

AUTONOMOUS VEHICLE REGULATION: HOW AN UNCERTAIN LEGAL LANDSCAPE MAY HIT THE BRAKES ON SELF-DRIVING CARS

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The automobile was an undeniably transformative invention. It revolutionized nearly every level of modern society, including personal and commercial transportation, national infrastructure, urban design and planning, and even warfare. Cars are arguably responsible for the shape and character of modern industrialized societies. But the enormous social utility of automobiles comes with a surprisingly large societal cost. Every year, more than 30,000 people in the United States die in car accidents.¹ Vehicle emissions take a huge toll on our environment.² Our cities are, to a large extent, far less walkable.³ Americans now spend an average of forty-two hours stuck in traffic every year.⁴ A 2010 report found that traffic accidents

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1. *General Statistics*, INS. INST. FOR HIGHWAY SAFETY: HIGHWAY LOSS DATA INST., <http://www.iihs.org/iihs/topics/t/general-statistics/fatalityfacts/state-by-state-overview> [<https://perma.cc/2MTC-KNF8>]; see also *Safer, Cleaner Transport Crucial for Improving Global Health, Report Shows*, WORLD BANK (Mar. 31, 2014), <http://www.worldbank.org/en/news/press-release/2014/03/31/safer-cleaner-transport-global-health> [<https://perma.cc/TP6F-Z4D9>] (finding that worldwide, road crashes result in “1.3 million deaths annually and 78.2 million nonfatal road injuries warranting medical care”).

2. See *Sources of Greenhouse Gas Emissions*, U.S. ENVTL. PROTECTION AGENCY (Dec. 11, 2015), <http://www3.epa.gov/climatechange/ghgemissions/sources/transportation.html> [<https://perma.cc/8U35-DRSZ>].

3. See Charles L. Marohn, Jr., *Cities for People—Or Cars?*, AM. CONSERVATIVE (Apr. 22, 2015), <http://www.theamericanconservative.com/articles/cities-for-people-or-cars> [<https://perma.cc/YU3G-H657>] (“[A] national consensus took shape in support of auto-based suburban expansion.”).

4. *Traffic Gridlock Sets New Records for Traveler Misery*, TEX. A&M TRANSP. INST. (Aug. 26, 2015), <http://mobility.tamu.edu/ums/media-information/press-release> [<https://perma.cc/Z4EE-92PV>].

cost American households \$836 billion every year,⁵ and traffic jams alone cost \$124 billion.⁶

Now, however, autonomous vehicles⁷ are right on the horizon. These vehicles, capable of navigating with little or no human intervention, may be the solution to many of the problems caused by traditional automobiles and provide some unexpected benefits. For example, ninety percent of car accidents are caused by human error.⁸ But once autonomous cars are commercially available, many predict accidents rates will decrease rapidly.⁹ Autonomous vehicles will also improve the flow of traffic, saving time and infrastructure spending.¹⁰ Interstate transport will become much cheaper and safer.¹¹ And the introduction of autonomous taxis may decrease the total amount of cars on the road, benefitting both our cities¹² and the environment.¹³

5. NAT'L HIGHWAY SAFETY ADMIN., THE ECONOMIC AND SOCIETAL IMPACT OF MOTOR VEHICLE CRASHES (2010, rev'd May 2015), <http://www-nrd.nhtsa.dot.gov/Pubs/812013.pdf> [<https://perma.cc/PRR5-YE2M>].

6. CTR. FOR ECON. & BUS. RES., THE FUTURE ECONOMIC AND ENVIRONMENTAL COSTS OF GRIDLOCK IN 2030 (2015), http://www.cebr.com/wp-content/uploads/2015/08/INRIX_costs-of-congestion_Cebr-report_v5_FINAL.pdf [<https://perma.cc/5PGS-4YTB>].

7. This Note uses the terms “autonomous vehicle” and “self-driving car” interchangeably. Additionally, this Note takes an optimistic view of autonomous vehicles—it assumes that they will work as predicted, and the analysis that follows is grounded in that assumption.

8. Bryant Walker Smith, *Human Error as a Cause of Vehicle Crashes*, CTR. FOR INTERNET & SOC'Y (Dec. 18, 2013), <http://cyberlaw.stanford.edu/blog/2013/12/human-error-cause-vehicle-crashes> [<https://perma.cc/ZZC4-3KG8>].

