PRODUCTS LIABILITY AND AUTONOMOUS VEHICLES: WHO'S DRIVING WHOM?

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Today the robot is an accepted fact, but the principle has not been pushed far enough. In the twenty-first century the robot will take the place which slave labor occupied in ancient civilization. There is no reason at all why most of this should not come to pass in less than a century, freeing mankind to pursue its higher aspirations.
-Nikola Tesla, February 9, 1935[1]

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[1] Matt Novak, *Nikola Tesla's Amazing Predictions for the 21st Century*, SMITHSONIAN (Apr. 19, 2013), http://www.smithsonianmag.com/history/nikola-teslas-amazing-predictions-for-the-21st-century-26353702/#6s2X63fpuuH1gGWC.99, https://perma.cc/29FU-MRYK.

I. INTRODUCTION

[1] On February 14, 2016, the by-now-famous Google self-driving car crashed itself into a city bus filled with passengers.[2] The car was traveling at two miles-per-hour along a busy road in Mountain View, California, when it turned into the lane of the oncoming bus which was traveling at nearly fifteen miles-per-hour.[3] Thankfully, none of the fifteen passengers aboard the bus or any of the car's occupants suffered injuries; however, the accident damaged the side of the bus and the car's front fender, wheel, and driver's side door.[4]

[2] While California's regulatory agencies squabbled among themselves about their role in determining liability, Google admitted to bearing some measure of responsibility.[5] The test driver failed to activate the manual override because he believed the bus would slow down and allow the car into the lane.[6] Both the test driver and the car misjudged, because three seconds later the car collided with the bus, marking the first time a self-driving car was directly responsible for a crash on public roads.[7]

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[2] *See* Nick Statt, *Google's bus crash is changing the conversation around self-driving cars*, VERGE (Mar. 15, 2016, 2:56 PM), http://www.theverge.com/2016/3/15/11239008/sxsw2016googleselfdrivingcarprogramgoalsaustin, https://perma.cc/492R-QLBK.

[3] *See id.*

[4] *See id.*; *see* Chris Ziegler, *A Google self-driving car caused a crash for the first time*, VERGE (Feb. 29, 2016, 1:50PM), http://www.theverge.com/2016/2/29/11134344/google-self-driving-car-crash-report, https://perma.cc/Y6U2-A86V.

[5] *See* Statt, *supra* note 2; *see generally* Alissa Walker, *What Google's Self-Driving Car Learned From Hitting That Bus*, GIZMODO (Mar. 11, 2016, 7:15 PM), http://gizmodo.com/what-googles-self-driving-car-team-learned-from-hitting-1764409297, https://perma.cc/U4F6-B5V2 (discussing Google's response to the February crash).

[6] *See* Statt, *supra* note 2; *see* Ziegler, *supra* note 4.

[7] *See* Ziegler, *supra* note 4; *see also* Chris Ziegler, *Watch the moment a self-driving Google car sideswipes a bus*, THE VERGE (Mar. 9, 2016, 11:57 AM) [hereinafter *Watch*

[3] This collision turned up the heat on a conversation already simmering among legal scholars, techies, automobile manufacturers, policy makers, Congress, and consumers about the interaction of this technology and tort law.[8] No legal framework currently exists for

the moment], http://www.theverge.com/2016/3/9/11186072/googleselfdrivingcarbuscrashvideo, https://perma.cc/RN9N-MBWK.

[8] *See generally, e.g.*, JAMES M. ANDERSON ET AL., AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS xiii (RAND Corp. 2016) [hereinafter RAND], http://www.rand.org/pubs/research_reports/RR443-2.html, https://perma.cc/UPL6-GE8Y (discussing the policy changes in response to new autonomous vehicle technology); Sven A. Beiker, *Legal Aspects of Autonomous Driving*, 52 SANTA CLARA L. REV. 1145,1146 (2012) (providing an overview of legal issues involving autonomous vehicles); Steve Brachmann, *Regulatory issues involving self-driving vehicles begin to take shape*, IPWATCHDOG (Apr. 3, 2015), http://www.ipwatchdog.com/2015/04/03/regulatory-issues-involving-self-driving-vehicles-begin-to-take-shape/id=56207/, https://perma.cc/BT2M-ZURZ (discussing regulatory issues surrounding autonomous vehicles); Frank Douma & Sarah A. Palodichuk, *Criminal Liability Issues Created by Autonomous Vehicles*, 52 SANTA CLARA L. REV. 1157, 1158–59 (2012) (describing the third party liability issues created by autonomous vehicles); Andrew P. Garza, Note, *"Look Ma, No Hands!:" Wrinkles and Wrecks in the Age of Autonomous Vehicles*, 46 NEW ENG. L. REV. 581, 616 (2012) (arguing that liability will fall on manufacturers but that increased safety benefits will decrease liability); Dorothy J. Glancy, *Privacy in Autonomous Vehicles*, 52 SANTA CLARA L. REV. 1171, 1173 (2012); Kyle Graham, *Of Frightened Horses and Autonomous Vehicles: Tort Law and its Assimilation of Innovations*, 52 SANTA CLARA L. REV. 1241, 1243 (2012) (discussing how tort liability evolves with emerging technology); Robert B. Kelly & Mark D. Johnson, *Defining a Stable, Protected and Secure Spectrum Environment for Autonomous Vehicles*, 52 SANTA CLARA L. REV. 1271, 1274 (2012) (discussing autonomous vehicle communication systems); Monica Kleja, *Läsarna: Tillverkarna ska ta ansvar för självkörande bilar* [*Readers: Manufacturers must take responsibility for self-driving cars*], NYTEKNIK (Feb. 24, 2016) (stating that manufactures must take responsibility for self-driving cars); Gary E. Marchant & Rachel A. Lindor, *The Coming Collision Between Autonomous Vehicles and the Liability System*, 52 SANTA CLARA L. REV. 1321, 1339 (2012) (arguing that the vehicle manufacturer should be liable for accidents caused in autonomous mode); Robert W. Peterson, *New Technology—Old Law: Autonomous Vehicles and California's Insurance Framework*, 52 SANTA CLARA L. REV. 1341, 1342 (2012) (discussing how insurance markets will be effected by autonomous vehicles); Eddie Pröckl, *Självkörande bilar känsligast för hackning*, NY TEKNIK 4–5 (Swed.) (Apr. 6, 2016) (discussing how self-driving cars can be hacked); J.B. Ruhl, *Can AI Make AI Obey the Law?*, LAW 2050 A FORUM ABOUT THE LEGAL FUTURE, (Feb. 16, 2016, 8:58 PM), https://law2050.com/ (outlining the legal issues stemming from

assigning liability when a self-driving car, like the Google car, crashes itself.[9] Some scholars optimistically predict that tort law will handle the introduction of this new technology easily, pointing to how well tort law has handled new technologies since the dawn of the industrial revolution.[10] Others foretell tort law's dismal failure to adapt, predicting that all liability will necessarily shift to the manufacturer, stunting the growth of the industry.[11] These doomsday prophets instead pin their hopes on statutory and regulatory reforms.[12]

[4] This comment explores two broad themes present in these conversations and makes two respective proposals. First, this comment discusses how autonomous vehicle technology affects the development of

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autonomous vehicles); John Villasenor, *Products Liability and Driverless Cars: Issues and Guiding Principles for Legislation*, BROOKINGS INSTITUTION PRESS, (Apr. 24, 2014) [hereinafter BROOKINGS], http://www.brookings.edu/~/media/research/files/papers/2014/04/products-liability-driverless-cars-villasenor/products_liability_and_driverless_cars.pdf, https://perma.cc/8D5W-8RUY (discussing the liability issues arising from autonomous vehicles).

[9] *See* Neal Katyal, *Disruptive Technologies and the Law*, 102 GEO. L.J. 1685, 1689 (2014).

[10] *See* Garza, *supra* note 8, at 616; Jeffrey R. Zohn, *When Robots Attack: How Should the Law Handle Self-Driving Cars That Cause Damages*, 2015 U. ILL. J.L. TECH. & POL'Y 461, 464 (2015) (arguing that "there is enough precedential law to support autonomous vehicle liability and that the law should treat autonomous vehicles like other autonomous machines, not traditional automobiles"); F. Patrick Hubbard, *"Sophisticated Robots:" Balancing Liability, Regulation, and Innovation*, 66 FLA. L. REV. 1803, 1872 (2014) (advocating the ability of tort law to balance victim compensation and innovation).

[11] *See* Roy Alan Cohen, *Self-Driving Technology and Autonomous Vehicles: A Whole New World for Potential Product Liability Discussion*, 82 DEF. COUNS. J. 328, 330–31 (2015), *reprinted in Products Liability*, IADC COMMITTEE NEWSLETTER; RAND, *supra* note 8, at xxii.

[12] *See* Marchant & Lindor, *supra* note 8, at 1340. *But see* Jeffrey K. Gurney, *Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles*, 2013 U. ILL. J.L. TECH. & POL'Y 247, 273 (2013) (arguing that "current products liability law will not be able to adequately assess [] fault" for autonomous vehicles and current doctrines should be reconsidered).

tort law, critiquing the ability of products liability law's current tests to handle autonomous vehicle technology, and proposes a new test. Second, this comment discusses how tort law affects the development of this technology and proposes steps manufacturers should take to limit their liability with respect to autonomous vehicles.

[5] Part II provides background information, beginning with an overview of how the technology works, to set the stage for a competent discussion of products liability issues. It then lays out the history of statutory and regulatory reforms, and the background of automotive products liability law. Part III presents how technology affects tort law by discussing how self-driving cars would fare under the present automotive products liability tests, and then proposes a new test. Part IV turns the lens around to examine how tort law affects technology. It discusses how liability concerns affect design elements and manufacturers' actions, and then proposes additional steps that manufacturers should take to limit liability. Finally, Part V is a brief conclusion.

II. BACKGROUND

[6] This section discusses how autonomous vehicle technology works, statutory and regulatory reforms, and predictions by other scholars on how products liability law will react to autonomous vehicles.

A. Background of the Technology and State of the Art

[7] Misconceptions about autonomous vehicles abound.[13] Among them: self-driving cars function through classical computer algorithms (complex if-then decision trees); driver assistance systems will gradually transform cars into completely autonomous vehicles; self-driving cars are programmed to make ethical judgments; and self-driving cars will faithfully follow all traffic regulations.[14]

[13] *See* Alexander Hars, *Top Misconceptions of Autonomous Cars and Self-Driving Vehicles*, THINKING OUTSIDE THE BOX: INVENTIVIO INNOVATION BRIEFS 1 (2016), http://www.driverless-future.com/?page_id=774, https://perma.cc/AM7U-R858.

[14] *See id.* at 1, 5.

[8] In reality, the levels of autonomous features range from zero to four.[15] The lower numbers indicate lower levels of autonomy, and many of

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[15] In 2013, NHTSA established five levels of automation in vehicles:

> **No-Automation (Level 0):** The driver is in complete and sole control of the primary vehicle controls – brakes, steering, throttle, and motive power – at all times.
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> **Function-specific Automation (Level 1):** Automation at this level involves one or more specific control functions. Examples include electronic stability control or pre-charged brakes, where the vehicle automatically assists with braking to enable the driver to regain control of the vehicle or stop faster than possible by acting alone.
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> **Combined Function Automation (Level 2):** This level involves automation of at least two primary control functions designed to work in unison to relieve the driver of control of those functions. An example of combined functions enabling a Level 2 system is adaptive cruise control in combination with lane centering.
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> **Limited Self-Driving Automation (Level 3):** Vehicles at this level of automation enable the driver to cede full control of all safety-critical functions under certain traffic or environmental conditions and in those conditions to rely heavily on the vehicle to monitor for changes in those conditions requiring transition back to driver control. The driver is expected to be available for occasional control, but with sufficiently comfortable transition time. The Google car is an example of limited self-driving automation.
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> **Full Self-Driving Automation (Level 4):** The vehicle is designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip. Such a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip. This includes both occupied and unoccupied vehicles.

See Russ Heaps, *Self-Driving Cars: Department of Transportation Issues New Classification Levels for Autonomous Cars*, AUTOTRADER (Oct. 2016), http://www.autotrader.com/car-shopping/self-driving-cars-department-of-transportation-issues-new-classification-levels-for-autonomous-cars-258322, https://perma.cc/98ZP-PKQV (citing Press Release, Nat'l High. Traf. Safety Admin., Preliminary Statement of Policy Concerning Autonomous Vehicles 4–5 (last visited Apr. 13, 2017) [hereinafter NHTSA Preliminary Statement], the features that fall into these categories, like cruise control, have been on the road for a long time.[16]

[9] The higher numbers indicate a greater level of autonomy. Adaptive cruise control, for example, uses radar sensors to measure the distance in front of the vehicle and change speed accordingly to keep a set distance. Although it cannot detect and react to a soft object that appears in front of the car (like a deer) it can come to a complete stop when the vehicle in front of it performs a panic brake. Another semi-autonomous feature, lane assist, uses a camera sensor on the front of the car to detect the white and yellow lines that demarcate lanes. When the car begins to drift in the lane, the car gives a warning, usually audible and visible, sometimes vibrating the seat to wake a sleepy driver; lane keeping assist (the next generation feature of lane assist) helps the car stay in the lane by "continuously applying a small amount of counter-steering force."[17]

[10] More advanced features offer hands-free driving, like Super Cruise (GM), Autopilot (Tesla), and Traffic Jam Assistant (BMW).[18] These systems employ the use of radar, sensors, cameras, LIDAR,[19] telematics,[20]

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http://www.nhtsa.gov/staticfiles/rulemaking/pdf/Automated_Vehicles_Policy.pdf, https://perma.cc/K9VB-5L54; *see also* LEWIS BASS & THOMAS PARKER REDICK, PROD. LIAB.: DESIGN AND MFG. DEFECTS § 26:3 (2d ed. 2017).

