PAVING THE ROAD AHEAD: AUTONOMOUS VEHICLES, PRODUCTS LIABILITY, AND THE NEED FOR A NEW APPROACH

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I. INTRODUCTION

Cars that drive themselves may seem about as realistic as Marty McFly's DeLorean in *Back to the Future*, but this is far from the case. Autonomous technology is available and in use in many new vehicle models.[1] In fact, in 2010 Google announced that the company had successfully built cars capable of driving themselves ("autonomous cars").[2] Even more amazing, at its 2010 announcement, Google also revealed its driverless cars (customized Toyota Prius models) had logged over 100,000 miles on public roads.[3] As of early 2013, Google's several autonomous vehicles have traveled over 300,000 miles, and have yet to cause a traffic accident.[4]

Autonomous vehicles are not merely a Google pet project; many automobile manufacturers have been implementing varying degrees of autonomous technology for years.[5] More recently, luxury automakers Lexus and Audi both unveiled their own versions of fully autonomous cars.[6] One of the most fascinating aspects of the growth in autonomous vehicle technology is the way that it could dramatically improve the safety of automobile travel.[7] Google's self-purported goal is to

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[1] Kurt Ernst, *Audi Becomes First Automaker Issued Nevada Autonomous Vehicle License*, FOXNEWS.COM (Jan. 8, 2013), http://www.foxnews.com/leisure/2013/01/08/audi-becomes-first-automaker-issued-nevada-autonomous-vehicle-license/.

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

[3] *Id.*

[4] Heather Kelly, *Self-Driving Cars Now Legal in California*, CNN (Oct 30, 2012, 12:30 PM), http://www.cnn.com/2012/09/25/tech/innovation/self-driving-car-california/index.html.

[5] *See, e.g.*, Phillip Reed, *Extra Eyes on the Road*, EDMUNDS.COM (May 5, 2009), http://www.edmunds.com/car-safety/autovue-lane-departure-warning-system.html; *Active Cruise Control*, BMW http://www.bmw.com/com/en/insights/technology/technology_guide/articles/active_cruise_control.html (last visited Feb. 5, 2013).

[6] Mark Hachman, *CES 2013: Audi Demonstrates Its Self-Driving Car*, POPSCI (Jan. 9, 2013, 6:00 PM), http://www.popsci.com/cars/article/2013-01/ces-2013-audi-demonstrates-its-self-driving-car; Tiffany Hsu, *CES: Audi, Lexus Explore Self-Driving Cars*, L.A. TIMES (Jan. 8, 2013, 2:24 PM), http://www.latimes.com/business/autos/la-fi-hy-autos-ces-lexus-audi-driverless-cars-20130109,0,1711753.story.

[7] Early estimates of simpler adaptive cruise control systems installed on Volvo models noted a 27% decrease in claims. Peter Valdes-Dapena, *Why Google's Self-Driving Car May Save Lives*, CNN MONEY (May 10, 2012, 5:50 AM), http://www.money.cnn.com/2012/05/10/autos/google-driverless-cars-safety/index.htm; *see also* Viknesh Vijayenthiran,

eliminate all traffic fatalities. Regardless of whether Google ever reaches that milestone, it is clear that autonomous vehicles can improve the landscape of transportation safety and revolutionize how we travel.[8]

The importance of autonomous vehicles, and largely the purpose for writing this Note, is that they have the potential to drastically reduce the numerous injuries and fatalities caused by automobile accidents.[9] In 2010 there were over five million traffic accidents in the United States.[10] Those accidents resulted in nearly 1.5 million injuries and over thirty-thousand fatalities.[11] While traffic accidents can be caused by a variety of factors, human error is often the root cause. For example, of the thirty-thousand fatalities in 2010, about one-third were caused by an individual driving with a blood alcohol level of over 0.08%.[12] Unfortunately, driving under the influence is only the tip of the iceberg in terms of human error in automobile accidents. It is rare to find an individual who has not engaged in at least some form of distracted driving, whether it is talking on a cell phone, texting while driving, or checking email. Even drowsy driving causes thousands of accidents each year.[13] Autonomous vehicles have the potential to drastically reduce, and possibly eliminate altogether traffic accidents that are caused by human error.[14]

The advantages of autonomous vehicles are not limited to safety. For example, autonomous vehicles are likely more efficient drivers than their human counterparts.[15] Ideally, a standard autonomous vehicle will likely not accelerate out of one intersection and then slam on the brakes at the next. Accordingly, as the number of autonomous vehicles on the road increases, emissions from automobiles

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Study Finds Early Autonomous Car Tech Reducing Crashes, FOXNEWS.COM (July 16, 2012), http://www.foxnews.com/leisure/2012/07/16/study-finds-early-autonomous-car-tech-already-reducing-crashes/.

[8] *See* David Coldewey, *Robot Cars Could Increase Highway Efficiency 273 Percent: Study*, NBC NEWS, http://www.nbcnews.com/technology/futureoftech/robot-cars-could-increase-highway-efficiency-273-percent-study-978760 (last visited Oct. 26, 2012) (asserting that autonomous vehicles working together can make highways more efficient and safe); Vijayenthiran, *supra* note 7 (explaining how autonomous vehicles are already preventing crashes).

[9] *See generally* Valdes-Dapena, *supra* note 7 (noting the potential safety benefits of autonomous vehicles).

[10] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., DOT HS NO. 811 522, TRAFFIC SAFETY FACTS: 2010 VEHICLE CRASHES: OVERVIEW 3 (rev. 2012), *available at* http://www-nrd.nhtsa.dot.gov/Pubs/811552.pdf.

[11] *Id.*

[12] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., DOT HS No. 811 606, TRAFFIC SAFETY FACTS 2010 DATA: ALCOHOL-IMPAIRED DRIVING 1 (2012), *available at* http://www-nrd.nhtsa.dot.gov/Pubs/811606.pdf.

[13] Nat'l Sleep Found., *Facts and Stats*, DROWSYDRIVING.ORG, http://www.drowsydriving.org/about/facts-and-stats/ (last visited Oct. 26, 2012).

[14] *See generally* Valdes-Dapena, *supra* note 7.

[15] *See* NIDHI KALRA ET AL., RAND CORP., LIABILITY AND REGULATION OF AUTONOMOUS VEHICLE TECHNOLOGIES 1 (2009).

could drop dramatically.[16] In addition to the benefits to the physical environment, autonomous vehicles could also have significant social impact. One of the most profound potential advantages of autonomous vehicles is their accessibility to disabled individuals for whom conventional driving is not possible. In particular, those with visual disabilities could experience unprecedented mobility and freedom with the advent of autonomous vehicles.

With the potential benefits of autonomous vehicles, it is no surprise that some state legislatures have been spurred into action by the rapid progression of the technology. For instance, on September 25, 2012, California followed Nevada's and Florida's leads and passed a law to allow autonomous cars on California's public roadways.[17]

California's new law expressly authorizes autonomous vehicles to operate on California roads, and also directs the California Department of Motor Vehicles to draft regulations for the operation of autonomous vehicles.[18] While California, Nevada, and Florida have taken the first important step towards addressing autonomous vehicles, all of the legislation is very basic, and none of it begins to address the potential liability issues with autonomous vehicles.[19]

With the implementation of such groundbreaking technology, the automobile industry and transportation as we know it are likely to see significant changes in the coming decades.[20] To address these changes, the law needs to be ready to adapt. Technology advances at a break-neck pace with new inventions and advances emerging constantly. The law, sometimes rightly so, does not progress at

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[16] *Id.*

[17] *See* Richard Read, *Google's Autonomous Car: Now Street-Legal in California*, CAR CONNECTION (Sept. 26, 2012), http://www.thecarconnection.com/news/1079422_googles-autonomous-car-now-street-legal-in-california.

[18] Office of Governor Edmund G. Brown Jr., *Governor Brown Signs Bill to Create Safety Standards for Self-Driving Cars*, CA.GOV (Sept. 25, 2012), http://www.gov.ca.gov/news.php?id=17752.

[19] *See generally* Act of Sept. 25, 2012, 2012 Cal. Stat. ch. 570 (codified at CAL. VEH. CODE § 38750 (West Supp. 2013)); Act of Apr. 13, 2012, 2012 Fla. Laws. ch. 2012-111 (codified at FLA. STAT. ANN. §§ 316.003, 316.85, 319.145 (West Supp. 2013)); Act of June 16, 2011, 2011 Nev. Stat. 2873 (codified at NEV. REV. STAT. ANN. ch. 482A (LexisNexis Supp. 2011)).

