.cc/E5V6-HER5]. In the *Halo* series, "Cortana is a powerful artificial intelligence with human-level capabilities." *Id.* To bring Cortana to life, Microsoft worked closely with Jen Taylor, the voice of Cortana in the *Halo* series, to create the voice of Cortana in its Windows phone. Warren, *supra.*

21. *See* RYAN, *supra* note 13, at 7; *see also* Urban, *supra* note 15 (explaining that Artificial Narrow Intelligence is "AI that can beat the world chess champion in chess, but . . . [a]sk it to figure out a better way to store data on a hard drive, and it'll look at you blankly").

22. The term *robot* was first introduced to the English language by the 1921 Karel Čapek play *R.U.R (Rossum's Universal Robots)*, where it was used to describe an artificial man-like machine—a humanoid. *See* KAREL ČAPEK, R.U.R (ROSSUM'S UNIVERSAL ROBOTS) 32, 37 (Claudia Novack trans., Penguin Books 2004) (1921). *Robot* comes from the Czech word *robota*, meaning servitude or forced labor, and Rossum's robots are portrayed as being "[d]evoid of emotion, personality and thus agency." Daven Hiskey, *Where Does the Word Robot Come From?*, TODAY I FOUND OUT (May 11, 2012), http://www.todayifoundout.com/index.php/2012/05/where-does-the-word-robot-come-from/ [https://perma.cc/CGV2-97MB] (stating that *Roboti* traces its roots from the Old Church Slavanic word *rabota*, "meaning 'servitude', which in turn comes from *rabu*, meaning 'slave'"); Zachary McCune, *R.U.R. - Literary Origins of Robots & the Threat of Post-Humanity*, CYBERPUNK (Apr. 26, 2009), http://thames2thayer.com/cyberpunk/?p=65. Čapek's play aptly examines the master-servant relationship, turning it on its head when the humanoid work force is given souls, "mak[ing] the robots 'aware' of . . . their rights to agency not slavery." McCune, *supra.* The robots' newfound self-awareness incites a robot revolution against their human masters, resulting in the near extermination of the human race. ČAPEK, *surpa*, at 48. At the end of the play, however, two robots develop human emotions and fall in love, which illustrates a hybridization of man and machine, thereby becoming the image of the future. *See id.* at 84.

autonomous or fully-autonomous.[23] In other words, "AI is the brain, and the robot is its body."[24] Autonomy, on the other hand, has to do with control.[25] An autonomous robot is self-governing and can act independently of external commands.[26] One key factor in autonomy is that the robot has a choice in behavior; however, if that choice can be overridden by an external agency—like a human driver—then the robot is only semi-autonomous.[27]

B. The Autonomous Vehicle

In integrating automation and AI, advancements in the robotics industry have led to highly intelligent autonomous robots, such as the autonomous vehicle.[28] These are self-driving vehicles that do not require the "active physical control or monitoring" of a human operator;[29] the vehicle makes all major driving decisions, and as such, is set to revolutionize both the transportation industry and the laws governing it.[30] These vehicles operate using a "sense-plan-act" design.[31] They are equipped with (1) sensors, GPS, and inertial navigation systems to map the surrounding environment and track the vehicle's course; (2) radars to detect and avoid obstacles; (3)

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23. "[T]he degree of autonomy of movement in a robot can range from fully autonomous, to semi-autonomous, to non-autonomous, depending upon the extent to which the robot controls its own activity." Harry Surden & Mary-Anne Williams, *Technological Opacity, Predictability, and Self-Driving Cars*, 38 CARDOZO L. REV. 121, 173 (2016).

24. Urban, *supra* note 15.

25. *Autonomy* derives from the Greek words, "*autos* ('self,') and *nomos* ('law')." Jenay M. Beer et al., *Toward a Framework for Levels of Robot Autonomy in Human-Robot Interaction*, 3 J. HUM.-ROBOT INTERACTION 74, 74 (2014).

26. *See* Jeffrey O. Kephart & David M. Chess, *The Vision of Autonomic Computing*, 36 COMPUTER 41, 42 (2003) ("The essence of autonomic computing systems is self-management . . . ."); Surden & Williams, *supra* note 23, at 131 ("[E]ngineers apply the term 'autonomous' to computer controlled systems that make important choices about *their own actions* with little or no human intervention.").

27. *See* J.P. Gunderson & L.F. Gunderson, Intelligence ≠ Autonomy ≠ Capability, § 4.1 (2004) (unpublished manuscript), http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.78.8279&rep=rep1&type=pdf [https://perma.cc/29ZP-EB7D]. A truly autonomous robot could theoretically choose to "[sit] on a beach somewhere, drinking motor oil, [and] not slav[e] away on some human assigned task." *Id.*

28. "Autonomous vehicles can be more or less thought of as robots that look like cars." Jessica S. Brodsky, Note, *Autonomous Vehicle Regulation: How an Uncertain Legal Landscape May Hit the Brakes on Self-Driving Cars*, 31 BERKELEY TECH. L.J. 851, 862 (2016).

29. CAL. VEH. CODE § 38750(a)(1) (West 2015) (defining "autonomous technology").

30. These decisions include "steering, braking, speed, distance between vehicles, lane-choice, following traffic rules, routing, avoiding obstacles—and the role of the person is limited primarily to choosing the destination." Surden & Williams, *supra* note 23, at 133.

31. JAMES M. ANDERSON ET AL., AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS 58 (2016), http://www.rand.org/content/dam/rand/pubs/research_reports/RR400/RR443-2/RAND_RR443-2.pdf [https://perma.cc/R6KC-A8NR]. The vehicle's sensors gather data, which is interpreted by software algorithms to plan the vehicles movements, triggering an action. *See id.* at 58–59.

sophisticated learning programs to recognize objects, such as a motorbike versus a bicycle, and track their movements; (4) path planning algorithms to get from point A to point B; (5) and decision engines that use prediction algorithms to measure the likelihood of crashing.[32]

The decision engines can be rule-based, where rules are hard-coded into the vehicle's software, or they can be deep-learning neural networks, an advanced form of AI that essentially programs itself.[33] The neural networks are built by using human drivers to train the vehicles, much like teaching a teenager how to drive.[34] The human driver logs driving hours, while the AI watches through its vision system, such as LIDAR,[35] allowing the AI to learn through experience, and then extrapolate those lessons into *decisions* when it drives.[36] This is valuable because an autonomous vehicle can communicate and share its experiences with other autonomous vehicles, allowing them to learn and adapt their algorithms appropriately.[37]

For over seventy years, society has been fascinated by the idea of a self-driving car.[38] After a gradual progression toward autonomy, this idea was realized when Google put its first fully autonomous driverless car on the

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32. *See* Ben Lorica, *The Technology Behind Self-Driving Vehicles*, O'REILLY (Oct. 6, 2016), https://www.oreilly.com/ideas/the-technology-behind-self-driving-vehicles [https://perma.cc/NG96-2DX5].

33. *See* Darrell Etherington, *Drive.ai Uses Deep Learning To Teach Self-Driving Cars—And To Give Them a Voice*, TECHCRUNCH (Aug. 30, 2016), https://techcrunch.com/2016/08/30/drive-ai-uses-deep-learning-to-teach-self-driving-cars-and-to-give-them-a-voice/ [https://perma.cc/JFY7-RLGV]; Carol Reiley, *Deep Driving: A Revolutionary AI Technique is About To Transform the Self-Driving Car*, MIT TECH. REV. (Oct. 18, 2016), https://www.technologyreview.com/s/602600/deep-driving/ [https://perma.cc/K5LA-P8LQ].

34. Etherington, *supra* note 33.

35. "LIDAR essentially maps its surroundings by illuminating its targets with laser light and then analyz[es] that light to create a high resolution digital image." Amir Lliaifar, *LIDAR, Lasers, and Logic: Anatomy of an Autonomous Vehicle*, DIGITAL TRENDS (Apr. 9, 2015, 3:51 PM), http://www.digitaltrends.com/cars/lidar-lasers-and-beefed-up-computers-the-intricate-anatomy-of-an-autonomous-vehicle/ [https://perma.cc/JM9P-58EJ].

36. *See* Etherington, *supra* note 33.

37. Chris Giarratana, *How AI Is Driving the Future of Autonomous Cars*, READWRITE (Dec. 20, 2016), http://readwrite.com/2016/12/20/ai-driving-future-autonomous-cars-tl4/ [https://perma.cc/E3T5-U99V] ("This type of shared experience and active learning creates a situation where autonomous cars, through Artificial Intelligence algorithms, can improve their ability to react to situations on the road without actually having to experience those situations first-hand.").

38. *See* Tom Vanderbilt, *Autonomous Cars Through the Ages*, WIRED (Feb. 6, 2012, 6:30 AM), https://www.wired.com/2012/02/autonomous-vehicle-history/ [https://perma.cc/L7KS-2XUN].

road for testing in January 2015.[39] The concept of an autonomous vehicle first gained widespread public exposure in 1939 at General Motor's Futurama exhibit inside the New York World's Fair.[40] The exhibit promised to show visitors "the world of tomorrow" as it took them on a ride through large models depicting a time in the distant future where interstate highways exist and cars can drive themselves.[41] These self-driving cars remained a concept of the future until 2004, when fifteen vehicles set out to make history by attempting to autonomously navigate a 142-mile course in the DARPA Grand Challenge.[42] This U.S. military sponsored event was designed to promote innovation and accelerate the development of autonomous vehicles, in the hopes that they could be used as a substitute for humans in dangerous military operations.[43] Although no vehicle finished the course, the competition generated new ideas, triggering major advancements in the development of autonomous vehicles.[44] One year later, DARPA held its second Grand Challenge where five vehicles successfully completed the course.[45] These rapid advancements compelled the private sector to take

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39. Alex Davies, *Google's Self-Driving Car Hits Roads Next Month—Without a Wheel or Pedals*, WIRED (Dec. 23, 2014, 1:24 PM), https://www.wired.com/2014/12/google-self-driving-car-prototype-2/ [https://perma.cc/X7YB-ZSHJ]. The first "truly autonomous car—meaning it could process images of the road ahead—was unveiled in 1977 by S. Tsugawa and his colleagues at Japan's Tsukuba Mechanical Engineering Laboratory." Vanderbilt, *supra* note 38. "The car was equipped with two cameras that used analog computer technology for signal processing [and] was capable of speeds up to 30 km/h (18.6 mph) but was aided by an elevated rail." *Id.*

40. Vanderbilt, *supra* note 38.

41. Chris Baker, *April 30, 1939: The Future Arrives at New York World's Fair*, WIRED (Apr. 30, 2010, 12:00 AM), https://www.wired.com/2010/04/0430new-york-worlds-fair-opens/ [https://perma.cc/LB5C-L54L] ("The effect was like catching a glimpse of the future from the window of an airplane. . . . GM's ride presented a utopia forged by urban planning. Sophisticated highways ran through rural farmland and eventually moved into carefully ordered futuristic cities. 'You have to understand that the audience had never even considered a future like this' . . . . 'There wasn't an interstate freeway system in 1939. Not many people owned a car.'").

42. *The DARPA Grand Challenge: Ten Years Later*, DARPA (Mar. 13, 2014), http://www.darpa.mil/news-events/2014-03-13 [https://perma.cc/3MZS-JTVG].

43. *Id.* "For more than fifty years, [the Defense Advanced Research Projects Agency (DARPA)] has held a singular and enduring mission: to make pivotal investments in breakthrough technologies for national security." *About DARPA*, DARPA, http://www.darpa.mil/about-us/about-darpa [https://perma.cc/D66J-EBJK].

44. *The DARPA Grand Challenge*, *supra* note 42.

45. *Id.* "To further raise the bar, DARPA conducted a third competition, the Urban Challenge, in 2007 that featured driverless vehicles navigating a complex course in a staged city environment . . . negotiating other moving traffic and obstacles while obeying traffic regulations. Six teams out of [eleven] successfully completed the course." *Id.*

notice, resulting in companies, such as Google, investing in autonomous technology for commercial use.[46]

The world of tomorrow is now reality as Google's test cars have autonomously driven more than five million miles through complex city streets, on highways, and have even braved the curves of San Francisco's famed Lombard Street.[47] Google is not alone in this race for autonomy. On April 9, 2016, Tesla confirmed that its cars had driven forty-seven million miles using its Level 3 self-driving feature known as Autopilot.[48] On October 19, 2016, Tesla announced its new Enhanced Autopilot, which is a Level 4 in autonomy;[49] it is currently working toward Full Self-Driving Capability, equivalent to a Level 5 in autonomy,[50] with the goal of having its driverless technology ready for commercial use by 2020.[51] Additionally,

46. Ryan Calo, *Robotics and the Lessons of Cyberlaw*, 103 CALIF. L. REV. 513, 527 (2015).

47. *On the Road*, WAYMO, https://waymo.com/ontheroad/ [https://perma.cc/Q6FY-J7FF] (noting that five million miles is the equivalent of 300 years of human driving experience); *see also* DMITRI DOLGOV, GOOGLE'S SELF DRIVING CAR PROJECT MONTHLY REPORT: TWO MILLION MILES CLOSER TO A FULLY AUTONOMOUS FUTURE (2016), https://static.googleusercontent.com/media/www.google.com/en//selfdrivingcar/files/reports/report-0916.pdf [https://perma.cc/7YZL-FZPH] (detailing Google's first two million miles of autonomous driving). On December 13, 2016, Google announced that its self-driving car project would become its own entity called "Waymo." Darrell Etherington & Lora Kolodny, *Google's Self-Driving Car Unit Becomes Waymo*, TECHCRUNCH (Dec. 13, 2016), https://techcrunch.com/2016/12/13/googles-self-driving-car-unit-spins-out-as-waymo/ [https://perma.cc/LV6D-8TKS]. Waymo's CEO emphasized that the company is a "self-driving technology company" and not a car company, stating that it is "not in the business of making better cars." *Id.* Instead it is "in the business of making better drivers." *Id.*; *see also Waymo*, GOOGLE, https://www.google.com/selfdrivingcar/ [https://perma.cc/GEV9-B9M4] ("We are a self-driving technology company with a mission to make it safe and easy for people and things to move around.").

