SUE MY CAR NOT ME: PRODUCTS LIABILITY AND ACCIDENTS INVOLVING AUTONOMOUS VEHICLES

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Abstract

Autonomous vehicles will revolutionize society in the near future. Computers, however, are not perfect, and accidents will occur while the vehicle is in autonomous mode. This Article answers the question of who should be liable when an accident is caused in autonomous mode. This Article addresses the liability of autonomous vehicle by examining products liability through the use of four scenarios: the Distracted Driver; the Diminished Capabilities Driver; the Disabled Driver; and the Attentive Driver.

Based on those scenarios, this Article suggests that the autonomous technology manufacturer should be liable for accidents caused in autonomous mode because the autonomous vehicle probably caused the accident. Liability should shift back to the "driver" depending on the nature of the driver and the ability of that person to prevent the accident. Thus, this Article argues that an autonomous vehicle manufacturer should be liable for accidents caused in autonomous mode for the Disabled Driver and partially for the Diminished Capabilities Driver and the Distracted Driver. This Article argues the Attentive Driver should be liable for most accidents caused in autonomous vehicles. Currently, products liability does not allocate the financial responsibility of an accident to the party that is responsible for the accident, and this Article suggests that courts and legislatures need to address tort liability for accidents caused in autonomous mode to ensure that the responsible party bears responsibility for accidents.

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I. INTRODUCTION

Television shows[1] and movies[2] have portrayed futuristic autonomous cars for years. Generation after generation, these autonomous cars were considered "cars of the future."[3] The future is now here;[4] Google and major car manufacturers[5] are currently test-driving and developing driverless cars. The

1. *See, e.g.*, *Knight Rider: Knight of the Phoenix (Part 1)* (NBC television broadcast Sept. 26, 1982).

2. *See, e.g.*, BATMAN (Warner Bros. Pictures 1989); CHRISTINE (Columbia Pictures Corp. 1983); DEMOLITION MAN (Warner Bros. Pictures 1993); I, ROBOT (Twentieth Century Fox Film Corp. 2004); MINORITY REPORT (Twentieth Century Fox Film Corp. 2002); TIMECOP (Largo Entm't 1994).

3. *See* Ben Klayman, *Self-Driving Cars Coming Our Way, but Don't Throw Out Your License Just Yet*, REUTERS (Aug. 15, 2012, 8:07 AM), http://www.huffingtonpost.com/2012/08/15/self-driving-cars_n_1777714.html.

4. *See* Terence Chea, *California Governor Signs Driverless Cars Bill*, ASSOCIATED PRESS (Sept. 26, 2012, 1:21 AM), http://bigstory.ap.org/article/calif-governor-sign-bill-ok-driverless-cars (quoting Governor Jerry Brown: "Today we're looking at science fiction becoming tomorrow's reality—the self-driving car.").

5. *See* Henry Fountain, *Yes, Driverless Cars Know the Way to San Jose*, N.Y. TIMES (Oct. 28, 2012), http://www.nytimes.com/2012/10/28/automobiles/yes-driverless-cars-know-the-way-to-san-jose.html?page wanted=all&_r=0 ("Most major automobile manufacturers are working on self-driving systems in one form or another."); *GM: Self-Driving Vehicles Could Be Ready by End of Decade*, GEN. MOTORS (Oct. 16, 2011), http://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2011/Oct/1016autonomous.html [hereinafter *GM*] (describing the development of technology for self-driving systems); Lauren Hepler, *Inside Nissan's Silicon Valley Self-Driving Lab*, SILICON VALLEY BUS. J. (July 31, 2013), http://www.bizjournals.com/sanjose/news/2013/07/31/inside-nissan-motor-cos-silicon.html?page=all (noting how Nissan is participating in autonomous driving technology); Amol Koldhekar, *Volvo Plans Self-Driving Cars in 2014, Envisions Accident-Free Fleet by 2020*, ENGADGET (Dec. 3, 2012, 9:07 PM), http://www.engadget.com/2012/12/03/volvo-self-driving-cars-2014/ (discussing plans to eliminate drivers); Ian Sherr & Mike Ramsey, *Toyota, Audi Move Closer to Driverless Cars*, WALL ST. J. (Jan. 3, 2013),

Google Car in particular has logged more than 300,000 miles of autonomous test-driving under a variety of conditions,[6] and this autonomous car has not been involved in a single accident.[7]

Sergey Brin, co-founder of Google, is predicting that Google Cars will be available for public use in five years.[8] General Motors predicts that self-driving cars will be on the road within the decade.[9] Stanford Law School is already teaching a course on the law of autonomous driving.[10] In preparation for the widespread use of self-driving cars,[11] states are beginning to pass autonomous vehicle laws.[12] Nevada was the first state to pass an autonomous vehicle law,[13] and it utilizes special license plates designated solely for autonomous vehicles.[14] Florida has also passed an autonomous vehicle law.[15]

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http://online.wsj.com/article/SB10001424127887323374504578220081249592640.html (noting that Toyota, Audi, Mercedes-Benz, and Ford are demonstrating autonomous driving features); David Undercoffler & Jerry Hirsch, *Lexus Teases Autonomous Vehicle Ahead of CES Debut*, L.A. TIMES (Jan. 4, 2013), http://www.latimes.com/business/autos/la-fi-hy-autos-lexus-autonomous-car-ces-20130104,0,5256642.story (noting how Lexus and Continental Corp. are currently developing driver-less cars).

6. Chris Urmson, *The Self-Driving Car Logs More Miles on New Wheels*, GOOGLE OFFICIAL BLOG (Aug. 7, 2012), http://googleblog.blogspot.com/2012/08/the-self-driving-car-logs-more-miles-on.html.

7. *Id.* There has been one accident involving the Google Car, but Google engineers were quick to point out that the vehicle was driven by a human when the accident occurred. *See* Mike Masnick, *Dear World: Self-Driving Cars Will Get Into Accidents Too (Though, This One Wasn't the Computer's Fault)*, TECHDIRT (Aug. 5, 2011, 1:49 PM), http://www.techdirt.com/articles/ 20110805/12233315407/dear-world-self-driving-cars-will-get-into-accidents-too-though-this-one-wasnt-computers-fault.shtml (arguing the inevitability of a self-driving car getting into an accident).

8. Iain Thomson, *Google Promises Autonomous Cars for All Within Five Years*, REGISTER (Sept. 25, 2012), www.theregister.co.uk/2012/09/25/google_automatic_cars_legal/.

9. *GM*, *supra* note 5.

10. Bryant W. Smith, *Stanford Students: Fall 2012 Course on the Law of Autonomous Driving*, CTR. FOR INTERNET & SOC'Y (July 10, 2012, 6:16 PM), http://cyberlaw.stanford.edu/blog/2012/07/stanford-students-fall-2012-course-law-autonomous-driving.

11. Twenty percent of vehicle owners said they "definitely would" or "probably would" purchase an autonomous vehicle for an additional $3,000. Press Release, J.D. Power and Assocs., 2012 U.S. Automotive Emerging Technologies Study (Apr. 26, 2012), *available at* http://autos.jdpower.com/content/press-release/gGOwCnW/2012-u-s-automotive-emerging-technologies-study.htm. At the current price of vehicles, thirty-seven percent said they would purchase a vehicle. *Id.* Others are not so excited for autonomous vehicles to become widespread. *See* Dutch Mandel, *Autonomous Driving? Ugh!*, AUTOWEEK, Mar. 4, 2013, at 12 ("You will have to pry my cold, dead hands from around my steering wheel before you plop me into a veal pen on wheels. I don't want any part of an autonomous vehicle. Me, I want to drive.").

12. *See* CAL. VEH. CODE § 38750(b) (2013) ("An autonomous vehicle may be operated on public roads for testing purposes . . . ."); FLA. STAT. § 316.85(1) (2012) ("A person who possesses a valid driver license may operate an autonomous vehicle in autonomous mode."); NEV. REV. STAT. § 482A.100 (2012) ("The Department shall adopt regulations authorizing the operation of autonomous vehicles on highways within the State of Nevada."). Other states are considering autonomous car laws, such as Hawaii, Arizona, and Oklahoma. Dave Smith, *Driverless Cars Coming: Google, Sergey Brin Help Introduce New Autonomous Vehicles Law in California*, INT'L BUS. TIMES (Sept. 26, 2012), http://www.ibtimes.com/driverless-cars-coming-google-sergey-brin-help-introduce-new-autonomous-vehicles-law-california. Colorado and Michigan are also in the process of enacting an autonomous vehicle law. Jonathon Oosting, *Autonomous Vehicles in Michigan: Self-Driving Bill Moves to Senate, Could Cruise to Governor*, MLIVE (Mar. 5, 2013), http://www.mlive.com/politics/index.ssf/2013/03/autonomous_vehicles_in_ michiga.html; Kristen Wyatt, *Driverless Cars in Colo.? Lawmakers May Allow Them*, DENVER POST (Feb. 4, 2013), http://www.denverpost.com/politics/ci_22515418/driverless-cars-co-lawmakers-could-allow-them.

13. Mary Slosson, *Google Gets First Self-Driven Car License in Nevada*, REUTERS (May 7, 2012, 10:16 PM), http://www.reuters.com/article/2012/05/08/us-usa-nevada-google-idUSBRE84701W20120508.

14. *Id.* Besides Google, other companies have received autonomous vehicle license plates. Kurt Ernst, *Audi Becomes First Automaker Issued Nevada Autonomous Vehicle License*, FOX NEWS (Jan. 8, 2013), http://www.foxnews.com/leisure/2013/01/08/audi-becomes-first-automaker-issued-nevada-autonomous-

California Governor Jerry Brown "drove" an autonomous car to Google's headquarters to sign his state's autonomous vehicle law.[16] The National Highway Traffic Safety Administration (NHTSA) is currently researching autonomous vehicle technology to develop appropriate regulations.[17] The NHTSA does not, however, recommend that states allow for public use of autonomous vehicles until the vehicles can be further researched.[18] Nonetheless, the NHTSA states that "it is encouraged by innovations in automated driving and their potential to transform our roadways."[19] Other states, however, are delaying passing autonomous vehicles laws until a liability scheme can be adopted.[20] In those states that have passed an autonomous vehicle law, no state permits driverless autonomous cars yet.[21]

States' preemptive passing of legislation indicates that they are very accepting of autonomous cars, probably because of the benefits these cars will provide to citizens of their respective states. Since human driver errors cause most automobile deaths,[22] autonomous vehicles should increase highway safety. The World Health Organization states that around 1.3 million people per year worldwide die from car accidents.[23] In 2010, 32,885 Americans died in car accidents,[24] and over 2.2 million people were injured in a vehicle.[25] Worldwide, Google and other car manufacturers argue that autonomous vehicles will reduce the number of car accident fatalities and injuries resulting

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vehicle-license/; *Nevada Oks Testing of Self-Driving Cars*, RENO GAZETTE-J., Dec. 20, 2012, at 5A (documenting Continental's vehicle-testing license).

15. Amir Efrati, *Google's Driverless Car Draws Political Power*, WALL ST. J. (Oct. 12, 2012), http://online.wsj.com/article/SB10000872396390443493304578034822744854696.html.

16. Chea, *supra* note 4.

17. David Shepardson, *U.S. Working to Set Rules for Self-Driving Cars*, DETROIT NEWS, Oct. 24, 2012, at D3. Volvo, in particular, is hoping that the federal government creates a regulatory scheme so that there is not a patchwork of different laws. *See* Press Release, Volvo Car Grp., Volvo Car Corporation Urges Seamless, Federal Framework for Regulating Autonomous Vehicles (Oct. 23, 2012), *available at* https://www.media.volvocars.com/global.enhanced/en-gb/media/preview.aspx?mediaid=46459.

18. Press Release, Nat'l Highway Traffic Safety Admin., Preliminary Statement of Policy Concerning Autonomous Vehicles 10 (May 30, 2013) [hereinafter NHTSA, Preliminary Statement], *available at* http://www.nhtsa.gov/staticfiles/rulemaking/pdf/Automated_Vehicles_Policy.pdf. The NHTSA based its reasoning on the fact that "self-driving vehicle technology is not yet at the stage of sophistication or demonstrated safety capability that it should be authorized for use by members of the public for general driving purposes." *Id.* at 14.