[20] *See, e.g.*, Jeff Cobb, *By 2040 Autonomous Cars Forecast to Comprise 75 Percent of All Vehicles*, HYBRIDCARS (Sept. 26, 2012), http://www.hybridcars.com/news/2040-autonomous-cars-forecast-comprise-75-percent-all-vehicles-52502.html; *GM: Self-Driving Vehicles Could Be Ready by End of Decade*, GM NEWS (Oct. 16, 2011), http://www.media.gm.com/content/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2011/Oct/1016_autonomous.html; Doug Newcomb, *You Won't Need a Driver's License by 2040*, CNN TECH (Sept. 18, 2012, 4:39 PM), http://www.cnn.com/2012/09/18/tech/innovation/ieee-2040-cars/index.html; *Nissan Car Drives and Parks Itself at Ceatec*, BBC NEWS (Oct. 4, 2012), http://www.bbc.co.uk/news/technology-19829906; Donna Tam, *Google's Sergey Brin: You'll Ride in Robot Cars Within 5 Years*, CNET (Sept. 25, 2012, 2:01 PM), http://news.cnet.com/8301-11386_3-57520188-76/googles-sergey-brin-youll-ride-in-robot-cars-within-5-years/.

such a fast clip. While law and technology may evolve to different degrees, they are interconnected in a variety of ways. Technology has significantly changed the substance and practice of the law. Advances in DNA matching and ballistics are just a handful of technological advances that have changed the law. Similarly, changes in the law can have significant impacts on the development of technology. If a law disfavors a particular product, either because it is unsafe or for some other reason, it can often cripple the producer of said product. In this manner, the legal landscape can drastically affect the way in which new technology influences society.[21]

The implementation of autonomous vehicles is a perfect example of the relationship between the law and innovative technology. The concept of cars that drive themselves raises a whole host of potential legal concerns. While there are countless criminal law questions that arise with such vehicles, this Note will focus on what may become the most significant legal hurdle for the implementation of autonomous vehicles: products liability. To determine liability in a traditional accident, conventional theories of liability primarily apportion liability based on manual error by the driver. Accordingly, automobile manufacturers are not held liable for the vast majority of the traffic accidents that occur.[22] While manufacturer liability is still present in cases where a failure of the vehicle causes an accident or enhances the damage, the majority of the liability in traffic accidents remains with the driver. Traditional liability becomes exponentially more confusing and difficult to apply, however, when the "driver" of a vehicle is not a human, but rather a complex system of interconnected machinery. The question becomes: Who is liable when autonomous cars eventually crash?

The ultimate goal of this Note is to provide the best solution to this question. To most effectively answer the question of liability, this Note is divided into several distinct sections. Part II provides a basic description of how autonomous vehicles function so as to illustrate the complexity of the legal questions these vehicles pose. Next, an overview of products liability law is presented to detail the relevant components of the current state of the law. Part III provides an application of current products liability law to potential autonomous vehicle claims. Such an application will showcase how ill-prepared products liability law is and the potential consequences to both manufacturers and potential plaintiffs. To address the concerns with current products liability law, Part IV suggests a no-fault compensation system that can promote the interests of manufacturers and plaintiffs alike.

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[21] *See* Murray Mackay, *Liability, Safety, and Innovation in the Automotive Industry*, *in* THE LIABILITY MAZE: THE IMPACT OF LIABILITY LAW ON SAFETY AND INNOVATION 191, 214–15 (Peter W. Huber & Robert E. Litan eds., 1991).

[22] *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 12 (detailing traffic accident causes, notably those accidents that were caused by alcohol-impaired drivers).

II. BACKGROUND

Varying degrees of autonomous technology have been present in the automobile industry for decades.[23] Depending on how one defines "autonomous," traditional devices such as air bags and seatbelts can be qualified as autonomous technology. In this basic sense, items that do not require human engagement to act are the basic examples of autonomous technology.[24] In relation to autonomous vehicles, however, the true definition of "autonomous" still varies. For the purposes of this Note, autonomous vehicle technology is defined according to a more accepted modern definition: "technologies and developments that enable a vehicle to assist, make decisions for, and, ultimately, replace a human driver."[25]

The following sections provide a foundation that is necessary to understand the unique legal concepts that autonomous vehicles raise. Section A provides a high-level summary of how autonomous vehicles function and also highlights the development of the technology through the example of Google's autonomous vehicles. Section B goes on to provide an overview of current products liability law that would apply to autonomous vehicles—namely, manufacturing and design defect claims.

A. Autonomous Safety Technology and the Development of the Google Car

For driverless cars to function, multiple components of autonomous technology have to work in sync to direct the vehicle. "Autonomous vehicles," however, is a term that is commonly used to refer to very different technologies. For example, two of the more common and currently used examples of autonomous vehicle technology are Adaptive Cruise Control (ACC) and Lane Departure Warning Systems (LDWS).[26] Both automated features assist the human driver and reduce the potential for human error.[27] ACC is similar to traditional cruise control, except that sensors and radar work in correlation to automatically adjust the speed of the vehicle based on the activity of the surrounding traffic without any driver input.[28] Notably though, for ACC to begin acting it must be enabled by the driver and can likewise be disabled at the driver's request.[29] LDWS

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[23] *See* Daniel Bartz, *Autonomous Cars Will Make Us Safer*, WIRED (Nov. 16, 2009, 8:00 AM), http://www.wired.com/autopia/2009/11/autonomous-cars (discussing early predictions and hopes of autonomous technology as well as a General Motors group that attempted to develop automated highway technology in 1950).

[24] *See* NIDHI KALRA ET AL., *supra* note 15, at 3.

[25] *Id.* at 1.

[26] Larry Carley, *Active Safety Technology: Adaptive Cruise Control, Lane Departure Warning & Collision Mitigation Braking*, IMPORTCAR (June 16, 2009), http://www.import-car.com/Article/58867/active_safety_technology_adaptive_cruise_control_lane_departure_warning__collision_mitigation_ braking.aspx.

[27] *Id.*

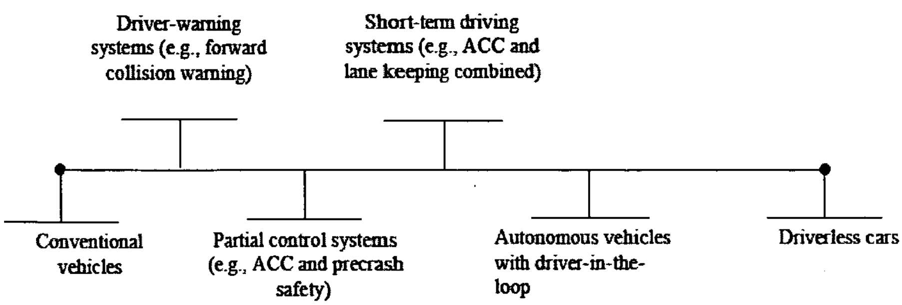
[28] *Id.*

[29] *Id.*

use cameras or sensors that monitor the location of the vehicle with respect to other traffic[30] and alert drivers if they begin drifting out of their lane.[31] LDWS became a priority after a 1999 National Highway Traffic Safety Administration (NHTSA) study noted that 62,000 traffic accidents occurred as a result of drifting.[32] If the system detects drifting or changing lanes without signaling, the system will alert the driver through audial and visual warnings.[33]

While both ACC and LDWS are examples of autonomous vehicle technology, they do not spark the same legal concerns as fully autonomous vehicles because, while ACC and LDWS are autonomous technologies in the sense that they act automatically, they do not take full control of all vehicle functions (notably steering), and they require driver input.[34] As such, they are more aptly characterized as "partial control systems."[35] Partial control systems are certainly examples of autonomous technology, but because of the difference noted above, their presence in a car is insufficient, on its own, to consider the car an autonomous vehicle.

The diagram from the RAND study shown below clarifies the varying degrees of autonomous technology in vehicles. Starting on the left with conventional automobiles, as the diagram moves to the right, the automated systems begin to take more control of the vehicle as human input decreases.[36]



For purposes of consistency, any autonomous vehicle mentioned in this Note refers to "autonomous vehicles with driver-in-the-loop," as referenced in the table. Stated more simply, this means that the vehicle is navigating without human input, but still with a human in the driver seat who can take control if a failure in automation were to occur. The distinction between such an arrangement and a truly driverless car is that in a driverless car, as the name implies, there would be no

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[30] *Id.*

[31] *Id.*

[32] BASAV SEN ET AL., U.S. DEP'T OF TRANSP., DOT HS NO. 809 571, ANALYSIS OF LANE CHANGE CRASHES, at viii (2003), *available at* http://www.nhtsa.gov/DOT/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/2003/DOTHS809571.pdf.

[33] Carley, *supra* note 26.