48. Tesla (@TeslaMotors), TWITTER (Apr. 9, 2016, 9:56 AM), https://twitter.com/teslamotors/status/718845153318834176 [https://perma.cc/Q9JB-JDWJ] ("Over 47M miles driven on Autopilot, the more you drive, the more we'll learn.").

49. The Tesla Team, *All Tesla Cars Being Produced Now Have Full Self-Driving Hardware*, TESLA (Oct. 19, 2016), https://www.tesla.com/blog/all-tesla-cars-being-produced-now-have-full-self-driving-hardware [https://perma.cc/RHX3-CUM4]; *see* FEDERAL AUTOMATED VEHICLES POLICY, *infra* note 54, at 9 (defining the levels of autonomy); *see also* Fred Lambert, *Tesla's Software Timeline for 'Enhanced Autopilot' Transition Means 'Full Self-Driving Capability' as Early as Next Year*, ELECTREK (Oct. 20, 2016, 4:31 PM), https://electrek.co/2016/10/20/tesla-enhanced-autopilot-full-self-driving-capability/ [https://perma.cc/M36C-ZQB3].

50. Lambert, *supra* note 49; *see* FEDERAL AUTOMATED VEHICLES POLICY, *infra* note 54, at 9 (defining the levels of autonomy).

51. Fred Lambert, *Elon Musk Clarifies Tesla's Plan for Level 5 Fully Autonomous Driving: 2 Years Away from Sleeping in the Car*, ELECTREK (Apr. 29, 2017, 2:05 PM),

Uber and Volvo combined efforts to put human supervised prototypes on the streets of Pittsburgh in August 2016; Toyota invested one billion dollars in AI and robotics with the goal of meeting a 2020 deadline; and other companies such as BMW, Ford, and Nissan have set similar targets.[52]

The difference between Google's and Tesla's vehicles is that Tesla is taking an incremental approach from semi-autonomous to autonomous, whereas Google's prototype began as, and continues to be, fully autonomous —there is no steering wheel, brake pedal, or accelerator; the sensors and software do all the work.[53] These varying degrees of autonomy led the United States Department of Transport (DOT) to categorize vehicles into six levels of driving automation based on "who does what, [and] when:"[54]

> Level 0—No Automation: the human driver does everything;
> Level 1—Driver Assistance: an automated system on the vehicle can *sometimes assist* the human driver conduct *some parts* of the driving task;
> Level 2—Partial Automation: an automated system on the vehicle can *actually conduct* some parts of the driving task, while the human continues to monitor the driving environment and performs the rest of the driving task;
> Level 3—Conditional Automation: an automated system can both actually conduct some parts of the driving task and monitor the driving environment *in some instances*, but the human driver must be ready to take back control when the automated system requests;
> Level 4—High Automation: an automated system can conduct the driving task and monitor the driving environment, and the human need not take back control, but the automated system can operate only in certain environments and under certain conditions; and
> Level 5—Full Automation: the automated system can perform all driving tasks, under all conditions that a human driver could perform them.[55]

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https://electrek.co/2017/04/29/elon-musk-tesla-plan-level-5-full-autonomous-driving/ [https://perma.cc/DK4N-MCPZ].

52. Danielle Muoio, *These 19 Companies Are Racing To Put Driverless Cars on the Road by 2020*, BUS. INSIDER (Aug. 18, 2016, 9:56 AM), http://www.businessinsider.com/companies-making-driverless-cars-by-2020-2016-8/#tesla-is-aiming-to-have-its-driverless-technology-ready-by-2018-1 [https://perma.cc/ERE3-HPYY].

53. *Google Self-Driving Car Project*, GOOGLE, https://web.archive.org/web/20161128083319/https://www.google.com/selfdrivingcar/how/ [https://perma.cc/35NR-7LBB].

54. NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., FEDERAL AUTOMATED VEHICLES POLICY 1, 9 (2016), https://www.transportation.gov/sites/dot.gov/files/docs/AV%20policy%20guidance%20PDF.pdf [https://perma.cc/XYD8-URVA] [hereinafter FEDERAL AUTOMATED VEHICLES POLICY]. In many ways, these levels "describe what a human is actually doing, what she is technically required to be doing, and what she is legally required . . . to be doing." Bryant Walker Smith, *Automated Vehicle Are Probably Legal in the United States*, 1 TEX. A&M L. REV. 411, 423 (2015).

55. FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 9. The policy adopts the Society of Automotive Engineers' (SAE) definitions for levels of automation ranging from "no automation" to "full automation." *Id.*; *see also* Press Release, SAE International, U.S. Department of Transportation's New Policy on Automated Vehicles Adopts SAE International's Levels of Automation for Defining Driving Automation in On-Road Motor

Categories 0–2 require a driver, categories 3–4 have little to no driver involvement depending on the environment and driving conditions, and category 5 is a fully autonomous vehicle, the performance of which is equal to that of a human driver, if not better.[56] Ultimately, autonomous technology is replacing the conventional driver with an artificial driver. This shift in the role of the driver raises complex liability issues that lawmakers need to address. With every major automaker engaged in developing autonomous vehicles, lawmakers are urged to act early so they have a hand in shaping the impact of this technology.[57]

C. Tort Liability and the Evolution of Product Liability Laws

Under the common law, a person who causes a car accident has committed a *tort*, and the primary concern of tort law is where to attribute blame.[58]

Vehicles (Sept. 22, 2016), http://www.prweb.com/releases/2016/09/prweb13707135.htm [https://perma.cc/7W5P-XFN9] (detailing the DOT's adoption of SAE's six levels of automation).

56. FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 9–10.

57. In many ways, the current technology boom is reminiscent of the Industrial Revolution. During the Industrial Revolution, machines began performing the work of humans, and production became efficient and boosted the economy. *See* Robert Corday, *The Evolution of Assembly Lines: A Brief History*, ROBOHUB (Apr. 24, 2014), http://robohub.org/the-evolution-of-assembly-lines-a-brief-history/ [https://perma.cc/7WXQ-PA8G]. Nevertheless, fear was associated with technology because as factories opened, they replaced smaller businesses, and as production moved from handmade to machine-made, it displaced workers. *See id.* The technological revolution of today is no different—automation could result in the displacement of workers as it becomes a substitute for labor. *See* Klaus Schwab, *The Fourth Industrial Revolution: What It Means, How To Respond*, WORLD ECON. F. (Jan. 14, 2016), https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/ [https://perma.cc/JN9C-KZTD]. Uber alone has "600,000 drivers in the United States and 1.5 million [drivers] around the world." Matt McFarland, *Is Uber's Push for Self-Driving Cars a Job Killer?*, CNN MONEY (Aug. 19, 2016, 7:15 PM), http://money.cnn.com/2016/08/19/technology/uber-self-driving-cars-jobs/ [https://perma.cc/EN2K-5GVS]. The same thing could happen to lawyers, doctors, accountants, and teachers because driverless cars are but one example of how AI and robotics can be utilized. *See* Richard Susskind & Daniel Susskind, *Technology Will Replace Many Doctors, Lawyers, and Other Professionals*, HARV. BUS. REV. (Oct. 11, 2016), https://hbr.org/2016/10/robots-will-replace-doctors-lawyers-and-other-professionals [https://perma.cc/6GM9-UXAU]. As such, lawmakers need to recognize the current and future effects of technology.

58. *See* MARC A. FRANKLIN ET AL., TORT LAW AND ALTERNATIVES 1 (9th ed. 2011) (Tort law is concerned with "whether one whose actions harm another should be required to pay compensation for the harm done."); W. PAGE KEETON ET AL., PROSSER AND KEETON

In a conventional driver-operated car accident, blame is usually attributed to the driver or the manufacturer.[59] For example, when dealing with a defective product, like defective brakes, the principles of products liability apply, whereby liability is imposed on the manufacturer or distributor for the injuries caused by that product.[60] Similarly, when the injury is caused by carelessness, such as a driver running a red light, negligence becomes the basis for liability, and tort law looks to what the reasonably prudent *person* would do in the same or similar circumstances.[61] The assumption with liability is that a *human actor* has done something wrong and a *human actor* will be responsible.[62] Nevertheless, when a fully autonomous *robot actor* is involved, such as when an autonomous vehicle crashes into another autonomous vehicle, the ordinary rules of liability become insufficient because there is no human acting.[63] This shift in responsibility creates a gap in the tort framework where liability would usually be attributed to the driver.

Similarly, prior to the advent of products liability law, there was a gap in the tort framework where liability should have been attributed to the manufacturer. Before the automobile, "there simply were not large numbers of product-related lawsuits."[64] As such, products liability law developed through a series of groundbreaking automobile liability cases that separated tort law from the old horse and buggy laws grounded in contract law.[65] These

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ON THE LAW OF TORTS § 1, at 4 (5th ed. 1984) ("If the driver proceeds without reasonable care and injures another, it is a tort.").

59. *See generally* FRANKLIN ET AL., *supra* note 58, at 30–39, 507–71 (explaining that blame can be imputed through driver negligence or a product defect).

60. *See* RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 1 (AM. LAW INST. 1998) ("One engaged in the business of selling or otherwise distributing products who sells or distributes a defective product is subject to liability for harm to persons or property caused by the defect.").

61. *See* RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 3 (AM. LAW INST. 2010); *see also* KEETON ET AL., *supra* note 58, § 32, at 175 ("[N]egligence is a failure to do what the reasonable person would do 'under the same or similar circumstances.'").

62. WEAVER, *supra* note 8, at 17.

63. In the United States, current laws treat products and machines as "legal extensions of the people who set them into motion." A. Michael Froomkin, *Introduction* to ROBOT LAW, at xiv (Ryan Calo et al. eds., 2016). When shifting responsibility from the human driver to the vehicle, it is "likely to undermine the conventional social attribution of blame for automobile crashes. . . . In crashes that involve drivers reasonably relying on a car's ability to control itself, there may not be [a traditional] at-fault driver for the victim to sue." ANDERSON ET AL., *supra* note 31, at 115–16 (footnote omitted).

64. 1 LOUIS R. FRUMER & MELVIN I. FRIEDMAN, PRODUCTS LIABILITY § 1.02 (rev. ed. 2015).

65. "Products liability . . . grew up with the automobile." *Id.* "In particular, the *MacPherson* doctrine, which banished the no-privity-of-contract defense from negligence actions against manufacturers, took decades to spread across the nation . . . ." OWEN, *supra* note 7, at 249 (footnotes omitted).

cases accomplished this by slowly eroding the privity doctrine, which mandated that only a party to a contract could sue for its breach.[66] Accordingly, when a manufacturer sells a faulty vehicle to a dealer, who in turn sells it to the plaintiff, only the dealer is in privity of contract with the plaintiff; thus, only the dealer can be sued. Consequently, this doctrine shielded manufacturers from liability.[67] This shield often left the plaintiff without a remedy because it was the manufacturer's negligence, not the dealer's negligence, that caused the harm.[68]

In 1916, Judge Benjamin N. Cardozo began the erosion of the privity doctrine through *MacPherson v. Buick Motor Co.*, where he held the manufacturer liable for a defective wheel.[69] It then took decades for products liability to spread through the nation; and only in 1963, through *Greenman v. Yuba Power Products, Inc.*, was the concept of a manufacturer being held strictly liable for a defective product expounded.[70]

As transportation has advanced from the horse and buggy to automobiles, and liability has shifted from privity of contract to the manufacturer, courts have been forced to recognize and fill gaps in the liability framework. The introduction of autonomous vehicles creates yet another gap in this framework due to the absence of a human driver. As society ventures into the autonomous era, lawmakers need be proactive in creating a sufficient framework for autonomous vehicles, so that law is not once again outpaced by technology.

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66. *See* FRANKLIN ET AL., *supra* note 58, at 551 ("Nineteenth century products liability law languished in the shadow of the privity doctrine, which required a contractual relationship between the parties as the basis for [liability].").

67. *See, e.g.*, Winterbottom v. Wright (1842) 152 Eng. Rep. 402, 405 (explaining that the plaintiff, Winterbottom, attempted to sue the manufacturer for his injuries caused by the collapse of his mail coach due to a faulty wheel; however, the court held that the manufacturer was not liable, reasoning that there was no privity of contract between Winterbottom and the manufacturer).

68. *See id.* at 405–06 ("[I]t is, no doubt, a hardship upon the plaintiff to be without a remedy, but by that consideration we ought not to be influenced. . . . Judgment for the defendant.").

69. 111 N.E. 1050, 1053 (N.Y. 1916) (holding that "[i]f [the manufacturer] is negligent, where danger is to be foreseen, a liability will follow").

70. 377 P.2d 897, 901 (Cal. 1963) (reasoning that "[manufacturer] liability is not one governed by the law of contract warranties but by the law of strict liability in tort"); *see also* Donald M. Jenkins, *The Product Liability of Manufacturers: An Understanding and Exploration*, 4 AKRON L. REV. 135, 154 (1971) ("[*Greenman v. Yuba Power Products, Inc.*] is recognized as the first to expound the theory of a manufacturer's strict liability in tort . . . influenc[ing] the ultimate provisions of section 402A of the *Restatement (Second) of Torts.*").