[16] *See id.*

[17] *See Lane Keeping Assist: Helps keep drivers within lanes*, TOYOTA, http://www.toyota-global.com/innovation/safety_technology/safety_technology/technology_file/active/lka.html, https://perma.cc/Q3S2-3V2K (last visited Apr. 22, 2016).

[18] *See* Aaron M. Kessler & Bill Vlasic, *Semiautonomous Driving Arrives, Feature by Feature*, N.Y. TIMES (Apr. 2, 2015), http://www.nytimes.com/2015/04/03/automobiles/semiautonomous-driving-arrives-feature-by-feature.html?_r=0, https://perma.cc/2BMC-NGGZ.

[19] LIDAR, or Laser Illuminating Detection and Ranging, is like radar, but uses lasers to detect objects and build a 3-D map of the car's surroundings. *See* Bryan Clark, *How Self-Driving Cars Work: The Nuts and Bolts Behind Google's Autonomous Car* Program, MAKEUSEOF (Feb. 21, 2015), http://www.makeuseof.com/tag/how-self-driving-cars-work-the-nuts-and-bolts-behind-googles-autonomous-car-program/, https://perma.cc/Z76W-6QUE.

and GPS[21] to assess the distance to the next car ahead and find the car's position on the road, and within the lane.[22] Then, like adaptive cruise control and lane assist, the car applies corrective measures to keep itself straight on the road.[23] Information, like road closures, is kept current with firmware updates which are administered wirelessly as needed.[24] FOTA (firmware updates over the air) has served cell phone end users for years, and now the technology has been adapted for updating automobile software.[25] Like a cell phone, the vehicle's software can be updated sans cables or expensive recalls.[26]

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[20] "Telematics is a general term that refers to any device which merges telecommunications and informatics. Telematics includes anything from GPS systems to navigation systems. It is responsible for many features in vehicles from OnStar to hands free mobile calling." *See Welcome to Telematics.com*, TELEMATICS.COM, http://www.telematics.com/, https://perma.cc/7VKQ-MUWM (last visited Apr. 22, 2016).

[21] "The Global Positioning System (GPS) is a satellite-based navigation system made up of at least 24 satellites … Each satellite transmits a unique signal and orbital parameters that allow GPS devices to decode and compute the precise location of the satellite. GPS receivers use this information and trilateration to calculate a user's exact location." *See What is GPS?*, GARMIN, https://www8.garmin.com/aboutGPS/, https://perma.cc/2F7D-P39H (last visited Apr. 18, 2017).

[22] *See generally* STEVEN H. BAYLESS ET AL., INTELLIGENCE TRANSP. SOC'Y OF AM., U.S. DEP'T OF TRANSP., CONNECTED VEH. INSIGHTS: TRENDS IN ROADWAY DOMAIN ACTIVE SENSING 2 (Aug. 14, 2013), https://ntl.bts.gov/lib/50000/50600/50696/Trends_in_Active_Sensing_JPO_format_Aug_23_2013__FHWA-JPO-13-086_.pdf, https://perma.cc/BG2B-HRBV.

[23] *See* Kessler & Vlasic, *supra* note 18.

[24] *See* Sami Haj-Assaad, *Future Cars Will Update Wirelessly To Stay Safe*, AUTOGUIDE.COM (Oct. 21, 2015), http://www.autoguide.com/auto-news/2015/10/future-cars-will-update-wirelessly-to-stay-safe.html, https://perma.cc/N9TN-7GFE.

[25] *See* Harman, *Redbend Software Management Platform Software Update Management*, REDBEND, http://www.redbend.com/en/products/software-update-and-management, https://perma.cc/93YT-WLGV (last visited Apr. 22, 2016).

[26] *See* REDBEND SOFTWARE, UPDATING CAR ECUS OVER-THE-AIR (FOTA) (2011) [hereinafter REDBEND WHITE PAPER] at 10, http://www.redbend.com/data/upl/whitepapers/red_bend_update_car_ecu.pdf, https://perma.cc/G243-XSEL.

[11] Fully autonomous vehicles (AVs) use all of these technologies, and more. They use sensors and GPS to find the car's position in the world, and determine what street and what lane the car is in.[27] Software interprets and categorizes the images perceived through sensors, like a cyclist or pedestrian; based on these categorizations, it predicts what the objects will do, like cross the street.[28] The software then selects a speed and trajectory for the car, like shifting lanes to allow extra room for the cyclist.[29]

[12] Contrary to popular belief, the software is not designed using a complex if-then decision tree to anticipate all possible driving scenarios.[30] Instead, it uses an algorithm to categorize the objects it senses.[31] The algorithm is fed with oodles of images containing various objects, like a child chasing a stray ball into the street.[32] Using pattern recognition (from the field of artificial intelligence) to sort and classify the images it senses, when it sees a new image the algorithm occasionally guesses incorrectly.[33] It then alters its internal parameters to increase its sorting accuracy—keeping changes that make the algorithm more accurate, and discarding

[27] *See How it works*, WAYMO, https://www.google.com/selfdrivingcar/how/, https://perma.cc/7V24-BQDL (last visited Apr. 22, 2016) [hereinafter *How it works*]; Muhammad Azmat & Clemens Schuhmayer, Inst. of Transp. & Logistics Vienna Univ. of Econ. & Bus., at Fed. Procurement Agency Austria Workshop Innovation Platform – E-mobility, *Future Scenario: Self Driving Cars—The Future has Already Begun* (May 7, 2015), https://www.researchgate.net/profile/Muhammad_Azmat4/publication/278329250_Future_Scenario_Self_Driving_Cars_-_The_future_has_already_begun/links/557f6fcf08aeea18b77962b6.pdf, https://perma.cc/A2SQ-5SQK.

[28] *See How it works*, *supra* note 27.

[29] *See id.*

[30] *See* Hars, *supra* note 13, at 4.

[31] *See id.*

[32] *See id.*; *see also How it works*, *supra* note 27.

[33] *See How it works*, *supra* note 27.

changes that decrease accuracy.[34] When the algorithm later sees new images, it classifies them with a higher accuracy. The algorithm, after a fashion, teaches itself to become a better driver.[35]

[13] It is not yet clear how AVs will interact with each other, or with traditional vehicles, to share information through vehicle to vehicle communication (V2V). [36] The National Highway Transportation Safety Administration ("NHTSA") reserved the 5.9GHz spectrum for V2V anticipating its incorporation into vehicles in the near future.[37] In the meantime, Google's car taught itself to become a better driver through refinements to the software in the hope that "[f]rom now on, [their] cars will more deeply understand that buses (and other large vehicles) are less likely to yield . . . than other types of vehicles..."[38]

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[34] *See id.*

[35] *See* Hars, *supra* note 13; *see also* Dorothy J. Glancy, *Legal Outlook for Autonomous, Automated, and Connected Cars*, FED'N OF DEF. & CORP. COUNS. ANN. MEETING (July 25–Aug. 1, 2015) http://www.thefederation.org/documents/04.Glancy%20-%20AutonomousCars.pdf, https://perma.cc/NT9Z-9D9P.

[36] V2V communication systems use short range radio to "talk" to each other. The Department of Transportation estimates V2V will avoid 76% of roadway crashes. *Self-Driving Cars and Insurance*, INS. INFO. INSTITUTE (July 2016) [hereinafter INSURANCE INFORMATION INSTITUTE], http://www.iii.org/issue-update/self-driving-cars-and-insurance, https://perma.cc/LW5H-AVJP. *But see* RAND, *supra* note 8, at xx; *and* Brachmann, *supra* note 8; *and* Dorothy J. Glancy, *Autonomous and Automated and Connected Cars-Oh My! First Generation Autonomous Cars in the Legal Ecosystem*, 16 MINN. J.L. SCI. & TECH. 619, 648 (2015) ("What remains uncertain is whether NHTSA's narrow definition of connected vehicles to include only DSRC V2V communications in passenger cars and light trucks, will be a required feature of first generation autonomous cars.")[hereinafter *Autonomous and Automated and Connected Cars-Oh My!*].

[37] *See* Press Release, Nat'l Highway Traffic Safety Admin., Transp. Sec. Foxx announces steps to accelerate road safety innovation (May 13, 2015), http://www.nhtsa.gov/About+NHTSA/Press+Releases/2015/nhtsa-will-accelerate-v2v-efforts, https://perma.cc/XA3C-CPS7.

[38] David Shepardson, *Google says it bears 'some responsibility' after self-driving car hot bus*, REUTERS (Feb. 29, 2016), http://www.reuters.com/article/us-google-selfdrivingcar-idUSKCN0W22DG, https://perma.cc/3GET-93C2.

[14] Since GM unveiled the first fully autonomous concept car at its Futurama exhibition during the 1939 World's Fair, most major car manufacturers have followed suit, working on their own fully autonomous models, and some have already begun testing on public roads.[39] Google boasted that before the Valentine's Day crash, its test cars had driven roughly one and a half million miles in autonomous mode.[40] Google estimated that its AVs will be available for consumption by 2018.[41] Other manufacturers targeted 2020 as their release date,[42] and the U.S. Secretary of Transportation predicts driverless cars will be "all over the world" by 2025.[43] AVs promise innumerable benefits to society, like:[44]

- drastically reduced frequency and fatality of crashes, which result in billions of dollars of damage each year and an immeasurable emotional toll on victims' families;[45]
- increased mobility and access to essential services for those who are unable or unwilling to drive, like minors, the elderly, or disabled persons;[46]

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[39] *See Self-Driving Cars: Past, Present and Future*, GEICO (Dec. 4, 2015), https://www.geico.com/more/driving/auto/car-safety-insurance/self-driving-cars-past-present-and-future/, https://perma.cc/BP3H-9WT6.

[40] *See id.*; *see* Mike Ramsey, *Google Self-Driving Car Hits Bus*, WALL ST. J. (Mar. 1, 2016, 8:47 AM), http://www.wsj.com/articles/google-self-driving-car-hits-bus-1456777567, https://perma.cc/6F9K-JUA4.

[41] *See* Azmat & Schuhmayer, *supra* note 27, at 10.

[42] *See id.*

[43] Jan Hauser, *Amerika schaltet auf Autopilot [America switches to Autopilot]*, FRANKFURTER ALLGEMEINE ZEITUNG (Sep. 19, 2015), http://www.faz.net/aktuell/wirtschaft/unternehmen/verkehrsminister-foxx-selbstfahrende-autos-in-10-jahren-standard-13811022.html, https://perma.cc/5WVU-PXDD.

[44] *See* RAND, *supra* note 8, at 9 (discussing these benefits and exhaustively listing the promises and perils related to AVs).

[45] *See id.* at 15.

[46] *See id.* at 9.

- substantially reduced traffic congestion, which currently exacts costs in terms of time, money, and frustration;[47]
- more efficient land use as people will be more willing to commute longer distances for work, so long as they can reclaim the commute time by engaging in other activities while the car is in motion;[48]
- reduced emissions and increased fuel economy, as cars become less susceptible to collision and thus need less tonnage to remain safe.[49]

[15] Yet for all these benefits, legal liability remains the greatest roadblock to mass adoption of AVs.[50] As this technology proliferates, and the line between car and driver blurs, the law must adapt to accommodate.

B. Background of Statutory and Regulatory Reforms

[16] Anticipating that AVs will occupy the roads within the next decade, lawmakers are reacting now to pave the way for these automated machines. Other stakeholders, like insurance companies, are updating their policies to keep pace with the shifting paradigm.[51]

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[47] *See id.* at 17.

[48] *See id.* at 28.

[49] *See* RAND, *supra* note 8, at 28.

[50] *See* INSURANCE INFORMATION INSTITUTE, *supra* note 36.

[51] *See* Driverlessuser, *HDI Gerling first insurance company to insure a driverless car*, DRIVERLESS CAR MARKET WATCH (Mar. 26, 2012) [hereinafter *HDI Gerling*], http://www.driverless-future.com/?p=171, https://perma.cc/58RW-4P74 ; INSURANCE INFORMATION INSTITUTE, *supra* note 36; Carrie Schroll, *Splitting the Bill: Creating A National Car Insurance Fund to Pay for Accidents in Autonomous Vehicles*, 109 NW. U.L. REV. 803, 814 (2015).