[34] *Id.*

[35] NIDHI KALRA ET AL., *supra* note 15, at 4–5.

[36] *Id.* at 4.

human participant in the driver seat. While truly driverless cars are an eventual possibility, early legislation shows that the more likely scenario is that there will need to be a licensed human in the vehicle for the purpose of a safety backup.[37]

As noted in the Introduction, there are numerous automakers invested in the development of autonomous vehicles. Google has been at the forefront of the development in the United States, and its history of autonomous vehicle development has been more widely publicized. Thus, this Note will focus on autonomous vehicles as developed by Google. While the technology that powers autonomous vehicles varies among developers, Google's model of autonomous vehicles provides enough of a general representation to address the legal issues presented by autonomous vehicles as a whole.

In traditional vehicles, the human driver handles virtually all of the interaction and response between the vehicle and the surrounding environment. The driver evaluates the surroundings (speed limit signs, lanes, weather, etc.), determines how the vehicle will perform (change lanes, speed up, slow down, etc.), and then ultimately decides how to execute that performance (accelerating through a turn, how far to turn the steering wheel, etc.).[38] Further, the driver must also provide relevant information to the environment, such as waving another vehicle through an intersection or engaging the blinker to signal a turn.[39] In a traditional automobile, the only autonomous response that the car exhibits occurs when the environment impacts the vehicle in some manner (e.g., airbags that deploy upon contact).[40]

For autonomous vehicles to function, different types of advanced technologies, working in concert with each other, perform all of the tasks detailed above.[41] In the case of Google's fleet of autonomous vehicles, the company took conventional Toyota Prius models and equipped them with a variety of advanced equipment that allows the car to execute the functions of a traditional driver.[42] One of the essential components that the autonomous car uses is a rotating Light Detection and Ranging (LiDar) unit on the roof.[43] The LiDar system scans two

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[37] CAL. VEH. CODE § 38750(b)(2) (West Supp. 2013) (effective Jan. 1, 2013) ("The driver shall be seated in the driver's seat, monitoring the safe operation of the autonomous vehicle, and capable of taking over immediate manual control . . . in the event of an . . . emergency."); *see* FLA. STAT. ANN. § 316.85(1) (West Supp. 2013) (effective July 1, 2012) ("A person who possesses a valid driver license may operate an autonomous vehicle in autonomous mode."); NEV. REV. STAT. ANN. § 482A.200 (LexisNexis Supp. 2011) (effective Mar. 1, 2012) (extending to autonomous vehicles the requirement of a driver's license to operate the vehicle).

[38] NIDHI KALRA ET AL., *supra* note 15, at 6.

[39] *Id.*

[40] *Id.*

[41] *Id.*; Thrun, *supra* note 2.

[42] John Markoff, *Google Cars Drive Themselves, in Traffic*, N.Y. TIMES (Oct. 9, 2010), http://www.nytimes.com/2010/10/10/science/10google.html?_r=0.

[43] *See* Travis Deyle, *Velodyne HDL-64E Laser Rangefinder (LIDAR) Pseudo-Disassembled*, HIZOOK (Jan. 4, 2009), http://www.hizook.com/blog/2009/01/04/velodyne-hdl-64e-laser-rangefinder-lidar-pseudo-disassembled.

hundred feet around the vehicle in each direction and creates a type of three-dimensional schematic of the car's surroundings.[44] To locate the vehicle within the environment, the left rear wheel is equipped with a position estimator.[45] The LiDar and position estimator work in conjunction with a mounted video camera and radar sensors to "see" what is going on in the car's environment.[46] This allows the car to respond when it notes identifying features in the surrounding environment, such as traffic lights and pedestrians.[47] The last component is a sophisticated computer located in the back of the vehicle.[48] This device processes all of the real-time data and directs the car as to how it should respond and safely interact with the environment.[49]

In an oversimplified description, the computer acts similarly to a brain as it combines and analyzes the information in order to ultimately direct the actions of the vehicle.[50] The ability to analyze and direct the vehicle is an extremely complicated process that involves complex communication between advanced technology features, an aspect that has significant implications for the legal issues regarding autonomous vehicles.[51] In traditional vehicles, the human driver analyzes the surrounding environment and makes decisions about how to direct the vehicle based on that analysis. In autonomous vehicles, however, the computer makes this "decision" based on data collected by the various other hardware features. This computer-based decisionmaking raises several questions: What happens when this decisionmaking process results in an accident? What if Google's self-driving car swerves into oncoming traffic to avoid a toddler crossing the street?

B. Overview of Current Products Liability Law

In modern products liability cases, there are four primary claims under which a plaintiff may seek remedy from the manufacturer or seller of a product: negligence, breach of warranty, tortious misrepresentation, and strict liability.[52] In any products liability case, a plaintiff must show that (1) the defendant sold a defective product, and (2) the defect was the proximate cause of the plaintiff's injury.[53] While breach of warranty and tortious misrepresentation claims may be

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[44] *Graphic: How Google's Driverless Car Works*, MERCURYNEWS.COM (Sept. 25, 2012, 3:15 PM), http://www.mercurynews.com/business/ci_21627954/graphic-how-google-driverless-car-works-robot-jerry-brown-law.

[45] *Id.*

[46] *Id.*

[47] *Id.*

[48] *See* Erico Guizzo, *How Google's Self-Driving Car Works*, IEEE Spectrum (Oct. 18, 2011, 9:00 GMT), http://www.spectrum.ieee.org/automaton/robotics/artificial-intelligence/how-google-self-driving-car-works.

[49] *See id.*

[50] *See* NIDHI KALRA ET AL., *supra* note 15, at 8.

[51] *Id.*

[52] MICHAEL I. KRAUSS, PRINCIPLES OF PRODUCTS LIABILITY 40 (2011).

[53] DAVID G. OWEN, PRODUCTS LIABILITY LAW 261 (2005).

somewhat interesting when applied to autonomous cars, products liability claims seem to require a more robust discussion. Further, a discussion of strict liability largely parallels suits brought under negligence, and thus a large part of the analysis is similar.[54] Moving to the different claims brought in automobile cases, crashworthiness does not, at first glance, present any uniquely difficult issues. While autonomous technology may modify vehicle design, the doctrine of crashworthiness seems to be equipped to address any new issues. Thus, for purposes of impact and brevity, this Note will primarily address autonomous cars under a strict liability scheme and will detail liability for automobile defects that cause accidents.

Strict products liability is considered the prominent legal theory by which plaintiffs can recover for losses caused by defective products.[55] The roots of strict liability are found in Justice Traynor's concurring opinion in the case of *Escola v. Coca Cola Bottling Co.*[56] Justice Traynor lists several reasons supporting the implementation of a strict liability scheme with regard to products, notably that the manufacturers and sellers of products are better suited than the public to bear the burden when accidents occur.[57] Traynor's opinion later became embodied in the *Restatement (Second) of Torts* (hereinafter *Second Restatement*) which ascribes liability to one who sells a product in a "defective condition unreasonably dangerous to the user," even if the seller has "exercised all possible care in the preparation and sale of [the] product."[58] While the *Restatement (Third) of Torts: Products Liability* (hereinafter *Third Restatement*) has attempted to push back on the concept of strict liability, it has not been widely recognized and the majority of courts follow an approach more analogous to that listed in the *Second Restatement*.[59]

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[54] KRAUSS, *supra* note 52, at 41.

[55] 1 LOUIS R. FRUMER & MELVIN I. FRIEDMAN, PRODUCTS LIABILITY § 8.01(1) (Cary Stewart Sklaren ed., 2012).

[56] 150 P.2d 436, 440 (Cal. 1944) (Traynor, J., concurring).

[57] *Id.* at 440–41.

[58] RESTATEMENT (SECOND) OF TORTS § 402(A) (1965). The full section reads:

> (1) One who sells any product in a defective condition unreasonably dangerous to the user or consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if (a) the seller is engaged in the business of selling such a product, and (b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold. (2) The rule stated in Subsection (1) applies although (a) the seller has exercised all possible care in the preparation and sale of his product, and (b) the user or consumer has not bought the product from or entered into any contractual relation with the seller.

Id.

[59] KRAUSS, *supra* note 52, at 72 n.3.

Recovery under a strict liability scheme similar to that detailed in the *Second Restatement* requires that a product be defective in some manner.[60] There are three primary defect claims available to plaintiffs in products liability cases: a manufacturing defect claim, a design defect claim, and a warning defect claim (sometimes referred to as an informational defect).[61] With respect to autonomous vehicles, manufacturing defect and design defect claims seem to present the most profound issues. Warning defect claims generally focus on the safety information that a seller gives a buyer and disclosure of potential risks.[62] For purposes of brevity, the following paragraphs will focus solely on manufacturing and design defect claims.