9. See, e.g., *Automobile Insurance in the Age of Autonomous Vehicles*, KPMG (June 2015), <https://www.kpmg.com/US/en/IssuesAndInsights/ArticlesPublications/Documents/automobile-insurance-in-the-era-of-autonomous-vehicles-survey-results-june-2015.pdf> [<https://perma.cc/Q45G-2F9X>] (“Accident frequency could drop by 80 [sic] percent.”).

10. Peter Cheney, *How Self-Driving Cars Will Ease Traffic Congestion*, GLOBE & MAIL (Dec. 12, 2013), <http://www.theglobeandmail.com/globe-drive/culture/commuting/how-self-driving-cars-will-ease-traffic-congestion/article15876882> [<https://perma.cc/DPB3-6NXB>].

11. See Scott Santens, *Self-Driving Trucks Are Going to Hit Us Like a Human-Driven Truck*, MEDIUM (May 14, 2015), <https://medium.com/basic-income/self-driving-trucks-are-going-to-hit-us-like-a-human-driven-truck-b8507d9c5961> [<https://perma.cc/357E-B5FR>].

12. See Nick Bilton, *Disruptions: How Driverless Cars Could Reshape Cities*, N.Y. TIMES (July 7, 2013), <http://bits.blogs.nytimes.com/2013/07/07/disruptions-how-driverless-cars-could-reshape-cities> [<https://perma.cc/9H6W-LAPF>]; Clive Thompson, *No Parking Here*, MOTHER JONES (Jan. 2016), <http://www.motherjones.com/environment/2016/01/future-parking-self-driving-cars> [<https://perma.cc/L6CQ-LFLY>].

13. Susan A. Shaheen & Timothy E. Lipman, *Reducing Greenhouse Emissions and Fuel Consumption*, 31 INTELLIGENT TRANSP. SOC'Y AM. 6 (2007), <http://www.itsa.org/files/pdf/ReducingGHGFuelConsump.pdf> [<https://perma.cc/U5KV-TLNE>].

But the transition from human-driven to autonomous cars will not be seamless because it remains unclear how they fit into existing legal and regulatory frameworks. Scholars have speculated about how exactly the law should and will handle the introduction of autonomous vehicles, reaching differing and often contradictory conclusions and suggestions. Some believe that existing legal frameworks will adequately address any issues, while others believe that new, comprehensive federal laws are necessary. This Note concludes that federal regulatory changes are probably necessary to address a variety of real and potential barriers to the successful nationwide introduction of autonomous vehicles. For the immediate future, Congress should at least consider a uniform, nationwide set of vehicle laws for autonomous vehicles. At most, the government should establish a new agency to handle novel issues surrounding artificial intelligence and robotics. Other scholars, however, have advocated for more moderate and sometimes unorthodox solutions that could solve the issues raised by autonomous vehicles without enacting new laws.

In Part I, this Note summarizes the history of autonomous vehicles. Part II discusses legal scholarship finding that autonomous vehicles are probably legal, then discusses the problems with using a traditional tort and contract law framework to assess autonomous vehicle liability, with a focus on products liability, assumption of risk, and varied state vehicle laws. Part III provides an overview of the current and pending state autonomous vehicle legislation, along with several scholars' proposed regulatory frameworks for the future. Finally, Part IV concludes that a uniform set of vehicle laws may be the best solution for the time being and discusses how inconsistent state laws may create obstacles for the design and release of autonomous vehicles.

I. THE HISTORY OF AUTONOMOUS VEHICLES

The world has been intrigued by the idea of a car that can drive itself since the early twentieth century.¹⁴ In 1939, General Motors (GM) displayed its *Futurama* exhibit,¹⁵ which consisted of a large model of a futuristic city where cars drove themselves seamlessly across automated highway tracks.¹⁶ Manual, human-driven automobiles at that time were incredibly dangerous, partly because of narrow, ill-paved roads that had

14. Marc Weber, *Where To? A History of Autonomous Vehicles*, COMPUTER HIST. MUSEUM, <http://www.computerhistory.org/atcm/where-to-a-history-of-autonomous-vehicles> [https://perma.cc/AU7X-PGZ6].