[17] So far, a handful of states have updated their traffic codes to permit AVs to take to public roads as test vehicles.[52] Although these first generation laws provide a rudimentary framework and certain changes or additions will be necessary,[53] a number of states already provide manufacturers with limited protection from liability,[54] and many expert

[52] "Nevada was the first state to authorize the operation of autonomous vehicles in 2011. Since then, ten other states—Alabama, California, Florida, Louisiana, Michigan, North Dakota, Pennsylvania, Tennessee, Utah and Virginia—and Washington D.C. have passed legislation related to autonomous vehicles. Governors in Arizona and Massachusetts issued executive orders related to autonomous vehicles." *Autonomous Vehicles – Self-Driving Vehicles Legislation*, NAT'L CONF. OF STATE LEGISLATURES (Feb. 23, 2016), http://www.ncsl.org/research/transportation/autonomous-vehicles-legislation.aspx#Enacted Autonomous Vehicle Legislation, https://perma.cc/YD9K-LAP5 ("[In 2016], 20 states introduced legislation. Sixteen states introduced legislation related to autonomous vehicles in 2015, up from 12 states in 2014, nine states and D.C. in 2013, and six states in 2012.").

[53] For example, AVs cannot be programmed to break the law. California requires that the test vehicle and driver must obey all provisions of the state Vehicle Code and the local highway laws. *See* CAL. CODE REGS. tit. 13, § 227.18(c) (2017). However, not giving an AV that same discretion to break a minor traffic regulation (like driving on the shoulder) to avoid a collision, would create unnecessary risk and could be a potential design defect. *See* Patrick Lin, *The Ethics of Autonomous Cars*, ATLANTIC (Oct. 8, 2013), http://www.theatlantic.com/technology/archive/2013/10/the-ethics-of-autonomous-cars/280360, https://perma.cc/2J4S-8GR2; Alexander Hars, *Supervising autonomous cars on autopilot: A hazardous idea*, INVENTIVIO INNOVATION BRIEFS, Issue 2013-09, http://www.inventivio.com/innovationbriefs/2013-09/Supervised-Autonomous-Driving-Harmful.2013-09.pdf, https://perma.cc/VJ3Y-7XW4 [hereinafter *Supervising Autonomous Cars*]. Programming AVs to break the law is perhaps not the wisest way to solve the problem. Instead, the traffic code could be updated to allow for an otherwise illegal maneuver to be deemed legal under certain conditions. *Compare Autonomous and Automated and Connected Cars-Oh My!*, *supra* note 36, at 653–54 (2015) (stating that traditional traffic laws should apply to first generation autonomous vehicles, but perhaps not later generations); *with* Benjamin I. Schimelman, *How to Train A Criminal: Making Fully Autonomous Vehicles Safe for Humans*, 49 CONN. L. Rev. 327, 330 (2016) (advocating that autonomous vehicles be developed to strategically break the rules of the road so they blend more easily into the existing ecosystem of human drivers).

[54] *See* U. Wash. Tech, Law & Pol'y Clinic, Autonomous Vehicle Law Report and Recommendations to the ULC 20 [hereinafter AV Team, Law Report] (unpublished report) (on file with University of Washington School of Law), https://www.law.washington.edu/clinics/technology/Reports/AutonomousVehicle.pdf, https://perma.cc/ZF52-AXFC ("Nevada, Florida, and Michigan require: If a third party

reports suggest limiting manufacturer liability promotes growth of autonomous technology.[55] Some scholars even go as far as recommending federal intervention to grant manufacturers immunity via statute.[56]

[18] AVs are also influencing federal regulations. The NHTSA, eager to realize the benefits of AVs,[57] announced a four-billion-dollar plan to "accelerate the development and adoption of safe vehicle automation through real-world pilot projects,"[58] and published an updated set of policy recommendations.[59] Before publishing the updated

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makes changes to an AV and those changes cause harm, the manufacturer is not liable for damages unless the defect was present when originally manufactured."); *see also* NEV. REV. STAT. § 482A.090 (2017); FLA. STAT. § 316.86 (2017); D.C. CODE § 50-2353 (2017); MICH. COMP. LAWS § 257.817 (2017).

[55] *See* RAND, *supra* note 8, at 138; *see* INSURANCE INFORMATION INSTITUTE, *supra* note 36.

[56] *See* M. Ryan Calo, *Open Robotics*, 70 MD. L. REV. 571, 602–07 (2011) (proposing limited immunity from liability for manufacturers of autonomous systems); *see* Marchant & Lindor, *supra* note 8, at 1337 (providing the rationale and case law for such legislative intervention).

[57] *See* INSURANCE INFORMATION INSTITUTE, *supra* note 36.

[58] *Secretary Foxx Unveils President Obama's FY17 Budget Proposal of Nearly $4 Billion for Automated Vehicles and Announces DOT Initiatives to Accelerate Vehicle Safety Innovations*, U.S. DEP'T TRANSP. (Jan. 14, 2016), https://www.transportation.gov/briefing-room/secretary-foxx-unveils-president-obama%E2%80%99s-fy17-budget-proposal-nearly-4-billion, https://perma.cc/L3K9-NZWN. NHTSA has the authority to update the Federal Motor Vehicle Safety Standards, and set emissions standards. Rules related to meeting those emissions standards are promulgated by the Environmental Protection Agency.

[59] *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., "DOT/NHTSA POLICY STATEMENT CONCERNING AUTOMATED VEHICLES" 2016 UPDATE TO "PRELIMINARY STATEMENT OF POLICY CONCERNING AUTONOMOUS VEHICLES" (2016) [hereinafter 2016 UPDATE], https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/autonomous-vehicles-policy-update-2016.pdf, https://perma.cc/78QA-3KLA; *Autonomous Vehicles – Self-Driving Vehicles Legislation*, *supra* note 52.

recommendations, NHTSA released a statement placing responsibility for accidents on the AV, *regardless of whether a human occupies the car.*[60]

[19] Consumer watchdog groups, wary of the potential dangers AVs represent, called this outrageous. They state the need for a competent human driver to supervise the car is evident in the number of times Google's autonomous technology has failed in the past months, prompting the human test driver to take the wheel.[61] This exemplifies the mixed feelings society as a whole has about AVs.[62] On the one hand, driverless cars are safer, more cautious drivers than humans who, in 2014, wrecked 6.1 million times in the United States alone.[63] Over 32,000 people perished with human error being the critical factor 94% of the time.[64] Even though we are desperate to improve these statistics and reclaim the time we forfeit commuting, only about half of us would actually ride in an AV.[65] Of that half, even fewer might be willing to put their children in a

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[60] *See* Richard Adhikari, *Feds Put AI in the Driver's Seat*, TECHNEWSWORLD (Feb. 11, 2016, 10:19 AM), http://www.technewsworld.com/story/83102.html, https://perma.cc/8BRZ-8F8B. This puts liability squarely on the manufacturer by way of the AV. The updated recommendations leave liability determinations up to the states. *See* Kelsey D. Atherton, *What You Need To Know About The New Federal Rules For Driverless Cars*, POPULAR SCI. (Sept. 21, 2016), http://www.popsci.com/read-federal-rules-for-driverless-cars, https://perma.cc/JHS6-QLB9.

[61] *See* Adhikari, *supra* note 60.

[62] *See* INSURANCE INFORMATION INSTITUTE, *supra* note 36.

[63] *See* NAT'L HIGH. TRAF. SAFETY ADMIN., 2014 CRASH DATA KEY FINDINGS (Nov. 2015) [hereinafter 2014 CRASH DATA].

[64] *See* Press Release, Nat'l Highway Traf. Safety Admin., Traf. Fatalities Fall in 2014, but Early Estimates Show 2015 Trending Higher (Nov. 24, 2015) http://www.nhtsa.gov/About+NHTSA/Press+Releases/2015/2014-traffic-deaths-drop-but-2015-trending-higher, https://perma.cc/8JD4-JJR3.

[65] *See* Adrienne Lafrance, *One Thing Baby Boomers and Millennials Agree On: Self-Driving Cars*, ATLANTIC (Oct. 16, 2015), http://www.theatlantic.com/technology/archive/2015/10/snake-people-cars/410923/, https://perma.cc/9GN4-JR77.

driverless car, or send them riding to the park on bicycles, crossing streets teeming with driverless cars.[66]

[20] While policy makers grapple with these conflicting attitudes,[67] they must also wrestle with legal issues like whether there should be a uniform traffic code, or whether federal law should preempt manufacturer liability.[68] NHTSA admitted that it has a limited authority to deal with many of these concerns, [69] and even with NHTSA's recently published recommendations, it may be years before policymakers sift through the findings and promulgate appropriate laws and rules.[70] Even then, laws and rules may take a number of revisions to perfect, especially when dealing with new technologies.[71] Consequently, tort law must adapt to handle these concerns.

C. Background of Automotive Products Liability Tort Law

[66] *See* Claire Cain Miller, *When Driverless Cars Break the Law*, N.Y. TIMES (May 13, 2014), http://www.nytimes.com/2014/05/14/upshot/when-driverless-cars-break-the-law.html, https://perma.cc/QG7V-H4EK (As Bryant Walker Smith, a fellow at Stanford University's Center for Automotive Research, succinctly stated, "It's the one headline, 'machine kills child,' rather than the 30,000 obituaries we have every year from humans killed on the roads. It's the fear of robots. There's something scarier about a machine malfunctioning and taking away control from somebody. We saw that in the Toyota unintended acceleration cases, when people would describe their horror at feeling like they could lose control of their car.").

[67] *See* Andrew Hawkins, *Voices Clash at First Public Hearing on Self-Driving Cars*, VERGE (Apr. 8, 2016), http://www.theverge.com/2016/4/8/11394454/self-driving-cars-nhtsa-dot-hearing-dc-regulations, https://perma.cc/97E4-L8TG (commenting that NHTSA's first public hearing on AVs lasted seven hours, ranging from "this is the best thing ever" to "ban self-driving cars before they kill us all.").

[68] *See id.*

[69] *See generally* 2016 UPDATE, *supra* note 59.

[70] *See supra* note 58.

[71] *See* Garza, *supra* note 8, at 589 ("Because '[e]rror in legislation is common, and never more so than when the technology is galloping forward,' it is important to avoid attempts to 'match an imperfect legal system to an evolving world that we understand poorly.'").

[21] Generally, a plaintiff claiming injury by an automobile may bring suit under several different theories of liability: (1) negligence, (2) strict liability, (3) breach of warranty, and/or (4) misrepresentation.[72] However strict liability is considered the "dominant legal theory" in products liability litigation, and therefore is the focus of this section.[73]

[22] Products liability's first case and controversy dates back to England's Industrial Revolution.[74] In that first case,[75] the court, protective of industry, foreclosed many claims through a legal fiction called "privity," whereby an insufficient relationship between two parties would

[72] *See* DEREK H. SWANSON ET AL., U.S. AUTOMOTIVE PROD. LIAB. LAW 3 (McGuireWoods, 2nd ed. 2009), https://www.mcguirewoods.com/news-resources/publications/us-automotive-products-liability.pdf, https://perma.cc/M25C-DCHQ.

[73] *See* Garza, *supra* note 8, at 589; AM. L. PROD. LIAB. 3d § 31:10 ("In manufacturing defect cases, strict liability and negligence are distinct theories and are based on different factual predicates. While strict liability rests on a showing only of a product defect, negligence requires a showing of fault leading to a product defect."); *see generally* Glancy, *supra* note 35, at 26; BROOKINGS, *supra* note 8, at 7–8 ("While the landscape is somewhat in flux with respect to the specific theories of liability that can be invoked to pursue claims regarding manufacturing defects, design defects, and failure to warn, all three remain central to products liability law.").

[74] *See* David G. Owen, *The Evolution of Products Liability Law*, 26 REV. LITIG. 955, 956 (2007) (stating that products liability dates back even further, "at least to Roman law, which imposed an implied warranty of quality against defects on sellers of certain goods, a rule that may be traced to ancient Babylon, one or two thousand years before").

[75] In Winterbottom v. Wright*,* Mr. Winterbottom was injured when the mail coach he drove collapsed because of shoddy construction. Winterbottom's employer, the Postmaster General, had purchased the mail coach from Mr. Wright, the manufacturer. Winterbottom sued Wright, but his case was dismissed based on a general rule that a product seller cannot be sued—even for proven negligence—by someone with whom he has not contracted, or in other words, someone with whom he is not "in privity." *See* Winterbottom v. Wright*,* 10 M & W 109, 114 (1842), *see* Vernon Palmer, *Why Privity Entered Tort – Tort An Historical Reexamination of Winterbottom v. Wright*, XXVII AM. J. LEGAL HIST. 85, 92 (1983).

bar a lawsuit.[76] Later courts made exceptions to this harsh rule by allowing exceptions for products that were inherently dangerous, eventually expanding the limits of inherent danger to swallow privity altogether.[77] In the 1960's courts began to recognize that manufacturers could be strictly liable for injuries resulting from the use of their products.[78]

[23] A strict products liability claim requires that the plaintiff prove "(1) that the defendant sold a defective product; and (2) that the defect proximately caused the plaintiff's harm."[79] Products liability claims come in three flavors: manufacturing defect, design defect, and warning defect.[80]

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[76] "The connection or relationship between two parties, each having a legally recognized interest in the same subject matter." *PRIVITY*, BLACK'S LAW DICTIONARY (10th ed. 2014).