1. Manufacturing Defect Claims

In general, strict liability in tort has been, and currently is, the preferred method for recovery in manufacturing defect cases.[63] The backbone of manufacturing defect claims is that "while consumers may abstractly comprehend the practical necessity of allowing imperfect production, their actual expectation when purchasing a new product is that its important attributes, including safety, will match those of other similar units."[64] In many cases, there has been no specific test applied to manufacturing defect claims.[65] In recent years, however, courts have begun to primarily use two different tests to apportion liability.[66] The first is a "departure from intended design" test, which functions as the name implies: when a design departs from the original, liability may be imposed.[67] Second is the malfunction doctrine, which is used when circumstances suggest a product defect, but there may be no direct evidence of one.[68] Such an approach requires a more circumstantial means of demonstrating liability.[69]

The departure from the intended design test stems from the *Third Restatement*, which states that 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."[70] Since the publishing of the *Third Restatement* in 1998, an increasing number of courts have used some variation of this approach when defining manufacturing defects,[71] and several

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60 RESTATEMENT (SECOND) OF TORTS § 402(A).

61 *See* KRAUSS, *supra* note 52, at 73.

62 *Id.* at 41.

63 David G. Owen, *Manufacturing Defects*, 53 S.C. L. REV. 851, 863 (2002).

64 *Id.* at 862.

65 *Id.* at 865.

66 *Id.*

67 *Id.* at 865–75.

68 *Id.*

69 *Id.* at 865.

70 RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2(a) (1998).

71 *See, e.g.*, Perez-Trujillo v. Volvo Car Corp., 137 F.3d 50, 53 (1st Cir. 1998) (holding that a manufacturing defect exists if the product differs from the manufacturer's

states have enacted statutes defining manufacturing defects in a similar fashion.[72] In statutes and cases that address manufacturing defect claims under the departure from design theory, plaintiffs establish defectiveness either by comparing the product that caused the incident to the manufacturer's formal design specifications, or by comparing the faulty product with the dimensions and other parameters of some otherwise identical product.[73]

In many manufacturing defect cases a plaintiff can use direct evidence that a product had an identifiable production defect and that the defect caused the injury.[74] Sometimes a product malfunctions, however, and evidence of a defect is not apparent, or perhaps does not exist at all.[75] In cases where direct evidence is seemingly unavailable, plaintiffs can still make a prima facie products liability case under the malfunction doctrine.[76] The malfunction doctrine is similar to a *res ipsa loquitur* approach, and a court may allow the inference of a defect if (1) the product malfunctioned, (2) the malfunction occurred during regular and proper use of the product, and (3) the product was not altered or misused in such a way that could cause the malfunction.[77] While the malfunction doctrine and *res ipsa loquitur* share several aspects in common, scholars and courts are quick to note that a *res ipsa loquitur* approach is different because it still raises the question of negligence, whereas the malfunction doctrine works under strict liability where negligence is not applicable.[78]

In applying the malfunction doctrine, courts generally take one of two approaches. Some courts treat the malfunction doctrine as a strict test, whereas others treat it as more of a principle of evidence that allows circumstantial

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intended design or other pieces from the same line); McKenzie v. S K Hand Tool Corp., 650 N.E.2d 612, 616 (Ill. App. Ct. 1995) (finding a manufacturing defect "because the measurements of the parts of the wrench were shown not to comply with the manufacturer's specifications"); Allstate Ins. Co. v. Ford Motor Co., 772 So. 2d 339, 344 (La. Ct. App. 2000) (holding a manufacturing defect exists where a "product deviated in a material way from the manufacturer's specifications or performance standards for the product or from otherwise identical products manufactured by the same manufacturer").

[72] *See* LA. REV. STAT. ANN. § 9:2800.55 (2009); N.J. STAT. ANN. § 2A:58C-2 (West 2000); OHIO REV. CODE ANN. § 2307.74 (LexisNexis 2010).

[73] Owen, *supra* note 63, at 870.

[74] *Id.* at 872.

[75] *Id.*

[76] *Id.* at 873. The doctrine is used by name in several jurisdictions, including Pennsylvania, which has the most developed history on the theory. *See, e.g.*, Rogers v. Johnson & Johnson Prods., Inc., 565 A.2d 751, 754 (Pa. 1989); Ducko v. Chrysler Motors Corp., 639 A.2d 1204, 1205–06 (Pa. Super. Ct. 1994); Troy v. Kampgrounds of Am., Inc., 581 A.2d 665, 668 (Pa. Super. Ct. 1990). Other courts use the same principles, but label it as the indeterminate defect theory. *See* Myrlak v. Port Auth., 723 A.2d 45, 55–56 (N.J. 1999). A last variation of the same principle is called a general defect. *See* Corcoran v. Gen. Motors Corp., 81 F. Supp. 2d 55, 66 (D.D.C. 2000).

[77] Owen, *supra* note 63, at 873.

[78] 1 DAVID G. OWEN ET AL., MADDEN & OWEN ON PRODUCTS LIABILITY § 7:12, at 431 (3d ed. 2000).

evidence to be used to infer a defect.[79] The malfunction doctrine as embodied in the *Third Restatement*[80] is frequently applied in cases involving automobiles.[81] Automobile accident cases fit well within the malfunction doctrine because in many cases the evidence showing a manufacturing defect is entirely destroyed or damaged beyond use. In particular, plaintiffs tend to use the malfunction doctrine in cases of steering failures,[82] brake failures,[83] and cases where inexplicable acceleration causes an accident.[84] While the malfunction doctrine offers an attractive option for plaintiffs in automobile products liability cases, it is not limitless. Courts note that while the doctrine does provide for the admission of circumstantial evidence to show a defect, "the law will not allow plaintiffs or juries to rely on guess, conjecture, or speculation."[85]

2. *Design Defect Claims*

Design defect claims generally highlight defects that have the potential to be much more widespread and catastrophic[86] while manufacturing defect claims usually address a single incident where an anomaly in the manufacturing process has caused an unsafe alteration to one product.[87] Design defect claims generally

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[79] *Id.*

[80] Section 3 states that a defect can be inferred when it "a) was of a kind that ordinarily occurs as a result of a product defect; and b) was not, in the particular case, solely the result of causes other than the product defect existing at the time of sale or distribution." RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 3 (1998).

[81] Owen, *supra* note 63, at 875.

[82] *See, e.g.*, Stewart v. Ford Motor Co., 553 F.2d 130 (D.C. Cir. 1977) (involving a vehicle that was only twelve days old and had traveled just over one thousand miles); Stewart v. Budget Rent-A-Car Corp., 470 P.2d 240 (Haw. 1970) (involving a vehicle with nearly three thousand miles); Caprara v. Chrysler Corp., 423 N.Y.S.2d 694 (App. Div. 1979), *aff'd on other grounds*, 417 N.E.2d 545 (N.Y. 1981).

[83] *See, e.g.*, Tweedy v. Wright Ford Sales, Inc., 357 N.E.2d 449, 450 (Ill. 1976) (involving brakes that failed to perform on a vehicle that had been driven only 7,500 miles); Vernon v. Stash, 532 A.2d 441 (Pa. Super. Ct. 1987) (involving the failure of a parking brake); Darryl v. Ford Motor Co., 440 S.W.2d 630, 632 (Tex. 1969) (involving the failure of brakes on a truck that was only months old and had fewer than one thousand miles).

[84] *See, e.g.*, Wakabayashi v. Hertz Corp., 660 P.2d 1309, 1311 (Haw. 1983) (involving a vehicle that was nearly two years old that had been driven over twenty-two thousand miles); Jurls v. Ford Motor Co., 752 So. 2d 260, 262 (La. Ct. App. 2000) (involving the failure of cruise control to correctly disengage); Phipps v. Gen. Motors Corp., 363 A.2d 955, 956 (Md. 1976) (involving the failure of an accelerator in a truck).

[85] Owen, *supra* note 63, at 878; *see also* Willard v. BIC Corp., 788 F. Supp. 1059, 1064 (W.D. Mo. 1991); State Farm Fire & Cas. Co. v. Chrysler Corp., 523 N.E.2d 489, 496–97 (Ohio 1988).

[86] KRAUSS, *supra* note 52, at 81.