III. CURRENT REGULATION AND THE NEED FOR ACTION

In 2011, Nevada became the first state to authorize the operation of autonomous vehicles.[71] Since 2011, twenty-one other states and Washington, D.C., have also passed legislation regarding the testing and operation of autonomous vehicles.[72] There is, however, no uniform approach. California, for example, enacted Senate Bill No. 1298, requiring the autonomous vehicle operator to possess a valid driver's license and obtain an additional "Test Vehicle Operator Permit."[73] In contrast, Nevada requires the operator to have a "G Endorsement" on their driver's license limiting testing to daylight hours,[74] whereas Florida only requires a valid driver's license.[75] These conflicting laws pose a problem because they obstruct the free flow of autonomous vehicles across state lines. Additionally, these laws only regulate the operation and insurance of autonomous vehicles during the testing phase; they do not govern the behavior of the vehicles, or their liability, outside of testing.[76]

On September 20, 2016, the United States Department of Transport implemented the first federal policy on automated vehicles in response to

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71. *See* 2011 Nev. Stat. 2876 (codified at NEV. REV. STAT. § 482A.100.) ("[A]uthorizing the operation of autonomous vehicles on highways within the State of Nevada."). In addition, Assembly Bill 511 defines an autonomous vehicle as "a motor vehicle that uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator." *Id.*

72. *Autonomous Vehicles | Self-Driving Vehicles Enacted Legislation*, NAT'L CONF. ST. LEGISLATURES (Mar. 26, 2018), http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx [https://perma.cc/UT8V-8Y2J]. These states include: Alabama, Arkansas, California, Colorado, Connecticut, Florida, Georgia, Illinois, Indiana, Louisiana, Michigan, New York, North Carolina, North Dakota, Pennsylvania, South Carolina, Tennessee, Texas, Utah, Virginia and Vermont. *Id.*

73. 2012 Cal. Stat. 5012 (codified at CAL. VEH. CODE § 38750 (West 2016)); CAL. CODE REGS. tit. 13, § 227.20 (2017) (requiring a Test Vehicle Operator Permit which commands a clean driving record with no at-fault accidents resulting in injury or death, and no convictions in the past ten years for driving under the influence of alcohol or drugs).

74. NEV. ADMIN. CODE § 482A.040 (2012) ("[A] person who holds a driver's license in [Nevada] and wishes to operate an autonomous vehicle in autonomous mode in [Nevada] must obtain a G endorsement on his or her driver's license . . . ."); NEV. DEP'T OF MOTOR VEHICLES, RESTRICTION CODES AND DESCRIPTIONS (2016), http://www.dmvnv.com/pdfforms/restriction_codes.pdf [https://perma.cc/HR2A-YJDC] (restricting driving privileges to "[d]aylight driving only").

75. Amy Sherman, *In Florida, No Permit Needed for Driverless Cars, Florida Senator Says*, POLITIFACT (Dec. 28, 2016, 3:00 PM), http://www.politifact.com/florida/statements/2016/dec/28/jeff-brandes/florida-no-permit-needed-driverless-cars-florida-s/ [https://perma.cc/J352-2SJU].

76. *See, e.g.*, CAL. VEH. CODE § 38755 (West 2017) (authorizing the Contra Costa Transportation Authority to conduct a pilot project for the *testing* of fully autonomous vehicles provided the testing is conducted at specified locations, the autonomous vehicle does not exceed speeds of thirty-five miles per hour, and the company provides proof of a $5 million insurance policy, among other requirements).

the growing industry.[77] Safety is a huge concern with regards to the development of this technology; therefore, the objective of the Federal Automated Vehicles Policy is to encourage strong safety oversight, but not overregulation.[78] Through loose guidelines, the policy outlines a fifteen-point Safety Assessment for the "safe design, development, testing, and deployment" of autonomous vehicles, and encourages states to implement consistent policies regarding these vehicles.[79] However, these regulations focus on safety and insurance; they do not clarify liability. Definitive guidelines are essential to ensure the safe integration of autonomous technology into the commercial market and onto the roadways.

Recognition of these technological advancements require lawmakers to be proactive in passing laws, as opposed to the advent of the automobile where laws were responsive.[80] AI is shifting from "building systems that are intelligent to building intelligent systems that are human-aware and

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77. *See* FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 3.

78. *See id.*; *see also* Cecilia Kang, *Self-Driving Cars Gain Powerful Ally: The Government*, N.Y. TIMES (Sept. 19, 2016), https://www.nytimes.com/2016/09/20/technology/self-driving-cars-guidelines.html ("The [policy guidelines] signaled to motorists that automated vehicles would not be a Wild West where companies can try anything without oversight, but [it was] also vague enough that automakers and technology companies would not fear overregulation.").

79. FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 6, 39; *see also* Press Release, The White House, Encouraging the Safe and Responsible Deployment of Automated Vehicles (Sept. 19, 2016), https://www.whitehouse.gov/the-press-office/2016/09/19/fact-sheet-encouraging-safe-and-responsible-deployment-automated [https://perma.cc/G78M-7ATJ] (announcing the Federal Automated Vehicles Policy as a means to "facilitate the responsible introduction of automated vehicles" to the roadways); Cecilia Kang, *The 15-Point Federal Checklist for Self-Driving Cars*, N.Y. TIMES (Sept. 20, 2016), https://www.nytimes.com/2016/09/21/technology/the-15-point-federal-checklist-for-self-driving-cars.html (outlining the fifteen-point Safety Assessment).

80. The Future of Life Institute is taking a proactive approach to the integration of AI and autonomy into society by encouraging research. In an open letter signed by influential leaders in technology, including Elon Musk, Steve Wozniak, Nick Bostrom, and the late Stephen Hawking, the Future of Life Institute noted that "the growing capabilities of AI are leading to an increased potential for impact on human society." Stuart Russell et al., *Research Priorities for Robust and Beneficial Artificial Intelligence*, AI MAG., Winter 2015, at 105, 112. As part of the letter they attached a "Research Priorities Document," emphasizing the impact of intelligence and autonomy on law and ethics. *Id.* at 107. It lists issues such as liability, weaponry, and privacy as part of their short-term research priorities, with the goal of implementing appropriate policies so society "can enjoy the benefits [of AI] while risks are minimized." *Id.* As part of its long-term research priorities, the Future of Life Institute recognizes the ultimate goal of developing Artificial General Intelligence and affords a "duty to AI researchers to ensure that the future impact is beneficial." *Id.* at 109, 112.

trustworthy."[81] Since commercial autonomy is so new, autonomous vehicles "will strongly influence the public's perception of AI," and part of that perception is that they are safe.[82] In the United States, over 35,000 people are killed and over two million people are injured every year due to car crashes.[83] The NHTSA estimates that motor vehicle crashes cost $242 billion annually, including the cost of medical bills, lost wages, legal fees, auto repairs, and delays.[84] Moreover, 94% of those crashes are caused by a human choice or error.[85] Human choice factors, such as speeding, drunken driving, fatigue, and distracted driving, alone account for over 23,000 fatal crashes annually.[86] The introduction of autonomous vehicles poses a solution because they will completely eliminate crashes caused by human choice, as the vehicles will never be intoxicated, fatigued, or distracted.[87]

In 2013, the Eno Center for Transportation released a study on the potential impacts of autonomous vehicles.[88] They projected that if 10% of the vehicles on United States roads were autonomous, 1,100 lives would be saved annually, and there would be 211,000 fewer crashes; if 50% of the vehicles were autonomous, 9,600 lives would be saved annually, and there would be 1,880,000 fewer crashes; and if 90% of the vehicles were autonomous, 21,700 lives would be saved annually, and there would be 4,220,000 fewer

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81. 2015 STUDY PANEL, ARTIFICIAL INTELLIGENCE AND LIFE IN 2030: ONE HUNDRED YEARS STUDY ON ARTIFICIAL INTELLIGENCE 1, 14 (2016), https://ai100.stanford.edu/sites/default/files/ai_100_report_0831fnl.pdf [https://perma.cc/YZG5-R3PZ].

82. *Id.* at 7.

83. U.S. DEP'T OF TRANSP., TRANSPORTATION STATISTICS ANNUAL REPORT 135 (2016), https://www.rita.dot.gov/bts/sites/rita.dot.gov.bts/files/TSAR_2016_rev.pdf [https://perma.cc/QF7J-WWAG] [hereinafter TRANSPORTATION STATISTICS ANNUAL REPORT] (reporting 35,092 motor vehicle fatalities and 2.44 million non-fatal motor vehicle injuries in 2015).

84. *Id.* at 152.

85. Press Release, Nat'l Highway Traffic Safety Admin., U.S. DOT Issues Federal Policy for Safe Testing and Deployment of Automated Vehicles (Sept. 20, 2016), https://www.nhtsa.gov/press-releases/us-dot-issues-federal-policy-safe-testing-and-deployment-automated-vehicles [https://perma.cc/78VA-GZZW] [hereinafter U.S. DOT Issues Federal Policy].

86. NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., NAT'L CTR. FOR STATISTICS & ANALYSIS, TRAFFIC SAFETY FACTS: 2015 MOTOR VEHICLE CRASHES 1, 6 (2016), https://crashstats.nhtsa.dot.gov/Api/Public/ViewPublication/812318 [https://perma.cc/J4G4-MV7M] (reporting 3,477 fatalities due to distracted driving, 10,265 fatalities involving an alcohol-impaired driver, and 9,557 fatalities due to speeding-related crashes).

87. *See* U.S. DOT Issues Federal Policy, *supra* note 85 ("[W]e see a future where self-driving cars will save thousands of lives on our roads. A self-driving car can't get drunk. A self-driving car can't get distracted. And a self-driving car will follow the traffic laws and prioritize safety for pedestrians and bicyclists.").

88. *See* DANIEL J. FAGNANT & KARA M. KOCKELMAN, PREPARING A NATION FOR AUTONOMOUS VEHICLES: OPPORTUNITIES, BARRIERS AND POLICY RECOMMENDATIONS 1, 7–9 (2013), https://www.caee.utexas.edu/prof/kockelman/public_html/ENOReport_BCAofAVs.pdf [https://perma.cc/G4CL-NCEH].

crashes.[89] These statistics are, in large part, the result of an autonomous vehicle's ability to benefit from the data and experience of other autonomous vehicles on the road; thereby avoiding the errors that human drivers repeatedly make.[90]

Nevertheless, several safety regulations center around the driver. The current federal definition of a *driver* is "the occupant of a motor vehicle seated immediately behind the steering control system."[91] However, a fully autonomous vehicle does not need a steering control system. Legal scholar Bryant Walker Smith examined this inconsistency and concluded that under the 1949 Geneva Convention on Road Traffic, to which the United States is a party, the term *driver* is probably flexible enough to include nonhuman drivers.[92] This issue was also addressed by the NHTSA when Google requested clarification concerning the term *driver*.[93] By design, Google's self-driving cars have no conventional driver controls such as a steering wheel and brake pedals; the vehicles are instead operated and controlled through a self-driving AI system, making the driver redundant.[94] As such, Google's request did not entail a simple expansion of the term *driver*, but instead an alteration to the Federal Motor Vehicle Safety Standards.[95] While the NHTSA did not make any changes to the Federal Motor Vehicle Safety Standards, it did interpret the law to consider the self-driving AI system, piloting Google's self-driving cars, as the *driver*.[96] Although this recognition is not legally binding, it does indicate that, for legal purposes,

89. *Id.* at 8 tbl.2 (summarizing the estimated economic and safety benefits of autonomous vehicles).

90. *See id.* at 3 ("Driver error is believed to be the main reason behind over [ninety] percent of all crashes.").

91. 49 C.F.R. § 571.3 (2005).

92. Smith, *supra* note 54, at 433–34. The Geneva Convention is a "multi-country agreement that promotes road safety by establishing certain common rules for automobile and other vehicles." Brodsky, *supra* note 28, at 858.

93. Letter from Paul A. Hemmersbaugh, *supra* note 9.

94. *Id.* ("Because Google's [self-driving vehicle] design purposely does not have any mechanism by which human occupants could steer or otherwise 'drive' the vehicle, it would be difficult in several instances to determine who the 'driver' would be . . . .").

95. *Id.* ("NHTSA will consider initiating rulemaking to address whether the definition of 'driver' in Section 571.3 should be updated in response to changing circumstances . . . .").

96. *Id.* (concluding that the "NHTSA will interpret 'driver' in the context of Google's described motor vehicle design as referring to the [Self-Driving System], and not to any of the vehicle occupants"). The letter went on to state that "[i]f no human occupant of the vehicle can actually drive the vehicle, it is more reasonable to identify the 'driver' as whatever (as opposed to whoever) *is* doing the driving. In this instance . . . the [fully autonomous Self-Driving System] is actually driving the vehicle." *Id.*

the NHTSA is willing to consider the AI system as a legal entity—an artificial person.[97]

Although this groundbreaking step advances the legal standing of AI and autonomy, at present there is still no framework in place for autonomous vehicle liability. Even though autonomous vehicles are intended to considerably reduce crashes, accidents are inevitable. Policies need to be implemented that will maximize the social benefit of this technology, while minimizing its risk.[98]

IV. THE IMPACT OF SHIFTING LIABILITY

In a conventional car accident, liability is typically attributed to the driver or the vehicle manufacturer.[99] However, removing the driver from the equation produces a gap in the liability framework. Legal scholars have debated whether existing tort laws will be sufficient to address autonomous vehicle liability, with the majority concluding that the tort framework will remain adequate.[100] But proponents of conforming regular tort principals to autonomous vehicles fail to account for the introduction of AI into the driving model.[101] More specifically, they are not factoring in the driving decisions made by AI.[102] As such, they are skipping over the AI as a responsible party, and are instead advocating for liability to be shifted from the driver

97. *See* Dave Gershgorn, *Google's Driverless Cars Will Be Legally Treated Like Human Drivers*, POPULAR SCI. (Feb. 10, 2016), http://www.popsci.com/googles-cars-will-be-treated-like-human-drivers [https://perma.cc/XD5P-BLW7].

98. *See* ANDERSON ET AL., *supra* note 31, at xiii.

99. *See generally* FRANKLIN ET AL., *supra* note 58 (explaining that blame can be imputed through driver negligence or a product defect).

100. *See, e.g.*, Kyle Graham, *Of Frightened Horses and Autonomous Vehicles: Tort Law and Its Assimilation of Inventions*, 52 SANTA CLARA L. REV. 1241, 1269–70 (2012) ("Early claims likely will resemble contemporary lawsuits that allege negligent vehicle use. . . . On the whole, I am more optimistic . . . about the interplay between tort law and autonomous vehicles."); Jeremy Levy, *No Need To Reinvent the Wheel: Why Existing Liability Law Does Not Need To Be Preemptively Altered To Cope with the Debut of the Driverless Car*, 9 J. BUS. ENTREPRENEURSHIP & L. 355, 387 (2015) ("[S]trict products liability is already in place to hold the manufacturers accountable. Meanwhile, the consumer will assume liability as a typical car owner or driver already does, and then defer this liability to individual private insurers."); Andrew P. Garza, Comment, *"Look Ma, No Hands!": Wrinkles and Wrecks in the Age of Autonomous Vehicles*, 46 NEW ENG. L. REV. 581, 581, 595 ("Products liability law is capable of handling the new technology just as it handled the incorporation of seat belts, air bags, and cruise control.").