15. Tom Vanderbilt, *Autonomous Cars Through the Ages*, WIRED (Feb. 6, 2012), <http://www.wired.com/2012/02/autonomous-vehicle-history> [https://perma.cc/8T3D-GA64].

16. Weber, *supra* note 14.

initially been used for horse-drawn carriages.¹⁷ To early designers, automated highways seemed to solve the problem of dangerous roads and unsafe automobiles, and those designers envisioned new infrastructures where magnetic fields or rails kept cars moving safely in contained lanes.¹⁸ Two decades later, GM and RCA, a major electronics company at the time, began experimenting with scale models of automated highway systems that featured coils that could detect “the alternating current of a wire embedded in the road and . . . adjust the steering wheel accordingly.”¹⁹ GM also developed the Firebirds, a series of concept cars that were used to promote automated driving but were actually not automated at all.²⁰ By the late 1950s, GM had developed additional models that used wire currents with some success and were able to detect obstacles in the road.²¹

GM’s concept cars were initially popular with the public, but once it became clear that the designers had reached the technological limits of the time period, research and development quickly waned.²² Additionally, Congress began passing a series of federal safety and emission standards, and research shifted to finding more fuel-efficient ways of designing cars.²³

Across the ocean in Japan, a team of engineers was working to develop its own version of an autonomous vehicle. In 1977, S. Tsugawa and his colleagues at the Tsubuka Mechanical Engineering Laboratory displayed the first truly autonomous car, which featured two cameras that could process images of the road and used white street markers to track its direction.²⁴

Then, beginning in the 1980s, universities began teaming up with transportation agencies and automotive companies to research and design new concepts for autonomous vehicles.²⁵ These concept vehicles tended to fall into two categories: automated highway systems that would guide automated vehicles on some sort of grid; and autonomous and semi-autonomous vehicles that could function independently of the highway

17. *Id.*

18. *Id.*

19. John Wetmore, *Driving the Dream*, AUTOMOTIVE HIST. REV., Summer 2003, at 7.

20. *Id.*

21. *Id.* at 9.

22. *Id.* at 10.

23. *Id.*

24. Alex Forrest & Mustafa Konca, *Autonomous Cars and Society*, WORCHESTER POLYTECHNIC INST. 8 (May 1, 2007), <https://www.wpi.edu/Pubs/E-project/Available/E-project-043007-205701/unrestricted/IQPOVP06B1.pdf> [<https://perma.cc/VJ4L-74ZV>].

25. JAMES M. ANDERSON ET AL., RAND, AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS 56 (2014).

infrastructure.²⁶ Research into these concepts resulted in promising demonstrations and products.²⁷ In 1997, the California Partners for Advanced Transit and Highways (PATH) demoed their project “DEMO 97,” which consisted of eight autonomous vehicles moving down 7.6 miles of the I-15 Highway embedded with magnets.²⁸ An example of an early independent autonomous vehicle was the vehicle developed by notable German aerospace engineer Ernst Dickmanns and his team in the early 1980s that managed to travel at one hundred kilometers per hour on an empty highway, guided by cameras.²⁹ The success of this project earned Dickmanns the nickname “the pioneer of the autonomous car.”³⁰ In 1995, Carnegie Mellon researchers demoed their NavLab series of autonomous vehicles, and the fifth model of the series drove across the country and was ninety-eight percent autonomous.³¹ However, the car was only able to drive about seventy miles without human intervention.³²

In the early to mid-2000s, researchers and automobile companies began to seriously consider autonomous vehicles within reach. The U.S. Defense Advanced Research Projects (DARPA) held a series of “Grand Challenges” to see who could develop the best autonomous vehicles and drive them through a race course, with a prize of one million dollars.³³ The first challenge, held in 2004, met with limited success: the winner, the Carnegie Mellon team, only managed to get its car 7.3 out of 150 miles before it got stuck on a turn.³⁴ The following year, the prize money increased to two million dollars and there were twice as many entries.³⁵ Stanford’s vehicle took first place, completing the course with an autonomous Volkswagen Touareg.³⁶ In 2007, DARPA staged an urban racecourse that featured four miles of congested traffic, and several of the vehicles completed the course.³⁷