[87] *Id.*

involve numerous products and sometimes even an entire line of automobiles.[88] When plaintiffs make a design defect claim, they are not asserting that an individual product was defective because it was not built according to the design specifications—as would be the case in a manufacturing defect claim—but that the design as a whole was defective.[89] This presents a much larger issue for manufacturers and retailers because, if the design defect claim is valid, then defects exist in their entire line of products, subjecting them to potentially massive liability costs. Automobile design defects are often the cause of major product safety recalls, and if not quickly remedied, could bring about massive class action lawsuits.[90]

Nearly all states follow some variation of the *Second Restatement*'s embodiment of design defect, which ascribes strict liability to manufacturers or retailers if the design is defective and unreasonably dangerous.[91] While the *Third Restatement* seemingly has attempted to push back at the notion of strict liability for design defect, courts still tend to follow a rule that is more in line with the *Second Restatement*.[92] When deciding design defect claims, courts use two primary tests to determine the defectiveness of a design: (1) the consumer expectations test, and (2) the risk-utility test.[93]

The consumer expectations test evaluates the defectiveness of a design based on whether "the danger posed by the design is greater than an ordinary consumer would expect when using the product in an intended or reasonably foreseeable manner."[94] Under the consumer expectations test, consumers must have "sufficient knowledge or familiarity with the design of the product to have reasonable expectations about its safety and performance."[95] Although such a definition is

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[88] *Id.*

[89] *Id.*

[90] A very recent example of the implications of design defect claims is the Toyota unexpected acceleration claims. Andrew Dalton, *Toyota Settles in Case of 2 Killed in Utah Crash*, YAHOO! FIN. (Jan. 18, 2013, 9:19 AM), http://finance.yahoo.com/news/toyota-settles-case-2-killed-utah-crash-091121534--finance.html.

[91] KRAUSS, *supra* note 52, at 83; RESTATEMENT (SECOND) OF TORTS § 402A (1965).

[92] *See* KRAUSS, *supra* note 52, at 83. The *Third Restatement* states that a design is defective

> when the foreseeable risks of harm posed by the product could have been reduced or avoided by the adoption of a reasonable alternative design by the seller or other distributor, or a predecessor in the commercial chain of distribution, and the omission of the alternative design renders the product not reasonably safe.

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

[93] KRAUSS, *supra* note 52, at 84–89 (discussing consumer expectation test); OWEN ET AL., *supra* note 78, § 8:5, at 463 (discussing risk-utility test).

[94] TERRENCE F. KIELY & BRUCE L. OTTLEY, UNDERSTANDING PRODUCTS LIABILITY LAW 135 (2006).

[95] *Id.* at 138–39.

applicable in some cases, the consumer expectations test is often difficult to apply to complex products such as automobiles.[96]

While the consumer expectations test is still in use in certain jurisdictions, there has been some discontent with its application.[97] As a result, the risk-utility test has emerged as the dominant test in design defect claims.[98] Under the risk-utility test, plaintiffs can succeed in proving a design defect if they demonstrate "the product's design proximately caused [their] injury and the defendant fails to establish, in light of the relevant factors, that, on balance, the benefits of the challenged design outweigh the risk of danger inherent in such design."[99]

Analysis under the risk-utility test falls in line with principles first set forth in an article by Dean John Wade, the American Law Institute's Reporter for the *Second Restatement*.[100] Dean Wade lists seven factors to weigh in considering the risk-utility test:

> (1) The usefulness and desirability of the product—it's utility to the user and to the public as a whole.
> (2) The safety aspects of the product—the likelihood that it will cause injury, and the probable seriousness of the injury.
> (3) The availability of a substitute product which would meet the same need and not be as unsafe.
> (4) The manufacturer's ability to eliminate the unsafe character of the product without impairing its usefulness or making it too expensive to maintain its utility.
> (5) The user's ability to avoid danger by the exercise of care in the use of the product.
> (6) The user's anticipated awareness of the dangers inherent in the product and their avoidability, because of general public knowledge of the obvious condition of the product, or of the existence of suitable warnings or instructions.
> (7) The feasibility, on the part of the manufacturer, of spreading the loss by setting the price of the product or carrying liability insurance.[101]

These factors are used to aid the court in deciding when there is a defect in design, but due to the nature of their composition, often result in a subjective analysis of defect. The ultimate goal of the risk-utility test is to determine if an accident could

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[96] *See id.* at 139.

[97] KRAUSS, *supra* note 52, at 87, 89.

[98] *See* John W. Wade, *On the Nature of Strict Tort Liability for Products*, 44 MISS. L.J. 825, 837–38 (1973) (providing an early example of the discontent with the consumer expectations test and noting the need for an alternative test in design defect cases).

[99] Barker v. Lull Eng'g Co., 573 P.2d 443, 456 (Cal. 1978).

[100] KRAUSS, *supra* note 52, at 88; Wade, *supra* note 98, at 837–38.

[101] KRAUSS, *supra* note 52, at 88; Wade, *supra* note 98, at 837–38.

have caused less damage or been avoided altogether if a reasonable alternative design had been used.[102]

Both the consumer expectations test and risk-utility test have been applied to cases involving automobile design defects. Each theory presents its own advantages and disadvantages, and as such, some states use a combination of the two tests.[103] Regardless of which theory is applied, or even if a combination of the two is used, each approach can ultimately require a subjective analysis by the decisionmaker. Especially in cases of new technology, it becomes increasingly difficult to determine reasonable expectations about a product and its safety features. Further, when a technology is novel, it is more difficult to determine if an alternative design—if there is one—would have provided better safety.

III. PRODUCTS LIABILITY APPLIED TO AUTONOMOUS VEHICLES: SQUARE PEG, ROUND HOLE

According to U.S. census data, from 2006 until 2009 in the United States alone, there were over thirty million automobile accidents resulting in over one hundred thousand fatalities.[104] Of the thousands of traffic accidents that occur each day, human error is involved in many of those cases.[105] If early estimates about autonomous vehicles prove to be even close to accurate, their widespread implementation could lead to one of the greatest safety advances in decades.[106] Especially in cases where distracted driving causes an accident, such as with drowsy driving or use of a cell phone, autonomous cars have serious potential to make the roadways a safer place for everyone involved.

While the potential safety benefits of autonomous vehicles are fairly clear, the legal course for them is not. There are thousands of vehicle accidents each day, and while autonomous vehicles are likely to be much safer than their human counterparts, they will inevitably be involved in accidents.[107] The following sections will address autonomous vehicle accidents and two potential forms of liability. Section A shows that applying conventional products liability law to autonomous vehicles will be difficult and inconsistent, will likely harm consumers and potential plaintiffs, and will delay the implementation of a beneficial safety technology. To avoid the problems with conventional products liability, Section B

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[102] *See* OWEN ET AL., *supra* note 78, § 8:5, at 463 (quoting McCarthy v. Olin Corp., 119 F.3d 148, 155 (2d Cir. 1997)).

[103] *See* Caterpillar Tractor Co. v. Beck, 593 P.2d 871, 884–87 (Alaska 1979) (using a form of both the risk-utility and consumer expectations tests).

[104] U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2012, at 693 tbl.1103 (2012), *available at* http://www.census.gov/prod/2011pubs/12statab/trans.pdf.

[105] *See generally* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 10, at 2 (noting with particularity the accidents, such as those caused by drunk driving where human error is a component).

[106] *See* Thrun, *supra* note 2 (suggesting that autonomous vehicle technology has the potential to reduce traffic accident casualties by as much as half).

[107] *See* U.S. CENSUS BUREAU, *supra* note 104.

suggests a federal no-fault compensation system, similar to the system used for vaccine product claims, as a more efficient and stable regime for liability claims relating to autonomous vehicles.

A. Problems Applying Current Products Liability Law to Autonomous Vehicles

Products liability cases involving traditional automobiles are difficult enough as it is.[108] Manufacturers may be subjected to liability even in cases where no definitive evidence of defect can be shown.[109] On the flip side, injured plaintiffs may suffer because of the difficulty involved in proving a defect in complicated technology like automobiles.[110] The consequences to both manufacturers and plaintiffs will likely only become more difficult with the advent of autonomous vehicles. The following sections address the problems associated with bringing a claim involving an autonomous vehicle. Section 1 provides an analysis of autonomous vehicle crashes for manufacturing defect claims, and Section 2 does the same for design defect claims.

1. Autonomous Vehicles Under a Manufacturing Defect Claim

Autonomous vehicles, when implemented, will likely cause a significant shift in liability away from customers and onto manufacturers.[111] The extent to which this will occur will largely depend on the development of the law relating to autonomous vehicles. Currently, states have been hesitant to give autonomous vehicles full control, and the early state statutes that address autonomous vehicles require a licensed driver to be able to take control of the vehicle in the event of some system failure.[112] Under such statutes, it seems possible that manufacturers could deflect some liability for accidents based on principles similar to human failures in traditional accidents.