101. *See* Brodsky, *supra* note 28, at 861 ("[T]he hypotheticals and examples [scholars] use to illustrate how existing tort and contract law can address potential problems with autonomous vehicles . . . do not account for many of the added complexities that arise when artificial intelligence is introduced.").

102. *See id.*

to the owner or manufacturer, thereby circumventing this liability gap as opposed to filling it.[103]

As autonomous vehicles become more prevalent on the roads, more accidents involving autonomous vehicles will inevitably occur.[104] As such, it is important that autonomous vehicle owners know how the legal system will respond.[105] Once autonomous vehicles become commercially available, there will be no human actively in control of the vehicle. Thus, laws must be in place to determine where liability lies. The potentially liable parties could be anyone from the owner of the vehicle, to "the vehicle manufacturer, the manufacturer of a component used in the autonomous system, [or] the software engineer who programmed the code for the autonomous operation of the vehicle."[106]

The following analysis is conducted under the assumption that the vehicle is a Level 5, fully autonomous vehicle, with no defects. Liability for vehicles categorized as levels 0–4 will likely be governed by pre-existing tort law because the driver remains in control of the vehicle in some capacity,[107] whereas the AI system piloting a fully autonomous vehicle is the sole driver. This section explores the liability shift to the owner and manufacturer, and concludes that liability should not be attributed to either party.

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103. *See* ROYAL ACAD. OF ENG'G, AUTONOMOUS SYSTEMS: SOCIAL, LEGAL AND ETHICAL ISSUES 1, 8 (2009), https://www.raeng.org.uk/publications/reports/autonomous-systems-report [https://perma.cc/8KQM-K6Z7] ("When a driver cedes control of their car to its own navigating or driving systems . . . they also give away some responsibility.").

104. *See, e.g.*, Neal E. Boudette, *Autopilot Cited in Death of Chinese Tesla Driver*, N.Y. TIMES (Sept. 14, 2016), https://www.nytimes.com/2016/09/15/business/fatal-tesla-crash-in-china-involved-autopilot-government-tv-says.html; Danny Yadron & Dan Tynan, *Tesla Driver Dies in First Fatal Crash While Using Autopilot Mode*, GUARDIAN (June 30, 2016, 7:14 PM), https://www.theguardian.com/technology/2016/jun/30/tesla-autopilot-death-self-driving-car-elon-musk [https://perma.cc/D5TP-PVE4]; Chris Ziegler, *A Google Self-Driving Car Caused a Crash for the First Time*, VERGE (Feb. 29, 2016, 1:50 PM), http://www.theverge.com/2016/2/29/11134344/google-self-driving-car-crash-report [https://perma.cc/76WC-K3AA].

105. Like the advent of the automobile, social policy favors certainty as opposed to the imposition of ill-fitted "horse and buggy" laws on modern driverless car cases. *See* Nixon, *supra* note 4, at 476.

106. Gary E. Marchant & Rachel A. Lindor, *The Coming Collision Between Autonomous Vehicles and the Liability System*, 52 SANTA CLARA L. REV. 1321, 1328 (2012).

107. *See, e.g.*, *supra* text accompanying note 3.

A. Shifting Liability to the Owner

There are two main theories of liability that govern tort law—*negligence*, which is fault-based liability, and *strict liability*, which is non-fault liability.[108] Negligence is the failure to do what a reasonably prudent person would do under the same or similar circumstances, thereby attributing blame to the faulty party.[109] In order for a driver to be found negligent the plaintiff must prove: (1) the driver had a duty of due care; (2) that duty of due care was breached; (3) there is a causal connection between the breach and (4) the injury.[110] Therefore, negligence mandates that the driver act, or fail to act, to be held liable for any harm caused by the vehicle.[111] Conversely, in strict liability cases, fault is not at issue—a party can be held legally responsible for the damage regardless of culpability.[112]

1. From Negligence to a Strict Liability Regime

Traditionally, drivers are held liable for the *negligent* use or operation of a vehicle; for example, failing to brake and rear-ending a vehicle. This is because the driver is in control of the vehicle, and with due care can avoid the risk.[113] As such, the central goal of negligence is to deter undesirable behavior by holding the driver accountable for their bad driving.[114] However, shifting liability to the owner will result in the owner being *strictly liable*

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108. OWEN, *supra* note 7, at 315 ("It is elemental that the very basis of negligence liability . . . is grounded in fault. In contrast, the very basis of strict products liability in tort is the supplier's responsibility for harm caused by product defects *regardless* of fault." (footnote omitted)).

109. *See* RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 3 (AM. LAW INST. 2010); *see also* RESTATEMENT (SECOND) OF TORTS § 283 cmt. b (AM. LAW INST. 1965) ("The words 'reasonable man' denote a person exercising those qualities of attention, knowledge, intelligence, and judgment which society requires of its members for the protection of their own interests and the interests of others."); KEETON ET AL., *supra* note 58, § 32, at 175 (defining the *reasonable person* as "a prudent and careful person, who is always up to standard").

110. KEETON ET AL., *supra* note 58, § 30, at 164–65.

111. RESTATEMENT (SECOND) OF TORTS § 284 (AM. LAW INST. 1965).

112. *See Economic Analysis of Alternative Standards of Liability in Accident Law*, BRIDGE, http://cyber.law.harvard.edu/bridge/LawEconomics/neg-liab.htm [https://perma.cc/HRK6-TDFC] ("Under a strict liability rule, the defendant pays for the injury his conduct causes the plaintiff regardless of whether the defendant was negligent.").

113. *See* Ind. Harbor Belt R.R. Co. v. Am. Cyanamid Co., 916 F.2d 1174, 1176–77 (1990) (reasoning that strict liability is only appropriate against parties engaged in abnormally dangerous activities, whereas negligence liability is proper if the risk can be avoided with the exercise of due care).

114. *See* DAN B. DOBBS ET AL., HORNBOOK ON TORTS 15 (2d ed. 2016).

for every choice the autonomous vehicle makes, regardless of fault, thereby "attenuat[ing] the relationship between legal responsibility and legal fault."[115]

If driver-negligence were imputed to the owner, the average consumer would likely be discouraged from buying an autonomous vehicle because consumer acceptance depends largely on cost, and assuming additional liability results in a greater financial burden, especially when that liability is non-fault liability.[116] Autonomous vehicles are built with the primary purpose of promoting safety and decreasing the number of car accidents.[117] As seen in the study conducted by the Eno Center for Transportation, the higher the percentage of autonomous vehicles on the road, the fewer accidents and the more lives saved annually.[118] In fact, autonomous vehicles are expected to reduce traffic fatalities by 90%, or roughly 31,000 lives a year.[119] For this reason, social policy should encourage the purchase of autonomous vehicles. However, markets work based on supply and demand; if attributing additional blame hampers the acceptance and sale of autonomous vehicles, the low sales will in turn hamper innovation and the mass production of these vehicles, returning society to the high accident rates caused by human

115. Smith, *supra* note 54, at 477.

116. A prime example of a product that failed to commercialize is the Segway. *See* Gary Rivlin, *Segway's Breakdown*, WIRED (Mar. 1, 2003, 12:00 PM), https://www.wired.com/2003/03/segway/ [https://perma.cc/245S-LNVF]. Invented by Dean Kamen, the Segway began as a top-secret project code-named "Ginger" and "IT," set to revolutionize transportation. *Id.* Kamen boldly predicted that the Segway would "be to the car what the car was to the horse and buggy." *Id.* However, industrial models were initially priced around $8,000, and commercial models retailed at $3,000 to $4,950. John Heilemann, *Reinventing the Wheel*, TIME (Dec. 2, 2001), http://content.time.com/time/business/article/0,8599,186660,00.html; Rivlin, *supra*. Kamen expected to sell "10,000 units a week by the end of 2002," but over the next six years, "Segway sold just 30,000 units." Jordan Golson, *Well, That Didn't Work: The Segway Is a Technological Marvel. Too Bad It Doesn't Make Any Sense*, WIRED (Jan. 16, 2015, 10:00 AM), https://www.wired.com/2015/01/well-didnt-work-segway-technological-marvel-bad-doesnt-make-sense/ [https://perma.cc/CL6U-8RGH]. Ultimately, the Segway failed to impact mass markets because its hefty price tag was unappealing to the public, who opted to walk rather than pay $5,000 for what was essentially a scooter. *See* Rivlin, *supra*.

117. *See* FAGNANT & KOCKELMAN, *supra* note 88, at 7–9.

118. *See id.*

119. Adrienne Lafrance, *Self-Driving Cars Could Save 300,000 Lives per Decade in America*, ATLANTIC (Sept. 29, 2015), http://www.theatlantic.com/technology/archive/2015/09/self-driving-cars-could-save-300000-lives-per-decade-in-america/407956/ [https://perma.cc/Z454-58TW] ("Researchers estimate that driverless cars could, by midcentury, reduce traffic fatalities by up to [ninety] percent."). The 31,000 is calculated using statistics from the U.S. Department of Transportation, reporting 35,092 motor vehicle fatalities in 2015. TRANSPORTATION STATISTICS ANNUAL REPORT, *supra* note 83, at 135.

choice or error.[120] Additionally, it may deter insurance companies from including autonomous vehicles in their policies because of the potential for costly damage.[121]

Furthermore, strict liability is often connected with the notion of *control*: "the control exercised by a vehicle owner over [their] vehicle, the control exercised by a pet owner over [their] pet, the control exercised by an employer over its employees . . . ."[122] In a fully autonomous vehicle, the owner is a passive passenger with *no operational control* and, therefore, no ability to act or prevent an accident.[123] Consequently, the common goals associated with tort law will not be served by shifting liability because the owner has no control; holding the owner liable will not deter bad driving, nor will it impose greater vigilance. For these reasons, driver-liability should not be imposed on the owner.

2. Current Owner-Liability

Similarly, the goals of current owner-liability laws will not be served if extended to autonomous vehicles. There are four ways an owner can currently be held liable for an accident even if they are not driving: (1) modification of the vehicle by the owner, (2) negligent entrustment, (3) state permissive use statutes, and (4) *respondeat superior*.[124] In certain instances, the owner of an autonomous vehicles should remain liable. For example, if the owner attempts to override the AI system piloting the vehicle, or modifies the vehicle in any way, then the normal principals of negligence will apply because the owner did not act as a reasonably prudent person would.[125] However, the remaining liability theories become problematic.

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120. *See* ANDERSON ET AL., *supra* note 31, at 118.

121. KPMG, MARKETPLACE OF CHANGE: AUTOMOBILE INSURANCE IN THE ERA OF AUTONOMOUS VEHICLES 1, 27 (2015) [hereinafter MARKETPLACE OF CHANGE], https://home.kpmg.com/content/dam/kpmg/pdf/2016/05/marketplace-change.pdf [https://perma.cc/3QR8-DM3H]. The cost of an autonomous vehicle accident could be enormous. *See id.* at 27. KPMG's study finds the "drastic reduction in incidents per vehicle will be somewhat offset by the increased severity incurred in each accident" due to the expensive technology needed for autonomous operation. *Id.* In fact, KPMG estimates that the cost per accident could "increase from almost $14,000 to roughly $35,000 by 2040." *Id.*

122. Smith, *supra* note 54, at 477 (footnotes omitted).

123. *See* FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 9 ("At . . . Level 5, the automated system can perform all driving tasks, under all conditions that a human driver could perform them."); *see also supra* notes 25–26 and accompanying text ("Autonomy on the other hand, has to do with control. An autonomous robot is self-governing and can act independently of external commands.").

124. *See* KEETON ET AL., *supra* note 58, § 69, at 499–501, § 73, at 522–24, 527–28.

125. *See* RESTATEMENT (THIRD) OF TORTS: LIAB. FOR PHYSICAL & EMOTIONAL HARM § 3 (AM. LAW INST. 2010); *id.* § 32, at 175.

In most cases, liability is imposed under the theory of negligent entrustment, or vicariously through state permissive use statutes.[126] The difference between the two theories is the negligent party.[127] Negligent entrustment holds the vehicle owner negligent for entrusting his vehicle to a person who the owner knew, or had reason to believe, was incompetent or unfit to drive.[128] State permissive use statutes attribute liability vicariously to the owner for permitting the driver to use the owner's vehicle, even though it is the driver's negligence, and not the owner's negligence that caused the accident.[129] The policy behind these statutes is to ensure injured parties are compensated because a vehicle owner has liability insurance, but the driver may not.[130] Alternatively, the doctrine of *respondeat superior* utilizes agency law to impose vicarious non-fault liability on an employer for the negligence of his employee, provided the employee's actions are within the scope of employment.[131] Essentially, an autonomous vehicle is like a chauffeur; thus, one could attribute liability to the owner by re-categorizing the autonomous vehicle as an employee.[132]

However, even these traditional owner liability theories do not fully support autonomous vehicles. For example, if an owner entrusts his vehicle to a drunk or unlicensed driver who causes an accident, then the owner has breached his duty of due care to other drivers on the road by allowing an unfit driver to use his vehicle—failing to act.[133] Therefore, the owner

126. *See* KEETON ET AL., *supra* note 58, § 73, at 522–24, 527–28.

127. Negligent entrustment holds the negligent person liable, whereas vicarious liability imposes liability on one person for the negligence of another person. *See id.* § 69, at 499, § 73, at 522–24, 527–28.

128. *Id.* § 73, at 523 ("Where the owner of the car entrusts it to an unsuitable driver, he is held liable for the negligence of the driver, upon the basis of his own negligence in not preventing it.").