19. *Id.* at 10.

20. Dan Strumpf, *Liability Issues Create Potholes on the Road to Driverless Cars*, WALL ST. J. (Jan. 27, 2013), http://online.wsj.com/article/SB10001424127887323854904578264162749109462.html (citing Arizona as a state hesitant to pass laws regarding autonomous cars).

21. *See* Mary M. Cheh, *D.C.'s Driverless-Car Bill Is a Measure the Auto Industry Can Support*, WASH. POST, Nov. 9, 2012, at A28 ("[A licensed driver] is a necessity of the current technology. In a few years, cars will be able to operate reliably without drivers, but we are not there yet."); Kurt Ernst, *California Senator Proposes Rules for Self-Driving Cars*, BUS. INSIDER (Mar. 13, 2012), http://articles.businessinsider.com/2012-0313/news/31158582_1_autonomous-vehicles-human-error-traffic-fatalities (discussing how a human operator is still required).

22. *See* Sven A. Beiker, *Legal Aspects of Autonomous Driving*, 52 SANTA CLARA L. REV. 1145, 1149 (2012) ("Driver error is by far (95%) the most common factor implicated in vehicle accidents.").

23. WORLD HEALTH ORG., GLOBAL PLAN FOR THE DECADE OF ACTION FOR ROAD SAFETY 2011–2020, at 4 (Mar. 2010), *available at* http://www.who.int/roadsafety/decade_of_action/plan/plan_english.pdf.

24. NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., 2010 MOTOR VEHICLE CRASHES: OVERVIEW 1 (Feb. 2012), *available at* http://www-nrd.nhtsa.dot.gov/Pubs/811552.pdf.

25. *Id.*

from human error because the computer controlling the autonomous vehicle does not get tired, intoxicated, or distracted as does the human driver.[26]

Apart from the incalculable intrinsic value of life and limb, reducing car accidents could result in significant cost savings. Automobile accidents in the United States cost around 300 billion dollars per year, as measured in deaths, health care, and property loss.[27] Traffic congestion costs are measured around 100 billion dollars.[28] By reducing the number of accidents that occur, Google Cars and other autonomous vehicles can greatly reduce these costs.[29]

Additionally, the autonomous vehicle will increase fuel efficiency, which will help protect the environment and save consumers money.[30] In 2007 alone, Americans used 2.8 billion gallons of excess gasoline at a financial cost of 87.2 billion dollars.[31] Autonomous vehicles will greatly improve fuel efficiency by harmonizing traffic flow.[32]

While the benefits and drawbacks of autonomous vehicles are the center of much discussion, this Article does not question the functionality or the usefulness of autonomous cars, but rather seeks to examine how tort liability doctrine applies to accidents involving an autonomous vehicle.[33] Since

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26. *See* Jerry Hirsch, *Self-Driving Cars Are Approaching Fast—and Safely*, L.A. TIMES (Sept. 30, 2012), http://articles.latimes.com/2012/sep/30/business/la-fi-autos-self-driving-cars-20120930 ("[T]here is some evidence that early autonomous driving functions are already improving safety."); John Markoff, *Google Cars Drive Themselves, in Traffic*, N.Y. TIMES (Oct. 9, 2010), http://www.nytimes.com/2010/10/10/science/10google.html?pagewanted=all ("Robot drivers react faster than humans, have 360-degree perception and do not get distracted, sleepy or intoxicated[.]"); Claire Cain Miller & Matthew L. Wald, *Self-Driving Cars for Testing Are Supported by U.S.*, N.Y. TIMES (May 30, 2013), http://www.nytimes.com/2013/05/31/technology/self-driving-cars-for-testing-are-supported-by-us.html?pagewanted=all&_r=0 ("Autonomous cars could increase safety because they are not subject to human error like disobeying traffic laws and falling asleep at the wheel, according to analysts, car companies and the transportation department.").

27. Dan Neil, *Who's Behind the Wheel? Nobody*, WALL ST. J. (Sept. 24, 2012), http://online.wsj.com/article/SB10000872396390443524904577651552635911824.html (citing *AAA Study Finds Costs Associated With Traffic Crashes Are More Than Three Times Greater Than Congestion Costs*, AAA NEWS ROOM (Nov. 3, 2011), http://newsroom.aaa.com/2011/11/aaa-study-finds-costs-associated-with-traffic-crashes-are-more-than-three-times-greater-than-congestion-costs/).

28. *Id.*

29. *Id.*

30. *See* Press Release, Volvo Car Grp., *supra* note 17.

31. Beiker, *supra* note 22, at 1150; *see also* Bryant W. Smith, *Managing Autonomous Transportation Demand*, 52 SANTA CLARA L. REV. 1401, 1410 (2012) (discussing how frequent braking and accelerating leads to higher costs).

32. Beiker, *supra* note 22, at 1150.

33. Others have written about tort liability and autonomous vehicles. *See* NIDHI KALRA, JAMES ANDERSON & MARTIN WACHS, RAND CORP., LIABILITY AND REGULATION OF AUTONOMOUS VEHICLE TECHNOLOGIES 22 (April 2009), *available at* http://www.its.berkeley.edu/publications/UCB/2009/PRR/UCB-ITS-PRR-2009-28.pdf (arguing that manufacturers will probably be liable for accidents caused by autonomous vehicles); 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); 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); 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). Others have written about autonomous vehicles in different contexts. *See generally* Beiker, *supra* note 22 (providing an overview of legal issues involving autonomous vehicles); Frank Douma & Sarah A. Palodichuk, *Criminal Liability Issues Created by Autonomous Vehicles*, 52 SANTA CLARA L. REV. 1157 (2012); Dorothy J. Glancy, *Privacy in Autonomous Vehicles*, 52 SANTA CLARA L. REV. 1171 (2012); Robert B. Kelly & Mark D. Johnson,

computers are not perfect,[34] it is practical to assume that self-driving cars will sometimes malfunction,[35] and it is important to examine tort liability when such malfunctions result in a car accident.[36] Specifically, who is liable when the car malfunctions and causes an accident while in autonomous mode; should the driver or the manufacturer be liable?[37] Because current products liability law does not adequately assess liability in this futuristic situation, this Article proposes that courts or legislatures need to adopt a new liability scheme that assesses responsibility to the proper party by using products liability principles and focuses on the driver's level of reliance on the autonomous vehicle.

In examining that issue, this Article first discusses projected designs for autonomous vehicles—focusing specifically on the Google Car—as well as the purposes of these cars. Part II describes four hypothetical scenarios that will be used in exploring products liability law. Part III provides an overview of the current products liability doctrines that govern product manufacturers, how those doctrines will apply to accidents involving autonomous technology, and shortfalls of each as applied to autonomous vehicles. Finally, Part IV asserts that adjustments to current products liability doctrines are necessary to ensure that tort liability stemming from autonomous vehicle accidents is allocated to the proper parties.

II. BACKGROUND INFORMATION

A. Overview of the Design and Purpose of the Autonomous Vehicle

1. Autonomous Vehicle Design

A basic understanding of autonomous vehicle design is necessary in analyzing tort liability that applies to such vehicles. Because Google has been the driving force behind the development of autonomous vehicles, analyzing its design plans provides a helpful overview of self-driving car design.[38]

Defining a Stable, Protected and Secure Spectrum Environment for Autonomous Vehicles, 52 SANTA CLARA L. REV. 1271 (2012) (discussing autonomous vehicle communication systems); Robert W. Peterson, *New Technology—Old Law: Autonomous Vehicles and California's Insurance Framework*, 52 SANTA CLARA L. REV. 1341 (2012) (discussing how insurance markets will be effected by autonomous vehicles); Smith, *supra* note 31 (discussing autonomous vehicle transportation).

34. *See* Masnick, *supra* note 7 ("[T]here's no way that autonomous vehicles will have a perfect track record and never, ever get into an accident. They will crash.").

35. *See Look, No Hands*, ECONOMIST, Sept. 1, 2012, at 17, 19, *available at* http://www.economist.com/node/21560989 ("It is only a matter of time before the maker of an autonomous vehicle is sued for unleashing a killer robot, says Michael Toscano, head of the Association for Unmanned Vehicle Systems International, an industry body in Arlington, Virginia."); Marchant & Lindor, *supra* note 33, at 1321 ("Cars crash. So too will autonomous vehicles . . . .").

36. *See* Matthew T. Henshon & Krasnow Waterman, *Imagine the Ram-If-Ications: Assessing Liability for Robotics-Based Car Accidents*, SCITECH LAW., Spring 2009, at 17 ("Resolving the uncertainty of liability may allow more technologies to come to market faster.").

37. Others have asked the same question. *See, e.g.*, Kenneth Anderson, *Google Cars Drive Themselves, and Robots and the Law*, VOLOKH CONSPIRACY (Oct. 17, 2010, 12:12 PM), http://www.volokh.com/2010/10/17/google-cars-drive-themselves-and-robots-and-the-law/; Strumpf, *supra* note 20; Markoff, *supra* note 26.

38. Other car companies are using a similar design for autonomous cars as well. *See* Fountain, *supra* note 5 ("[All manufacturers] rely on sensors to gather data about the car's environment, processors to crunch

Google plans to combine its autonomous technology with preexisting vehicles,[39] rather than develop its own vehicle specifically for autonomous driving. Currently, Google is testing its technology on a fleet of Toyota Priuses,[40] an Audi,[41] and a Lexus.[42] Google places a structure on top of the car that navigates, detects traffic, and measures and analyzes the surroundings through the use of radar sensors, laser rangefinders, video cameras, global positioning systems (GPSs), and maps.[43] The laser rangefinders map out the driving environment, "[t]he cameras and vehicle radars . . . detect potential obstacles,"[44] and the GPS determines the location of the vehicle to help it stay on the correct path.[45] This information is sent to Google data centers that use this data to constantly update the maps sent out to all Google Cars,[46] which helps other autonomous cars that come across that location.[47] Developers then refine the algorithms this technology utilizes by driving the cars in various terrains.[48] The interior of the vehicle has a user interface to help drivers monitor what the autonomous technology is currently doing.[49]

Although Google plans to develop a fully autonomous vehicle, its current design—and the current laws—still requires a driver behind the steering wheel.[50] The driver is able to assume control of the vehicle by moving the steering wheel or touching the pedals.[51] The driver can also assume control of the vehicle by utilizing a button that switches the vehicle in or out of self-driving mode.[52] If the vehicle does not realize what to do in a certain driving situation, a voice lets the user know that the car is giving control back to the driver.[53]

Autonomous vehicles have the capability to communicate with each

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the data, algorithms to interpret the results and make driving decisions, and actuators to control the car's movements."). Continental Corporation's autonomous vehicle, for instance, uses "four short-range radar sensors (two at the front, two at the rear), one long-range radar and a stereo camera" to safely drive the vehicle in various situations. *Continental Becomes First Automotive Supplier to Receive Nevada's Autonomous Vehicle Testing License*, PR NEWSWIRE (Dec. 19, 2012), http://www.prnewswire.com/news-releases/continental-becomes-first-automotive-supplier-to-receive-nevadas-autonomous-vehicle-testing-license-184141281.html.

39. *See* Fountain, *supra* note 5 ("Google says it does not want to make cars, but instead work with suppliers and automakers to bring its technology to the marketplace."). Most of the other car manufacturers are likewise using autonomous technology on their existing vehicles. *See* Sherr & Ramsey, *supra* note 5.

40. Markoff, *supra* note 26.

41. *Id.*

42. Fountain, *supra* note 5 (automated Lexus RX 450h).

43. Peter Valdes-Dapena, *Thrilled and Bummed by Google's Self-Driving Car*, CNN MONEY (May 18, 2012, 1:07 PM), http://money.cnn.com/2012/05/17/autos/google-driverless-car/index.htm.

44. Kelly & Johnson, *supra* note 33, at 1276.

45. *Id.*

46. Sebastian Thrun, *What We're Driving at*, GOOGLE OFFICIAL BLOG (Oct. 9, 2010), http://googleblog.blogspot.com/2010/10/what-were-driving-at.html.