[108] *See* Greg Risling, *Settlements May Signal Toyota's Legal Strategy*, BOS. GLOBE (Jan. 19, 2013), http://www.bostonglobe.com/business/2013/01/19/toyota-settles-case-killed-utah-crash/jx7BLYOdSYUSYEzdFziGIM/story.html (noting the two divergent claims presented as the cause of numerous Toyota models unexpectedly accelerating and causing accidents).

[109] *See* Chris Woodyard, *Toyota to Pay $1.1B in "Unintended Acceleration" Cases*, USA TODAY (Dec. 26, 2012, 8:27 PM), http://www.usatoday.com/story/money/cars/2012/12/26/toyota-unintended-acceleration-runaway-cars/1792477/ (highlighting the potential for substantial costs to manufacturers).

[110] *See* Csaba Csere, *It's All Your Fault: The DOT Renders Its Verdict on Toyota's Unintended Acceleration Scare*, CAR & DRIVER, http://www.caranddriver.com/features/its-all-your-fault-the-dot-renders-its-verdict-on-toyotas-unintended-acceleration-scare-feature (last visited Mar. 3, 2013) (noting the difficulty plaintiffs can have in actually showing that a defect was the cause of the accident).

[111] NIDHI KALRA ET AL., *supra* note 15, at ix.

[112] CAL. VEH. CODE § 38750(b)(2) (West Supp. 2013) (effective Jan. 1, 2013); FLA. STAT. ANN. § 316.85(1) (West Supp. 2013) (effective July 1, 2012).

Nevertheless, autonomous vehicles are generally designed to replace human intervention with a safer alternative.[113] By having the vehicle perform the tasks of a human driver, however, manufacturers risk the vehicle incurring the same liability that a human driver would. How long it will take for autonomous cars to replace human drivers is uncertain,[114] but it is inevitable that these vehicles are going to cause accidents, and plaintiffs will inevitably seek recourse. Of the products liability claims discussed in this Note, manufacturing defect claims are the most natural means to address autonomous vehicles. While manufacturing defect claims may currently be best suited to address autonomous vehicles, they are not without significant problems. Namely, this Note argues that manufacturing defect claims could provide significant obstacles to plaintiffs seeking redress, enhance the uncertainty of liability costs to manufacturers, and ultimately slow the implementation of autonomous vehicles.

While autonomous vehicles will present unique issues and hurdles under manufacturing defect claims, it is important to note that there are many instances where such claims may be well equipped to deal with autonomous vehicles. If a radar sensor is not installed according to specifications and that faulty installation causes an accident, the manufacturer will be liable. In general, it seems apparent if autonomous vehicles are manufactured incorrectly or components fail, liability will fall to the manufacturer. In such clear situations, the manufacturing defect test is completely capable of addressing autonomous vehicles defects. While these claims will afford future plaintiffs redress, they will likely not occur with any type of frequency. Advances in manufacturing and fabrication technology have reduced the rate of defects and will likely continue to improve in the future.[115]

Autonomous vehicles are likely to improve the safety of vehicle travel, but it will be many years, if ever, before human drivers are ultimately replaced. What that means is that there will continue to be drivers who drive while drowsy or are distracted by their cell phones, and ultimately there will continue to be human error in driving. While autonomous cars will likely enhance vehicle travel safety, it is seemingly impossible that they will be able to navigate the roads entirely without incident.

In addition to cases where a defect in production is clear, the malfunction doctrine can also offer an avenue for recovery in cases where autonomous vehicles crash, but no direct evidence of a defect is available.[116] Recall that the malfunction doctrine contains three basic elements: (1) the product malfunctioned, (2) the malfunction occurred during a regular and proper use of the product, and (3) the product was not altered or misused in a way that could lead to the malfunction.[117] By allowing circumstantial evidence, the malfunction doctrine allows a

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[113] For a more detailed description of how autonomous vehicles perform the tasks of a traditional human driver, see *supra* Part II.A.

[114] *See* text accompanying and sources cited *supra* note 20.

[115] NIDHI KALRA ET AL., *supra* note 15, at 28.

[116] *See* Owen, *supra* note 63, at 873 ("[A] product defect may be inferred by circumstantial evidence . . . .").

[117] *See supra* Part II.B.1.

decisionmaker to infer the presence of a defect.[118] While this aspect of the malfunction doctrine can be applicable to autonomous vehicles, it presents problems for both manufacturers and plaintiffs.

The malfunction doctrine would likely negatively affect manufacturers of autonomous vehicles because it could subject them to liability in cases where no defect was present. Driving is a notoriously unsafe practice, and while autonomous vehicles can improve that, it is still a risk-involved activity. With traditional human drivers behind the wheel there are occasionally no-fault accidents. Cars crash, but responsibility is not necessarily pinned on one specific individual. With autonomous cars, that would likely change. The malfunction doctrine permits manufacturing defect claims where evidence allows the inference of a defect. At a very basic level, autonomous vehicles take control away from the driver and place it with the vehicle. In cases where autonomous vehicles crash, the very fact that the vehicle crashed seems to be evidence that supports a defect. Autonomous vehicles are not intended to crash, and so when one does, it would seem that plaintiffs would be incentivized to bring a products liability suit under the malfunction doctrine.

It will likely take considerable time for courts to develop a predictable jurisprudence with respect to the malfunction doctrine as applied to autonomous vehicles. If plaintiffs are incentivized to bring a manufacturing defect claim every time an autonomous vehicle crashes, then during such a period the costs of defending constant product liability claims would place a heavy burden on manufacturers. While predictions are that autonomous vehicles will be safer than their human driver counterparts, it is impossible to predict how frequently they will be involved in accidents. Regardless of the circumstances of a potential accident, because autonomous vehicles take control away from a human driver, any crash draws the manufacturer's liability into question. Thus, it is certainly rational for manufacturers to be reluctant to subject themselves to such speculative liability. If the economic incentive is overcome by the costs of potential litigation, society may be deprived of the significant safety benefits that autonomous vehicle could provide.

The malfunction doctrine also presents problems for plaintiffs. It is entirely conceivable that an autonomous vehicle may crash while operating in a fully functional capacity. For instance, imagine a toddler runs across the street in front of an autonomous car and the car slams on the brakes and swerves to avoid the toddler, ultimately crashing into another vehicle. The car did not have a defect that caused the accident, but performed according to design when swerving to avoid the toddler. With traditional vehicles, when a driver overreacts to an environmental circumstance and causes an accident, the driver is liable.

When human drivers operate a vehicle, they analyze their surroundings, make decisions, and take action. Autonomous vehicles however, require a computer to make such decisions based on the environment around the vehicle.[119] As a result,

[118] Owen, *supra* note 63, at 873.

[119] NIDHI KALRA ET AL., *supra* note 15, at xi.

the malfunction theory gets significantly more complex when applied to autonomous vehicles. Everything on the car could be functioning according to specifications, but the vehicle just interprets the data in a way that ultimately causes an accident. Effectively then, when no direct evidence of a defect is present, plaintiffs will have to question the "decision" made by the technology. Such an allegation does not necessarily imply the vehicle malfunctioned according to the traditional use of the malfunction theory.

A computer incorrectly interpreting data is not the same as a steering wheel that locks, an accelerator that gets stuck, or a vehicle that catches on fire. The malfunction theory, at its most basic level, requires that plaintiffs allege some type of defect and allege the accident would not have happened but for that defect.[120] The hypothetical situation posed above shows that it is not a stretch to believe that an autonomous vehicle could cause an accident without having some defect that causes a malfunction. Driving is filled with a multitude of variables that play into a human driver's choice of action, and the same applies to autonomous vehicles. Thus, a plaintiff seeking to establish a manufacturing defect under the malfunction theory would have to prove the decision made by an autonomous vehicle would likely not have occurred but for some abnormality created by a failure in the manufacturing process.

Manufacturing defect claims as applied to autonomous vehicles could have two vastly different effects. On one hand, it could open up manufacturers to liability for basically any crash that involves an autonomous car. Autonomous vehicles take control from the human driver, and thus any crash could imply a defect in the production of the vehicle. On the other hand, a plaintiff could have an exceedingly difficult time proving that an autonomous vehicle's response to its environment is a result of an abnormality in design. Regardless of who manufacturing defect claims ultimately benefit, the effect on the development of autonomous vehicles would be negative. If manufacturers are subjected to increased liability, then development will likely not be as aggressively pursued. But if plaintiffs are denied recovery, then there may be less incentive to buy, and thus a decreased market for autonomous vehicles. With the huge potential safety benefits that autonomous vehicles could provide, any such scenario would ultimately be of consequence to the general public.