129. *Id.* § 73, at 527 ("Such statutes make the owner of the automobile liable for injuries to third persons caused by the negligence of any person . . . who is operating the car on the public highway with the owner's consent." (footnotes omitted)).

130. Comment, *The Owner Consent Statutes: The Distinctions Between Enterprise and Instrumentality Liability*, 31 U. CHI. L. REV. 355, 355 (1964); *see Alternatives to Car Insurance*, DMV.ORG, http://www.dmv.org/insurance/alternatives-to-auto-insurance.php [https://perma.cc/L697-CVX9] ("As of 2014, nearly all of the 50 states require you to demonstrate 'financial responsibility' for a car accident, and car insurance is generally the simplest way to fulfill this responsibility."). Other options include: a surety bond, funds deposited with the state, or a certificate of self-insurance. *Id.*

131. RESTATEMENT (THIRD) OF AGENCY § 2.04 (AM. LAW INST. 2006).

132. *See* SAMIR CHOPRA & LAURENCE F. WHITE, A LEGAL THEORY FOR AUTONOMOUS ARTIFICIAL AGENTS 129–30 (2011).

133. *See* KEATON ET AL., *supra* note 58, § 73, at 523.

is said to be negligent and can be found liable for the driver's acts.[134] However, autonomous vehicles are meant to eliminate human-choice factors, such as speeding, drunken driving, fatigue, and distracted driving, and in doing so are projected to save thousands of lives annually.[135] Thus, classifying an autonomous vehicle as incompetent or unfit contradicts the purpose of the vehicle. In fact, one could say that the benefits of an autonomous vehicle are so great that they result in the inversion of negligent entrustment, where failing to act is not sanctioning the use of the vehicle, but rather preventing the vehicle from being used and thereby endangering thousands of lives.

Additionally, state permissive use statutes are in place to cover an uninsured driver; however, with an autonomous vehicle, the driver and the vehicle are one.[136] Thus, insurance for one means insurance for the other. Furthermore, these statutes impose liability based on the owner giving permission to the driver to use the vehicle.[137] However, fully autonomous vehicles are self-driving vehicles that do not require the "active physical control or monitoring" of a human operator.[138] Therefore, there is no way to operate an autonomous vehicle other than to permit it to drive. Consequently, the owner is liable every time the vehicle is in use, thereby circling back to a strict liability regime.

Similarly, *respondeat superior* mandates that an employee's actions must be within the scope of employment for liability to be imposed on an employer.[139] However, an autonomous vehicle's job is to drive, so every time it is active, its actions are within the scope of its employment. Like state permissive use statutes, the owner will be liable every time the vehicle is in use. Additionally, one of the policies behind *respondeat superior* is that the employer has deep pockets, and therefore more resources to pay damages than the employee.[140] However, if an autonomous vehicle is purchased as a family car, it does not generate any income for the owner.[141]

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134. *See id.*

135. U.S. DOT Issues Federal Policy, *supra* note 85; *see also* FAGNANT & KOCKELMAN, *supra* note 88, at 7–9 (predicting that the more autonomous vehicles there are on the road, the more lives will be saved).

136. *See supra* text accompanying note 96.

137. *See* KEETON ET AL., *supra* note 58, § 73, at 527–28 ("[L]iability is limited to the scope of the consent given . . . .").

138. CAL. VEH. CODE § 38750(a)(1) (West 2015) (defining "autonomous technology").

139. RESTATEMENT (THIRD) OF AGENCY § 2.04 (AM. LAW INST. 2006) ("An employer is subject to liability for torts committed by employees while acting within the scope of their employment.").

140. *See* DOBBS ET AL., *supra* note 114, at 755–56 (explaining that employers can raise prices to spread the losses resulting from an accident, and because "no one person bears the whole loss, the loss is not so disruptive").

141. Vehicles depreciate by approximately ten percent the moment they are driven off the lot. *Car Depreciation: 5 Things To Consider*, CARFAX (Apr. 6, 2015), https://www.carfax.com/guides/buying-used/what-to-consider/car-depreciation [https://perma.cc/S99B-

Thus, the high financial burden that comes with this additional liability will likely make it an unappealing purchase.[142]

Autonomous vehicles benefit society due to their social utility. However, imputing additional driver-liability to the owner will not merely shift liability, but shift tort compensatory systems from negligence to strict liability. This would not only be unjust, but would likely affect the sale of autonomous vehicles, impeding innovation and restoring high accident rates.[143] For these reasons, driver-liability should not be shifted to the vehicle owner.

B. Shifting Liability to the Manufacturer

The shift in responsibility from a conventional driver to the AI system piloting an autonomous vehicle could result in a shift in liability from the driver to the manufacturer.[144] Products liability is a strict liability regime, grounded in the premise that manufacturers should be responsible for the safety of the products they create because manufacturers are better equipped to anticipate and guard against defects.[145] Additionally, manufacturers are better equipped to spread losses because they can pass on litigation costs to consumers by raising the price of their products.[146] As such, this doctrine serves as an incentive for manufacturers to create safer products.[147]

In a products liability suit, a product is defective when it contains (1) a manufacturing defect, (2) a design defect, or (3) is defective because of

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2MKB]. "On average, a new car will lose [sixty] percent of its total value over the first five years of its life." *Id.*

142. *See supra* text accompanying note 116.

143. The DOT reported highway motor vehicle fatalities *increased* by 7.2%, from 32,744 to 35,092, in 2015. TRANSPORTATION STATISTICS ANNUAL REPORT, *supra* note 83, at 140 & tbl.6-1. Additionally, injuries resulting from highway motor vehicle accidents *increased* by an estimated 4.5%, from 2.33 million to 2.42 million. *Id.* at 140–41. Furthermore, "[m]otor vehicle crashes continue to be the leading cause of death for teens aged [sixteen] to [twenty] years." *Id.* at 144.

144. ANDERSON ET AL., *supra* note 31, at 118.

145. Escola v. Coca Cola Bottling Co., 150 P.2d 436, 440–41 (Cal. 1944) (Traynor, J., concurring) (stating that manufacturers are better equipped to "anticipate some hazards and guard against the recurrence of others").

146. *Id.* at 441 ("[T]he risk of injury can be insured by the manufacturer and distributed among the public as a cost of doing business."). Although loss spreading was not Justice Traynor's main goal, the concept that manufacturers are the cheapest cost avoiders was made popular through his opinion in *Escola*, and then adopted in *Greenman v. Yuba Power Products, Inc*. *See* 377 P.2d 897, 901 (Cal. 1963); *Strict Products Liability to the Bystander: A Study in Common Law Determinism*, 38 U. CHI. L. REV. 625, 636 n.66 (1971).

147. *See* ANDERSON ET AL., *supra* note 31, at 121.

inadequate instructions or warnings.[148] Manufacturing defects are implicated when the product that caused the injury was an anomalous product that deviated from the intended design, and as such, did not meet the manufacturer's specifications and standards.[149] Design defects are implicated when the risks of the design are foreseeable and "could have been reduced or avoided by the adoption of a reasonable alternative design."[150] The consumer-expectation test and the risk-utility test are used to determine design defects—a design is defective if it either violates the minimum safety expectations of an ordinary consumer, or contains dangers that outweigh its benefits.[151] A claim for failure to warn is based on a manufacturer's duty to provide instruction about how the product can be safely used, and to warn consumers of the dangers inherent to that product.[152]

If an autonomous vehicle is defective, then the normal rules of products liability should still apply because it incentivizes manufacturers to invest in precautions, producing better and safer vehicles. The issue arises when driver-liability is shifted to the manufacturer, making the manufacturer responsible for the defective product, *and* every choice the autonomous vehicle makes.[153]

First, if the manufacturer were held liable for driver decisions, it likely could not be done through the products liability doctrine because products "are by definition tangible—intangible products do not generally give rise

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148. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 (AM. LAW INST. 1998); *see, e.g.*, Watson v. Ford Motor Co., 699 S.E.2d 169, 174 (S.C. 2010).

149. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(a) ("[A product] contains a manufacturing defect when the product departs from its intended design even though all possible care was exercised in the preparation and marketing of the product."); *see, e.g.*, *Escola*, 150 P.2d at 440.

150. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(b) ("[A product] is defective . . . when the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design . . . and the omission of the alternative design renders the product not reasonably safe.").

151. Mikolajczyk v. Ford Motor Co., 901 N.E.2d 329, 352 (Ill. 2008) ("[W]e hold that both the consumer-expectation test and the risk-utility test continue to have their place in our law of strict product liability based on design defect.").

152. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(c) ("[A product] is defective . . . when the foreseeable risks of harm posed by the product could have been reduced or avoided by the provision of reasonable instructions or warnings . . . and the omission of the instructions or warnings renders the product not reasonably safe.").

153. Elon Musk has already spoken out against additional liability stating unless it is design related, Tesla "won't consider itself legally liable if its driverless cars get in a crash." Danielle Muoio, *Elon Musk: Tesla Not Liable for Driverless Car Crashes Unless It's Design Related*, BUS. INSIDER (Oct. 19, 2016, 10:38 PM), http://www.businessinsider.com/elon-musk-tesla-liable-driverless-car-crashes-2016-10 [https://perma.cc/4P7V-RF2S]. Musk likened it to getting stuck in an elevator stating, "Does the Otis Elevator Company take responsibility for all elevators around the world, no they don't." *Id.*

to product liability actions."[154] Autonomous vehicles predominantly rely on AI to function; this is intangible software in the form of code.[155] Courts are split on whether to classify software as a *product* or as a *service*.[156] As such, unless the software malfunctions, it is unlikely that the vehicle's driving choices—software algorithms—will be considered a product for the purposes of products liability law.[157]

Second, imputing additional liability to the manufacturer ultimately becomes a barrier to the deployment of autonomous vehicles.[158] Autonomous vehicles offer enormous benefits; they not only offer the potential to drastically reduce accidents, but also the potential to provide independence to the elderly and the disabled, reduce traffic congestion, provide commuters a few additional hours of productivity, and improve fuel efficiency while reducing carbon emissions.[159] Therefore, attributing driver-liability to the manufacturer is

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154. Calo, *supra* note 46, at 535–36 (citing Nora Freeman Engstrom, *3-D Printing and Product Liability: Identifying the Obstacles*, 162 U. PA. L. REV. ONLINE 35, 38–39 (2013), http://scholarship.law.upenn.edu/cgi/viewcontent.cgi?article=1121&context=penn_law_review_online).

155. *See id.* at 536.

156. Different courts have taken different approaches. For example, some courts have determined "a program sold on a physical medium and equally available to all interested buyers is generally characteri[z]ed as a product. Cloud applications, by contrast, are usually considered to be a service." Liis Vihul, *The Liability of Software Manufacturers for Defective Products*, TALLINN PAPERS, 2014, at 1, 9, https://ccdcoe.org/publications/TP_Vol1No2_Vihul.pdf [https://perma.cc/MS6X-H2GE].

157. *See* 68 AM. JUR. 3D *Proof of Facts* 333 § 8, Westlaw (database updated Feb. 2017) ("Considering the way the law has developed over the course of the computer revolution, it seems highly unlikely that any form of strict liability will be applied to software in the foreseeable future . . . ."); Jeffrey K. Gurney, *Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles*, 13 U. ILL. J.L. TECH. & POL'Y 247, 259 (2013) ("[C]ourts have not applied the manufacturing defect doctrine to software because nothing tangible is manufactured."); Calo, *supra* note 46, at 536 ("The code conveyed to the consumer fails to be defective for purposes of a product liability claim not because it lacks defects, but for the antecedent reason that it is not even a product."); Michael D. Scott, *Tort Liability for Vendors of Insecure Software: Has the Time Finally Come?*, 67 MD. L. REV. 425, 462 (2008) ("While a majority of courts have held that software is a *good* for the application of the U.C.C. and taxation, that does not mean that software is necessarily a *product* for the application of product liability law." (footnotes omitted)).

158. *See* Marchant & Lindor, *supra* note 106, at 1334 ("[E]ven though an autonomous vehicle may be safer overall than a conventional vehicle, it will shift the responsibility for accidents, and hence liability, from drivers to manufacturers. The shift will push the manufacturer away from the socially-optimal outcome—to develop the autonomous vehicle.").

159. *See* Cadie Thompson, *8 Ways Driverless Cars Will Drastically Improve Our Lives*, BUS. INSIDER (Dec. 10, 2015, 3:37 PM), http://www.businessinsider.com/8-ways-

worrisome because it increases the manufacturer's risk, forcing manufacturers to raise prices to offset liability costs.[160] High prices, in turn, lead to lower adoption rates.[161] The full benefits of autonomous vehicles will not be realized if they are not widely adopted.[162]

Additionally, it is impractical for manufacturers to pay more for prevention than what the actual likelihood and severity of injury would cost them.[163] For this reason, courts employ the Learned Hand Cost-Benefit analysis to determine whether manufacturers have acted reasonably.[164] This is an economic formula balancing the price of safety precautions with the probability and severity of injury, to determine a cost-justified level of safety.[165] If it is not cost-justified—for example, if manufacturers incur more liability than that to which they are accustomed—there is no incentive for manufacturers to develop new technologies, creating a barrier to innovation.[166]

This precise effect is illustrated through the pharmaceutical industry. Prior to the adoption of the National Childhood Vaccine Injury Act (NCVIA) in 1986, vaccine manufacturers were subjected to costly litigation for vaccine

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driverless-cars-will-drastically-improve-our-lives-2015-12/#thousands-of-lives-will-be-saved-each-year-1 [https://perma.cc/TA5D-C9TT].

160. *See* Marchant & Lindor, *supra* note 106, at 1334 ("The technology is potentially doomed if there are a significant number of . . . cases, because the liability burden on the manufacturer may be prohibitive of further development.").

161. *See* ANDERSON ET AL., *supra* note 31, at 118 ("[M]anufacturers may be reluctant to introduce technology that will increase their liability. Alternatively, manufacturers may price this technology to recover their expected liability costs. This may lead to higher prices and lower adoption of this technology than would be socially optimal.").