47. *See* Fountain, *supra* note 5.

48. Tom Vanderbilt, *Let the Robot Drive: The Autonomous Car of the Future Is Here*, WIRED (Jan. 20, 2012, 3:24 PM), http://www.wired.com/magazine/2012/01/ff_autonomouscars/all/.

49. User Interface for Displaying Internal State of Autonomous Driving Sys., U.S. Patent No. 8,260,482 (filed July 8, 2010).

50. *See supra* note 21 and accompanying text.

51. Valdes-Dapena, *supra* note 43.

52. *Id.*

53. *Id.*

other.[54] As they become more common, autonomous vehicles will become safer because of this feature, which further removes a level of unpredictability for the computer—human behavior.[55] The vehicles will also be able to communicate with traffic signals and signs.[56] Because of these abilities, the benefits of autonomous cars will greatly increase as they become more common.

2. Purposes of the Autonomous Vehicle

While the designs of autonomous vehicles may change over time, the primary purpose of autonomous vehicles is to get the user from one place to another. For most people, traditional vehicles also serve this purpose; however, autonomous vehicles also assist those who cannot safely drive themselves.[57] "Too many people are underserved by the current transport system. They are blind, or too young to drive, or too old, or intoxicated."[58] Google demonstrated the capacity for autonomous vehicles to change this aspect of the transportation system when it allowed a blind person to "drive" the vehicle to run some errands.[59]

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54. Koldhekar, *supra* note 5 ("The main technology underpinning Volvo's autonomous automobiles is wireless internet, which would enable each car to be assigned a certain point on the road and give different vehicles the ability to interact with each other."); *see also* Kelly & Johnson, *supra* note 33, at 1277–78 (discussing how the vehicles will communicate with each other).

55. A well-programmed computer algorithm cannot take into account all of the various ways that people drive. Smith, *supra* note 31, at 1412–13 (discussing the additional benefits of widespread autonomous car use).

56. Ann Craig, *Work on Autonomous Control of Driverless Vehicles Through Intersections Receives Recognition*, VA. TECH NEWS (Dec. 4, 2012), http://www.vtnews.vt.edu/articles/2012/12/120412-vtti-zohdyrakhabestpaper.html (quoting Ismail Zohdy: "Intelligent transportation systems are an interaction of many complex entities that communicate with each other, such as vehicles, traffic signals, and advisory signals. Driverless vehicles would be capable of interacting with these other entities . . . ."). Combined with the new "connected vehicle" program that the NHTSA is undertaking, which allows vehicles to "wirelessly communicate with each other as well as with traffic signals, pavement embedded sensors[,] and other road equipment," autonomous vehicles could become even safer because the computer technology will be able to communicate with everything else on the road—except pedestrians of course. Steve Johnson, *Silicon Valley Technology Could Be Key to Safer Driving*, SAN JOSE MERCURY NEWS (Nov. 6, 2012), http://www.mercurynews.com/cars/ci_21915077/silicon-valley-technology-could-be-key-connect-cars.

57. NHTSA, Preliminary Statement, *supra* note 18, at 14 ("Mobility for those with a range of disabilities will be greatly enhanced if the basic driving functions can be safely performed by the vehicle itself, opening new windows for millions of people."); Beiker, *supra* note 22, at 1151 ("[A]utonomous driving technology can help elderly or disabled citizens keep an active lifestyle such as running daily errands and maintaining their social relationships."); Allison Arieff, *Driving Sideways*, N.Y. TIMES (July 23, 2013, 9:00 PM), http://opinionator.blogs.nytimes.com/2013/07/23/driving-sideways/?_r=0 ("[S]elf-driving vehicles provide mobility for those who lack it — the disabled, seniors, even children — and for those who perhaps shouldn't have access to it otherwise (i.e., drunken drivers)."). Sergey Brin of Google hopes that the cars could transport blind people and other people who cannot drive. Hirsch, *supra* note 26 (quoting Sergey Brin: "Some people have other disabilities. Some people are too young [to drive]. Some people are too old. Sometimes we're too intoxicated [to drive]."); *see also* Shepardson, *supra* note 17 (paraphrasing NHTSA Administrator David Strickland who stated that autonomous cars could allow senior citizens and the blind to drive safely); Smith, *supra* note 31, at 1409 ("Self-driving cars that do not need human drivers or monitors may substantially increase mobility for those who cannot (legally) drive themselves because of youth, age, disability, or incapacitation.").

58. Thomson, *supra* note 8.

59. *See* Mary B. Quirk, *Google's Helpful Self-Driving Car Brings Blind Passenger to Taco Bell*, CONSUMERIST (Mar. 29, 2012), http://consumerist.com/2012/03/29/googles-helpful-self-driving-car-brings-

Another purpose of autonomous vehicles not served by traditional vehicles is to increase a person's productivity.[60] The autonomous car will allow people behind the wheel to perform tasks other than driving.[61] In today's productivity-driven society, this aspect of autonomous vehicles is very appealing.

B. Four Scenarios

In order to further analyze autonomous cars and the interplay of tort liability, it is helpful to examine four specific scenarios: the Distracted Driver, the Diminished Capabilities Driver, the Disabled Driver, and the Attentive Driver.

1. The Distracted Driver

Sarah has a long drive home for Thanksgiving right before her finals begin. Traditionally, she would not make the trip home so that she could study, but now, because of Google, Sarah can do both. She gets into her Google Car—a fully autonomous vehicle—with her torts textbook, and, instead of driving home, she rides in the driver seat while reading her textbook. The Google Car is driving for her and notifying her when she needs to pay attention to the road. About halfway home, the Google Car malfunctions and hits another driver without ever telling Sarah to take control of the car. Arguably, Sarah's car caused the accident. Who is liable? Is Sarah—the driver in the traditional sense—liable, or is Google—the manufacturer—liable because the car was driving itself when the accident occurred?

The Distracted Driver is the autonomous car user who is not paying attention;[62] it could be someone reading a book like Sarah, using a cell phone,[63] eating a snack, or any other situation. Essentially, the Distracted Driver purposefully engages in a task other than driving, thus relying on the

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blind-passenger-to-taco-bell/.

60. *See* Urmson, *supra* note 6 ("One day we hope this capability will enable people to be more productive in their cars."); *see also* Markoff, *supra* note 26 (quoting Sebastian Thrun, Director of the Stanford Artificial Intelligence Laboratory and Google engineer: "Can we text twice as much while driving, without guilt? . . . Yes, we can, if only cars will drive themselves."); Thrun, *supra* note 46 ("[T]he U.S. Department of Transportation estimates that people spend on average 52 minutes each working day commuting. Imagine being able to spend that time more productively."). Another car maker, Volvo, has likewise stated the goal of increasing productivity of people. *See* Press Release, Volvo Car Grp., *supra* note 17 ("[Autonomous technology] creat[es] possibilities for the driver to safely focus on something else while the car is driven autonomously.").

61. Currently each American on average spends an hour per day in a vehicle. Smith, *supra* note 31, at 1410. *See also* Nick Bilton, *Disruptions: How Driverless Cars Could Reshape Cities*, N.Y. TIMES (July 7, 2013, 11:00 AM), http://bits.blogs.nytimes.com/2013/07/07/disruptions-how-driverless-cars-could-reshape-cities/ ("[D]riverless cars will allow people to live farther from their offices and that the car could become an extension of home.").

62. *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., NATIONAL MOTOR VEHICLE CRASH CAUSATION SURVEY 2 (2008), *available at* http://www-nrd.nhtsa.dot.gov/Pubs/811059.PDF ("[A]bout 18 percent of the drivers [in the accidents studied] were engaged in at least one interior non-driving activity.").

63. *See* Mike Masnick, *Is There a Better Way to Text While Driving?*, TECHDIRT (Aug. 25, 2010, 8:16 AM), http://www.techdirt.com/articles/20100823/02465910726.shtml.

autonomous vehicle completely.

2. The Diminished Capabilities Driver

Richard is in his eighties. At one time Richard was a superb driver, but, as he has aged, driving has become more difficult for him. He struggles when turning his head to look for traffic, and he does not react at the same speed as he once did. Richard does not want to depend on others for his travels, so he purchases an autonomous vehicle. This vehicle allows Richard to safely get from one place to another without depending on others. On the way to his grandchild's Little League Baseball game, the vehicle starts malfunctioning. Richard attempts to take control of the vehicle but does not react quickly enough to avoid the accident, and the vehicle hits another car. Is Richard liable or is Google?

The Diminished Capabilities Driver is the person whose driving capabilities are diminished for some reason; it could be an elderly person like Richard, an intoxicated person,[64] or a minor.[65] This person typically would not be driving because of his or her diminished capabilities and would have to rely on others.[66] Thus, the Diminished Capabilities Driver could benefit greatly from the convenience and independence an autonomous vehicle provides.

3. The Disabled Driver[67]

Christie enlists in the army and serves her country. A tragedy occurs overseas: Christie is hit by a grenade, and she is permanently blinded by shrapnel that hits her eyes. Upon returning home, she finds herself completely dependent on others to drive her places, but she does not like to burden family and friends with her disability. Fortunately, she learns of a new technology that will give her independence and the ability to get around. She purchases an autonomous car. One day, on her way to the local VFW, Christie's autonomous vehicle begins malfunctioning and alerting her of the technology failure. Because Christie is blind and cannot assume control of the vehicle, she can only sit there and pray for the best. Is Christie liable or is Google?

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64. *See* Douma & Palodichuk, *supra* note 33, at 1163–64 (discussing the possibility of a "take me home I'm drunk" button for these cars).

65. Obviously children cannot currently operate a motor vehicle, but many people have suggested that autonomous vehicles could eventually be used to drive children to their sporting events and schools, increasing society's productivity even more. *E.g.*, Douma & Palodichuk, *supra* note 33, at 1164; Smith, *supra* note 31, at 1409.

66. This Article does not ignore the fact that Diminished Capability Drivers, while relying on the autonomous technology, could be undertaking other activities while in the vehicle much like Distracted Drivers. The difference between the two drivers is that the Distracted Driver can—other than for the distraction—drive the vehicle in a safe manner; whereas the Diminished Capabilities Driver has a condition that makes it harder for the person to drive the vehicle safely.

67. This Article does not ignore the practical reality that states would have to pass laws allowing people with disabilities to have an autonomous vehicle. Currently, people with disabilities of this sort cannot operate a motor vehicle. States may create a public policy exception for autonomous vehicles. Google has already allowed a blind person to drive the vehicle. *See* Quirk, *supra* note 59 (discussing the car taking the blind man through Taco Bell's drive-thru).

The Disabled Driver is the person who cannot drive a traditional vehicle because of a physical disability, such as blindness[68] or an amputated limb.[69] Thus, the Disabled Driver relies entirely on the autonomous nature of the car in that he or she can take control—just not safely—of the autonomous car in the event of a computer malfunction.

4. The Attentive Driver

Tucker commutes forty-five minutes to work five days a week. He has grown tired of making this commute, considering that he spends an hour and a half doing nothing "productive." Tucker hears about autonomous vehicles. Tucker has a healthy skepticism of new technology, so it takes time for him to get comfortable using technology, even when the product has been out for years. Nevertheless, Tucker decides to try an autonomous vehicle so that he can use his commuting time more productively. At first, Tucker does not take his eyes off the road, but eventually he starts to trust the vehicle. One day Tucker watches his autonomous vehicle drift into the other lane. Rather than grab the wheel, he watches to see if his car is actually as perfect as it had previously been and if it will fix itself, avoiding the accident. Unfortunately, there is a vehicle in his blind spot, and Tucker's autonomous vehicle collides with the other vehicle. Is Tucker liable for not taking control of the autonomous vehicle, or is Google?

The Attentive Driver, like Tucker, is the user who watches the road and surroundings in the same way he or she would while driving a traditional vehicle. The Attentive Driver may not trust the autonomous ability of the vehicle such that he or she constantly checks that the car is driving correctly, or the Attentive Driver may simply not have any other tasks to address while in the vehicle. The key is that the Attentive Driver has the potential to foresee and prevent accidents, unlike the Distracted, Diminished Capabilities, and Disabled Drivers.