[77] *See* MacPherson v. Buick Motor Co., 111 N.E. 1050, 1053 (N.Y. 1916) (enlarging "inherent danger" to swallow the general rule of privity). Justice Cardozo wrote, "We hold, then, that the principle of [inherent danger] is not limited to poisons, explosives, and things of like nature, to things which in their normal operation are implements of destruction. If the nature of a thing is such that it is reasonably certain to place life and limb in peril when negligently made, it is then a thing of danger. Its nature gives warning of the consequences to be expected. If to the element of danger there is added knowledge that the thing will be used by persons other than the purchaser, and used without new tests, then, irrespective of contract, the manufacturer of this thing of danger is under a duty to make it carefully." *Id.*

[78] *See* William L. Prosser, *The Fall of the Citadel (Strict Liability to the Consumer)*, 50 MINN. L. REV. 791, 791 (1966) (suggesting that Henningsen v. Bloomfield Motors, Inc., 121 A.2d 69, 90 (1960) marked the "fall of the citadel of privity"); *see also* Greenman v. Yuba Power Products, Inc., 377 P.2d 897 (Cal. 1963) (wherein Justice Traynor famously writes, "To establish the manufacturer's liability it was sufficient that plaintiff proved he was injured while using the [product] in a way it was intended to be used as a result of a defect in the design and manufacture of which the plaintiff was not aware that made the [product] unsafe for its intended use.").

[79] DAVID G. OWEN, PROD. LIAB. L. 257 (3d ed. 2015). Although the Restatement (Second) of Torts uses the language "defective condition unreasonably dangerous," Owen argues that most courts and commentators encapsulate this phrase with the use of the term "defective," which simply means that a product is "more dangerous than it properly should be." *See id.*, at 258.

[80] AM. L. PROD. LIAB. § 17:3 (3d ed. 2017).

Manufacturing defects are defects that occur when a product fails to meet the design specification.[81] A design defect occurs when a product is designed in a way that makes it unreasonably dangerous.[82] A warning defect occurs when the manufacturer breaches his duty to provide adequate warning, or instructions to use the car in a safe manner.[83] Additionally, specific to automotive products liability, many jurisdictions recognize some form of "crashworthiness" doctrine.[84] Under this doctrine, courts recognize that accidents are foreseeable by vehicle manufacturers, and vehicles must therefore be designed in a way that minimizes injuries to occupants.[85]

[24] Autonomous products liability cases are further divided into two species, "(1) accidents caused by automotive defects, and (2) aggravated injuries caused by a vehicle's failure to be sufficiently 'crashworthy' to protect its occupants in an accident."[86] These species mirror the two crashes resulting from any single accident.[87] In the "first crash" the car

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[81] *See id.*

[82] *See id*.; "Allegations of defective design can also be made under any theory of liability. In negligence, the plaintiff must prove the breach of a design standard. In warranty, the question is whether the design renders the automobile unfit for its ordinary purposes. In strict liability, the issue is framed in terms of a defect that renders an automobile unreasonably dangerous. The strict liability standard is often left to the jury solely on the instruction that a defect exists if the automobile is more dangerous than an ordinary consumer would have expected." SWANSON ET AL., *supra* note 72, at 8.

[83] *See* AM. L. PROD. LIAB. § 17:3 (3d ed. 2017).

[84] Larsen v. General Motors Corp. was the landmark case for crashworthiness doctrine. In *Larsen*, the steering column of the Corvair caused head trauma above and beyond that which would have been sustained in the crash alone. *See* Larsen v. General Motors Corp., 391 F.2d 495, 502–03 (8th Cir. 1968). Crashworthiness doctrine is also recognized in The Restatement (Third) of Torts, which specifically adopts the theory under another name: the so-called enhanced injury doctrine. *See* RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 16(a) (AM. LAW INST.1998); *see also* 63A. AM. JUR. 2D PROD. LIAB. § 931 (2d. ed. 2017).

[85] *See Larsen*, 391 F.2d at 502.

[86] Garza, *supra* note 8, at 590 (citing Owen, *supra* note 74, at 1056–57).

[87] *See id*. at 594.

collides with an object, like a tree or a city bus.[88] In the "second crash" the car's occupants collide with the interior.[89] The following sections examine how automotive products liability claims fit within these species and the tests courts apply.

1. Defects Leading to the First Crash

[25] Defects causing accidents are typically manufacturing or design defects.[90] "A classic example of a manufacturing defect case would be one in which a tire manufacturer used substandard practices in its plant, resulting in the components of the tire separating and failing later while being used."[91] Additionally, plaintiffs have prevailed on manufacturing-defect claims in cases where "unintended, sudden[,] and uncontrollable acceleration" causes an accident.[92] In such cases, plaintiffs have been able to recover under a "malfunction theory" which uses a *res ipsa loquitur*-like inference to allow "deserving plaintiffs to succeed notwithstanding what would otherwise be…[an] insuperable problem of proof" of defect in the product.[93]

[26] Plaintiffs have also prevailed where a design defect causes injury. For example, in the 1970s and 1980s litigation proliferated when vehicles were "designed with a high center of gravity, which increased their propensity to roll over."[94] The two primary tests used by courts in design defect cases are "the consumer-expectations test and the risk-utility test."[95]

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[88] *See id*.

[89] *See id*.

[90] *See* Owen, *supra* note 74, at 1056–28.

[91] *Auto Products Liability*, CONLEY GRIGGS PARTIN, http://www.conleygriggs.com/auto-products-liability, https://perma.cc/GBM2-ZQ85 (last visited Apr. 21, 2017).

[92] Consalo v. Gen. Motors Corp., 609 A.2d 75, 76 (N.J. Super. Ct. App. Div. 1992).

[93] RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 cmt. a (AM. LAW INST. 1998) ("Strict liability . . . performs a function similar to the concept of *res ipsa loquitur* . . . .").

[94] Garza, *supra* note 8, at 591.

[27] For a manufacturing defect claim, courts apply the consumer-expectation test to determine whether the product is unreasonably dangerous.[96] Under a design-defect claim, courts apply the consumer-expectation test as well as the risk-utility test. "[U]nder [the consumer-expectation] test, a plaintiff succeeds by proving that the product failed to perform as an ordinary consumer would expect when used in an intended or reasonably foreseeable manner."[97] Under the risk-utility test, a plaintiff must show the "magnitude of the danger outweighs the utility of the product, as designed."[98] Additionally, plaintiffs may also seek recovery for injuries sustained in the second crash.

2. Defects Enhancing Injuries in the Second Crash

[28] "Litigation can also arise where a plaintiff alleges that the vehicle is not sufficiently 'crashworthy,'"[99] or in other words, the car fails to adequately protect occupants in a collision from injuries sustained during the "second crash" between the occupants and the interior of the vehicle.[100]

[29] For example, in the landmark case *Larsen v. General Motors Corp.*, the plaintiff drove a 1963 Chevrolet Corvair into a head-on collision, the impact of which fatally "thrust [] the steering mechanism

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[95] *Id.*

[96] *See* RESTATEMENT (SECOND) OF TORTS § 402A (AM. LAW INST. 1979); Salerno v. Innovative Surveillance Tech., Inc., 932 N.E.2d 101, 109 (Ill. App. Ct. 1st Dist. 2010); Linda Sharp, Annotation, *Products Liability: Consumer Expectation Test*, 73 A.L.R. 5th 75, *3 (1999).

[97] Sharp, *supra* note 96; *see Salerno*, 932 N.E.2d at 109.

[98] Baley v. Fed. Signal Corp., 982 N.E.2d 776, 790 (App. Ct. 1st Dist. 2012).

[99] *See* Garza, *supra* note 8, at 593.

[100] *See id.*, at 593–94.

[rearward] into the [plaintiff's] head."[101] The court held that even though collisions are not the intended use of an automobile, general negligence principles applied when the manufacturer's failure to use reasonable care to avoid subjecting the car's occupants to unreasonable risk of injury either caused the plaintiff's injuries, or enhanced his injuries.[102] The court went on to state that automobiles do not function solely as a means of transportation, but as "a means of *safe* transportation" ("or as safe as is reasonably possible under the present state of the art").[103]

[30] Like *Larsen*, these claims are typically design defects, and courts apply both the consumer expectation test and the risk utility test. However, "the more complex a product is, the more difficult it is to apply the consumer-expectation test."[104] Indeed, raising the argument of complexity has become a standard defense in automotive products liability claims.[105] As a result, courts seem to prefer the risk-utility test.[106] However, courts and scholars alike have debated whether or not these tests provide an appropriate "vehicle" for remedy, and if they are appropriate to apply to

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[101] Larsen v. General Motors Corp., 391 F.2d 495, 496–97.

[102] *See id.* at 502.

[103] *Id.*

[104] Garza, *supra* note 8, at 591; BRUCE K. OTTLEY, ROGELIO A. LASSO & TERRENCE F. KIELY, UNDERSTANDING PRODUCTS LIABILITY LAW 137–38 (2d ed. 2013).

[105] *See, e.g.*, Jackson v. General Motors Corp., 60 S.W.3d 800, 804 (Tenn. 2001).

[106] *See* Garza, *supra* note 8, at 601–02; Gurney, *supra* note 12, at 261 ("Because of the complexity of traditional automobiles, some courts hesitate to apply the consumer expectations test to most automotive accidents."); *but see* Aubin v. Union Carbide Corp., 177 So. 3d 489, 493–94 (Fla. 2015) (applying consumer expectation test, rather than risk utility test, applied to design defect claim against asbestos manufacturer); *Jackson*, 60 S.W.3d at 806 (citing Cunningham v. Mitsubishi Motors Corp., No. C-3-88-582, 1993 U.S. Dist. LEXIS 21299, at *14 (S.D. Ohio June 16, 1993)) ("This Court is simply not willing to . . . preclud[e] the use of the consumer expectation test in a situation involving a familiar consumer product which is technically complex or uses a new process to accomplish a familiar function. Many familiar consumer products involve complex technology.").

AVs.[107] The next section explores the application of these current tests to AVs.

III. How Technology Affects Tort Law

[31] Google's car crash (described in the Introduction) evokes images of the classic trolley car problem—"an ethical brainteaser" perplexing philosophers since 1967.[108] A runaway trolley barrels toward five innocent people tied to the tracks. If you pull a lever you can divert the trolley and switch the tracks, where the trolley will run over and kill one man. Do you do nothing and allow fate to run its course? Or do you actively decide to kill the one man and spare the five? The trolley car scenario has received renewed attention in the debate surrounding AVs.[109] If an AV is presented with a similar choice, would it divert its path to save a busload of school children, but kill the car's occupant in the process by colliding with a tree instead? Or save the occupant, but let all the children die? Would the injured party have a products liability claim against the AV's manufacturer? If so, what test would a court use?

[32] This section explores the bad comparisons drawn between AVs and other technologies, both automotive and otherwise; the inappropriate

[107] *See* Garza, *supra* note 8, at 601–02; Gurney, *supra* note 12, at 261; *but see* Aubin v. Union Carbide Corp., 177 So. 3d 489, 493–94 (Fla. 2015) (applying consumer expectation test, rather than risk utility test, applied to design defect claim against asbestos manufacturer); *Jackson*, 60 S.W.3d at 806 (citing Cunningham v. Mitsubishi Motors Corp., No. C-3-88-582, 1993 U.S. Dist. LEXIS 21299, at *14 (S.D. Ohio June 16, 1993)).

[108] Corey Doctorow, *The Problem with Self-driving Cars: Who Controls the Code?*, GUARDIAN (Dec. 23, 2015, 7:00 PM), https://www.theguardian.com/technology/2015/dec/23/the-problem-with-self-driving-cars-who-controls-the-code, https://perma.cc/LE5H-P5B9 (noting that the Trolley Problem was first posed by Philippa Foot).

[109] *See* Jared Newman, *How to Make Driverless Cars Behave*, TIME (June 6, 2014), http://time.com/2837472/driverless-cars-ethics-morality/,https://perma.cc/ER8X-SWFM.

application of current products liability tests to AVs; and finally, proposes a new test.

A. Drawing Bad Comparisons

[33] Some scholars believe that tort law in its current state is perfectly capable of handling this new technology because (1) the application of tort law to AV technology is similar to its application to other non-automotive technology, like elevators and autopilot for ships and airplanes;[110] and (2) products liability law has a good track record of handling other automotive technology, like "seatbelts, airbags, and cruise control."[111]

1. Non-automotive Technology

[34] AVs are not analogous to elevators or autopilot. Elevators operate in a limited fashion, moving in two directions along a single path.[112] They do not make complex and sophisticated decisions, and when an elevator fails, determining liability is a much simpler matter because human intervention is typically not a factor in play.[113] Elevator users are not held liable "unless they are exceptionally negligent."[114] By comparison, while humans can avoid an elevator by taking the stairs, humans cannot avoid AVs simply by driving a traditional car, walking, or taking the city bus.

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[110] *See* Zohn, *supra* note 10, at 464 (examining how civil liability will attach to autonomous vehicle accidents).

[111] Garza, *supra* note 8, at 595 (discussing the application of products liability law in accidents by autonomous vehicles).

[112] *See How do elevators work*, DISCOVERYKIDS, http://discoverykids.com/articles/how-do-elevators-work/, https://perma.cc/RQ38-T9Z4 (last visited Apr. 15, 2017).