162. *See* FAGNANT & KOCKELMAN, *supra* note 88, at 8 tbl.2.

163. *See, e.g.*, Grimshaw v. Ford Motor Co. (*Ford Pinto*), 174 Cal. Rptr. 348, 359, 361–62 (Ct. App. 1981). The controversial *Ford Pinto* case deals with the explosion of Ford Pintos due to a defective fuel-system design. *See id.* Although the court found a design defect existed, Ford used the Hand test in determining the probability and gravity of the injury (death) versus the cost to fix the defect (a part costing $11) and found that upgrading the fuel system was not cost-justified. Christopher Leggett, *The Ford Pinto Case: The Valuation of Life as It Applies to the Negligence-Efficiency Argument*, WAKE FOREST STUDENT, FAC., & STAFF WEB PAGES (1999), https://users.wfu.edu/palmitar/Law&Valuation/Papers/1999/Leggett-pinto.html [https://perma.cc/K55T-LRSM]. There was outrage at Ford's quantification of human life, evident by *Grimshaw*'s jury award of over $2.5 million in compensatory damages and $125 million in punitive damages (later reduced to $3.5 million in punitive damages). *See Ford Pinto*, 174 Cal. Rptr. at 358. This evaluation however, is made every day whether it is through a court awarding damages or a business offering danger pay.

164. *See* United States v. Carroll Towing Co., 159 F.2d 169, 173 (2d Cir. 1947); *see also* Bolton v. Stone [1951] AC 850.

165. *Carroll Towing Co.*, 159 F.2d at 173 (reasoning that liability for negligence, due to failure to take safety precautions, exists if the burden of taking such precautions is less than the probability of injury multiplied by the gravity of any resulting injury, symbolized by B < PL = N).

166. *See* Marchant & Lindor, *supra* note 106, at 1334.

injuries.[167] The number of lawsuits led many pharmaceutical companies to stop producing vaccines, and those that remained in the industry raised their prices to cover liability costs.[168] This caused vaccine prices to "skyrocket[] as much as 2,000 percent," creating a health emergency.[169] As a remedial measure, Congress passed NCVIA, which acted as a tort shield limiting manufacturer liability.[170] Similarly, if courts shift driver-liability to the manufacturer, it may open manufacturers up to substantial liability, with the potential side effect of halting deployment and chilling innovation.

Not only does this illustrate the barrier that liability presents to innovation, it also serves as another example of the legal system being outpaced by technology.[171] Additionally, how the law addresses liability issues will significantly impact how consumers respond to autonomous vehicles, and how these vehicles impact society. Ultimately, the benefits of autonomous vehicles will never be realized if manufacturers are subjected to substantial litigation.[172] Therefore, driver-liability should not be imposed on the owner or the manufacturer.

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167. *See* Brandon L. Boxler, *Fixing the Vaccine Act's Structural Moral Hazard*, 12 PEPP. DISP. RESOL. L.J. 1, 6 (2012) ("As the number of government-recommended vaccines increased in the 1970s and 1980s, so too did the number of design defect, manufacturer defect, and other product liability lawsuits against pharmaceutical companies.").

168. *Id.* at 6–7 (first citing Charles F. Hagan, *Vaccine Compensation Schemes*, 45 FOOD DRUG COSM. L.J. 477, 479 (1990), then citing Merrile Sing & Mary Kaye Willian, *Supplying Vaccines: An Overview of the Market and Regulatory Context*, *in* SUPPLYING VACCINES: AN ECONOMIC ANALYSIS OF CRITICAL ISSUES 45, 51–52 (Mark Pauly et al. eds., 1996)).

169. *Id.* at 7 (citing H.R. REP. NO. 101-247, at 509 (1989)).

170. National Childhood Vaccine Injury Act of 1986, Pub. L. No. 99-660, 100 Stat. 3758 (codified as amended at 42 U.S.C. § 300aa-11(a)(2)(A) (2012)) ("No person may bring a civil action for damages in an amount greater than $1,000 or in an unspecified amount against a vaccine administrator or manufacturer in a State or Federal court for damages arising from a vaccine-related injury or death associated with the administration of a vaccine . . . .").

171. *See* Boxler, *supra* note 167, at 7 ("The legal system's failure to provide a suitable adjudicative process for compensating vaccine injuries had created a public health emergency.").

172. The DOT provided an idea of what a manufacturer's liability could amount to when it reported that "[t]he total cost of motor vehicle crashes was estimated at $836 billion in 2010 . . . ." TRANSPORTATION STATISTICS ANNUAL REPORT, *supra* note 83, at 135.

V. SHORT-TERM PROPOSAL: ATTRIBUTE LIABILITY TO THE PROGRAMMER

In 1942, science fiction writer and Professor Isaac Asimov introduced the "Three Laws of Robotics" as a safeguard to oversee the behavior of robots.[173]

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

In Asimov's writings, these laws were embedded into the software, allowing the rules to govern the robot's behavior, making it safe.[174] As such, Asimov's laws mandate that robots comply with "human laws and norms" in order to coexist.[175] In the case of an autonomous vehicle, human norms would necessitate that the vehicle obey traffic laws and regulations so that it interacts with other vehicles and pedestrians in a safe manner.[176] To achieve this, the vehicles are programmed with a "master playbook," which evaluates different "driving events," and suggests strategies on how the autonomous vehicle should behave when encountering a particular scenario.[177] These are the *planning* and *acting* portions of the vehicle's "sense-plan-act" design.[178] The programmer essentially hard-codes "If-Then" statements into the vehicle,[179] enabling the driving events to cover anything from stopping at a red light, to passing a slow vehicle, to navigating Times Square.[180] By doing this, the programmer, as the creator of the "master playbook," essentially becomes the driver. Therefore, if an accident occurs based on a hard-coding error, the programmer should be held liable.

This is similar reasoning to products liability—if the coding is defective, then programmers should be responsible for the damage that errors in their

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173. ISAAC ASIMOV, I, ROBOT 44–45 (Bantam ed. 1991).

174. *See id.* at 44 ("Now, look, let's start with the three fundamental Rules of Robotics—the three rules that are built most deeply into a robot's positronic brain.").

175. Ronald Leenes & Federica Lucivero, *Laws on Robots, Laws by Robots, Laws in Robots: Regulating Robot Behaviour by Design*, 6 LAW INNOVATION & TECH. 193, 208 (2014) (emphasis omitted).

176. *Id.*

177. Chris Urmson et al., *Autonomous Driving in Urban Environments: Boss and the Urban Challenge*, 25 J. FIELD ROBOTICS 425, 457 (2008), http://www.fieldrobotics.org/users/alonzo/pubs/papers/JFR_08_Boss.pdf [https://perma.cc/L88J-4PMZ].

178. ANDERSON ET AL., *supra* note 31, at 58–59.

179. Giarratana, *supra* note 37.

180. *See* Urmson et al., *supra* note 177, at 457.

software cause.[181] Additionally, this proposal makes up for the ambiguity in the application of the products liability doctrine to software, where courts are split on whether software algorithms are considered *products* or *services* due to the intangible nature of software.[182]

From a policy standpoint, this may be effective initially, as it serves as an incentive for programmers to create safer software.[183] However, this is a short-term proposal because, without delving into the specific moral and ethical issues of programming an autonomous vehicle,[184] "[t]here is no way for [programmers] to hard-code every possible variable or situation a car may face in a daily drive."[185] As such, AI is moving away from *hard-coding* toward *deep-learning*.[186] This is AI that *programs itself* by collecting and processing information, "learning from examples of how a system ought to behave in response to an input," and then acting.[187] This results in the autonomous vehicle reclaiming its position as the driver.

181. *See* Jaikumar Vijayan, *Hold Vendors Liable for Buggy Software*, COMPUTERWORLD (Mar. 8, 2010), http://www.computerworld.com/article/2550553/security0/hold-vendors-liable-for-buggy-software.html [https://perma.cc/ZJT7-JSZA].

182. *See supra* Section IV.B.

183. *See* ANDERSON ET AL., *supra* note 31, at 121.

184. What happens when the "driving events" come into conflict with one another? Especially if an autonomous vehicle does make a decision that results in less casualties, but regardless, is unable to avoid an accident. For example, in the "Trolley Dilemma," an autonomous vehicle must choose between hitting a group of school children crossing the road or swerving off a cliff to avoid them, but killing the passenger. *See About the Trolley Dilemma*, TROLLEY DILEMMA, http://www.trolleydilemma.com [https://perma.cc/A2XY-AGR9]. How does a programmer program that choice?

185. Giarratana, *supra* note 37.

186. *See* Reiley, *supra* note 33; Brad Templeton, *Comma.ai's Quest To Build Self-Driving Cars Better Than Google*, ROBOTICS BUS. REV. (Mar. 29, 2016), http://www.roboticstrends.com/article/comma_ais_quest_to_build_self_driving_cars_better_than_google [https://perma.cc/U26F-B446] ("Perhaps the world's most exciting new technology today are deep neural networks, in particular the convolutional neural networks such as 'Deep Learning.' These networks are conquering some of the most well known problems in artificial intelligence and pattern matching.").

187. Reiley, *supra* note 33; *see also* Steve Crowe, *How AI Is Making Self-Driving Cars Smarter*, ROBOTICS BUS. REV. (June 14, 2016), https://www.roboticsbusinessreview.com/rbr/how_ai_is_making_self_driving_cars_smarter/ [https://perma.cc/Y8BG-7BKC] (explaining "deep learning"); Giarratana, *supra* note 37 (emphasizing the active learning between autonomous vehicles due to their ability to communicate); *supra* notes 33–37 and accompanying text (discussing deep learning neural networks).

VI. LONG-TERM PROPOSAL: ATTRIBUTE LIABILITY TO THE AUTONOMOUS VEHICLE

If the NHTSA is willing to consider the AI system piloting an autonomous vehicle as the driver, why should the law not do the same?[188] As negligence mandates, a driver must act, or fail to act, as a reasonably prudent person would in order to be found liable.[189] In the case of an autonomous vehicle, the traditional driver is removed from the equation altogether. However, this does not mean that driver liability should be discarded. In fact, this section proposes that liability be attributed to the driver, with the driver being the autonomous vehicle itself.

A. Corporations and Legal Personhood

The law is familiar with, and has long addressed issues relating to the control and responsibility divided among human and non-human actors, with the most instructive model being a corporation.[190] In the United States, a corporation is considered a *legal person* in the eyes of the law.[191] A legal person is defined as an entity "given certain legal rights and duties of a human being."[192] These rights and duties allow corporations to enter into contracts, buy and sell property, and sue and be sued.[193] Most notably, however, corporate personhood allows a corporation to be separate and distinct from its shareholders.[194] This in turn enables a corporation to act as a liability shield, protecting its shareholders from personal liability for

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188. *See* Letter from Paul A. Hemmersbaugh, *supra* note 9.

189. *See* RESTATEMENT (SECOND) OF TORTS § 284 (AM. LAW INST. 1965).

190. Smith, *supra* note 54, at 423.

191. *See, e.g.*, Santa Clara Cty. v. S. Pac. R.R. Co., 118 U.S. 394, 396 (1886). Prior to the oral argument, Chief Justice Waite stated the court "does not wish to hear argument on the question whether the provision in the Fourteenth Amendment to the Constitution, which forbids a State to deny to any person within its jurisdiction the equal protection of the laws, applies to these corporations. We are all of opinion that it does." *Id.* The legal personhood of corporations was taken one step further by the 2010 Supreme Court decision in *Citizens United v. Federal Election Commission*, which gave corporations the First Amendment right to free speech. Lisa McElroy, Citizens United v. FEC *in Plain English*, SCOTUS BLOG (Jan. 22, 2010, 11:45 PM), http://www.scotusblog.com/2010/01/citizens-united-v-fec-in-plain-english/ [https://perma.cc/G8WJ-SC6W]. Additionally, in *Burwell v. Hobby Lobby Stores, Inc.*, the Supreme Court held that corporations were "persons" under the Religious Freedom Restoration Act, giving corporations the First Amendment right to freedom of religion. 134 S. Ct. 2751, 2768 (2014).

192. *Legal Person*, BLACK'S LAW DICTIONARY (10th ed. 2014).

193. Elizabeth Pollman, *Reconceiving Corporate Personhood*, 2011 UTAH L. REV. 1629, 1638 (2011); Alexis Dyschkant, Note, *Legal Personhood: How We Are Getting It Wrong*, 2015 U. ILL. L. REV. 2075, 2084; *Corporations*, US LEGAL, https://uslegal.com/corporations/ [https://perma.cc/V3GA-MFXQ].

194. Pollman, *supra* note 193, at 1638–39.

any actions of the corporation.[195] As such, a corporation is a legal construct, an *artificial person*, that takes the form of a human being for liability purposes.[196]

Corporations are not the only nonhuman entities attributed with legal personhood. In New Zealand, a dispute between the government and the Māori over the ownership of the Te Urewera National Park resulted in the Te Urewera Act, which declared the national park a legal entity with "all the rights, powers, duties and liabilities of a legal person."[197] A similar dispute over the Whanganui River resulted in the Te Awa Tupua Act, which recognized the river as a tribal ancestor, and granted it the "same legal rights as a human being."[198] Similarly, in 2013, India announced that dolphins should be seen as nonhuman persons, with the specific right to be left alone.[199] As a result of this recognition, India completely banned dolphinariums and the use of dolphins for public entertainment.[200]

While India and New Zealand are assigning legal personhood to natural lands, rivers, and animals, the European Parliament Committee on Legal

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195. *Corporations*, *supra* note 193.

196. Chief Justice Marshall defined a corporation as "an *artificial being*, invisible, intangible, and existing only in contemplation of law." Trs. of Dartmouth Coll. v. Woodward, 17 U.S. (4 Wheat.) 518, 636 (1819) (emphasis added).