III. PRODUCTS LIABILITY LAW AS APPLIED TO AUTONOMOUS VEHICLES

A. Overview of Products Liability Law

Products liability is the main basis for manufacturer liability. Plaintiffs can sue for manufacturing defects, design defects, and failures to warn.[70] Crashworthiness is another products liability doctrine applied to automobiles.[71] However, since this analysis is focusing on Google Cars and crashworthiness is concerned with the structure and design of the vehicle, the analysis of a

68. Smith, *supra* note 31, at 1409 ("Nine percent of adults identify as blind or report 'trouble seeing, even when wearing glasses or contact lenses.'").

69. *See* Bradley Keyes, *New Found Freedom With Driverless Cars*, DRIVERLESS WORLD (June 21, 2011), http://driverlessworld.com/2011/06/new-found-freedom-with-driverless-cars/ (discussing the number of people with disabilities that could use self-driving vehicles).

70. Watson v. Ford Motor Co., 699 S.E.2d 169, 174 (S.C. 2010).

71. *See, e.g.*, Garza, *supra* note 33, at 593–94 (discussing crashworthiness for autonomous vehicles).

vehicle's crashworthiness would be the same for a vehicle with autonomous technology and one without autonomous technology.[72] A products liability suit can allege any or all of these theories.[73] Manufacturing defects are implicated when a good is not produced according to its specification[74] or under the malfunction doctrine when there is an unexplainable accident.[75] Design defects are alleged when the foreseeable risks of harm could have been reduced or avoided by use of a reasonable alternative design.[76] There are two main tests for design defects: the consumer expectations test and the risk-utility test.[77] A failure to warn claim is based on a manufacturer's duty to provide instruction about how the product can be safely used and to warn consumers of hidden dangers.[78] In Part III.B, this Article will analyze autonomous cars under each of the three common grounds for products liability suits—manufacturing defect, design defect, and warning defect. In Part III.B.5, this Article will also examine the defenses to products liability suits. There are four defenses that are applicable to autonomous vehicle suits: comparative negligence, misuse, state of the art, and assumption of the risk.[79]

B. Products Liability Doctrines Applied to Autonomous Vehicles

1. Manufacturing Defects

Manufacturing defects occur when the product does not meet the manufacturer's specifications and standards.[80] The Restatement (Second) of Torts and the Restatement (Third) of Torts: Products Liability both include a manufacturing defect claim for products liability.[81] To succeed, a plaintiff must prove that the product does not conform to the specifications, regardless of whether there was negligence in the manufacturing process.[82]

In the context of autonomous vehicles, a plaintiff could prevail by showing that the autonomous equipment failed to work as specified by the

72. Google is planning on putting the autonomous technology on cars produced by other manufacturers and is not using a special car. *See supra* note 5 and accompanying text. Because of that, the crashworthiness analysis would be the same for the vehicle that Google uses for its technology.

73. *Watson*, 699 S.E.2d at 174.

74. *See* RESTATEMENT (SECOND) OF TORTS § 402A cmt. h (1965) ("The defective condition may arise not only from harmful ingredients, not characteristic of the product itself either as to presence or quantity, but also from foreign objects contained in the product, from decay or deterioration before sale, or from the way in which the product is prepared or packed.").

75. David G. Owen, *Manufacturing Defects*, 53 S.C. L. REV. 851, 871–72 (2002).

76. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(b) (1998).

77. *See* David G. Owen, *Design Defects*, 73 MO. L. REV. 291, 299 (2008) ("All courts judge the adequacy of a product's design upon one of two basic standards, or some combination thereof: (1) the 'consumer expectations' test . . . and/or (2) the 'risk-utility' test . . . .").

78. *Watson*, 699 S.E.2d at 174.

79. *See infra* Part III.B.5.

80. *See* Owen, *supra* note 75, at 865 ("A defect in manufacture simply meant that through some mistake in the production process the product was rendered 'defective.'").

81. *See* RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(a) (1998) ("[A product] contains a manufacturing defect when the product departs from its intended design even though all possible care was exercised in the preparation and marketing of the product."); RESTATEMENT (SECOND) OF TORTS § 402A (1965) (supporting RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(a) (1998)).

82. *E.g.*, Hall v. Chrysler Corp., 526 F.2d 350, 352 (5th Cir. 1976).

manufacturer.[83] For instance, if the laser sensors do not detect oncoming traffic or when to turn, like the specifications require, then the user should be able to recover under a manufacturing defect claim. 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.[84] 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.[85] This will be tricky for a plaintiff to do if the defect is really a software error (algorithm). Therefore, the traditional manufacturing defect theory will be most useful to plaintiffs when the parts did not meet the manufacturing specifications.

Under the malfunction doctrine, a variation of the manufacturing defect doctrine, a plaintiff can show a manufacturing defect without specifically proving how it was defective.[86] A plaintiff must prove that: "(1) the product malfunctioned, (2) the malfunction occurred during proper use, and (3) the product had not been altered or misused in a manner that probably caused the malfunction."[87] The major benefit to the malfunction doctrine is that a plaintiff can prove that the product malfunctioned with circumstantial evidence.[88]

This doctrine's application to autonomous vehicles helps a plaintiff hold a manufacturer liable for the accident. A plaintiff could prove that the accident was caused by a malfunction in the autonomous technology.[89] The accident itself is proof of the first[90] and second elements.[91] The third element requires a plaintiff to prove that the vehicle was not altered, such as by simply showing that the car is in its original condition. Presumably the technology will be programmed differently for each vehicle's specifications because each vehicle may accelerate faster, have different brake systems, and other unique abilities of cars.[92] If the vehicle owner changed any part of the vehicle, a manufacturer

83. *Cf.* Marchant & Lindor, *supra* note 33, at 1323 (arguing that manufacturing defect claims will be uncommon because software and navigation systems are manufactured with low error rates).

84. *See* 68 AM. JUR. 3D PROOF OF FACTS 333 § 8 (last updated Sept. 2013) ("[N]o cases have been found applying [manufacturing defects] to software.").

85. *Id.*

86. *See* RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(a) cmt. a (1998) ("Strict liability . . . performs a function similar to the concept of res ipsa loquitur . . . .").

87. Owen, *supra* note 75, at 873.

88. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 3 cmt. c (1998) ("The inference of defect may be drawn . . . without proof of the specific defect."); *see also* Stackiewicz v. Nissan Motor Corp., 686 P.2d 925, 929–30 (Nev. 1984) (holding that a steering wheel malfunction caused an accident).

89. *See, e.g.*, 68 AM. JUR. 3D PROOF OF FACTS § 1 (2013) (suggesting that technology that fails to meet product specifications may be classified as "defective" and give rise to a cause of action).

90. The accident is evidence that the automobile malfunctioned. *See* Dietz v. Waller, 685 P.2d 744, 747–48 (Ariz. 1984) ("No specific defect need be shown if the evidence, direct or circumstantial, permits the inference that the accident was caused by a defect.").

91. Proof of proper use would be that the vehicle is in autonomous mode. The only problem with this element would occur if the autonomous car was not permitted to be operated in certain weather conditions. *See* Marchant & Lindor, *supra* note 33, at 1327 (mentioning the possibility that a manufacturer may include in the manual instructions that the owner should not use the car under certain weather conditions).

92. This would be different if the person could download an update or if the technology adapts to the vehicle.

will always argue that any modification to the vehicle changed the technology's ability to safely drive in autonomous mode and, thus, was the cause of the accident.[93] Therefore, to use the malfunction doctrine, a plaintiff will need to prove that the vehicle was not altered by any changes to the vehicle that may have caused the program to malfunction or that the technology was updated to meet the new vehicle modifications.[94]

Although the malfunction doctrine will be useful to plaintiffs in autonomous vehicle products liability suits, there are some limitations to its application. Some jurisdictions do not recognize the malfunction doctrine.[95] Courts that do apply the doctrine hesitate to apply it to claims in a widespread fashion[96] and typically require a showing of unique circumstances before applying it.[97] When applying the doctrine to traditional vehicles, some courts require that the vehicle was relatively new[98] and that the vehicle part was not repaired.[99] An expert is usually required to show that the accident could not have been caused by anything other than the alleged defect.[100] 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.

2. Design Defects

a. Consumer Expectations Test

A traditional manufacturing defect claim will not help plaintiffs with algorithm defects because of the malfunction doctrine's limitations; so, plaintiffs will likely assert design defects. This Part focuses on one of the design defect tests. The Restatement (Second) of Torts includes the consumer

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93. *See* Garza, *supra* note 33, at 581 (noting manufacturers have been reticent to make changes on vehicles because of liability concerns).

94. Owen, *supra* note 75, at 873–74 ("The malfunction doctrine [provides that] plaintiff need not establish that a specific defect caused an accident if circumstantial evidence permits an inference that the product, in one way or another, probably was defective.").

95. *See, e.g.*, Christopher H. Hall, Annotation, *Strict Products Liability: Product Malfunction or Occurrence of Accident as Evidence of Defect*, 65 A.L.R. 4TH 346 (2013) (enumerating jurisdictions that do not recognize the malfunction doctrine).

96. Owen, *supra* note 75, at 878 ("The doctrine presents a seductive but faulty shelter for plaintiffs with insufficient proof of defect and causation, and the law reports brim with decisions that recite the propriety of the doctrine as a general proposition but hold it inapplicable to the facts.").

97. DAVID G. OWEN, PRODUCTS LIABILITY LAW § 7.4, at 470 (2d ed. 2008) ("Although the malfunction doctrine may come to a plaintiff's rescue when circumstances fairly suggest the responsibility of a product defect, it is hornbook law that proof of a product accident alone proves neither defectiveness nor causation.").

98. *Compare* Corcoran v. General Motors Corp., 81 F. Supp. 2d 55, 69 (D.D.C. 2000) ("[A]lthough brake failure in a new car gives rise to the inference that a defect existed when the car entered the stream of commerce, . . . this inference is unavailable to the plaintiff, whose complaint involves a seven and a half year old car which he drove approximately 23,000 miles without incident."), *with* Holloway v. General Motors Corp., 271 N.W.2d 777, 779 (Mich. 1978) (reversing a directed verdict on malfunction theory for a four-year-old car driven 47,000 miles where the alleged defect was in the suspension).

99. *See, e.g.*, Parsons v. Ford Motor Co., 85 S.W.3d 323, 326 (Tex. Ct. App. 2002) (explaining that the dealer repaired the ignition that caused the fire).

100. *See* OWEN, *supra* note 97, § 6.3, at 365 ("[E]xpert proof is often necessary [under the malfunction doctrine] to rule out other possible causes of the accident.").

expectations test as one method for analyzing design defects;[101] however, the Restatement (Third) of Torts: Products Liability rejected the consumer expectations test for design defects.[102] Like the Restatement (Third), many courts have criticized using the consumer expectations test for design defects;[103] many states, however, still use this test.[104] The Restatement (Second) of Torts defines a design defect as a defect that is unreasonably dangerous beyond the contemplation of the consumer.[105] A product has a design defect if it is "dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it."[106] However, a manufacturer is not required to make perfectly safe goods.[107] Thus, under the consumer expectations test, a court looks to what a reasonable consumer would expect from a product.[108]

Because of the complexity of traditional automobiles,[109] some courts hesitate to apply the consumer expectations test to most automotive accidents.[110] Although autonomous technology could be considered "complex," developing consumer expectations does not require knowledge of the complexity.[111] In the context of autonomous vehicles, the consumer will expect the vehicle to operate on its own in a reasonably safe manner. The manufacturer necessarily will need to advertise that the autonomous vehicle is safe; otherwise no one will trust the vehicle. This advertising could also lead consumers to have unrealistic expectations of the autonomous vehicle's capabilities.[112] When a car deviates from the consumer's expectations and causes an accident, a consumer expectations jurisdiction should permit a plaintiff to use this test. For instance, assume a situation where a vehicle's map of a turn is defective and instead of turning left where it was supposed to,

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101. RESTATEMENT (SECOND) OF TORTS § 402A cmt. g (1965); Douglas A. Kysar, *The Expectations of Consumers*, 103 COLUM. L. REV. 1700, 1712–13 (2003).