[113] *See* Kyle Colonna, *Autonomous Cars and Tort Liability*, 4 CASE W. RES. J.L. TECH. & INTERNET 81, 93 (2012) (distinguishing between elevators and AVs, but concluding strict liability would apply to both).

[114] Zohn, *supra* note 10, at 483; *see* Willoughby v. Montgomery Elevator Co., 87 S.W.3d 509, 512 (Tenn. Ct. App. 2002); *see also* Cent. of Ga. Ry. Co. v. Lippman, 36 S.E. 202, 207 (Ga. 1900) (stating that common carriers usually cannot avoid liability for negligence).

Therefore, the test in cases where a person is injured by riding a malfunctioning elevator is not appropriate for the passengers of the city bus struck by the Google car.

[35] Nor do AVs fit well into a category with autopilot systems for airplanes and boats, which require human vigilance and intervention.[115] Requiring human vigilance of AVs is incomparable to autopilot systems because pilots are highly trained, air traffic is highly regulated, and there are far less planes in the sky than cars on the road.[116] Moreover, requiring human vigilance in AVs is undesirable.[117] One of the benefits of AV driving is freeing up a driver's time for other tasks. Yet cognitive science research on distracted driving suggests that human reengagement after periods of occupation with another task is difficult and dangerous.[118] Ergonomic research indicates human brains are not good at routine supervision tasks, so if an AV goes for many miles without incident, the human driver will likely stop paying attention.[119] While some states have required that test vehicles keep a vigilant human driver at the ready, imposing this requirement on consumers forecloses one of the greatest

[115] *See Supervising Autonomous Cars*, *supra* note 53, at 2.

[116] *See* Jerry Hirsch, *253 million cars and trucks on U.S. roads; average age is 11.4 years*, L.A. TIMES (June 9, 2014), http://www.latimes.com/business/autos/la-fi-hy-ihs-automotive-average-age-car-20140609-story.html, https://perma.cc/7AL3-KFHC; Rose Eveleth, *A Map of Every Passenger Plane in the Skies at This Instant*, SMITHSONIAN MAG. (Sept. 17, 2012), http://www.smithsonianmag.com/smart-news/a-map-of-every-passenger-plane-in-the-skies-at-this-instant-39070996/, https://perma.cc/7HD7-F648.

[117] In fact, Elon Musk, co-founder of Tesla, predicted that human driving will be outlawed within twenty years. *See* Josh Lowensohn, *Elon Musk: Cars You Can Drive Will Eventually be Outlawed*, VERGE (Mar. 17, 2015, 2:40 PM), http://www.theverge.com/transportation/2015/3/17/8232187/elon-musk-human-drivers-are-dangerous, https://perma.cc/FQA4-WVEY.

[118] *See* RAND, *supra* note 8, at xx.

[119] *See Supervising Autonomous Cars*, *supra* note 53, at 1.

benefits of the technology: mobility for the elderly, minors, and the disabled.[120]

2. Automotive Technology

[36] To date, automotive products liability law has adapted to cover new technologies as they entered the stream of commerce. At one time seatbelts, airbags, and cruise control were new technologies.[121] At least one scholar suggests that AVs will be perceived as the next generation of automotive safety features, and the law will treat AVs as it has seatbelts and airbags.[122] However, AVs differ greatly from other safety features in their complexity. AVs have significant implications not just for the vehicle's occupants, but for the environment outside the vehicle as well—including other drivers and pedestrians (unlike airbags and seatbelts, which primarily affect the car's internal environment).[123]

[37] Although cruise control draws a closer comparison, because it is a more complex feature and rates a higher level of autonomy,[124] courts have

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[120] *See id.* at 1–2; Zohn, *supra* note 10, at 482 (arguing the elimination of "appeal of this product to elderly, disabled, or other individuals that would otherwise struggle with operating an automobile" is a necessary evil to assure a competent driver remains ready to take the wheel of an AV).

[121] *See History of Seat Belts in the U.S.*, BISNAR CHASE, http://www.bestattorney.com/auto-defects/defective-seatbelts/history-of-seat-belts.html, https://perma.cc/3FKY-Z42P (last visited Apr. 18, 2017).

[122] *See* Garza, *supra* note 8, at 603 ("While analogizing vehicle restraint and air bag statistics to OAVs is admittedly an apples-to-oranges affair, these statistics may be indicative of how the benefits of autonomous vehicle technologies are likely to be perceived.").

[123] *See generally* Karinna Hurley, *How Pedestrians Will Defeat Autonomous Vehicles*, SCI. AM. (Mar. 21, 2017), https://www.scientificamerican.com/article/how-pedestrians-will-defeat-autonomous-vehicles/, https://perma.cc/FF3V-9E7P (discussing the implications of autonomous vehicles on pedestrians and traffic flow).

[124] Seatbelts and airbags rate a level 0, but cruise control rates at level 1 and adaptive cruise control at level 2. *See* Heaps, *supra* note 15, at 3–5.

split over which test applies in cruise control cases, applying either the consumer expectation test or the risk utility test.[125] It is unlikely that courts would be any better settled over which test to apply to something even more complex like AVs. However, as the next section explains, neither test is appropriate for application to AVs.

B. Applying Outdated Theories and Tests

[38] Even if a good comparison could be drawn, current theories and tests for recovery are inappropriate for application to AVs. For example, recovery under a manufacturing defect theory is inappropriate when the alleged defect is a software error, or an error in the computing algorithms employed by AVs, because software is not a manufactured product.[126] The spin-off malfunction theory[127] may be a more appropriate vehicle to recovery because it allows a plaintiff to show that the defect in the software occurred in the absence of any outside tampering.[128] However,

[125] Cruise control is also a mechanical feature but a complex one that courts have had a mixed reaction over, allowing either consumer-expectation or risk-utility, leaning away from consumer expectation. *See* Garza, *supra* note 8, at 600–03.

[126] *See* Cohen, *supra* note 11, at 332. "Manufacturing defects claims in the autonomous vehicle context face a significant complication: courts have not applied the manufacturing defect doctrine to software because nothing tangible is manufactured. Because of this, a plaintiff will not be able to allege under a manufacturing defect theory that the software erred, rather the plaintiff will want to allege that the autonomous technology did not meet manufacturing specifications. This will be tricky for a plaintiff to do if the defect is really a software error (algorithm)." Gurney, *supra* note 12, at 259; *see also* Jessica S. Brodsky, *Autonomous Vehicle Regulation: How an Uncertain Legal Landscape May Hit the Brakes on Self-Driving Cars*, 31 BERKELEY TECH. L.J. 851, 863–64 (2016) (discussing that because software is not a product "courts have used the economic loss doctrine to limit liability when an economic loss is suffered due to software failure but have also allowed tort actions to proceed when software glitches lead to actual physical harm.").

[127] A "malfunction theory" which uses a "*res ipsa loquitur* like inference to infer defectiveness in strict liability where there was no independent proof of a defect in the product." Garza, *supra* note 8, at 591.

[128] *See id*.

not all jurisdictions recognize this theory, and the courts that do utilize it are hesitant to do so in a widespread fashion.[129]

[39] It is more likely that when an AV crashes itself the way that Google's car did, plaintiffs would bring suit under a theory of design defect. Still, the tests courts apply under this theory are not appropriate for application to AVs.

1. Consumer Expectation Test

[40] Courts and scholars have criticized the consumer expectation test as inappropriate under a theory of design defect because of the complexity of traditional automobiles.[130] In fact, the Restatement (Third) rejected this test for design defects altogether.[131] If the consumer expectation test meets criticism for being inappropriate for design defects in general, and traditional vehicles in particular, this test would be even more problematic when applied to AVs which have added layers of complexity over traditional cars.[132] Furthermore, employing this test would place manufacturers in the awkward position of managing consumer expectations and providing adequate warnings for safe use of AVs, while

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[129] "Some jurisdictions do not recognize the malfunction doctrine. Courts that do apply the doctrine hesitate to apply it to claims in a widespread fashion and typically require a showing of unique circumstances before applying it. When applying the doctrine to traditional vehicles, some courts require that the vehicle was relatively new and that the vehicle part was not repaired. An expert is usually required to show that the accident could not have been caused by anything other than the alleged defect. These limitations, along with the fact that some jurisdictions do not recognize the malfunction doctrine, limit the usefulness of the doctrine, making it difficult to apply for autonomous vehicles." Gurney, *supra* note 12, at 260.

[130] *See* Garza, *supra* note 8, at 591–92; Gurney, *supra* note 12, at 260–61; Cohen, *supra* note 11, at 332–33.

[131] *See* RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2 cmt. g (AM. LAW INST.1998) ("[C]onsumer expectations do not constitute an independent standard for judging the defectiveness of product designs.").

[132] *But see* Gurney, *supra* note 12, at 261 ("Although autonomous technology could be considered complex,' developing consumer expectations does not require knowledge of the complexity.").

simultaneously encouraging use and advertising the overall increased safety of the product. This forces car companies to talk out of both sides of the mouth—confusing consumers and courts alike.[133]

2. Risk-utility Test

[41] Many courts prefer the risk-utility test, which the Restatement (Third) recognizes as the sole test for design defects,[134] but this test too has drawbacks in the context of AV litigation. For example, even though experts anticipate that mass adoption of AVs will likely drive down the overall cost of automotive products liability cases,[135] the cost of litigating a design defect in an AV's software may be sky high.[136] Applying the test to an AV's physical components would likely not look much different than

[133] It could be argued that other manufacturers are similarly situated without confusing consumers or courts. For example, cigarette manufacturers must place warnings on their products, all the while advertising and selling their wares. The effects of tobacco use are widely known, and even though manufacturers must *now* place a warning on their products, they were not the first decry the unhealthy effects of tobacco use. Conversely, the perils of AV use are not widely known (although they may be widely *assumed* by consumers, either accurately, or without any factual basis). Making AV manufacturers responsible for disseminating detrimental information about a fledgling technology (which carries substantial societal benefits) is therefore not akin to requiring cigarette makers place a warning on their product (which do not carry a substantial societal benefit)—which they did only *after* their addictive product was established in the marketplace, and *after* years of litigation. AV manufacturers would have little incentive to fully disclose potential risks, because even though doing so might allow manufacturers to present an assumption of risk defense, the defense would only extend to occupants of the AV, *not* to victims outside the AV, and courts often refuse to recognize this defense, instead lumping it in to a comparative negligence analysis. *See* Marchant & Lindor, *supra*, note 8, at 1336–37.

[134] *See* Gurney, *supra* note 12, at 262; RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(b) (AM. LAW INST.1998).

[135] *See* RAND, *supra* note 8, at xxii (noting AV technology would bring about a "decreased number of crashes and associated lower insurance costs"); *see also* BROOKINGS, *supra* note 8, at 2 (noting AV technology would "increase safety on highways by reducing both the number and severity of accidents").

[136] *See* Glancy, *supra* note 35, at 26 ("To the extent that such litigation does occur, it is likely to be technologically challenging and more than usually expensive").

design defect cases for traditional vehicles because litigation of semi-autonomous features adequately explores defects related to the types, placement, and uses of various sensors.[137]

[42] Cases revolving around the design of the software or algorithms specific to AVs, on the other hand, present a much more difficult case to make—in particular showing a safer alternative design at the time of manufacture.[138] Finding an expert witness to testify will likely be difficult and expensive due to the cutting edge nature of the field, making this method of recovery unavailable for widespread use.[139] When manufacturers develop a safer alternative algorithm, firmware updates can be installed over the air, giving car manufacturers every motivation to administer an update promptly because the cost of recall will not need to be factored and weighed.[140] Assuming there was any delay or missed update, depending on the jurisdiction, rules of evidence would bar admission of later software updates that constitute subsequent remedial measures.[141]

3. Crashworthiness Doctrine

[43] One scholar speculated that software and algorithm defects cannot be successfully brought under the doctrine of crashworthiness, because software and algorithm defects relate to the "first crash" rather than the

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[137] *See* BROOKINGS, *supra* note 8, at 8–9.

[138] *See, e.g.*, *Burden of Proving Feasibility of Alternative Safe Design in Products Liability Action Based on Defective Design,* 78 A.L.R. 4th 154, *3.

[139] *See* Gurney, *supra* note 12, at 265–66.

[140] *See* REDBEND WHITE PAPER, *supra* note 26, at 2.

[141] *See* Owen, *supra* note 74, at 400 (discussing that state jurisdictions are split as to whether to admit into evidence subsequent remedial measures); *see also* FED. R. EVIDENCE 407; *see also* CHRISTOPHER B. MUELLER, LAIRD C. KIRKPATRICK & CHARLES H. ROSE., EVIDENCE PRACTICE UNDER THE RULES 231 (3d ed. 2009) ("FRE 407 bars evidence of subsequent remedial measures to prove negligence, culpable conduct, product or design defects, or the need for a warning or instruction.").

"second crash,"[142] but the trolley car scenario teaches otherwise.[143] If an AV was put in a position where a first crash *must* occur (either a collision with the tree or the children), shouldn't the car be designed to select the option that gives its occupants the least injury? A failure to do so might give the occupants a crashworthiness claim (among others).[144] Whether an AV can—or should—be so designed is discussed in more detail in the next section.[145] In short, it is merely a matter of time before an AV finds itself in the trolley car scenario, and in such an instance, the doctrine of crashworthiness will not be an appropriate test.