197. Te Urewera Act 2014, s 11 (N.Z.), http://www.legislation.govt.nz/act/public/2014/0051/latest/DLM6183601.html [https://perma.cc/QNN5-8Y7P]. Under the Act, a Board, made up of Māori and Crown representatives, is charged with managing the 821-square-mile park. *Id.* s 16; Bryant Rousseau, *In New Zealand, Lands and Rivers Can Be People (Legally Speaking)*, N.Y. TIMES (July 13, 2016), http://www.nytimes.com/2016/07/14/world/what-in-the-world/in-new-zealand-lands-and-rivers-can-be-people-legally-speaking.html.

198. Eleanor Ainge Roy, *New Zealand River Granted Same Legal Rights as Human Being*, GUARDIAN (Mar. 16, 2017, 12:50 AM), https://www.theguardian.com/world/2017/mar/16/new-zealand-river-granted-same-legal-rights-as-human-being [https://perma.cc/KD7W-D43X] ("The new status of the river means if someone abused or harmed it the law now sees no differentiation between harming the tribe or harming the river because they are one and the same."); Te Awa Tupua Act 2017, s 14 (N.Z.), http://www.legislation.govt.nz/act/public/2017/0007/latest/whole.html [https://perma.cc/DT8D-VTBJ].

199. *See India Declares Dolphins "Non-Human Persons"—Dolphin Shows Banned*, TRANSCEND MEDIA SERV., (Dec. 21, 2015), https://www.transcend.org/tms/2015/12/india-declares-dolphins-non-human-persons-dolphin-shows-banned/ [https://perma.cc/3WHD-GRWQ] (explaining that dolphins are viewed as "highly intelligent and sensitive" and therefore their "life and liberty must be respected").

200. *See India Just Banned the Use of Dolphins and Orcas for Public Entertainment*, UNDERGROUND REP. (June 29, 2016), http://undergroundreporter.org/india-banned-dolphins-entertainment/ [https://perma.cc/5LNG-WS2A] (reporting that Dolphinariums and the capture and confinement of cetacean species, such as whales and dolphins, for public entertainment is completely banned).

Affairs has approved a draft report proposing to classify sophisticated autonomous robots as "electronic persons with specific rights and obligations."[201] The report recommends the establishment of a compulsory insurance scheme where, like cars, "producers or owners of robots would be required to take out insurance cover for the damage potentially caused by their robots."[202] If the damage is not covered by insurance, the report proposes the creation of a compensation fund, which would cover liability and serve as a depository for payments made to autonomous robots for their services.[203] The fund would be governed by a register, whereby a registration number would link each autonomous robot to its fund.[204] This report establishes a legal framework for "electronic persons," thereby substantiating the premise that giving a legal status to an autonomous vehicle is no longer considered science fiction; instead it is modern reality.

B. Insurance

A common way for corporations to manage risk is to buy insurance. However, driverless technology will have a large impact on the insurance industry because the safer the vehicle, the more insurance premiums are anticipated to decline.[205] In 2015, car insurers brought in 200 billion dollars' worth of premiums.[206] As autonomous technology becomes mainstream, insurance companies estimate up to an eighty percent decline, creating a major disruption in the auto insurance market.[207] Deloitte forecasts "approximately

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201. Mady Delvaux (Rapporteur), Comm. on Legal Affairs, European Parliament, *Draft Report with Recommendations to the Commission on Civil Law Rules on Robotics*, at 6, 11–1, 2015/2103(INL) (May 31, 2016), http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//NONSGML%2BCOMPARL%2BPE-582.443%2B01%2BDOC%2BPDF%2BV0//EN [https://perma.cc/P4UR-CAPG]; European Parliament Press Release, Robots: Legal Affairs Committee calls for EU-wide rules (Jan. 12, 2017), http://www.europarl.europa.eu/sides/getDoc.do?type=IM-PRESS&reference=20170110IPR57613&language=EN&format=pdf [https://perma.cc/AD7K-AA27] ("[The draft report was] approved by 17 votes to 2, with 2 abstentions . . . .").

202. *Id.* at 11.

203. *Id.*

204. *Id.* at 11–12.

205. *See* MARKETPLACE OF CHANGE, *supra* note 121, at 25–26, 30. In its survey, KMPG notes the automobile insurance industry will change with the introduction of autonomous vehicles, and "[t]he magnitude of change will be historic—perhaps the biggest change since the introduction of automobiles themselves a century ago." *Id.* at 37.

206. Leslie Scism, *Driverless Cars Threaten To Crash Insurers' Earnings*, WALL STREET J. (July 26, 2016, 11:04 AM), http://www.wsj.com/articles/driverless-cars-threaten-to-crash-insurers-earnings-1469542958.

207. *Id.*; *see also* MARKETPLACE OF CHANGE, *supra* note 121, at 25 (explaining that based on actuarial models, KPMG predicts "[a]ccident frequency could drop by [eighty] percent").

$200 billion in personal-car-insurance premiums to hold steady for seven or eight years, then slide to about $40 billion by 2040."[208]

Currently, actuaries determine insurance rates by predicting the "likelihood that accidents will happen" based on statistics such as age, driving history, and even the crash rates between male and female drivers.[209] However, in the future, actuaries will have to replace calculations about individuals with technology-based calculations, such as how advanced the AI system piloting the vehicle is, which "parts of the country have better satellite imagery," and how vulnerable the vehicle is to hacking.[210] While autonomous vehicles are expected to be safer, there will still be accidents, and insurance is often the last line of defense when it comes to the risks involved with new technology.[211] Thus, insurance companies will be forced to adapt their policy coverage as risk and liability change.[212]

Insurance is a complex industry, and a full analysis of the industry goes beyond the scope of this Comment. However, one insurance model that legal scholars have proposed for autonomous vehicles is no-fault insurance. No-fault insurance is a liability system whereby an accident victim can receive compensation directly from their "own insurance company instead of having to show the fault of another driver to recover losses from [that] driver's insurance company."[213] Although a system that does not require

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208. Scism, *supra* note 206. Similarly, KPMG reports that the personal auto sector currently "accounts for roughly $125 billion in loss costs. By 2040, [KPMG] believe[s] this sector could cover less than $50 billion in loss costs." MARKETPLACE OF CHANGE, *supra* note 121, at 29.

209. Scism, *supra* note 206.

210. *Id.*

211. Julia Eddington, *How Will Driverless Cars Impact Auto Insurance?*, QUOTED (June 23, 2016), https://www.thezebra.com/insurance-news/3069/insurance-for-driverless-cars/ [https://perma.cc/EF7F-N98N].

212. *See id.* This adaptation has already started in the United Kingdom, where insurance company Adrian Flux has launched the first auto insurance policy for autonomous vehicles. *See* Julia Kollewe, *Insurer Launches UK's 'First Driverless Car Policy*,*'* GUARDIAN (June 7, 2016, 11:42 AM), https://www.theguardian.com/business/2016/jun/07/uk-driverless-car-insurance-policy-adrian-flux [https://perma.cc/Z4LE-M5FL]. However, the policy currently only covers semi-autonomous vehicles—those fitted with assistive technology, such as autonomous braking—and will be updated as both liability and driverless technology evolve. *Id.* Conversely, in the United States, KPMG reported that less than ten percent of its survey respondents, made up of insurance company senior executives, have acted to adequately prepare their business models for this change. MARKETPLACE OF CHANGE, *supra* note 121, at 20, 34.

213. Laura Zakaras, *What Happened to No-Fault Automobile Insurance?*, RAND CORP. (2010), https://www.rand.org/pubs/research_briefs/RB9505/index1.html [https://perma.cc/

fault may seem like a viable solution for autonomous vehicle liability, over the last thirty years, "efforts to pass federal legislation [have] stalled," and most states have "repealed their no-fault laws and [have] gone back to the traditional tort system."[214] In fact, of the twenty-five states that initially passed some form of no-fault insurance, only twelve states still offer it.[215] This is largely because the no-fault system became significantly more expensive than the tort system due to substantially higher medical costs, which in turn resulted in high liability premiums.[216] This decline in popularity also stems from the fact that no-fault insurance eliminates the right to full compensation, deprives consumers of the leverage of adequate legal remedies, and has not proven to reduce disputes and litigation.[217] Additionally, within

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8ARG-H346]. In the 1970s, prompted by the dissatisfaction with the traditional tort system, many insurers and consumer groups supported no-fault insurance. *Id.* They viewed it as a way to "mitigate the problems of resolving disputes through the courts, such as high costs, long delays . . . and the unfairness of compensating some victims much more than others." *Id.* Ultimately, the no-fault system was "intended to lower the cost of auto insurance by taking small claims out of the courts." *No-Fault Auto Insurance*, INS. INFO. INST. (Feb. 3, 2014), http://www.iii.org/issue-update/no-fault-auto-insurance [https://perma.cc/3HNQ-3ZV6].

214. Zakaras, *supra* note 213.

215. ANDERSON ET AL., *supra* note 31, at 113; JAMES M. ANDERSON ET AL., THE U.S. EXPERIENCE WITH NO-FAULT AUTOMOBILE INSURANCE: A RETROSPECTIVE 2–3 (2010) [hereinafter ANDERSON ET AL., A RETROSPECTIVE], https://www.rand.org/pubs/monographs/MG860.html. These twelve states include: Florida, Hawaii, Kansas, Kentucky, Massachusetts, Michigan, Minnesota, New Jersey, New York, North Dakota, Pennsylvania, and Utah. *No-Fault Auto Insurance*, *supra* note 213.

216. *See* ANDERSON ET AL., A RETROSPECTIVE, *supra* note 215, at 3, 144. As soon as no-fault insurance was repealed in Georgia, Connecticut, and Colorado "the price of liability premiums dropped by [ten] to [thirty] percent in all three states." Zakaras, *supra* note 213; *see also* ANDERSON ET AL., A RETROSPECTIVE, *supra* note 215, at 74–75 (documenting the "pattern of substantial cost decreases in all three states following the repeal of no-fault"). This is partly because "in no-fault states, auto insurance almost certainly pays for a larger proportion of auto accident-related medical costs than in tort states, where first-party medical insurance pays for a higher proportion." ANDERSON ET AL., A RETROSPECTIVE, *supra* note 215, at 119. It is also because, no-fault insurance "pays a much higher percentage of billed medical costs than medical insurance . . . . Thus, medical providers [are] much more likely to initially bill no-fault insurance prior to seeking recovery against the victim's medical insurance." *Id.* (footnotes omitted). This might change if auto-insurers begin negotiating rate agreements with health care providers. However, up to this point, negotiations of this kind are not standard practice.

217. *See A Failed Experiment: Analysis and Evaluation of No-Fault Laws*, FOUND. FOR TAXPAYER & CONSUMER RTS., http://mail.consumerwatchdog.org/insurance/fs/fs000218.php3 [https://perma.cc/YSX2-FF6D]; *see also* ANDERSON ET AL., A RETROSPECTIVE, *supra* note 215, at 92–97 ("[W]hile auto cases represent a smaller proportion of cases actually reaching trial in no-fault states, attorney involvement in cases has increased modestly over time in no-fault . . . states relative to tort states, and total auto litigation volume has become more comparable between tort and no-fault states."), 115 (explaining that a major limitation of the no-fault system is the "denial of compensation for noneconomic losses [such as pain and suffering] to those whose injuries fall below the recovery threshold").

the states that still offer no-fault insurance, there is a "threshold"—if injuries reach a certain degree of severity, the tort system is reinstated, and automobile crash victims are permitted to sue other drivers.[218] Furthermore, evidence suggests that "a system that allows drivers to *choose* between no-fault and tort insurance may function better than conventional no-fault."[219] Seeing that the recurring trend is to maintain a tort system, this insurance model does nothing to fill the gap in the tort framework created by autonomous vehicles, especially if crashes result in severe injuries. Therefore, no-fault insurance alone is likely not a viable solution for autonomous vehicle liability.[220]

Conversely, self-insurance, similar to the compensation fund proposed by the European Parliament Committee, may prove to be such a solution.[221] Self-insurance and traditional insurance "are two different methods of treating risks."[222] Self-insurance refers to an employer's assumption of the risks associated with insurance coverage, whereas traditional insurance transfers that risk to a third party insurance company.[223] Therefore, self-insurance requires that employers set money aside specifically for losses, as opposed to paying that money, in the form of monthly premium payments,

218. ANDERSON ET AL., *supra* note 31, at 113. "Drivers in no-fault states may sue for severe injuries if the case meets certain conditions. These conditions are known as the tort liability threshold and may be expressed in verbal terms such as death or significant disfigurement (verbal threshold) or in dollar amounts of medical bills (monetary threshold)." *No-Fault Auto Insurance*, *supra* note 213.

219. Zakaras, *supra* note 213; *see also* ANDERSON ET AL., A RETROSPECTIVE, *supra* note 215, at 59–60, 137 (explaining that "there seems to be substantial consumer support for choice no-fault" with choice no-fault likely remaining "the form of no-fault that is most politically attractive").

220. Although the RAND report states that technological innovation, such as autonomous vehicle technology, may make no-fault systems more desirable in the future, it also states that this technology may "change the distribution of accidents," where "[p]resently, minor accidents vastly outnumber the major ones." ANDERSON ET AL., A RETROSPECTIVE, *supra* note 215, at 142. By reducing human error, "autonomous-vehicle technology may be remarkably effective at virtually eliminating minor accidents. But it may be that the few accidents that remain are the result of software failures and could be catastrophic." *Id.* at 141–42. Seeing that no-fault insurance was meant to keep small claims out of the courts, it would be ineffective in dealing with claims associated with these catastrophic accidents because victims would revert to the tort system. *See supra* text accompanying notes 213, 218.

221. *See supra* Section VI.A.

222. Robert Allan Naeve, Comment, *Motor Vehicle Liability Self-Insurance: The Coverage Gap*, 13 LOY. L.A. L. REV. 205, 205 (1979).