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

103. *See, e.g.*, Branham v. Ford Motor Co., 701 S.E.2d 5, 15 (S.C. 2010) ("[W]e find the consumer expectations test and its focus on the consumer ill-suited to determine whether a product's design is unreasonably dangerous.").

104. *See* Owen, *supra* note 77, at 300 ("[The consumer expectations test] remains a persistent, if embattled, liability test in at least certain types of design defect cases in many states.").

105. RESTATEMENT (SECOND) OF TORTS § 402A cmt. g (1965).

106. RESTATEMENT (SECOND) OF TORTS § 402A cmt. i (1965).

107. *See, e.g.*, *id.* ("Many products cannot possibly be made entirely safe for all consumption.").

108. *See, e.g.*, Vincer v. Esther Williams All-Aluminum Swimming Pool Co., 230 N.W.2d 794, 798 (Wis. 1975) ("This is an objective test and is not dependent upon the knowledge of the particular injured consumer, although his knowledge may be evidence of contributory negligence under the circumstances.").

109. *See generally* Soule v. General Motors Corp., 882 P.2d 298 (Cal. 1994); Heaton v. Ford Motor Co., 435 P.2d 806 (Or. 1967).

110. Garza, *supra* note 33, at 601–02. *But see, e.g.*, Jackson v. Gen. Motors. Corp., 60 S.W.3d 800, 806 (Tenn. 2001) (citing Cunningham v. Mitsubishi Motors Corp., No. C-3-88-582, 1993 WL 1367436, at *6 (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.").

111. *See Jackson*, 60 S.W.3d at 806 ("[I]t may be difficult for plaintiffs in cases involving highly complex products to establish that the product is dangerous to an extent beyond that which would be contemplated by an ordinary consumer, even though the consumer expectation test may, technically, apply.").

112. *See, e.g.*, KALRA, ANDERSON & WACHS, *supra* note 33, at 24 ("If advertising overpromises the benefits of these technologies, consumers may misuse them.").

the vehicle instead turns ten feet too early, driving the car into a ditch. Because this accident would be a software defect, the plaintiff needs to assert a design defect claim.[113] Under the consumer expectations test, the driver's expectation was that the maps would work properly and the vehicle would follow those maps. In this example, the expectations were not complex. The vehicle caused the accident, the autonomous vehicle did not meet the person's expectations, and a court should allow the driver to present the consumer expectations test to the jury.

Since the consumer expectations test is based on expectations of the "reasonable consumer,"[114] not the subjective expectations of the particular consumer, it will not matter which of the four drivers[115] is behind the wheel. The expectations are based on the reasonable person and not the reasonable Distracted Driver or the reasonable Diminished Capabilities Driver.[116]

Thus, although the Attentive Driver described in Part II has lower "expectations" of the vehicle's capabilities to drive safely[117] than, for instance, the Distracted Driver,[118] a manufacturer could not argue that this attentive plaintiff did not trust the vehicle to drive safely. Although the consumer expectations test could apply to autonomous vehicles on a widespread basis, it is not recognized for design defects in every jurisdiction, and those jurisdictions that do recognize it may hesitate to do so in the context of autonomous vehicles because they may argue that autonomous vehicles are complex.

b. Risk-Utility Test

Because the consumer expectations test is applied to design defects in only a minority of jurisdictions, most plaintiffs will need to use the risk-utility test to prove a design defect.[119] The risk-utility test is the dominant test for design defects in products liability.[120] The Restatement (Third) of Torts: Products Liability endorsed the risk-utility test as the sole test for design defects.[121] Section 2(b) of that Restatement provides:

> A product . . . is defective in design when the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design by the seller . . . and the omission of the alternative design renders the product not

113. *See supra* note 84 and accompanying text.

114. Vincer v. Esther Williams All-Aluminum Swimming Pool Co., 230 N.W.2d 794, 798 (Wis. 1975).

115. *See supra* Part II.B.

116. *See Vincer*, 230 N.W.2d at 798.

117. *See supra* Part II.B.4 ("The Attentive Driver may not trust the autonomous ability of the vehicle such that he or she constantly checks that the car is driving correctly.").

118. *See supra* Part II.B.1 ("[T]he Distracted Driver purposefully engages in a task other than driving, thus relying on the autonomous vehicle completely.").

119. *See* Owen, *supra* note 77, at 301 ("[M]ost modern courts have abandoned consumer expectations as the predominant test for design defectiveness.").

120. *See id.* at 307 ("The risk-utility test is the principal standard for judging the safety or defectiveness of a product's design.").

121. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(b) (1998).

reasonably safe.[122]

A manufacturer is not required under the risk-utility test to use the safest design possible.[123] Rather, under the risk-utility test "[a] product is defective in design if the safety benefits from altering the design as proposed by the plaintiff would have exceeded the costs of such an alteration."[124] To prevail, a plaintiff must present a reasonable alternative design that would have prevented the accident.[125]

In the autonomous vehicle context,[126] design defect claims may allege a defect in the design of some tangible feature of the autonomous vehicle or may allege a defect in the software that controls the vehicle. For instance, a plaintiff could allege that the sensors could have been designed better to capture the surroundings of the automobiles. A plaintiff's design defect claim against a manufacturer for the actual design of a tangible feature ordinarily will be easier for a plaintiff to prove than for the design of the software because presenting expert testimony on the positioning or technology is more straightforward than presenting expert testimony on the ability of the manufacturer to write a safer algorithm.[127] Unfortunately, the majority of the design defect cases will concern the algorithm because most of the accidents will concern a computer malfunction.[128] The software could cause the car to accelerate faster than normal, it could have the vehicle miss a stop sign or red light, or a variety of other incidents.[129] Here, a plaintiff would need a highly specialized expert to testify[130] as to how the algorithm could have been written (designed) in a safer manner that would have prevented the accident. Because of the complexity of the lawsuit, the costs of a risk-utility suit and the difficulty in having a qualified expert testify to the alleged design defect, this type of claim will be hard to use widespread to hold the manufacturer liable for

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122. *Id.*

123. *See* RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(b) cmt. a ("Society does not benefit from products that are excessively safe . . . any more than it benefits from products that are too risky. Society benefits most when the right, or optimal, amount of product safety is achieved.").

124. David G. Owen, *Toward a Proper Test for Design Defectiveness: "Micro-Balancing" Costs and Benefits*, 75 TEX. L. REV. 1661, 1689 (1997).

125. *Id.* at 1675 n.48.

126. The autonomous vehicle is analogous to an autopilot plane, where design defect claims are permitted to go forward. Marchant & Lindor, *supra* note 33. In *Richardson v. Bombardier, Inc.*, No. 8:03CV544T31MSS, 2005 WL 3087864, at *13 (M.D. Fla. Nov. 16, 2005), the court permitted the plaintiffs to assert a design defect when a plane crashed in autopilot but found that the plaintiffs did not introduce enough evidence to support the claim. Therefore, it is likely that courts would also allow design defect claims against autonomous vehicles.

127. *See* Graham, *supra* note 33, at 1270 ("For a plaintiff to reach a jury on a design-defect claim, she may have to engage in a searching review of the computer code that directs the movement of these vehicles. This project may be difficult, and expensive.").

128. *See* Marchant & Lindor, *supra* note 33, at 1328 ("[T]he malfunction in an autonomous vehicle will usually be a programming error or system failure."). This occurs because the software will misinterpret an object or fail to realize what something is. *Id.* at 1327–28. This type of design defect challenges the software itself. *Id.*

129. Analogous to these examples are cruise control malfunctions. *See, e.g.*, Cole v. Ford Motor Co., 900 P.2d 1059 (Or. Ct. App. 1995). In the cruise control cases, the plaintiffs argue that the cruise control accelerated rapidly or failed to disengage. *Id.* at 1066. Likewise, with autonomous vehicles, the autonomous vehicle technology could accelerate rapidly or fail to disengage.

130. *See infra* Part III.B.4 (discussing the necessity for expert testimony in design defect cases).

accidents caused in autonomous mode.[131]

Because of the limitations of the consumer expectations test and the costliness of the risk-utility test, design defect claims will be tough for plaintiffs to prove for an everyday accident and will be more likely to succeed in cases involving the design of tangible features of the vehicle rather than the software.

3. Failure to Warn

The final category of traditional products liability law is the warning defect. There are two parts to the duty to warn: "informing buyers of hidden dangers" and instructing buyers on how to safely use the product.[132] The Restatement (Third) of Torts: Products Liability states that:

> A product . . . is defective because of inadequate instructions or warnings when the foreseeable risks of harm posed by the product could have been reduced or avoided by the provision of reasonable instructions or warnings by the [manufacturer] . . . and the omission of the instructions or warnings renders the product not reasonably safe.[133]

This standard focuses on whether the warnings provided were adequate.[134] These doctrines can be applied in the autonomous vehicle context too. A main obligation of manufacturers imposed by the duty to warn will involve letting consumers know of any dangers[135] a driver may face when using the autonomous technology. For instance, if the vehicle is brought to a particular location that the maps cannot identify,[136] the vehicle could malfunction and cause harm. A consumer may not know that the vehicle struggles in remote locations, and the manufacturer would have a duty to warn the owner that the autonomous technology could malfunction or does not operate properly there.

Perhaps the main basis for warning defects in the autonomous vehicle context, however, will be the failure to instruct users on how to safely use the autonomous vehicles. Because autonomous vehicles will be a new technology and the risk of harm will be great if they are not operated properly, manufacturers will need to make sure that consumers know how to operate

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131. *See* Graham, *supra* note 33 and accompanying text.

132. OWEN, *supra* note 97, § 9.1, at 581.

133. RESTATEMENT (THIRD) OF TORTS: PRODS. LIAB. § 2(c) (1998).

134. *See, e.g.*, Pavlides v. Galveston Yacht Basin, 727 F.2d 330, 338–39 (5th Cir. 1984) ("The question of whether or not a given warning is legally sufficient depends upon the language used and the impression that such language is calculated to make upon the mind of the average user of the product." (citing Bituminous Cas. Corp. v. Black & Decker Mfg. Co., 518 S.W.2d 868, 872–73 (Tex. App. 1974))).

135. The amount and extent of these are hard to figure out during the prototype stage.

136. *See* User Interface for Displaying Internal State of Autonomous Driving Sys., U.S. Patent No. 8,260,482 (filed July 8, 2010) ("For example, computer 110 may not be able to control aspects of vehicle 101 safely if vehicle 101 is at a particular location which computer 110 is unable to identify based on the geographic location of vehicle 101, if vehicle 101 is at a particular location which is not sufficiently defined or described by detailed map 136, or if computer 110 detects a large number of obstacles in the vicinity of vehicle 101.").

them. This may require a special instruction video[137] that users must watch before purchasing vehicles equipped with autonomous technology. Another alternative would be having driver's education classes cover autonomous driving.[138] Regardless of the solution adopted, autonomous vehicle manufacturers will need to make sure that consumers are instructed on how to safely use these cars or manufacturers could be liable for breaching their duty to warn consumers.

4. Evidence Issues

Under any of the products liability schemes listed above, two evidentiary issues—expert testimony issues and subsequent remedial measures—will recur in almost all autonomous vehicle products liability suits. Because of the complexity of the technology, a plaintiff will need expert testimony to explain product safety and accidents to the court and the jury,[139] which will make most product liability suits cost prohibitive.

To illustrate how the cost of expert witnesses often will be cost prohibitive, this Article will examine expert testimony in the design defect context. With design defects, the major hurdle for a plaintiff to get over will be finding evidence of a reasonable alternative design.[140] Autonomous vehicles by their very nature are futuristic and the car's movement is controlled by algorithms.[141] To prove defectiveness, a plaintiff will need an expert witness to testify to a jury that the highly complex algorithm could have been written safer and that the costs of discovering and implementing this new algorithm would not exceed the benefits of doing so.[142] This will presumably require multiple experts:[143] a computer scientist to understand the algorithm; a mathematician to rewrite the equation; an economist to weigh the costs and benefits of the change; and an expert in the field of autonomous vehicles to

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137. The video would consist of showing the driver how to disengage autonomous driving, informing the driver of how the vehicle interacts with the driver, and instructing the driver on how to operate the user interface.