2. Autonomous Vehicles Under a Design Defect Claim

Advances in manufacturing technology make it unlikely that a large number of manufacturing defect suits would ultimately occur.[121] Thus, the majority of claims relating to autonomous vehicles would likely be brought under design

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[120] Owen, *supra* note 63, at 878; *see also* Willard v. BIC Corp., 788 F. Supp. 1059, 1064 (W.D. Mo. 1991); State Farm Fire & Cas. Co. v. Chrysler Corp., 523 N.E.2d 489, 496–97 (Ohio 1988); Woodin v. J.C. Penny, Co., 629 A.2d 974, 976–77 (Pa. Super. Ct. 1993); Thomas v. Amway Corp., 488 A.2d 716, 721–22 (R.I. 1985).

[121] NIDHI KALRA ET AL., *supra* note 15, at 28.

defect. But design defect claims are also fraught with problems and are likely less equipped to address autonomous car accidents than are manufacturing defect claims. The following paragraphs will show that both the consumer expectations test and the risk-utility test present significant hurdles for plaintiffs pursuing design defect claims for autonomous cars. Such hurdles would essentially make design defect claims unavailable to any plaintiffs injured by autonomous cars.

The first and less frequently used test for design defect is the consumer expectations test.[122] At its core, this test seeks to prove the existence of a design defect based on evidence that a product does not conform to the reasonable expectations of a consumer.[123] In some cases the consumer expectations test is a usable means of identifying a design defect. If a hammer is designed in such a way that the head flies off, the consumer expectations test fits well. A reasonable consumer would expect a hammer to perform its function of impacting nails without the head becoming dislodged and injuring someone. In such a scenario, consumers have common general expectations about the use of the product and are familiar with the functionality of a hammer. Further, because hammers are a simple product, users' safety expectations can be articulated with a fair degree of consistency.

The difficulty with applying the consumer expectations test is that not every product is as simple as a hammer. As products become increasingly more complex, a great deal of uncertainty can arise with the consumer expectations test, primarily because the test largely stems from the negligence principle of reasonableness on the part of the ordinary consumer. The difficulty arises in determining where to draw the line for the basis of reasonableness. In the case of the traditional automobile, a very complex product, it becomes more difficult to apply the principle of reasonableness. A mechanic's reasonable expectations about automobiles will likely be significantly different than a grandmother who only drives to church and back on Sundays. The challenge then becomes how specific a court will be when defining a reasonable consumer. Is an ordinary consumer an educated consumer, one with a mechanical engineering degree, or one who has a mechanical engineering degree who works for Ford? Depending on where courts draw the line, the expectations that courts deem "reasonable" may differ widely.

Autonomous vehicles only exacerbate the present problems with the consumer expectations test. A basic tenet of the consumer expectations test is that a consumer needs to have "sufficient knowledge or familiarity with the design of the product to have reasonable expectations about its safety or performance."[124] The technology that allows these vehicles to function is extremely advanced and novel, thus there are likely few individuals who have the requisite knowledge to have a reasonable expectation about the safety of these vehicles.[125] This basically

[122] KRAUSS, *supra* note 52, at 84–86.

[123] *See* KIELY & OTTLEY, *supra* note 94, at 135.

[124] *Id.* at 138.

[125] *See id.* at 138–39 (noting that the complexity of the automobile "frequently tests the limits of the consumers' expectations").

eliminates for many years the consumer expectations test for plaintiffs injured by autonomous vehicles. Consumers will certainly have expectations about how autonomous vehicles will function, but considering that some courts choose not to apply the consumer expectations test to devices such as airbags, it will likely be a considerable time until courts are comfortable applying the test to autonomous cars.[126]

The second test commonly applied to design defect claims, the risk-utility test, would likely prove as difficult to apply as the consumer expectations test. The risk-utility test focuses on the safety benefits of a proposed design compared to alternative models in the same category.[127] Early in the implementation of autonomous vehicles, the risk-utility test will likely not afford any remedy to plaintiffs. Dean Wade proposed seven factors to consider in the risk-utility test.[128] Of those seven factors, three could be of particular interest when applied to autonomous vehicles. First, is "[t]he availability of a substitute product which would meet the same need and not be as unsafe."[129] Second, is "[t]he usefulness and desirability of the product—its utility to the user and to the public as a whole."[130] Third, is "[t]he user's anticipated awareness of the dangers inherent in the product and their avoidability, because of general public knowledge of the obvious condition of the product, or of the existence of suitable warnings or instructions."[131]

The first factor at issue focuses on the availability of alternate products that would perform the same functions and be less unsafe.[132] It will likely be considerable time until there are a sufficient number of manufacturers involved in the production of autonomous vehicles. Accordingly, potential plaintiffs would be limited in their ability to show that there are safer alternate designs available.

Another interesting issue under the risk-utility test involves the social utility that autonomous vehicles serve. Analyzing autonomous vehicles under Dean Wade's second factor could show there is a strong case in support of the argument that autonomous vehicles' utility to the public as a whole is considerable. Specifically, autonomous vehicles are likely to be significantly safer than human drivers,[133] and thus are of substantial utility to public safety.[134] Furthermore, they will be of great utility to people with disabilities who cannot drive standard vehicles. Accordingly, manufacturers would seem to largely benefit from such a

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[126] *See* Pruitt v. Gen. Motors Corp., 86 Cal. Rptr. 2d 4, 6 (Ct. App. 1999) (noting that air bags are too complex to use the consumer expectations test).

[127] Wade, *supra* note 98, at 837–38.

[128] *Id.*

[129] *Id.* at 837.

[130] *Id.*

[131] *Id.*

[132] *Id.*

[133] *See* Vijayenthiran, *supra* note 7 (noting that studies of early autonomous vehicle technologies demonstrate a reduction in accidents).

[134] *See* Valdes-Dapena, *supra* note 7 (noting the potential safety benefits of autonomous vehicles).

consideration under the risk-utility test. When the utility of a product is considerable, it lends evidence that there may not have been a design defect.

The factor that becomes increasingly interesting when applied to autonomous vehicles is "the user's anticipated awareness of the dangers inherent in the product and their avoidability, because of general public knowledge of the obvious condition of the product, or of the existence of suitable warnings or instructions."[135] In particular, it is interesting to hypothesize what potential autonomous vehicle purchasers will expect as the inherent danger of the cars. This question because more difficult in light of the current legislation regarding autonomous vehicles, which requires a licensed driver to be present as a backup to the technology.[136] The fact that the law requires a driver to be present as a backup seems to support the idea that the car may fail, in which case the driver would be forced to take over. If this remains the case, then individuals whose autonomous vehicles crash may be without recourse. Specifically, they would lack evidence that they were not aware of the "dangers inherent in the product."[137]

Whether it is the consumer expectations or risk-utility test that is used, plaintiffs will likely have a difficult time bringing design defect claims against autonomous vehicle manufacturers. The technology is novel and complex, and it could be years before consumers can develop consistent safety expectations about the vehicles. The consumer expectations test would be difficult to apply in the early years of implementation. Further, the factors presented by Dean Wade would seem to support autonomous vehicle manufacturers. Absent a clear defect in design, autonomous vehicles present such a profound potential safety benefit that courts may be swayed to rarely find design defects. The limited alternate models and the clear possible risks would also lessen plaintiff's chances of success.

B. The Need for a No-Fault Scheme for Autonomous Vehicles

Current products liability claims will be difficult to apply to autonomous vehicles and will ultimately disadvantage both plaintiffs and manufacturers.[138] Plaintiffs will be limited in the claims that they can bring relating to autonomous vehicles. Those remaining claims will involve complex legal issues that will likely result in expensive and elaborate lawsuits. For manufacturers, the implementation of autonomous vehicles presents a significant shift in the layout of liability for accidents.[139] Further, the jurisprudence on the matter will likely take some time to stabilize.[140] The combination of the two makes cost predictions about autonomous

[135] Wade, *supra* note 98, at 837–38; *see* Valdes-Dapena, *supra* note 7 (noting the potential safety benefits of autonomous vehicles).

[136] CAL. VEH. CODE § 38750(b)(2) (West Supp. 2013); *see* FLA. STAT. ANN. § 316.85(1) (West Supp. 2013); NEV. REV. STAT. ANN. § 482A.200 (LexisNexis Supp. 2011); *supra* text accompanying note 37.

[137] Wade, *supra* note 98, at 837–38.

[138] *See supra* Part III.A.

[139] *Id.*; *see also* NIDHI KALRA ET AL., *supra* note 15, at ix.