These contests brought significant popularity to autonomous vehicles, and companies such as GM and Volkswagen teamed up with leading university research centers to develop more advanced autonomous

26. *Id.*

27. *Id.*

28. *Id.*

29. *Id.*

30. Vanderbilt, *supra* note 15.

31. ANDERSON, *supra* note 25, at 56.

32. Vanderbilt, *supra* note 15.

33. *Id.*

34. *Id.*

35. *Id.*

36. *Id.*

37. *Id.*

vehicles.³⁸ Notably, Google also established a Driverless Cars initiative, hiring some of the best engineering talent in the field and providing them with access to Google's substantial resources.³⁹ As of late 2015, Google's efforts appear to have paid off: Google's autonomous vehicle crossed the million-mile mark in June, having driven a total of one million miles on public roads, through congested traffic areas, and on challenging streets such as San Francisco's famously curved Lombard Street.⁴⁰ Google's cars have only been involved in sixteen minor accidents in six years, all of which are allegedly the fault of other drivers.⁴¹

Several other companies are trying their hand at autonomous vehicles. Uber opened up its own self-driving car lab in early 2015 with the vision of creating driverless taxis.⁴² Tesla has been working on self-driving cars for several years, rolled out an autopilot mode to its existing cars beginning in October 2015, and hopes to commercially release a line of fully autonomous vehicles by 2018.⁴³ BMW,⁴⁴ Mercedes-Benz,⁴⁵ and now Apple⁴⁶ have decided to develop their own versions of self-driving cars. The Obama administration has even proposed a four-billion-dollar, ten-year plan to spur the development of these vehicles.⁴⁷ But with imminent public release

38. ANDERSON, *supra* note 25, at 57.

39. *Id.*

40. *Google Self-Driving Car Project*, GOOGLE (June 3, 2015), <https://plus.google.com/+SelfDrivingCar/posts/iMHEMH9crJb> [<https://perma.cc/NLB4-N4SY>].

41. *Google Self-Driving Car Monthly Report*, GOOGLE (Aug. 2015), <http://static.googleusercontent.com/media/www.google.com/en/us/selfdrivingcar/files/reports/report-0815.pdf> [<https://perma.cc/7EY2-TKF7>].

42. Jemima Kiss, *Uber: 'We'll Ease the Transition to Self-driving Cars'*, GUARDIAN (Sept. 16, 2015), <http://www.theguardian.com/technology/2015/sep/17/uber-well-ease-the-transition-to-self-driving-cars> [<https://perma.cc/7WP2-MKK9>].

43. Cadie Thompson, *Elon Musk Says Tesla's Fully Autonomous Cars Will Hit the Road in 3 Years*, TECH INSIDER (Sept. 25, 2015), <http://www.techinsider.io/elon-musk-on-teslas-autonomous-cars-2015-9> [<https://perma.cc/L4HL-YPB5>].

44. Tim Adams, *Self-driving Cars: From 2020 You Will Become a Permanent Backseat Driver*, GUARDIAN (Sept. 13, 2015), <http://www.theguardian.com/technology/2015/sep/13/self-driving-cars-bmw-google-2020-driving> [<https://perma.cc/EU7D-NU9H>].

45. Hannah Jane Parkinson, *Mercedes-Benz Announces Plans to Develop Luxury Driverless Cars*, GUARDIAN (Sept. 15, 2015), <http://www.theguardian.com/technology/2015/sep/15/mercedes-benz-eyes-luxury-driverless-cars-uber-self-driving-autonomous-vehicles> [<https://perma.cc/48GL-VJTJ>].

46. Lauren Helper, *Apple, Google, Tesla and the Race to Electric Self-Driving Cars*, GREENBIZ (Sept. 22, 2015), <http://www.greenbiz.com/article/apple-google-tesla-and-race-electric-self-driving-cars> [<https://perma.cc/AB7Y-M3UD>].