138. This solution would not be much help for current drivers, but would help ensure that the future generations of drivers are instructed on how to use these vehicles. The NHTSA recommends states requiring someone licensed to specifically operate autonomous vehicles. NHTSA, Preliminary Statement, *supra* note 18, at 14.

139. David G. Owen, *A Decade of Daubert*, 80 DENV. U. L. REV. 345, 347–48 (2002) ("Expert testimony is often necessary to establish defectiveness in manufacture, design, and warning and instructions . . . . [A] products liability case usually will fail without proof of defect and cause by expert testimony.").

140. *See* Watson v. Ford Motor Co., 699 S.E.2d 169, 174 (S.C. 2010) ("[Design defects] necessarily involve sophisticated issues of engineering, technical science, and other complex concepts that are quintessentially beyond the ken of a lay person.").

141. *See* Owen, *supra* note 139, at 354 ("[T]he Frye 'general acceptance' test tended to exclude testimony on cutting-edge science and technology."). Although *Daubert* has made it easier to get novel theories in front of a jury, courts do not allow experts to testify about unreliable theories. *Id.* at 362–63.

142. Analogous to a future autonomous vehicle case is an auto-pilot case. In *Richardson v. Bombardier, Inc.*, No. 8:03CV544T31MSS, 2005 WL 3087864, at *3 (M.D. Fla. Nov. 16, 2005), the district court noted the multiple experts that were required, and because of the complex nature of the auto-pilot claim, "the entire case was based on expert testimony."

143. Depending on the complexity of the suit, multiple experts will easily be required. *See, e.g.*, Cole v. Ford Motor Co., 900 P.2d 1059 (Or. Ct. App. 1995) (noting that multiple experts were required for cruise control defect case).

make sure that this is possible and that it would not have adverse effects on the vehicle. The cost of these experts will make it difficult for a plaintiff to bring suit.[144] When considering that a lawsuit for autonomous vehicles could be for a dent in a car or a fender bender,[145] the costs of acquiring experts will far exceed the cost of repairing the vehicle. Therefore, design defect claims would only go forward on claims for loss of life or large monetary claims because the financial cost of bringing the suit would not exceed the potential judgment.

To help ease these costs, depending on the jurisdiction,[146] a plaintiff will be able to use a subsequent update in the algorithm or safety update as evidence that there was a reasonable alternative design. In federal courts, however, Federal Rule of Evidence (FRE) 407 prohibits introduction of subsequent remedial measures.[147] The ability to use a subsequent update to the algorithm in state court will greatly improve a plaintiff's chance of success on the design defect claim because it will remove costs associated with developing an algorithm and proving the algorithm will help increase safety. The plaintiff will need to file the claim in state court to avoid FRE 407's bar against subsequent remedial measures. In any jurisdiction, a plaintiff will be able to introduce updates to the algorithm—and algorithms used by competing manufacturers—if they predate the accident[148] but were not installed in the plaintiff's car.[149]

Because of the costs of expert witnesses, none of these doctrines—manufacturing defects, design defects, and warning defects—will be practical to hold the manufacturer liable for accidents caused while the vehicle is in autonomous mode except in cases involving substantial damages.

5. Products Liability Defenses as Applied to Autonomous Vehicles

Products liability law does not leave manufacturers defenseless against a

144. *See* Garza, *supra* note 33, at 612 ("Because of the extraordinary cost of experts in products liability litigation, many plaintiffs are turned away because, even if they were to recover, the prospective award would not cover the expense of litigating the claim." (citing Joseph Sanders, *Adversarial Legalism and Civil Litigation: Prospects for Change*, 28 LAW & SOC. INQUIRY 719, 723 (2003))); Graham, *supra* note 33, at 1270 (arguing that a design defect "may be difficult, and expensive").

145. This Article asserts that the manufacturer should be liable for almost all damages caused while the vehicle is in autonomous mode. *See infra* Part IV.

146. OWEN, *supra* note 97, § 6.4, at 400 (discussing that state jurisdictions are split as to whether to admit into evidence subsequent remedial measures).

147. FED. R. EVID. 407. *See also* CHRISTOPHER B. MUELLER, LAIRD C. KIRKPATRICK & CHARLES H. ROSE III, EVIDENCE PRACTICE UNDER THE RULES § 4.23, at 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.").

148. If the autonomous technology manufacturer had warned the consumer that the car needed an update, and the plaintiff did not update the algorithm, this could lead to comparative fault. *See infra* Part III.B.3.

149. *See* MUELLER, KIRKPATRICK & ROSE III, *supra* note 147, § 4.23, at 235 ("FRE 407 does *not* bar evidence of remedial measures taken after an accident similar to the one giving rise to plaintiff's claim but before plaintiff's own accident."). These types of claims will depend on how sophisticated and readily available updates are for autonomous cars. For instance, is an autonomous car owner required to go to the dealership to get updates or will the technology be immediately updated by Google's headquarters? Answers to these questions are not available yet, but the answers could have implications for subsequent remedial updates to the algorithm.

products liability suit. Four defenses—comparative negligence, misuse, state of the art, and assumption of risk—will be applicable to autonomous vehicles. In products liability suits involving autonomous vehicles, the manufacturer could raise a comparative negligence defense, arguing that it should not be fully liable—or liable at all—because of the plaintiff's negligence.[150] This doctrine's interplay with the four scenarios discussed above is paramount.[151] When applied to the four scenarios discussed in Part II, it becomes clear that when evaluating the driver's negligence courts should focus on the driver's decision not to intervene when the vehicle malfunctions.[152] This would require a comparison between the role of the defective vehicle and the role of the plaintiff's conduct in causing the accident.[153] Here, the particular accident would be the harm caused when the autonomous vehicle malfunctions—it may be to the driver, to another vehicle or person, or both. This type of comparative fault requires the court to focus on the ability of a driver to exercise ordinary care in preventing the accident. If the driver fails to exercise ordinary care, fault should be apportioned based on the driver's ability to mitigate or prevent the accident.

If courts were to examine what a plaintiff was doing prior to the accident, they would defeat a major purpose of these vehicles—increased productivity.[154] This occurs because a plaintiff who sits behind the wheel and reads a book, like Sarah from Part II,[155] would be more "negligent" in failing to pay attention to the road than a person like Tucker who was paying attention to the road. A liability scheme that, for instance, finds the Distracted Driver more liable than the Attentive Driver would impede the ability of consumers to use these vehicles for increased production. Therefore, courts should focus on the ability of the person to prevent the accident, rather than what the driver was doing prior to the accident—otherwise the utility of these vehicles could be greatly diminished.

This comparative fault system—looking at the driver's ability to prevent the accident—can be applied to the four scenarios from Part II. The Disabled Driver would not be able to prevent an accident and should have no comparative fault. On the opposite side of the spectrum, the Attentive Driver would be able to prevent the accident, unless evidence could be introduced that the accident could not have been prevented. Both the Diminished Capabilities and Distracted Drivers create more complex situations. The Diminished

150. *See* Daly v. General Motors Corp., 575 P.2d 1162, 1172 (1978) (noting that without comparative fault, the law "perpetuate[s] a system which . . . places . . . 'upon one party the entire burden of a loss for which two are, by hypothesis, responsible.'" (quoting WILLIAM PROSSER, TORTS § 67, at 433 (4th ed. 1971))).

151. *See supra* Part II.B (discussing the four scenarios used to analyze autonomous cars and tort liability).

152. *See* West v. Caterpillar Tractor Co., 336 So. 2d 80, 92 (Fla. 1976) ("The consumer or user is entitled to believe that the product will do the job for which it was built. On the other hand, the consumer, user, or bystander is required to exercise ordinary due care.").

153. Courts already use a similar comparative fault for other products. *See, e.g.*, Murray v. Fairbanks Morse, 610 F.2d 149, 159–60 (3d Cir. 1979) (electrical control panel).

154. *See supra* Part II.A.2 (discussing the purposes of autonomous vehicles pertaining to people who cannot drive for numerous reasons).

155. *See supra* Part II.B.1 (the Distracted Driver scenario).

Capabilities Driver could potentially stop the accident depending on the condition causing the diminished capabilities and what the Diminished Capabilities Driver was doing at the time. By the very nature of the Diminished Capabilities Driver, the person will probably not have the same reflexes and ability to assume control of the vehicle as an attentive driver. The Distracted Driver's comparative fault would depend on the person's ability to realize an accident was about to occur and the time available to prevent it. If the Distracted Driver has time to prevent the accident and acts negligently in not doing so, the Distracted Driver should assume some responsibility. If the Distracted Driver did not have time to prevent the accident, the manufacturer should be fully liable.

Courts should not allow manufacturers to force everyone to be an attentive driver to protect liability.[156] If courts make everyone be on the lookout at all times, the purposes of the vehicles—providing transportation to those who cannot currently drive and increasing productivity[157]—would be defeated. The big advantage for the consumer in purchasing an autonomous vehicle is to increase productivity. Further, if manufacturers advertise that the vehicles will make people more productive and that the technology is safe, it would not make sense to allow them to assert that a plaintiff was at fault by not paying attention at all times.

Misuse is another defense an autonomous vehicle manufacturer might raise.[158] A manufacturer does not have a duty to protect against all misuses, but it does have "a duty to prevent an injury caused by the foreseeable misuse of its product."[159] The misuse defense is applicable in autonomous vehicle products liability suits where the plaintiff has misused the car in an unforeseeable manner, perhaps by making modifications to the vehicle.[160] However, the driver of an autonomous vehicle is not "misusing" an autonomous vehicle simply by doing other activities while behind the wheel.[161] In other words, because it is foreseeable that users will not pay attention like they do in regular vehicles, a court should reject a manufacturer's argument that being distracted in the vehicle is misuse in the context of misuse defense. Thus, this defense should be reserved to instances similar to when a person modifies the vehicle that causes the technology to malfunction.

The state-of-the-art defense will often be a powerful block to design

156. A manufacturer will presumably give instructions and warnings that the driver is required to pay attention to the road at all times.

157. *See supra* Part II.A.2.

158. *See, e.g.*, General Motors Corp. v. Hopkins, 548 S.W.2d 344, 349 (Tex. 1977) ("We cannot charge the manufacturer of a knife when it is used as a toothpick and the user complains because the sharp edge cuts.").

159. Jurado v. Western Gear Works, 619 A.2d 1312, 1318 (N.J. 1993).

160. *See, e.g.*, Cox v. General Motors Corp., 514 S.W.2d 197, 200 (Ky. 1974) (explaining that misuse as a matter of law is established when an owner modifies his or her vehicle by installing wider and larger wheels than the vehicle was designed to support).

161. *General Motors Corp.*, 548 S.W.2d at 344 (referring to manufacturers' duty to protect against foreseeable "misuses" of the product; a driver not paying one hundred percent attention to the road during autonomous mode would be as foreseeable).

defect and warning defect claims.[162] For warning defects, courts look at what the manufacturer could have reasonably foreseen based on current technology and scientific knowledge at the time of production.[163] For design defects, state-of-the-art defenses "involve the feasibility of adopting curative design measures to reduce or eliminate a risk of which the manufacturer is aware."[164] Although a manufacturer may be aware of a danger, current technological and scientific limits may make the risk unavoidable or protecting against the risk financially unfeasible to research.[165] This defense will be applicable in suits involving autonomous vehicles much like it is applicable in suits involving traditional vehicles, but it does not implicate any of the four scenarios because it is based on the technological advances of autonomous vehicles. A plaintiff can always argue that better technology would have prevented the accident, but the manufacturer may be applying the latest technology at the time such that there may well be no reasonable design alternative. 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.