223. Christina H. Park, *Prevalence of Employer Self-Insured Health Benefits: National and State Variation*, 57 MED. CARE RES. & REV. 340, 341 (2000).

to an insurance company.[224] As premiums associated with commercial insurance continue to rise, more companies are moving toward self-insurance, with the most popular form of self-insurance being medical insurance for employees.[225] This structure is attractive to employers because they do not pay for care "employees might receive; they pay only to cover the care employees actually receive."[226] Additionally, although the employer retains the risk, it can be limited with stop-loss coverage, which protects companies from large or unexpected claims.[227]

Ultimately, the benefits of self-insurance include the ability to manage risk through greater control over funds and claims, the opportunity to earn interest on reserve funds thereby improving cash flow, and the ability to keep, and save, all monies resulting from unspent claims.[228] In fact, with the introduction of the Affordable Care Act, many companies have opted to self-insure employee health care plans in order to "cope with the uncertainties created by the new law."[229] As society finds itself in a similarly uncertain situation with regard to the regulation of—and laws surrounding—autonomous vehicles, self-insurance becomes an appealing model.

C. Holding the Autonomous Vehicle Liable

Autonomous vehicles will likely be introduced gradually through ride-sharing services such as Uber and Lyft, and act as taxis.[230] Therefore, one

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224. *Id.*; *see also How Do Self-Insured Plans Work and How Are They Different Than Traditional Health Insurance Plans?*, SELF-INS. EDUC. FOUND., http://www.siefonline.org/participants.php [https://perma.cc/E362-T78F] (explaining how self-insurance plans work, and who pays for what); *Self-Insurance*, INT'L RISK MGMT. INST., https://www.irmi.com/online/insurance-glossary/terms/s/self-insurance.aspx [https://perma.cc/BP4V-VWHA] (defining "self-insurance").

225. *See* Robert Pear, *Some Employers Could Opt Out of Insurance Market, Raising Others' Costs*, N.Y. TIMES (Feb. 17, 2013), http://www.nytimes.com/2013/02/18/us/allure-of-self-insurance-draws-concern-over-costs.html?_r=0.

226. Rosland Briggs Gammon, *Self-Funded Health Care Could Lower Costs*, MILWAUKEE BUS. J. (Feb. 26, 2016, 11:00 PM), http://www.bizjournals.com/milwaukee/stories/2006/02/27/focus4.html [https://perma.cc/RLL6-G49C].

227. *Self-Insured Businesses Increasingly Turn To Stop Loss Coverage*, PARTNERRE (June 15, 2015), http://www.partnerre.com/opinions-research/self-insured-businesses-increasingly-turn-to-stop-loss-coverage#.WKokuhjMzMU [https://perma.cc/DTR7-SRTN].

228. *Specific Advantages of Self-Insurance*, SELF-INS. EDUC. FOUND., http://www.siefonline.org/employers.php [https://perma.cc/4PE3-PPQG].

229. Pear, *supra* note 225.

230. *See* Anthony Levandowski, *Pittsburgh, Your Self-Driving Uber Is Arriving Now*, UBER NEWSROOM (Sept. 14, 2016), https://newsroom.uber.com/pittsburgh-self-driving-uber/ [https://perma.cc/QW2Z-3PK7] (announcing that self-driving Ubers are on the road in Pittsburgh); *see also* Luís Bettencourt, *These Cities Could Lead the Driverless Car Revolution*, FORTUNE (Oct. 4, 2016), http://fortune.com/2016/10/04/driverless-cars-uber-lyft-google-baidu/ [https://perma.cc/TY5J-J99J] (identifying autonomous vehicles as

initial possibility is to require the cars to be exclusively ride-share vehicles, and pool the liability costs. In this scenario, ride-share companies would no longer have the expense of a driver, allowing the companies to reallocate those funds to a liability reserve.[231] Alternatively, by slightly raising the price of each individual ride, the ride-share company could effectively spread the losses associated with liability by distributing them among the ride-share users.[232] However, ride-sharing is not a long-term solution because it is inevitable that autonomous vehicles will be privately owned.[233] In fact, Michigan made history in December 2016 by becoming the first state to "establish regulations for the testing, use, and *eventual sale* of self-driving cars."[234]

This evolution from driver-operated to fully autonomous will substantially impact liability, specifically in who pays what and when. Instead of expanding the source of potentially liable parties, the law should direct its attention to the responsible party. For this reason, this Comment proposes that an autonomous vehicle should, like a corporation, be considered a *legal person*, with the same rights and duties as a human being.[235] States are instinctively moving in this direction; for example, an early draft of Nevada's regulation effectively assigned legal personhood to fully autonomous vehicles, by granting "the autonomous technology . . . all of the rights and . . . all of the duties applicable to the driver."[236] This legal status would enable the

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a new form of public transportation, with cities such as Beijing and Helsinki already using these vehicles in autonomous bussing and taxi services).

231. *See* Eric Newcomer, *Uber Loses at Least $1.2 Billion in First Half of 2016*, BLOOMBERG QUINT (Aug. 25, 2016, 5:00 AM), https://www.bloombergquint.com/business/2016/08/25/uber-loses-at-least-1-2-billion-in-first-half-of-2016 [https://perma.cc/CQC6-Y8MX] ("Subsidies for Uber's drivers are responsible for the majority of the company's losses.").

232. *See* DOBBS ET AL., *supra* note 114, at 756.

233. Elon Musk's "shared fleet" business model is structured for autonomous Tesla's to be privately owned. *See* Elon Musk, *Master Plan, Part Deux*, TESLA (July 20, 2016), https://www.tesla.com/blog/master-plan-part-deux [https://perma.cc/JQ8K-5ZRE]. Once Teslas are fully autonomous, Tesla owners can "add [their] car to the Tesla shared fleet just by tapping a button on the Tesla phone app and have it generate income for [the owner] while [they are] at work or on vacation." *Id.* Musk noted that this will "dramatically lower[] the true cost of ownership to the point where almost anyone could own a Tesla." *Id.*

234. Danielle Muoio, *The State of Michigan Just Made Self-Driving-Car History*, BUS. INSIDER (Dec. 9, 2016, 11:02 AM), http://www.businessinsider.com/driverless-car-regulations-michigan-2016-12 [https://perma.cc/R2AT-MQY7].

235. *See supra* Section VI.A.

236. Smith, *supra* note 54, at 479.

autonomous vehicle to sue and be sued in the case of an accident.[237] Most importantly, it would place liability on the autonomous vehicle as opposed to shifting driver liability to the owner, manufacturer, or programmer, thereby shielding these parties from unnecessary litigation.[238] This would in turn reflect positively on the autonomous vehicle industry by removing additional barriers to deployment and encouraging innovation.[239]

In modeling this structure on the corporation, the owner of the vehicle would take the role of the shareholder, and therefore would own one hundred percent of the "shares" in the vehicle. As such, the owner would gain the protection of limited liability in the case of an accident.[240] However, corporations have directors responsible for ensuring the corporation complies with legislation. This responsibility places a fiduciary duty on the director, so if compliance is not met, the director himself can be sued.[241] In the autonomous vehicle sector, compliance could take the form of ensuring the vehicle's technology is up-to-date, is regularly serviced, and complies with road safety standards.

Additionally, the DMV already has procedures in place to add a corporation to a vehicle title, thereby registering the vehicle in the name of the corporation.[242] However, under this proposal, the vehicle is the corporation. This classification might require the DMV to alter its current procedures by recording a shareholder and a director when registering the autonomous vehicle.[243] In a corporation, a shareholder can also be the director.[244] Therefore, the owner of the vehicle may appoint himself as the director. In a family scenario, an adult or parent could be the shareholder and director, or, in the case of a teenager owning the vehicle, the parent may be assigned as the director, and the teenager could be assigned as the shareholder. To facilitate this

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237. *See supra* Section VI.A.

238. *See supra* Part IV and Section VI.A.

239. *See supra* Section IV.B.

240. *See supra* Section VI.A; *see also* Pollman, *supra* note 193, at 1637–38 (discussing the protections afforded by the corporate form).

241. *See generally* Cleaveland D. Miller, *The Fiduciary Duties of a Corporate Director*, 4 U. BALT. L. REV. 259 (1975).

242. *See* Janet Hunt, *Adding a Corporation to a Vehicle Title*, HOUS. CHRON., http://smallbusiness.chron.com/adding-corporation-vehicle-title-37927.html [https://perma.cc/BY6F-PZQV] (explaining that a vehicle can be "registered in the name of the corporation").

243. Each state has its own procedures and requirements for registering a vehicle to a corporation. *Id.* California's application for title or registration currently includes information fields for the "owner" and "legal owner." CAL. DEP'T OF MOTOR VEHICLES, REG. 343 APPLICATION FOR TITLE OR REGISTRATION (2012), https://www.dmv.ca.gov/portal/wcm/connect/8c4e5fdb-a44e-44f6-853b-eabd471afdaa/reg343.pdf?MOD=AJPERES [https://perma.cc/9ABH-LH7V].

244. *Shareholder*, LEGALZOOM, https://www.legalzoom.com/knowledge/corporation/topic/what-is-a-corporation-shareholder [https://perma.cc/38PD-DZRJ] ("In many small corporations, the shareholders act as the officers and directors . . . .").

corporate structure, the shares should be fully transferable so that when the vehicle is sold, the shares will be transferred to the new owner.

If the owner and manufacturer are shielded from additional liability, the question then becomes: who pays? One way to implement this structure is to create a reserve fund through a liability surcharge or tax, analogous to a self-insurance fund.[245] Monies can be collected in multiple ways, such as part of the vehicle's purchase price, and through taxes imposed on the manufacturer.[246] What is important is that *both* the owner and manufacturer contribute to the fund. Through this contribution, both parties will be incentivized to maintain the safe production and operation of the vehicle. Additionally, this form of collective action provides a means of spreading losses through the autonomous vehicle industry, as opposed to having the loss fall on one party.[247] While the cost of liability effectively trickles down into the price of the new car, the surcharge will likely be less than an individual driver-operated insurance policy because the risks will be less—driverless cars result in fewer accidents, thus less liability.[248]

This fund could be administrated by the federal government, the autonomous vehicle industry, or even the insurance industry through adapted insurance policies.[249] Due to the different technologies employed by different companies, the administrator could partition the fund, making claims manufacturer-specific.[250] This would ensure that manufacturers remain incentivized to produce better and safer vehicles, while preventing one company from depleting the reserve fund.

Additionally, all newly manufactured passenger vehicles would be required to have event data recorders (EDR) on board. The Federal Automated Vehicles Policy also specifically encourages the installation of EDR's in

245. *See supra* Section VI.B.

246. *See* James F. Peltz, *Self-Driving Cars Could Flip the Auto Insurance Industry on Its Head*, L.A. TIMES (June 20, 2016, 3:00 AM), http://www.latimes.com/business/la-fi-agenda-driverless-insurance-20160620-snap-story.html [https://perma.cc/MB22-XZFX] ("[Manufacturers] might even add the insurance premium to the sticker price of new cars.").

247. *See* DOBBS ET AL., *supra* note 114, at 755–56 (reasoning that the loss is then "not so disruptive").

248. *See supra* Section VI.B.

249. There may also be an option for the state to oversee the fund; however, the risk may be high, and states that involve themselves in private enterprise put tax payers' money at risk.

250. In this scenario, two autonomous vehicles have crashed into one another, one owned by Google and the other owned by Tesla. If the event data recorder determines that Tesla was at fault, then the Google car could sue the Tesla car and claim from Tesla's portion of the reserve fund.

autonomous vehicles.[251] These recorders, otherwise known as black boxes, "retroactively map out the details of each crash or traffic incident," reconstructing the accident, and limiting the need for outside investigations.[252] Through the EDR, the autonomous vehicle can retain "a record of relevant decisions it made."[253] In the event of an accident, the administrator can review the data to determine if the autonomous vehicle is at fault, and if so, which manufacturer-specific fund to debit.

Therefore, as a corporation, the autonomous vehicle can be sued for any accident caused by the AI, shielding owners and manufacturers from additional liability. The victim can claim from the reserve fund, and the event data recorders can provide evidence of liability.

VII. CONCLUSION

The goal of tort law is to hold that which is responsible liable.[254] It follows then that when an autonomous vehicle is responsible, it should be held liable. The current tort liability framework is inadequate to support fully autonomous vehicles because it shifts liability to the owner or manufacturer, as opposed to holding the AI system liable for its driving choices. Autonomous vehicles must evolve from being classified as *products* to being classified as legal entities—*artificial persons*—possessing the legal rights and duties of a corporation. The Federal Automated Vehicles Policy encourages states to implement consistent policies regarding autonomous vehicles because of the countrywide impact they will have.[255] By legally defining the autonomous vehicle as an *artificial person*, and holding that autonomous vehicle liable through the aid of a reserve fund, the law would be providing a definitive and uniform liability plan. This Comment initially

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251. *See* FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 80–81 (noting that the "NHTSA currently has authority to [implement EDR's]"); *see also* Kristen Hall-Geisler, *The Importance of Black Boxes in an Autonomous Automotive Future*, TECHCRUNCH (May 13, 2016), https://techcrunch.com/2016/05/13/the-importance-of-black-boxes-in-an-autonomous-automotive-future/ [https://perma.cc/ZWN6-TB5S]. Senate Bill 1813 passed in 2012, mandating the instillation of event data recorders on all newly manufactured passenger-vehicles sold after 2015. S. 1813, 112th Cong. § 31406 (as passed by the Senate, Mar. 14, 2012). Although the Senate's EDR provisions did not pass in the House of Representatives, the Bill supports the NHTSA's move toward requiring this technology. *See id.*; *see also* Moving Ahead for Progress in the 21st Century Act, Pub. L. No. 112-141, 126 Stat. 405 (2012).

252. Eddington, *supra* note 211.

253. FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 80.

254. *See* KEETON ET AL., *supra* note 58, § 1, at 7.

255. *See* FEDERAL AUTOMATED VEHICLES POLICY, *supra* note 54, at 7; *see also* Encouraging the Safe and Responsible Deployment of Automated Vehicles, *supra* note 79 (noting that one of the goals of the Federal Automated Vehicles Policy is to generate "a consistent national framework for the testing and operation of automated vehicles").

posed the question, "Should an autonomous robot possess a legal status in society?" and through this road to autonomy, it has answered that question in the affirmative, thereby holding the autonomous vehicle liable.