47. Brent Snaveley & Nathan Bomey, *Obama Administration Ready to Put \$4 Billion Toward Self-Driving Cars*, USA TODAY (Jan. 14, 2016), <http://www.usatoday.com/story/money/cars/2016/01/14/nhtsa-detroit-auto-show-autonomous-vehicles/78792868> [<https://perma.cc/3P26-RRZX>].

comes a series of important questions: how should these cars be regulated, and who should be liable when something goes wrong?⁴⁸

II. CURRENT CONCEPTIONS OF THE LAW APPLICABLE TO AUTONOMOUS VEHICLES

As the reality of commercially available self-driving cars becomes more imminent, concerns about how the law—specifically tort law—will treat liability for autonomous vehicles has risen considerably.⁴⁹ Recently, Volvo’s CEO Håkan Samuelsson announced in a press release that he believes that regulatory rather than technological hurdles are the biggest barriers to moving forward with self-driving tech, and as such, he has promised that Volvo “will accept full responsibility whenever one of its cars is in autonomous mode.”⁵⁰ This could be a huge step towards smoothing out and simplifying the laws of self-driving, but not all car manufacturers share Samuelsson’s view. Tesla, for example, may be designing its semi-autonomous vehicles specifically so that the human driver will be liable in the event of an accident.⁵¹ The electric car manufacturer plans to equip newer Model S sedans with semi-autonomous features, “including the capability to pass other cars without driver intervention.”⁵² That feature will be activated by hitting the turn signal, ensuring that “the driver has given thought to whether the maneuver is safe.”⁵³ Although not exactly the same situation, this serves as an example of how car manufacturers are approaching the issue of tort liability for autonomous vehicles in different ways. But before addressing the question of tort liability, it is important to

48. See Andrew Del-Colle, *The 12 Most Important Questions About Self-Driving Cars*, POPULAR MECHANICS (Oct. 8, 2013), <http://www.popularmechanics.com/cars/a9541/the-12-most-important-questions-about-self-driving-cars-160164180> [<https://perma.cc/6F33-E6PX>].

49. See, e.g., Chris Nichols, *Liability Could Be Roadblock for Driverless Cars*, SAN DIEGO TRIBUNE (Oct. 30, 2013), <http://www.sandiegouniontribune.com/news/2013/Oct/30/liability-driverless-car-transovation-google> [<https://perma.cc/78XY-5TD3>].

50. Chris Ziegler, *Volvo Says It Will Take the Blame If One of Its Self-Driving Cars Crashes*, THE VERGE (Oct. 7, 2015), <http://www.theverge.com/2015/10/7/9470551/volvo-self-driving-car-liability> [<https://perma.cc/NAG2-JATV>]. But note that the CEO hints that Volvo would not be responsible if the car’s software was hacked, and it would treat that as a criminal offense.

51. Mike Ramsey, *Who’s Responsible When a Driverless Car Crashes? Tesla’s Got an Idea*, WALL ST. J. (May 13, 2015), <http://www.wsj.com/articles/tesla-electric-cars-soon-to-sport-autopilot-functions-such-as-passing-other-vehicles-1431532720> [<https://perma.cc/YFF8-K32Y>] (“Hitting the turn signal not only tells the car it can pass, but also ensures the driver has given thought to whether the maneuver is safe.”)

52. *Id.*

53. *Id.*

address an equally important question: namely, are autonomous vehicles even legal under current law?

A. AUTONOMOUS VEHICLES ARE PROBABLY LEGAL

Legal scholar Bryant Walker Smith has written extensively on the subject of autonomous vehicles, and he concludes that under the current statutory and regulatory framework, self-driving cars “are probably legal in the United States.”⁵⁴ He comes to this conclusion after reviewing international agreements, federal regulations, and state vehicle codes.⁵⁵ Smith argues that the Geneva Convention, the 1949 multi-country agreement that promotes road safety by establishing certain common rules for automobile and other vehicles, “does not categorically prohibit automated driving.”⁵⁶ He notes further that under the Geneva Convention, the term “driver” is flexible enough that it may include non-human drivers, especially because international law recognizes the legal fiction of personhood that corporations can hold.⁵⁷ Smith concludes that the Geneva Convention creates an obligation that vehicles be controlled, but such control requirements may be satisfied “if a human is able to intervene in operation of a vehicle” or “if that vehicle operates within the bounds of human judgment.”⁵⁸ At most, Smith argues, the Geneva Convention requires people to take control and intervene if necessary,⁵⁹ but it may also allow a car that is loosely and more generally controlled by human decisions.⁶⁰

Smith next turns to the National Highway Traffic Safety Administration’s (NHTSA) regulations and similarly concludes that “federal motor vehicle safety standards do not categorically prohibit automated driving.”⁶¹ Although these rules tend to assume the presence of a driver behind the steering wheel, such a driver is not specifically mandated.⁶² Smith also looks to state vehicle codes and finds that on the whole, “state vehicle codes do not categorically prohibit automated

54. Bryant Walker Smith, *Autonomous Vehicles Are Probably Legal in the United States*, 1 TEX. A&M L. REV. 411 (2014).

55. *Id.*

56. *Id.* at 424.