While not all jurisdictions recognize assumption of risk as a defense,[166] it will play a role in autonomous vehicle products liability litigation in those jurisdictions that do recognize it.[167] The defense asserts that a "user has fully consented to incur a risk which he or she fully comprehends."[168] There are two elements: "(1) [T]he plaintiff must know and understand the risk; and . . . (2) the plaintiff's choice to encounter it must be free and voluntary."[169] The knowledge and understanding element requires a subjective look into the plaintiff's state of mind to show that the plaintiff knew the risks; thus, this defense does not take an objective look at what a reasonable plaintiff would know.[170] Thus, to avail themselves of an assumption of risk defense, autonomous vehicle manufacturers will need to disclose the potential risks of autonomous vehicles to each consumer.[171] The free and voluntary element requires that the "plaintiff ma[de] a true and meaningful *choice* to engage a particular risk, presumably to advance an interest (even mere convenience) that the plaintiff considers more valuable than avoidance of the risk."[172]

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162. OWEN, *supra* note 97, § 10.4, at 733.

163. *See, e.g.*, Geressy v. Digital Equip. Corp., 980 F. Supp. 640, 649 (E.D.N.Y. 1997) (elaborating upon a manufacturer's duty to warn based on its knowledge of foreseeable risk).

164. Gary C. Robb, *A Practical Approach to Use of State of the Art Evidence in Strict Products Liability Cases*, 77 NW. U. L. REV. 1, 22–25 (1982).

165. *Id.*

166. Marchant & Lindor, *supra* note 33, at 1336.

167. *E.g.*, Berg v. Sukup Mfg. Co., 355 N.W.2d 833, 835 (S.D. 1984).

168. David G. Owen, *Products Liability: User Misconduct Defenses*, 52 S.C. L. REV. 1, 24 (2000) (citing Rahmig v. Mosley Mach. Co., 412 N.W.2d 56, 74 (Neb. 1987)).

169. *Id.* at 25.

170. *Id.* at 29.

171. Marchant & Lindor, *supra* note 33, at 1336 ("[F]or such a defense to apply to autonomous vehicles, the manufacturer would have to fully disclose the potential risks of the vehicle, including the likely failure modes and some approximate sense of their probability.").

172. Owen, *supra* note 168, at 31.

Applying this defense to autonomous vehicles, and in particular to the four aforementioned scenarios,[173] shows its relevance to this new technology.[174] For instance, a manufacturer could warn that the user should be in control of the vehicle in snowy conditions.[175] A manufacturer could give clear warnings in the instruction manual or in the vehicle and perhaps have the car communicate directly to the operator that it is snowing; thus, the user will knowingly assume the risk of the vehicle's inability to drive safely in snow. Assume for the sake of discussion that the user did not know, nor had any reason to suspect that it would begin snowing when he or she begins the trip. During the trip, the vehicle tells the driver that he or she needs to take control of the vehicle because it is beginning to snow.

Here, which driver[176] is in control will limit a manufacturer's ability to successfully assert this defense. The Disabled Driver could not be said to have assumed the risk—even if the vehicle told them it was snowing—because the person would not be making a free and voluntary decision to encounter the risk since the Disabled Driver cannot safely assume control of the vehicle. The Diminished Capabilities Driver—depending on the condition of the driver[177]—could be said to have assumed the risk, but the Diminished Capabilities Driver was relying on the vehicle to drive because he or she may not be able to drive well in snow, making it harder to say that the person freely and voluntarily assumed the risk of letting the autonomous technology continue driving. The Distracted Driver could be said to have assumed the risk if the person was warned that it was snowing at that time.[178] This is a just and fair result because

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173. *See supra* Part II.B.

174. Google's user interface patent lists many different circumstances where the autonomous technology may struggle:

> Once the control computer has been engaged, it must determine whether it may competently control aspects of the vehicle. For example, computer 110 may not be able to control aspects of vehicle 101 safely if vehicle 101 is at a particular location which computer 110 is unable to identify based on the geographic location of vehicle 101, if vehicle 101 is at a particular location which is not sufficiently defined or described by detailed map 136, or if computer 110 detects a large number of obstacles in the vicinity of vehicle 101.

See User Interface for Displaying Internal State of Autonomous Driving Sys., U.S. Patent No. 8,260,482 (filed July 8, 2010). Since there are many situations where the autonomous vehicle will not safely operate, if the user does not take control of the vehicle and has been adequately warned about those situations, the assumption of risk defense will become relevant for a subsequent accident.

175. *See* Marchant & Lindor, *supra* note 33, at 1327 (mentioning the possibility that a manufacturer may include in the manual instructions that the owner should not use the car under certain weather conditions).

176. *See supra* Part II.B (describing four types of drivers).

177. The driver may be intoxicated or the driver could be a minor. *See supra* Part II.B.2. If the driver is intoxicated, manufacturers may argue that he/she assumed the risk of an accident. *See* OWEN, *supra* note 97, § 17.5, at 1161. This defense will fail if the "driver does not know of and voluntarily encounters a particular defect." *See id.*; *see also* Mercurio v. Nissan Motor Corp., 81 F. Supp. 2d 859, 861–62 (N.D. Ohio 2000) (denying use of the assumption of risk defense because there was no evidence that the plaintiff was aware of the exact problem that he alleged was defective). Thus, an autonomous vehicle manufacturer would need to prove—to use the assumption of risk defense—that the plaintiff knew of, for instance, the defective algorithm; risk of an accident alone is not enough. *See Mercurio*, 81 F. Supp. 2d at 861–62 ("The dangerous condition for which Plaintiff seeks recovery is the alleged uncrashworthiness of the Nissan Altima—not the risk of an accident generally.").

178. Here, the Distracted Driver may be reading a book and not paying attention to the road at all. If that is the case, the Distracted Driver may not know that the weather condition changed. Without the vehicle warning the driver of the weather condition change, it cannot be said that the Distracted Driver assumed the

the Distracted Driver can safely operate the vehicle, but the person decides to partake in another activity.[179] If the vehicle encounters a situation where it cannot safely drive and the person knows that it cannot safely drive, allowing the autonomous technology to continue driving is voluntarily encountering a risk. The Attentive Driver, like the Distracted Driver, would be said to have assumed the risk of the vehicle driving itself through the snow. The Attentive Driver would know that the weather condition changed and knowingly and voluntarily made the decision to allow the vehicle to continue driving itself rather than making the safe decision to turn off the autonomous mode. Based on this illustration, courts should use the assumption of risk defense to help protect manufacturers from liability where a driver knowingly and voluntarily lets the autonomous technology continue driving, even when it cannot safely do so.

IV. SHORTCOMINGS IN THE ABILITY OF TRADITIONAL PRODUCTS LIABILITY DOCTRINE TO HANDLE CLAIMS INVOLVING AUTONOMOUS VEHICLES

Based on the foregoing, current products liability law would struggle with the introduction of autonomous vehicles. Products liability law needs to accommodate the introduction of autonomous vehicles into the marketplace[180] while still assigning liability for accidents to the proper party, which will often be the party in control of the vehicle at the time the accident occurs. The proper party will sometimes depend on what type of individual is driving the vehicle.[181]

Autonomous technology manufacturers should be liable for most accidents caused when the vehicle is in autonomous mode.[182] When an accident occurs in autonomous mode, it is probably the technology manufacturer's fault because the technology itself was operating the vehicle, not the traditional driver.[183] As discussed below, there are circumstances when a manufacturer should not be liable or should have its liability reduced.

The primary purpose of products liability is to ensure that manufacturers put reasonably safe products on the market by holding them liable for harm caused by defective products they place into the marketplace.[184] The

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risk of having the autonomous vehicle drive in a condition that it cannot safely navigate.

179. *See supra* Part II.B.1 (discussing the Distracted Driver who ignores the warning to take back control).

180. As stated in Part I, the introduction of the autonomous car will increase highway safety. By having huge liability concerns, the innovation could be deterred, and society would lose the benefits of the autonomous vehicles. *See* M. Ryan Calo, *Open Robotics*, 70 MD. L. REV. 101, 130 (2011) (stating that huge liability concerns "could act as a significant disincentive to investments").

181. This Article uses four scenarios from Part II.B to explore this liability scheme in more detail.

182. This should be the manufacturer of the autonomous technology, not the vehicle manufacturer. *Cf.* Marchant & Lindor, *supra* note 33, at 1339 (arguing that the vehicle manufacturer is likely to be liable for accidents caused).

183. An obvious example of the technology not causing the accident would be an accident caused by another vehicle.

184. *See, e.g.*, Greenman v. Yuba Power Prods., Inc., 377 P.2d 897, 901 (Cal. 1963) ("The purpose of [products] liability is to insure that the costs of injuries resulting from defective products are borne by the manufacturer that put such products on the market rather than by the injured persons who are powerless to

manufacturer writes and controls the algorithm for the autonomous technology.[185] Holding manufacturers liable would, thus, ensure that they are constantly improving and updating the algorithm, further increasing autonomous vehicle safety. Otherwise, the manufacturer would not have a driving force behind updating the algorithm. As stated in the risk-utility discussion,[186] a plaintiff could argue that the algorithm should have been updated to fix the error, but that would be hard and costly for a plaintiff to prove when taking expert testimony and the complexity of the lawsuit into account.[187] Therefore, the easiest method for courts to ensure autonomous vehicle safety would be to hold the manufacturer liable for accidents caused in autonomous mode.

To create an incentive for increased safety and to ensure that the party responsible for the accident bears the liability, the autonomous technology manufacturer should be liable rather than the automobile producer. Because the autonomous technology will most likely be the cause of an accident that occurs in autonomous mode, it is more practical to hold the autonomous technology manufacturer liable. The autonomous technology manufacturer is in the best position to adjust the algorithm and has the most incentive to avoid costs by ensuring that the algorithm is performing properly. Admittedly the vehicle manufacturer—if different than the autonomous technology manufacturer[188]—will also have an incentive to ensure that the vehicles are not causing accidents, but the vehicle manufacturer will not have direct control over the algorithm. Courts and legislatures need to take steps to hold autonomous technology manufacturers liable for when accidents occur. This will create certainty for the marketplace and also allow manufacturers to include projected liability in the price of the technology.

Arguments against holding technology manufacturers liable are increased costs and deterrence of innovation.[189] Admittedly, technology manufacturer liability for accidents caused during autonomous mode will result in additional costs to them, but the manufacturer would be able to spread the costs by incorporating them in the sale price of autonomous technology and vehicles.[190] The manufacturers could then adjust the price of the autonomous vehicles to compensate them for the cost of liability.

An argument against this liability scheme could be that, by holding manufacturers liable, innovation will be deterred.[191] That seems unlikely given

protect themselves.").

185. *See supra* Part II.

186. *See supra* Part III.B.2.b.

187. Graham, *supra* note 33, at 1270.

188. For instance, Google does not intend on producing its own vehicles, but rather it intends to sell its technology to current vehicle manufacturers. *See supra* Part II.A.1.

189. *See* KALRA, ANDERSON & WACHS, *supra* note 33, at 30 (discussing effects of current liability law on the adoption of autonomous vehicle technologies).

190. *See* David G. Owen, *Products Liability: Principles of Justice for the 21st Century*, 11 PACE L. REV. 63, 72 (1990) ("The products liability system . . . does serve as a form of third-party insurance mechanism, in which the manufacturer, at least theoretically, adds a component to each product's price—as a kind of insurance premium—to reflect anticipated future payouts for liability claims.").

191. KALRA, ANDERSON & WACHS, *supra* note 33, at 30.

the popularity of these vehicles.[192] People 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. This is so because the consumer's insurance premiums would decrease since the consumer would no longer be at fault for accidents caused in autonomous mode, presumably there would be fewer accidents when people no longer drive,[193] and the person could become more productive by using an autonomous vehicle.[194] Also, the manufacturer would still be able to defend against claims, much like a traditional driver.[195] In addition, people may actually be deterred from purchasing autonomous vehicles if they do not necessarily trust the vehicle and know that they will be liable for accidents that they did not cause. Thus, the deterrence argument undermines the growing popularity these vehicles have and the fact that consumers are willing to pay more for the increased productivity that these vehicles will provide them. This argument also dismisses the fact that people may hesitate purchasing these vehicles if they bear the liability for accidents caused in autonomous mode.