[140] *See supra* Part III.A.

vehicles uncertain, which will likely delay the widespread availability of autonomous vehicles.[141]

For many products, the problems detailed above would not be of significant concern to the public as a whole. Many would argue that delaying the time that a new ladder or new child's toy takes to hit the market would be of no substantial concern. However, autonomous vehicles require a different sort of analysis. In 2010 there were over 5.4 million traffic accidents in the United States.[142] Those accidents resulted in over two million injuries and over thirty thousand fatalities.[143] Of the thirty thousand fatalities in 2010, about one-third were caused by an individual driving with a blood alcohol level of over 0.08%, and many more were also caused by human error.[144] It is undeniable that too many Americans have been injured or killed in automobile accidents, many of which could have been avoided if the driver had not been distracted or made a poor decision. The sum total of these accidents likely results in millions of dollars in costs for healthcare, insurance, and damage repair. Overall, the damage caused by automobiles, in particular human error in automobiles, takes a heavy toll on society.

Autonomous cars have the ability to change all of that. If fully implemented, accidents caused by a drunk driver could be completely eliminated. An individual could leave the bar, have his car pick him up, and never put other drivers at risk.[145] Further, the disabled and the elderly could enjoy unprecedented levels of mobility.[146] The environment would benefit as travel becomes more efficient. Productivity and individual freedom could skyrocket as individuals gain significantly more free time. The benefits of autonomous vehicles are profound, and their implementation is of the upmost importance for all of the above reasons and more.

While such a utopian world created by autonomous cars is likely far in the future, society cannot afford to delay the use of these vehicles in our day-to-day lives. Thirty-thousand people die each year in traffic accidents, and this technology has the potential to change that.[147] For these reasons, a no-fault compensation scheme, similar to that created by the National Childhood Vaccination Injury Act, should be implemented to address autonomous vehicles. Such a no-fault scheme would create a roadmap for the future of autonomous vehicles, ease manufacturer concerns, and ultimately encourage autonomous vehicle development. Further, such a scheme would provide consistent and available remedies for plaintiffs who are injured when autonomous vehicles inevitably crash.

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[141] *See id.*

[142] NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 10.

[143] *Id.*

[144] *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 12.

[145] It is important to note that this would be in violation of the current laws addressing autonomous vehicles.

[146] Jeremy A. Kaplan, *Amazing! Google's Self-Driving Car Allows the Blind to Drive*, FOXNEWS.COM (Mar. 28, 2012), http://www.foxnews.com/tech/2012/03/28/amazing-google-self-driving-cars-allow-blind-to-drive/.

[147] *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 12.

1. Overview of the National Childhood Vaccination Injury Act (NCVIA)

The NCVIA came about due to two primary issues during the 1980's: the "inadequate and inconsistent nature of existing state tort remedies and the instability of vaccine supplies due to prior litigation."[148] Vaccine makers had become the target of considerable liability, which caused several manufacturers to leave the market.[149] Further, there was significant pressure from proplaintiff groups who were concerned about the inconsistency of the tort system with respect to vaccine injury claims.[150] A culmination of these concerns spurred Congress to pass the NCVIA.[151]

The NCVIA created a no-fault compensation system as an alternative to the ineffective state tort system.[152] The federal system eliminated the need for plaintiffs to demonstrate that there was a defect in the vaccine.[153] Plaintiffs seeking redress could file a petition in the United States Court of Federal Claims and provide service on the Secretary of Health and Human Services.[154] Their petition could contain one of two claims: an on-table claim or an off-table claim.[155] An on-table claim refers to a table that contains a list of vaccine-related injuries and relevant timelines for pursuing those claims.[156] If a petitioner cannot demonstrate an on-table claim then they must pursue an off-table claim, which requires a higher standard of proof and evidence of causation.[157] It is important to note the NCVIA does not entirely remove the availability of the state tort system, but rather just requires plaintiffs to assert claims through the NCVIA first.[158] If petitioners are not satisfied with the adjudication under the NCVIA, they can move into state or federal court.[159] The NCVIA, however, does remove remedies in tort for injuries that are the "unavoidable side effects" of vaccinations.[160]

Petitioners who successfully bring a claim are rewarded damages from the Vaccine Injury Compensation Trust Fund.[161] A $0.75 excise tax on recommended

[148] Elizabeth A. Breen, *A One Shot Deal: The National Childhood Vaccine Injury Act*, 41 WM. & MARY L. REV. 309, 316 (1999).

[149] Daniel A. Cantor, *Striking a Balance Between Product Availability and Product Safety: Lessons from the Vaccine Act*, 44 AM. U. L. REV. 1853, 1858 (1995).

[150] *Id.*

[151] *Id.* at 1856.

[152] *Id.* at 1860.

[153] Breen, *supra* note 148, at 317.

[154] *Id.* at 318.

[155] *See id.*

[156] *Id.*; *see* 42 C.F.R. § 100.3 (2011) (providing the most recently revised Vaccine Injury Table).

[157] Breen, *supra* note 148, at 318.

[158] Cantor, *supra* note 149, at 1861.

[159] *Id.*

[160] *Id.*

[161] Health Res. & Servs. Admin., *National Vaccine Injury Compensation Program*, U.S. DEP'T HEALTH & HUM. SERVS., http://www.hrsa.gov/vaccinecompensation/index.html (last visited Feb. 10, 2012).

vaccines is used to generate the funds for awards given to successful claimants.[162] Administration of awards under the NCVIA is generally less than that of the sometimes excessive damages awarded under tort law. By standardizing the awards, the NCVIA provided vaccine manufacturers with more certain liability. Further, the NCVIA provided a more efficient process for plaintiffs to seek remedy.

2. A No-Fault Compensation System for Autonomous Vehicles

The NCVIA has several components particularly relevant to the legal landscape surrounding autonomous vehicles. A federal no-fault system would provide a clear picture of liability for manufacturers seeking to develop and implement autonomous vehicles. By accurately gauging their potential liability costs, manufacturers could better price and develop autonomous vehicles. Further, plaintiffs would ultimately benefit from a standardized and streamlined process similar to that created under the NCVIA. The potential pitfalls associated with current products liability would be mitigated, and plaintiffs could seek recourse without the complex and costly litigation they would otherwise be forced to pursue.

While the reasoning for the enactment of the NCVIA is in some ways unique to vaccinations, there are several similar principles relating to autonomous vehicles. Vaccines focus on prevention and public safety. Autonomous cars do the same. Human error while operating an automobile accounts for thousands of American deaths each year, and autonomous vehicles have the potential to change this.[163] Further, similar to vaccinations, there will be unavoidable side effects from using autonomous vehicles, and injuries are sure to eventually result. Autonomous vehicles will inevitably crash, albeit hopefully less frequently, and injuries will result. An additional similarity is that state tort systems are likely ill-equipped to deal with autonomous vehicle liability.[164] A similar pattern is likely to emerge if manufacturers cannot ascertain a more certain road ahead for their potential liability costs. Like vaccines, though, a lack of development in autonomous vehicles could result in a significant consequence to public safety.

While the exact makeup of a no-fault compensation system is beyond the scope of this Note, there are a few points to consider going forward. First, the types of vehicles that are included under a no-fault scheme will be of the utmost importance and should be clearly and narrowly defined. Second, both manufacturing and design defect claims should be covered under the system, but not informational defects. One of the most important aspects of implementing autonomous vehicles is that the public must understand what the vehicles are truly

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[162] *Id.*

[163] *See* Valdes-Dapena, *supra* note 7 (noting the potential safety benefits of autonomous vehicles).

[164] *See supra* Part III.A (noting the difficulties associated with applying current products liability law to autonomous vehicles).

capable of and how the vehicles can be safely used. Lastly, the program should be enacted for a set time. Autonomous cars are novel technology with profound benefits but they are not the last stop. An endless no-fault compensation scheme may deter advancements in technology by encouraging the development of technology that only fits under the system.

IV. CONCLUSION

Autonomous vehicles have the potential to change the future of transportation, enhance travel safety, improve the environment, help the disabled, and ultimately bring more freedom to our daily lives. For autonomous vehicles to reach their full potential, the legal system must be ready to adopt new policies that will advance the interests of manufacturers and potential plaintiffs alike. The current liability system, namely strict products liability, does not provide such an environment. Manufacturing and design defects are ill-suited to address the unique issues raised by autonomous vehicles. This uncertain and ill-fitting legal landscape will likely deter manufacturers from producing autonomous vehicles and preclude those injured by such technology from receiving an adequate remedy. A no-fault compensation system, similar to that set up under the NCVIA would solve both problems. Manufacturers would be able to accurately gauge liability costs and would be encouraged to produce this new technology. Plaintiffs would benefit as well from access to a consistent and efficient system of remedies. While a no-fault compensation regime is a unique solution, autonomous vehicles are a unique technology. By fostering development while maintaining legal redress, a no-fault system will benefit society as a whole by furthering this transformative new technology.

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