[44] We humans have not solved this brainteaser, and we cannot expect that a car will make a "better" judgment when we do not know or agree which is the better outcome.[146] In other words, when an AV selects either bad outcome (kill the occupant or kill the children), some might suppose this constitutes a design defect.[147] In particular, it might give rise to a

[142] *See* Gurney, *supra* note 12, at 257–58 ("[S]ince this analysis is focusing on Google Cars and crashworthiness is concerned with the structure and design of the vehicle, the analysis of a vehicle's crashworthiness would be the same for a vehicle with autonomous technology and one without autonomous technology").

[143] *See* Newman, *supra* note 109.

[144] *See generally* Nicholas Stringfellow, *Law and the Problem of Autonomous Cars*, COLUM. SCI. & TECH. L. REV. (Nov. 22, 2015), http://stlr.org/2015/11/22/law-and-the-problem-of-autonomous-cars/, https://perma.cc/93JP-6D99 (raising the issue that autonomous cars should be able to account for minimizing loss or injury when a crash is inevitable).

[145] *See* discussion *infra* Part IV.

[146] *See* Stringfellow, *supra* note 144; *see also* Jonathan O'Callaghan, *Should a Self-Driving Car Kill its Passengers in a "Greater Good" Scenario?*, IFLSCIENCE (Oct. 26, 2015), http://www.iflscience.com/technology/should-self-driving-car-be-programmed-kill-its-passengers-greater-good-scenario, https://perma.cc/L3P5-LCPC (reporting the results of Amazon's Mechanical Turk, an online crowdsourcing tool, which presented respondents with a modern trolley car scenario: "on the whole, people were willing to sacrifice the driver in order to save others, but most were only willing to do so if they did not consider themselves to be the driver. While 75% of respondents thought it would be moral to swerve, only 65% thought the cars would actually be programmed to swerve").

[147] *See* Stringfellow, *supra* note 144; *see* O'Callaghan, *supra* note 146.

claim under the crashworthiness doctrine, which dictates that vehicles must be designed in a way that minimizes injuries to occupants.[148]

[45] However, because society has not decided on a clear preferable outcome to this scenario, it is just as possible that neither outcome could be considered a design defect. A recent study presented respondents with a scenario wherein an AV found itself in a trolley car predicament.[149] Most respondents were willing to sacrifice the driver—*if they were not the driver*.[150] This study shows that society is unclear how it wants—or expects—an AV to behave under trolley car circumstances. It is therefore hard to argue that either outcome is the result of a defective design, when society is not clear on how it believes AVs should be designed with respect to the trolley problem. Consequently, imposing the doctrine of crashworthiness on AVs means that, at least in the particularly morbid scenario described above, the occupant always wins—and the children always die. This requirement usurps society's role in determining the best outcome to the trolley car problem, and it is therefore inappropriate to impose the crashworthiness doctrine on AVs, at least in this context. Without an existing products liability principle to apply, scholars are left to speculate over what an appropriate standard might be.

C. PROPOSAL: Adapting Tort Law Accordingly

[46] Although the tests described above fall short when it comes to AVs, they do demonstrate the inventiveness and adaptability of tort law. So even though tort law, in its present state, is not currently capable of handling this new technology, tort law will adapt by developing new, more appropriate tests.

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[148] *See* Larsen v. General Motors Corp., 391 F.2d 495, 502 (8th Cir. 1968).

[149] *See* Jean-François Bonnefon, Azim Shariff & Iyad Rahwan, *Autonomous Vehicles Need Experimental Ethics: Are We Ready for Utilitarian Cars?*, ARXIV, at 10 (Oct. 13, 2015), http://arxiv.org/pdf/1510.03346v1.pdf, https://perma.cc/4ZTL-VVH3.

[150] *See id.* at 8; *see also* O'Callaghan *supra* note 146.

[47] This comment proposes one such test: the reasonable car standard. Scholars suggest that AVs should be treated as other automotive innovations (*e.g.* seat belts, airbags, cruise control),[151] or as non-automotive machines (*e.g.* elevators, autopilot).[152] This comment proposes treating AVs in a way that is more like the way we treat human drivers: by adopting a reasonable car standard.[153]

[48] A reasonable car standard holds a car manufacturer liable only when the car does not act in a way that another reasonable AV would act. The data collection devices inside these new vehicles capture all the relevant information leading up to a collision.[154] This data would be compared to data derived and compiled from other similarly situated AVs. Allowing the factfinder to compare an AV with a traditional model permits a "false choice" which the reasonable car standard circumvents.[155] This standard presents the added advantage of being applicable regardless of whether the car contained a human occupant, meaning car manufacturers could continue to develop AVs with the goal of eliminating human override capability—which is congruent with current NHTSA policy.[156] However, if a human occupant failed to override the AV, the reasonable car

[151] *See supra* note 121 and accompanying text.

[152] *See* Colonna, *supra* note 113, at 93, 97, 99.

[153] *See* Nick Belay, Note, *Robot Ethics and Self-Driving Cars: How Ethical Determinations in Software Will Require a New Legal Framework*, 40 J. LEGAL PROF. 119, 129 (2015) (advising a legislative solution with a reasonableness standard).

[154] *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., Event Data Recorders, 24, 28 (2006) (codified at 49 C.F.R. pt. 563), https://www.gpo.gov/fdsys/pkg/CFR-2011-title49-vol6/pdf/CFR-2011-title49-vol6-part563.pdf, https://perma.cc/Y3RE-MFP5.

[155] Garza, *supra* note 8, at 604; *see also* Marchant & Lindor, *supra* note 8, at 1333; *see also* 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, 381 (2016) (discussing a comparison of human drivers to AVs under a consumer expectation test).

[156] *See* U.S. DEP'T OF TRANSP., NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *Fed. Automated Vehicles Policy*, 1, 5 (2016).

standard does not necessarily foreclose a claim against the negligent human driver.

[49] The reasonable car standard also accounts for the growth of technology. First generation cars will likely not be as "smart" as later generations, and drawing comparisons between generations and across brands would be painting with colossal brush strokes. Nor is it clear yet how much information cars will be able to share with each other.[157] This standard instead allows for the comparison of AVs at the moment the fatal decision is made, and could be applied in a manner that takes V2V[158] capabilities into consideration.

[50] This standard also resolves issues of privity in an inclusive manner. Currently, most automotive products liability litigation involves the plaintiff suing the manufacturer of *their own* car.[159] The reasonable car standard allows claims to be brought by passengers, occupants of other vehicles, and pedestrians alike.

[51] Additionally, the reasonable car standard leaves room for the trolley car problem. It allows society, by way of a jury, to give input into what the best outcome should be, and compares an AV's choice to what a reasonable AV would have done under similar circumstances. Although what that outcome would be, and how a jury might judge it, is still uncertain, the reasonable car standard gives society the same input it has when a human driver faces the same decision.

[157] NHTSA has reserved the 5.9GHz spectrum for V2V ("vehicle-to-vehicle") communication. Press Release, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., Transportation Sec. Foxx Announces Steps to Accelerate Road Safety Innovation (May 13, 2015), https://www.nhtsa.gov/press-releases/transportation-sec-foxx-announces-steps-accelerate-road-safety-innovation, https://perma.cc/2YVK-SMNE.

[158] V2V communication systems use short range radio to "talk" to each other. The Department of Transportation estimates V2V will avoid 76% of roadway crashes. *See* INSURANCE INFORMATION INSTITUTE, *supra* note 36. *But see* RAND, *supra* note 8, at xx; *see also* Brachmann, IPWATCHDOG, *supra* note 8.

[159] *See* Marchant & Lindor, *supra* note 8, at 1339–40.

[52] Unfortunately, successful application of the reasonable car standard depends on production of information by car manufacturers regarding the behavior of other cars in similar situations. Manufacturers might be hesitant to reveal this information for a number of reasons (*e.g.* publicity, consumer privacy, trade secret protection, etc.). However, the normal rules of discovery would compel manufacturers to disclose information necessary to establish the reasonable car standard.

[53] Another flaw in the reasonable car standard applies to the first generation of AVs: small sample size. With a limited number of AVs on the road, ascertaining what a reasonable car would do might be difficult, and the answer may be unreliable.[160] However, as the technology proliferates, this problem will become less profound.

[54] Other scholars have discussed and rejected a reasonableness standard under a negligence theory.[161] Especially in a trolley car scenario, negligence would be the improper standard when the injury resulted from an intervening act on behalf of the AV. In other words, there is a distinction between "*intending*" injury and "merely *foreseeing* it".[162]

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[160] *See* Zohn, *supra* note 10, at 477 (finding this flaw in applying the risk-utility test to self-driving cars); *see also* Paul A. Eisenstein, *Driver Becomes 'Co-Pilot' in the Self-Drive Car*, NBC NEWS (Aug. 28, 2013, 11:17 AM), http://www.nbcnews.com/business/driver-becomes-co-pilot-self-drive-car-8C11022532, https://perma.cc/2D6H-9ATN (discussing the Nissan Leaf autonomous vehicle being developed).

[161] *But see* Jeffrey K. Gurney, *Crashing into the Unknown: An Examination of Crash-Optimization Algorithms Through the Two Lanes of Ethics and Law*, 79 ALB. L. REV. 183, 227 (2016) [*Crashing into the Unknown*] (stating that intent cannot be inferred from AV software for purposes of an intentional tort because, "certainly if the manufacturer had its choice, no one would ever be harmed by its car"); *see also* Nathan A. Greenblatt, *Self-Driving Cars Will Be Ready Before Our Laws Are*, IEEE SPECTRUM, (Jan. 19, 2016), http://spectrum.ieee.org/transportation/advanced-cars/selfdriving-cars-will-be-ready-before-our-laws-are, https://perma.cc/Z535-PDN9 (arguing for an application of ordinary negligence laws to AVs).

[162] Patrick Lin, *The Ethics of Autonomous Cars*, THE ATLANTIC, (Oct. 8, 2013), https://www.theatlantic.com/technology/archive/2013/10/the-ethics-of-autonomous-cars/280360/, https://perma.cc/4VXY-XTDZ.

Applying the reasonable car standard in the strict liability setting of products liability would be a proper test because products liability does not pivot on this intent/foreseeability distinction, but whether any safer alternative design existed. The reasonable car standard would serve as a threshold to this issue to prevent the floodgates of litigation from opening so wide as to deter innovation. Determining how a reasonable AV would act and comparing it to an allegedly deviant AV would be far less invasive and expensive for the parties than litigating whether a safer alternative design would be implemented by comparing lines of computer code (which would likely be confusing for the factfinder).[163]

[55] In sum, although tort law in its current state lacks an appropriate vehicle for remedy when it comes to AVs, tort law is robust enough to adapt as it always has to new technologies. One means of adapting is by applying a new standard: the reasonable car standard. Just as this new technology will influence the evolution of products liability law, so too products liability law will influence the evolution of technology and the actions of car manufacturers.

IV. How Tort Law Affects Technology

[163] *See* Levy, *supra* note 155, at 382 ("The burden of expert testimony in such cases evaluating the technology would also be high, and could result in challenges due to protection of trade secrets in scrutinizing a company's technology."); *Crashing into the Unknown, supra* note 161, at 236 (discussing how a safer crash-optimization algorithm would require various experts). *Compare* Chris Savoie, *IoT, the Internet of Threats? Novel Liability Issues for Connected, Autonomous Vehicles and Intelligent Transportation Systems*, 12 NO. 3 ABA SciTech Lawyer 12, 15 (Spring 2016) (stating that finding the reasonableness of a decision making matrix in AVs would involve complex expert testimony which would be confusing to jurors and expensive to litigants creating "a disincentive for lawyers to take on relatively small cases (small to the attorney but significant to the injured party)"), *with* Matt McFarland, *Who's responsible when an autonomous car crashes?*, CNNTECH, (Jul. 7, 2016, 2:00 PM), http://money.cnn.com/2016/07/07/technology/tesla-liability-risk/, https://perma.cc/9G2X-L3VE (stating that design defect litigation may open up new class action lawsuits brought by consumers alleging a design defect in AV software damages the resale value of the AV).

[56] New technology affects the evolution of law and vice versa. This section explores how automotive products liability law is shaping the technology involved with AVs, from different design components to steps that manufacturers are taking to limit liability without stunting growth. Finally, this section proposes that while it remains unclear how the law will react to AVs, manufacturers may take prospective steps to limit, divide, and shift liability.

A. Effecting Design Elements

1. Mechanical Components

[57] Certain design features of AVs are responsive to legal requirements. For example, California law requires that all AVs be equipped with a steering wheel and a driver at the ready.[164] However, it is not just statutory and regulatory reform driving the incorporation of certain design elements. Products liability concerns exert a similar influence.