Because autonomous vehicle manufacturers should be held liable for accidents caused while the vehicle is in autonomous mode, current products liability law will not be able to adequately assess that fault. As stated in Part III,[196] current law is too cost-prohibitive to allow for many of the suits, whereas manufacturers could be liable similar to how traditional car drivers are liable. Thus, courts should remedy some of these problems by altering doctrines when applied to autonomous vehicles. The defenses, on the other hand, are relevant and can be applied to autonomous vehicles.

The malfunction doctrine[197] can be used, but courts should not always require plaintiffs to introduce expert witnesses to prove the case because it could be cost prohibitive. Courts should put the burden on manufacturers to inspect the vehicle for alterations since manufacturers will be able to best decide what type of vehicle alterations could have affected the proper use of autonomous technology.[198] It would also be too cost prohibitive to make plaintiffs introduce expert testimony on every action to show that there was no other cause of the accident.[199] The other doctrine that could be used to hold manufacturers liable is the consumer expectations test.[200] The major issue is

192. *See supra* note 11 and accompanying text.

193. *See supra* notes 22–27 and accompanying text; *see also* Garza, *supra* note 33, at 608 (discussing how the incorporation of safety devices reduces insurance premiums).

194. *See, e.g.*, Masnick, *supra* note 63 (speculating that autonomous vehicles would allow for safe texting while driving).

195. Here, the manufacturer would argue that it was the other car's fault or, if the car was human-operated, that it was the driver's fault.

196. *See supra* Part III.B.4.

197. Owen, *supra* note 75, at 871–74.

198. Plaintiffs should be able to contest the autonomous technology manufacturer's assessment by introducing their own witnesses to prove that any alteration did not cause the accident.

199. *See* Garza, *supra* note 33, at 62 ("Because of the extraordinary cost of experts in products liability litigation, many plaintiffs are turned away because, even if they were to recover, the prospective award would not cover the expense of litigating the claim.").

200. *See, e.g.*, Vincer v. Esther Williams All-Aluminum Swimming Pool Co., 230 N.W.2d 794, 798 (Wis. 1975) ("[T]he test in Wisconsin of whether a product contains an unreasonably dangerous defect

that the majority of the states reject the consumer expectations test,[201] so this analysis will focus primarily on using the malfunction doctrine.

To start with the simplest scenario of a car accident, the car owner should be liable when he or she is driving the car and the vehicle is not in autonomous mode. The accident should be assessed to the user like a traditional car accident. Proof that the driver was operating the vehicle for a time period prior to the accident[202] should be an absolute defense for the manufacturer against the Distracted Driver, the Diminished Capabilities Driver, and the Attentive Driver. With the Disabled Driver, Google and car manufacturers may need to install technology that prohibits the user from taking control of the car.[203] By holding the manufacturer liable for accidents caused in autonomous mode, the manufacturer will be incentivized to put in a mechanism that alerts Google when the driver has taken control of the vehicle. The plaintiff can introduce evidence that the vehicle malfunctioned out of autonomous driving and that it was not caused by the driver's decision to assume control of the car to help rebut the assignment of liability.[204]

Returning to the main focus of this Article, the assignment of liability is more complicated for accidents caused in autonomous mode. The manufacturer should be at least partially liable for accidents caused while the vehicle is in autonomous mode. Liability should adjust based on which of the scenarios[205] applies. Courts should use a type of comparative fault based on which of the four types of drivers is behind the wheel. This type of comparative fault should be based on whether the operator was negligent in failing to take control of the malfunctioning vehicle and prevent the accident.[206] This requires the parties to figure out what the defendant was doing at the time of the accident.[207]

With the Disabled Driver, the manufacturer should assume all of the liability.[208] Every malfunction will probably result in an accident because the Disabled Driver cannot assume control of the vehicle—the Disabled Driver

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depends upon the reasonable expectations of the ordinary consumer concerning the characteristics of this type of product.").

201. Owen, *supra* note 77, at 301–02.

202. This should not apply when the driver takes control immediately before the accident, unless the manufacturer could prove that the driver took control and was negligent, because presumably the driver took control trying to prevent the accident. It would be entirely unjust to hold him or her liable for trying to mitigate harm.

203. Legislatures should require this upon granting disabled people the opportunity to purchase these vehicles.

204. An example of this situation would be if the autonomous technology was trying to override the driver's ability to safely operate the vehicle.

205. *See supra* Part II.B.

206. *See supra* Part III.B.5 (discussing how liability should be apportioned when drivers fail to exercise ordinary care during a malfunction).

207. This could be done through interrogatories and witness testimony.

208. This Article does not discuss the various protections that manufacturers could get from legislatures for this type of accident. Without belaboring the obvious, a manufacturer would not have an incentive to allow disabled people to use the vehicle if there would be runaway liability when an accident occurs. Because of the greatly improved benefits that autonomous vehicles could provide disabled people, it would not be surprising to see some sort of liability protection for manufacturers when a disabled person uses the vehicle. This is, however, beyond the scope of this Article.

should not be able to assume control of the vehicle[209]—and is relying fully on the ability of the autonomous car to drive itself. When an accident occurs in this situation, the court should hold the manufacturer liable for the injuries caused. Reexamining Christie's situation from Part II, it becomes evident that the manufacturer should be liable. Christie was blind, and when the vehicle malfunctioned, she could not safely take control of the vehicle. The manufacturer should be allowed to present defenses. A manufacturer should be able to present evidence that the person with disabilities had the vehicle altered, which caused the technology to fail. In addition, if a manufacturer warns about the autonomous vehicle's inability to drive safely—for instance, in snow and the Disabled Driver knows it is snowing before leaving—the manufacturer should be able to assert an assumption-of-risk defense.[210]

On the opposite side of the spectrum is the Attentive Driver, who should assume all the liability for the accident. Here, when the accident occurs, the Attentive Driver will know and be able to assume control of the vehicle to prevent the accident. Tucker, in Part II, decided to watch as the vehicle malfunctioned, even though he could have taken control of the vehicle to prevent the accident. He did not, and he should bear the responsibility of the accident. The driver should be allowed to rebut this presumption by introducing evidence that the technology allowing for user control malfunctioned. If proven, liability should shift to the manufacturer as a manufacturing defect.[211] The user should also be allowed to introduce expert testimony that, because of the circumstances when the technology malfunctioned, the driver could not have prevented the accident. This could be done by showing that, for instance, the car was surrounded by other vehicles when it malfunctioned and in a split second hit another vehicle in the lane next to it. In this situation, there would be little to no time at all to prevent the accident. Thus, liability should properly shift back to the manufacturer. So in Tucker's situation, Tucker could have introduced evidence that even if he had attempted to take control of the vehicle to prevent the accident, he could not have because the vehicle was in his blind spot and there was no time to prevent the accident. If such evidence were presented, liability should shift back to the manufacturer.

The Diminished Capabilities Driver and the Distracted Driver scenarios present tougher challenges. The Diminished Capabilities Driver should be partially liable for accidents depending on the person's circumstances and the circumstances of the accident. The Diminished Capabilities Driver relies on the ability of the autonomous vehicle. Although this person could take over the vehicle, the Diminished Capabilities Driver would probably not be driving

209. Manufacturers should have to make a special edition of these vehicles for persons with disabilities or the manufacturer should disable the overrides for the driver to take control of the vehicle.

210. But this should be distinguished from a situation where the Disabled Driver had no idea that it was going to snow. *See supra* Part III.B.5.

211. Here, the plaintiff would assert a manufacturing defect that the autonomous technology in the vehicle did not meet the manufacturer's specifications. *See supra* Part III.B.1 for more information concerning this claim.

unless the vehicle drove itself. Courts need to carve out different levels of comparative fault depending on the circumstances of the driver and the accident. For instance, if the driver is a minor who is not allowed to legally drive—and does not presumably know how to drive safely—liability should fall on the manufacturer. With someone like Richard from Part II,[212] liability would depend on Richard's ability to prevent the accident. In that example, Richard could not prevent it due to his reflexes, and he should not be liable. There is no evidence that he was negligent, since he tried to prevent the accident to the best of his abilities. Therefore, the manufacturer should bear responsibility for the accident. As stated above for the Attentive Driver, there are situations in which the manufacturer should assume all liability for the accident.

More so than the Diminished Capabilities Driver, the Distracted Driver should have more comparative fault assessed to him or her. The Distracted Driver, unlike the Diminished Capabilities Driver, has no impediments slowing down his or her reflexes.[213] The vehicle would need to warn the Distracted Driver that the autonomous technology is failing. Revisiting Sarah's situation from Part II, the manufacturer should be liable because the vehicle did not warn her that it was malfunctioning. Once the Distracted Driver has been warned of the technology malfunction, the Distracted Driver should be partially liable if he or she could have prevented the accident but was negligent in trying to do so. This would be based on the facts of each case. If the driver could not prevent the accident, the driver should not be liable at all. But if, for instance, the person was reading a book and the vehicle informed the individual that the technology was malfunctioning and the vehicle is the only car on the road, the Distracted Driver may have time to prevent a subsequent off-road excursion. Therefore, the Distracted Driver should be liable if the accident could have been prevented.

This liability scheme could be created judicially or, more preferably, legislatively.[214] Enacting this liability scheme legislatively would remove uncertainty for manufacturers concerning the tort liability of autonomous vehicles.[215] If it is done judicially, manufacturers will not receive the same certainty as to which liability scheme they will face in a particular jurisdiction if—and when—an accident occurs.[216] Legislatively, this scheme could—and should—be adopted when a state passes an autonomous vehicle law because it will provide more certainty to autonomous technology manufacturers when they are researching and developing this technology, which will make them

212. *See supra* Part II.B.2 (discussing a scenario of an elderly driver).

213. *See supra* Part II.B.1 (discussing the Distracted Driver scenario).

214. This is especially preferable for jurisdictions that do not recognize the malfunction doctrine or the consumer expectations test for design defects, because those states cannot judicially handle autonomous vehicles.

215. *See* Sanders, *supra* note 144, at 721 ("[D]efense groups, from physicians to pharmaceutical companies to automobile manufacturers, repeatedly turn to legislatures seeking relief from what they perceive to be the costs and uncertainties of the tort system.").

216. *Id.*

more willing and eager to continue innovating.[217]

By enacting a statute, a state legislature will also help courts avoid the problem of trying to apply products liability law to autonomous cars.[218] If legislatures do not act, state courts can apply similar principals under existing negligence and products liability law by using a variation of the malfunction doctrine and consumer expectations test as stated above.[219]

V. CONCLUSION

Autonomous vehicles have the potential to revolutionize travel and highway safety. Within decades, autonomous vehicles will be widespread.[220] The benefits to the marketplace, safety, productivity, and efficiency that autonomous vehicles will bring have the potential to be enormous. This Article has argued that current products liability law will not be able to adequately assess responsibility to the party that caused the accident. This Article proposed a liability scheme that assesses fault based on the cause of autonomous vehicle accidents. This liability system should be adopted legislatively to provide autonomous technology manufacturers with certainty and to help courts assess liability appropriately. Because autonomous vehicles will be on the market within a decade and the cars will inevitably malfunction,[221] legislatures and courts need to start developing liability schemes to ensure that the party who caused the accident bears the responsibility.

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217. Henshon & Waterman, *supra* note 36, at 16 ("Resolving the uncertainty of liability may allow more technologies to come to market faster."); Tyler Cowen, *Can I See Your License, Registration and C.P.U?*, N.Y. TIMES (May 28, 2011), http://www.nytimes.com/2011/05/29/business/economy/29view.html?_r=0 (discussing the problems with stifling innovation).

218. As shown in Part III, this may be difficult under the current products liability scheme.

219. *See* Owen, *supra* note 77, at 299 (discussing the tests that courts use to judge the adequacy of a product's design).

220. CASenDems, *Padilla – SB 1298 Autonomous Vehicle Standards Press Conference*, YOUTUBE (Mar. 1, 2012), http://www.youtube.com/watch?v=U__XmypoGIY.

221. John Markoff, *Collision in the Making Between Self-Driving Cars and How the World Works*, N.Y. TIMES (Jan. 23, 2012), http://www.nytimes.com/2012/01/24/technology/googles-autonomous-vehicles-draw-skepticism-at-legal-symposium.html?_r=0.