[58] For example, keeping a "kill-switch" in the car,[165] whereby an occupant is responsible for assuming control of the vehicle in the event the

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[164] *See* CAL. CODE REGS. tit. 13, § 227.18 (2014). Most traffic codes do not have this requirement presumably because the traffic code was written for traditional vehicles possessing these features. However, in "California, Nevada, Michigan, and Florida, test drivers must be able to reassume immediate control at any time in the event of an AV failure or emergency, which requires two things: [1] There must be a driver's seat with a steering wheel and pedals; [and] [2] The driver must be in the driver's seat and monitoring safe operation at all times." AV Team, *Law Report*, *supra* note 54, at 4; *see also* NEV. REV. STAT. § 482A.060 (2013); MICH. COMP. LAWS SERV. § 257.665(1) (2016) (LexisNexis 2016); Additionally, insurance policies require a driver remain at the ready. *see HDI Gerling*, *supra* note 51.

[165] *See* Zohn, *supra* note 10, at 478 ("All autonomous vehicles that are currently being designed have an emergency override switch that will enable drivers to manually take over driving should they feel it is necessary."); Andrew R. Swanson, Comment, *"Somebody Grab the Wheel!": State Autonomous Vehicle Legislation and the Road to a National Regime*, 97 MARQ. L. REV. 1085, 1091 (2014) (describing the override function on autonomous vehicles).

car encounters conditions it is not mature enough to handle, might provide manufacturers with an escape from liability.[166] This requires that the car maintain features that permit human control (*e.g.* steering wheel, pedals, rearview mirror, horn, and emergency brake).[167] Because, as previously mentioned, this requirement severely limits one of the greatest benefits of the technology—mobility for the elderly, minors, and the disabled—the law should work to alleviate this requirement.[168] In the meantime, AVs require human supervision—at least for the first generation.[169]

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[166] *See* Robert Sykora, *The Future of Autonomous Vehicle Technology as A Public Safety Tool*, 16 MINN. J.L. SCI. & TECH. 811, 818 (2015) ("Kill-switch complications continued to vex insurers, however. Multiple occupants in a single AV created a 'who's in charge?' confusion when each thought the other to have responsibility to hit the kill-switch. With no pedals and no wheel, there was no clear 'driver's seat,' so actual responsibility remained somewhat ambiguous.") Additionally, a "number of states already have statutes that impose liability on registered owners of run-away vehicles, which are often described in the statutes as 'driverless vehicles.' These 'driverless car' statutes impose liability on registered owners as presumed 'drivers'. Since there may be no humans at all in autonomous cars used to transport only cargo, either these statutes or some form or vicarious liability may impose damages liability on either the autonomous car's owner or its operator." Glancy, *supra* note 35, at 27–28.

[167] "Allowing the operation of an autonomous vehicle without a driver aboard is risky this early in the development of the technology. While the goal may be to enable things like the parking of the vehicle after a human has been dropped off, there are many foreseeable situations in which the vehicle will incorrectly interpret road signs, parking-garage signs, or subtle communications with another driver in the tight quarters of a parking garage – all situations in which human intervention may be required. While these challenges are likely surmountable in the medium to long-term, regulators should be wary of allowing [autonomous vehicles] to operate without humans aboard in the near future." AV Team, *Law Report*, *supra* note 54, at 21–22.

[168] *See supra* text accompanying notes 44, 120.

[169] *See* Zohn, *supra* note 10, at 482 ("[A]t least in the early years of this technology, it is reasonable to impose the expectation on autonomous cars to make sure the owners are using it responsibly."); *but see* Glancy, *supra* note 35, at 4, ("It is unclear whether there will still be some form of dashboards, steering wheels, accelerator and brake pedals.").

[59] Another example is the "black box" recorder, or event data recorder (EDR).[170] Like the kill switch discussed above, although EDRs are required in AVs by California and Nevada law, tort law exerts a similar pressure to keep accurate records of events leading up to a collision. Doing so brings more benefit than harm to manufacturers. AVs will share the road with traditional models for several generations, and most collisions are the result of human error.[171] Therefore, providing accurate data will shift liability away from the manufacturer and onto the human driver in the vast majority of cases—either the human driver of the traditional vehicle, or the human driver who failed to operate the kill switch in the AV.[172]

[60] Other suggestions yet to be incorporated include colored lighted license plate identifiers, so police may discern when a human driver is in control,[173] and concept cars touting more forward looking features, like reclining[174] or swiveling[175] front seats. To be sure, an AV's hardware pushes the law to new places—as does its software.

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[170] *See generally* CAL. VEH. CODE § 38750(c)(1)(G) (2017) (requiring California to have crash data recorders for autonomous vehicles sold to the public with detailed requirements for their use, but not requiring them for testing); *but see* NEV. REV. STAT. ANN. §482A.060 (2017) (requiring Nevada to have recorders on autonomous vehicles used for testing as well as autonomous vehicles offered for sale to the public); NHTSA Preliminary Statement, *supra* note 15, at 14 (stating that NHTSA recommends test vehicles have crash-data recorders); *see also* Dr. Sven A. Beiker, *Legal Aspects of Autonomous Driving*, 52 SANTA CLARA L. REV. 1145, 1152 (2012) (proposing data recorders in AVs should be mandatory).

[171] *See generally* 2014 CRASH DATA, *supra* note 63 (reporting that over 32,000 people perished with human error being the critical factor 94% of the time).

[172] *See* Gurney, *supra* note 12, at 267-68 (discussing the applicability and weaknesses of this comparative-fault defense).

[173] *See* AV Team Law Report, *supra* note 54, at 11.

[174] *See* Matt McFarland, *Here's Volvo's concept of a self-driving car's interior*, WASH. POST, (Nov. 18, 2015), https://www.washingtonpost.com/news/innovations/wp/2015/11/18/heres-volvos-concept-of-a-self-driving-cars-interior/?tid=ptv_rellink, https://perma.cc/JSY3-D8VL.

2. Software Components[1]

[61] Going back to the trolley car scenario, many people question whether an AV can—or rather, should—be programmed to select a particular outcome.[176] One answer to this is that an AV should, in theory, avoid a trolley car scenario altogether. Daniela Rus, head of the Artificial Intelligence lab at M.I.T. believes that a "capable perception and planning system, perhaps aided by sensors that can detect non-line-of-[sight] obstacles" would provide an AV with sufficient situational awareness and control.[177] Rus explains, "A self-driving car should be able to not hit anybody—avoid the trolley problem altogether!"[178] Currently, the algorithms that drive AVs have not matured enough to handle routine driving scenarios, and struggle with four way stops,[179] snow[180], and apparently driving in urban settings with city buses.[181] These challenges stem in part from the software's timid nature: abiding by traffic laws and driving defensively amid aggressive human drivers, who do not always

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[175] *See* Jim Motavalli, *Automakers Rethink Seats for Self-Driving Cars*, N.Y. TIMES, (Jan. 15, 2015), http://www.nytimes.com/2015/01/16/automobiles/automakers-rethink-seats-for-self-driving-cars.html?_r=0, https://perma.cc/4AFU-Q6SG.

[176] *See* Stringfellow, *supra* note 144 and accompanying text.

[177] *See* Joel Achenbach, *Driverless cars are colliding with the creepy Trolley Problem*, WASH. POST, (Dec. 29, 2015), https://www.washingtonpost.com/news/innovations/wp/2015/12/29/will-self-driving-cars-ever-solve-the-famous-and-creepy-trolley-problem/, https://perma.cc/DC5K-LBPP.

[178] *Id*.

[179] *See* Matt Richtel & Conor Dougherty, *Google's Driverless Cars Run Into Problem: Cars With Drivers*, N.Y. TIMES, (Sept. 1, 2015), http://www.nytimes.com/2015/09/02/technology/personaltech/google-says-its-not-the-driverless-cars-fault-its-other-drivers.html, https://perma.cc/3R3Y-QG8M.

[180] *See* Achenbach, *supra* note 177.

[181] *See* Statt, *supra* note 2.

come to a complete stop or make room for fellow drivers.[182]

[62] This deficit could be corrected with a little tweaking, but the question then becomes: *should* AVs be programmed to solve the trolley car problem? And *how*? As many readers will have guessed, the trolley car problem has no "right answer."[183] A utilitarian solution would save the greatest number of people, but places the operator (or in the case of AVs, the programmer) in the position of playing God—actively deciding who lives and who dies.[184] Not surprisingly, not all people agree on the best outcome. The public's conflicting thoughts on AVs is mirrored in the disagreement over the trolley car outcome.[185] As mentioned earlier, most people are willing to sacrifice the driver—so long as they are not the driver.[186]

[63] Simply put, even if the first generation of AVs were able to find a solution to this problem,[187] society has not yet agreed on what that answer

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[182] *See* Richtel & Dougherty, *supra* note 179.

[183] Stringfellow, *supra* note 144; Achenbach, *supra* note 177.

[184] *See id*.

[185] Stringfellow, *supra* note 144; *See also* Jonathan O'Callaghan, *Should A Self-Driving Car Kill Its Passengers In A "Greater Good" Scenario?*, IFLSCIENCE, (Oct. 25, 2015), http://www.iflscience.com/technology/should-self-driving-car-be-programmed-kill-its-passengers-greater-good-scenario, https://perma.cc/2SF9-JBQP (reporting the results of Amazon's Mechanical Turk, an online crowdsourcing tool, which presented respondents with a modern trolley car scenario: "on the whole, people were willing to sacrifice the driver in order to save others, but most were only willing to do so if they did not consider themselves to be the driver. While 75% of respondents thought it would be moral to swerve, only 65% thought the cars would actually be programmed to swerve."); *see also* Bonnefon, *Utilitarian Cars*, *supra* note 149.

[186] *Supra* note 150 and accompanying text.

[187] *See e.g., Programming Safety into Self-Driving Cars*, NAT'L SCI. FOUND. (Feb. 2, 2015), http://www.nsf.gov/discoveries/disc_summ.jsp?cntn_id=134033&org=IIS, https://perma.cc/MY8E-YBU8 (introducing algorithms designed to incorporate adequate safety controls in semi-autonomous vehicles).

should be.[188] Therefore, requiring this capability in AVs is senseless until society decides on the most desirable outcome. Furthermore, it is irrational to forestall the societal benefits AVs present until a solution to the trolley car problem is devised. One insightful writer put it well:

> Humans are freaking out about the trolley [problem] because we're terrified of the idea of machines killing us. But if we were totally rational, we'd realize 1 in 1 million people getting killed by a machine beats 1 in 100,000 getting killed by a human. For some reason, we're more okay with the drunk driver or texting while driving. In other words, these cars may be much safer, but many people won't care because death by machine is really scary to us given our nature.[189]

[64] Setting aside the trolley car problem, tort law has affected other aspects of AV software, like FOTA; because a safer alternative design would weigh against a manufacturer in a design defect claim,[190] making updates to the software in a timely and cost-effective manner is

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[188] *See e.g., Why Self Driving Cars Must be Programmed to Kill*, MIT TECH. REV. (Oct. 22, 2015), https://www.technologyreview.com/s/542626/why-self-driving-cars-must-be-programmed-to-kill/, https://perma.cc/3TF3-P96A (discussing findings that show "[p]eople are in favor of cars that sacrifice the occupant to save other lives—as long they don't have to drive one themselves").

[189] Achenbach, *supra* note 177. Notably, in 2016 Joshua Brown died when his Tesla autopilot system failed to recognize a tractor-trailer turning in front of his Model S and collided. The NHTSA is investigating the incident, but there has been no indication that this fatal crash has stymied demand for AVs. *See* Matt McFarland, *Who's responsible when an autonomous car crashes?*, CNNTECH (Jul. 7, 2016, 2:00 PM), http://money.cnn.com/2016/07/07/technology/tesla-liability-risk/, https://perma.cc/U2XX-9M45.

[190] This defense may also apply to claims of design defect as to the algorithm itself. A plaintiff could allege that the algorithm could have been written better, but the manufacturer could argue that assessing a new risk that precipitates the accident was technologically infeasible at the time. *See* Gurney, *supra* note 12, at 269.

imperative. FOTA allows manufacturers to send software updates wirelessly as they develop, with little lag time, and at minimal cost.[191]

[65] Additionally, although many state laws provide liability protection for manufacturers in the event that some third-party tampers with the software, hacking is a foreseeable risk, the consequences of which are potentially catastrophic.[192] As a result, data communication security oriented to minimize vulnerability has produced enhanced methods of encrypting communications.[193]

[66] Existing products liability laws have hot-housed other advancements like telematics[194] and V2V communication[195] as well. Telematics refers to "the transfer of data to and from a moving vehicle."[196] It allows traditional cars and AVs to stay up to date on road conditions by reporting information to a central hub, which in turn communicates the information to other users (think of the traffic app Waze).[197]

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[191] *See* REDBEND WHITE PAPER, *supra* note 21 and accompanying text.

[192] *See* Pröckl, *Självkörande bilar*, *supra* note 8, at 4–5 (discussing how AVs can be hacked).

[193] *See id.*

[194] *See* RAND, *supra* note 8, at xxi. "Telematics is a general term that refers to any device which merges telecommunications and infomatics. Telematics includes anything from GPS systems to navigation systems. It is responsible for many features in vehicles from OnStar to hands free mobile calling." *What is Telematics?*, TELEMATICS (last visited Apr. 18, 2017), http://www.telematics.com/uses-of-telematics-technology/, https://perma.cc/K5MU-3XUP [hereinafter TELEMATICS].

[195] V2V communication systems use short range radio to "talk" to each other. The Department of Transportation estimates V2V will avoid 76% of roadway crashes involving at least one light vehicle. *See* NHTSA, *Frequency of Target Crashes for IntelliDrive Safety Systems*, 1, 6 (2010), https://www.nhtsa.gov/DOT/NHTSA/NVS/Crash%20Avoidance/Technical%20Publications/2010/811381.pdf,. https://perma.cc/UD89-MM2N; *but see* RAND, *supra* note 8, at xx; *see also* AV Team Law Report, *supra* note 54, at 14–21.

[196] RAND *supra* note 8, at 75.

[197] *Id*.

[67] V2V uses short wave radio to allow cars to exchange information at a distance of up to 300 meters.[198] This range goes beyond the capabilities of sensors, cameras, and radar in that it can "see around corners" or "through" objects to assess driving conditions well down the road and avoid collisions and traffic jams.[199] For example, if a collision occurs or the roadway is otherwise obstructed, a car slowing down to pass by or rerouted can send the information to a car 300 meters behind it to slow down or avoid the area. That car in turn can relay the message even further, conveying to cars well behind and thereby avoid unnecessary congestion.[200]

[68] Although V2V is not restricted to use in AVs, it has enormous implications for AVs, allowing them to communicate among themselves or with traditional vehicles.[201] That increased communication provides a redundancy in the event of a sensor failure,[202] or, for example, would allow an AV to know for certain that a city bus indeed intended to slow down and let the AV into the lane.[203]

[69] While technology managed to evolve despite the constraints of existing laws, manufacturers have taken other actions to limit their liability and still innovate.

B. Effecting Manufacturer's Actions

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[198] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *V2V Fact Sheet*, http://www.safercar.gov/v2v/index.html, https://perma.cc/2AXT-6RVW (last visited Apr. 11, 2017).

[199] *Id*.

[200] *See id*.

[201] *Id*.

[202] RAND *supra* note 8, at 76.

[203] *Id.* at 75.

1. Applying Some Pressure

[70] In March 2016, AV proponents petitioned Congress to regulate the industry in order to avoid letting states construct a patchwork of laws which could hamper innovation.[204] Chris Urmson, Google's self-driving car project technical leader stated, "[i]f every state is left to go its own way without a unified approach, operating self-driving cars across state boundaries would be an unworkable situation and one that will significantly hinder safety innovation, interstate commerce, national competitiveness and the eventual deployment of autonomous vehicles."[205]

[71] On September 19, 2016, the NHTSA delivered on its promise to publish updated recommendations for the treatment of AVs, including a request for states to work together to develop uniform policies.[206] NHTSA has said that it will not prevent states from setting their own standards for AVs (so long as they do not conflict with federal law), but this request signals that the NHTSA expects states to cooperate and strive for uniformity.[207]

2. Stopping the Buck

[72] This uncertainty led Volvo to take the drastic step of announcing in October 2015, that it would assume full liability whenever one of its cars is in autonomous mode.[208] Volvo Car Group President and CEO Håkan

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[204] Nathan Bomey, *Self-driving Car Leaders ask for National Laws*, USA TODAY, (March 15, 2016, 10:27 PM), http://www.usatoday.com/story/money/cars/2016/03/15/google-alphabet-general-motors-lyft-senate-commerce-self-driving-cars/81818812/, https://perma.cc/V5XZ-ELQU.

[205] *Id.*

[206] *See* BI Intelligence, *NHTSA releases self-driving car guidelines*, BUS. INSIDER, (Sept. 21, 2016, 2:24 PM), http://www.businessinsider.com/nhtsa-releases-self-driving-car-guidelines-2016-9, https://perma.cc/S2E6-9428.

[207] *See id.*

[208] *See* Press Release, *US urged to establish nationwide Federal guidelines for autonomous driving*, VOLVO CAR GROUP (Oct. 7, 2015),

Samuelsson warned that a lack of federal guidelines for the testing and certification of AVs may cost the U.S. its leading position in the field.[209] He stated, "Europe has suffered to some extent by having a patchwork of rules and regulations. It would be a shame if the U.S. took a similar path to Europe in this crucial area."[210] Mr. Samuelsson explained that the lack of federal oversight risks slowing the growth and development of AV technologies, "by making it extremely difficult for car makers to test, develop and sell [AVs]. The absence of one set of rules means car makers cannot conduct credible tests to develop cars that meet all the different guidelines of all 50 [] states."[211]

[73] In a fashion, Volvo self-insured its self-driving cars. By assuming all liability, Volvo expressed confidence in its product, and found a way to more accurately project costs—eventually passing them on to the consumer.[212] Consumers will likely be willing to pay a slightly higher price for the assurance that litigation will be avoided.[213] Since Volvo made this promise, Google and Mercedes Benz followed suit making similar assurances.[214] However, this tactic of cutting out the insurance industry

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https://www.media.volvocars.com/global/en-gb/media/pressreleases/167975/us-urged-to-establish-nationwide-federal-guidelines-for-autonomous-driving, https://perma.cc/5N85-D5UM [hereinafter VOLVO PRESS RELEASE]; *see also* Kirsten Korosec, *Volvo CEO: We will accept all liability when our cars are in autonomous mode*, FORTUNE (Oct. 7, 2015, 3:34 PM), http://fortune.com/2015/10/07/volvo-liability-self-driving-cars/, https://perma.cc/GK49-8TWP.

[209] *See* VOLVO PRESS RELEASE, *supra* note 208.

[210] *Id.*

[211] *Id.*; *see* Korosec, *supra* note 208.

[212] *See* Gurney, *supra* note 12, at 272 (stating that manufacturers could "adjust the price of the autonomous vehicles to compensate them for the cost of liability").

[213] *See id.* at 273 (stating that "[p]eople would probably be willing to pay more for autonomous cars knowing that the manufacturer will be liable for accidents caused while the vehicle is in autonomous mode").

[214] *See* Mark Harris, *Why You Shouldn't Worry About Liability for Self-Driving Car Accidents*, IEEE SPECTRUM (Oct. 12, 2015 8:00PM), http://spectrum.ieee.org/cars-that-

could be considered anti-competitive, and it may cause insurance companies to mobilize in opposition.[215] For conservative manufacturers who are not willing to take such a drastic step, this comment proposes alternative steps to reduce liability.

C. PROPOSAL: Limiting, Dividing, and Shifting Liability

[74] This comment proposes that manufacturers who do not voluntarily assume liability may take the following steps to limit liability: petition Congress for preemptive protection, "split the bill" with insurance companies, and develop special training modules as part of the purchase or lease agreement.

1. Going to Capitol Hill

[75] Manufacturers could apply additional pressure to state and federal legislative and regulatory bodies to write laws and rules limiting their liability, targeting Congress in particular. In the past, Congress protected industries that provided a good that served a public health interest (like vaccine manufacturers[216]) or provided transportation (like the airline industry[217]).[218]

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think/transportation/self-driving/why-you-shouldnt-worry-about-liability-for-selfdriving-car-accidents, https://perma.cc/2YHZ-LAVP.

[215] *See* Alexander Hars, *Volvo's liability promise for autonomous mode may cut out insurance companies and independent repair shops*, DRIVERLESS CAR MARKET WATCH (Oct. 24, 2015), http://www.driverless-future.com/?p=856, https://perma.cc/Q5AM-EYV4 [hereinafter *Volvo's liability promise*].

[216] *See* Marchant & Lindor, *supra* note 8, at 1331.

[217] *See id.* at 1338.

[218] One critique of total preemption is that it may lead to victims subsidizing corporations. *See* Christopher B. Dolan, *Self-Driving Cars & the Bumpy Road Ahead*, TRIAL (February 2016), https://www.justice.org/what-we-do/enhance-practice-law/publications/trial-magazine/self-driving-cars-and-bumpy-road-ahead, https://perma.cc/D6J8-JQ3T.

[76] Manufacturers can argue that AVs provide *both* a benefit to public health, by reducing the number of accidents due to human error,[219] and a source of transportation, and they are therefore deserving of liability protection via federal action.[220] The social benefits of AVs range from a sharp decrease in traffic related fatalities, to more efficient land use, significantly reduced emissions, reduced social isolation, and access to essential services.[221] Some projections predict AVs could save nearly 300,000 lives over the course of a decade in the U.S. alone—putting AVs in the company of public health benefits like vaccines, which save 42,000 lives per U.S. birth cohort.[222] Moreover, the reduced emotional toll on the families of the 300,000 potential victims is immeasurable.[223]

[77] Yet, for all these benefits, legal liability remains the greatest roadblock to mass adoption of AVs.[224] Pressure from foreign markets, as Samuelsson pointed out, coupled with pressure from manufacturers may convince Congress to act.

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[219] *See* Sophia H. Duffy & Jamie Patrick Hopkins, *Sit, Stay, Drive: The Future of Autonomous Car Liability*, 16 SMU SCI. & TECH. L. REV. 453, 479 (2013) (arguing that negligent driving can, in effect, be eliminated by autonomous cars).

[220] *See* RAND, *supra* note 8, at xxii (asserting that Congress could preempt state tort law to limit manufacturer liability, or in the alternative create an non-rebuttable presumption of human control in AVs); *see also* Marchant & Lindor, *supra* note 8, at 1338–39 (discussing preemption of state tort action by the Federal Motor Vehicle Safety Standards).

[221] *See generally* RAND, *supra* note 8 (listing numerous benefits of autonomous vehicles).

[222] *See* 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/?utm_source=SFTwitter, https://perma.cc/F63V-QKZH; *see also* MORBIDITY AND MORTALITY WEEKLY REPORT, CDC (May 20, 2011), http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6019a5.htm, https://perma.cc/C8UF-PTK9.

[223] *See* LaFrance, *supra* note 222.

[224] *See* INSURANCE INFORMATION INSTITUTE, *supra* note 36.

2. Going Dutch[225]

[78] Autonomous technology also shakes up the insurance industry, and much has been written predicting reactions.[226] Certainly, if the AV is in autonomous mode when a crash occurs, as the Google car was, insurance companies will seek to shift liability away from the human driver and toward manufacturers.[227] One scholar suggests establishing a national car insurance fund to pay for AV accidents.[228] This comment proposes that manufacturers could lead the effort. A national fund presents the advantage of allowing manufacturers to negotiate with other stakeholders (*e.g.* NHTSA, insurance companies, and ride sharing companies) to determine a proportional contribution, rather than rolling the dice in court whenever a plaintiff files a products liability claim. Without lawmaker action to completely immunize manufacturers from liability, the next best option may be negotiating liability absent a jury.

[79] Working with the insurance industry may be a better move than working against it. As altruistic as Volvo's self-insurance model may seem, it has the potential to alienate the insurance industry. As previously mentioned, cutting out insurance companies may create friction and ultimately backfire if the move is deemed anti-competitive.[229]

3. Going it Alone

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225 *See generally* Schroll, *supra* note 51 (utilizing the metaphor "splitting the bill" to describe a national car insurance fund to pay for accidents involving AVs).

226 *See id.*; *see generally* Sophia H. Duffy & Jamie Patrick Hopkins, *Sit, Stay, Drive: The Future of Autonomous Car Liability,* 16 SMU SCI. & TECH. L. REV. 453 (2013); *see* Garza, *supra* note 8; *see* Marchant & Lindor, *supra* note 8, at 1327–28; *see generally* Julie Goodrich, Comment, *Driving Miss Daisy: An Autonomous Chauffeur System,* 51 HOUS. L. REV. 265, 269–70 (2013).

227 *See* Schroll, *supra* note 51, at 810.

228 *Id.* at 822.

229 *See Volvo's liability promise*, *supra* note 215.

[80] In the face of regulatory drought, manufacturers may take unilateral steps to limit liability. For example, manufacturers could develop and provide special training modules for prospective buyers, making satisfactory completion a part of the purchase or lease agreement. As previously mentioned, manufacturers will want to avoid the awkward position of managing consumer expectations and providing adequate warnings for safe use of AVs, while simultaneously encouraging use and advertising the overall increased safety of the product.[230] Training modules would provide manufacturers with the opportunity to fully verse purchasers in the capabilities and limitations of AVs, allowing manufacturers to fulfill their duty to provide adequate warnings in a controlled environment—somewhat privately, or at least not center stage in front of a public that is already terrified by the idea of death by machine.[231]

V. Conclusion

[81] Fully autonomous vehicles already roam public streets, but automotive products liability law lags behind the technology. Tort law in its current state cannot appropriately address concerns arising from the mass adoption of AVs, and while lawmakers ponder the best course of action, manufacturers must be prepared to litigate the necessary changes—like the adoption of a reasonable car standard.

[82] Just as the law reacts to new technology, technology symbiotically reacts to the law. Thus, manufacturers must design accordingly, while consumer demand requires that manufacturers design AVs that push the limits of existing products liability law. Therefore, to ensure that innovation is not unduly hampered, manufacturers must take additional steps like seeking liability protection via legislation, leading the way to establish a national insurance fund, and developing training modules for buyers as part of purchase and lease agreements.

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[230] *See* Achenbach, *supra* note 177.

[231] *See id*.

[83] AV cars *are* here. The law *will* react. Manufacturers should ready themselves to influence that reaction.