57. *Id.* at 434. But note that acknowledging the personhood of a corporation is not the same as giving personhood to a vehicle.

58. *Id.* at 435.

59. *Id.* at 440.

60. *Id.*

61. *Id.* at 458.

62. *Id.* at 458–59. This is most likely because when these laws were written, no one even contemplated that autonomous vehicles could one day be a reality.

driving.”⁶³ He surveys regulations in every state as well as the Uniform Vehicle Code and concludes that even if automated vehicles are not prohibited, the regulations probably require a human driver, and there are numerous and various state obligations that might restrict the level of independence and complicate the operation of autonomous vehicles.⁶⁴ Smith also finds that under some states’ laws, vehicles themselves cannot be drivers under the existing law, but he also highlights an early draft of Nevada’s autonomous vehicle legislation that would have granted personhood and rights to autonomous vehicles if human drivers were not required.⁶⁵ Assuming that Smith’s analyses and conclusions are correct, autonomous vehicles may already have a place in existing law, but not without some uncertainties.

B. AUTONOMOUS VEHICLES AND CURRENT TORT AND CONTRACT LAW

There has been much debate and discussion about whether existing laws are already sufficient to handle autonomous vehicle liability. John Villasenor, a professor of electrical engineering and public policy at UCLA, writes that “existing tort and contract law frameworks are generally very well equipped to address” questions of liability in the context of autonomous vehicles.⁶⁶ He draws on existing legal scholarship in the area and argues that “[p]roducts liability law offers a time-tested framework that has proven to be adaptive to technology-driven liability issues in . . . other contexts,”⁶⁷ and he believes that the same framework “will be equally capable of doing so when applied to autonomous vehicles.”⁶⁸

Villasenor then discusses how existing law could be applied to the following theories of liability: negligence, strict liability, misrepresentation, and breach of warranty.⁶⁹ Under each of these theories, he posits a hypothetical where the theory would be applicable and gives examples of what the plaintiff could potentially argue.⁷⁰ He concludes by acknowledging that his analysis is not a comprehensive treatment of products liability law

63. *Id.* at 463.

64. *Id.*

65. *Id.* at 479.

66. JOHN VILLASENOR, BROOKINGS INST., PRODUCTS LIABILITY AND DRIVERLESS CARS: ISSUES AND GUIDING PRINCIPLES FOR LEGISLATION (2014), http://www.brookings.edu/~media/research/files/papers/2014/04/products-liability-driverless-cars-villasenor/products_liability_and_driverless_cars.pdf [<https://perma.cc/UNZ3-GDE2>].

67. *Id.*

68. *Id.*

69. *Id.* at 7.

70. *Id.* at 7–13.

in relation to self-driving cars, but he remains confident that the current tort and contract framework will adequately address liability.⁷¹ He uses the various examples in his paper to rebut the fear that many scholars and critics have recently articulated: namely, that legal liability will prove to be an impediment to innovation and may even prevent autonomous vehicles from becoming commercially available at all.⁷² He provides several guidelines and suggestions for policymakers moving forward, specifically that liability issues need not be preemptively resolved before autonomous vehicles are released⁷³ and that Congress “should not preempt state tort remedies with respect to autonomous vehicle liability.”⁷⁴ He does suggest that federal safety standards for autonomous vehicles should be enacted,⁷⁵ and that there should be some level of liability at the federal level for commercial autonomous vehicles, such as trucks or buses.⁷⁶

Other legal scholars share Villasenor’s view that current laws are sufficient to address autonomous vehicles. Andrew Garza writes that “[p]roducts liability law is capable of handling the advent of autonomous vehicles just as it handled seatbelts, air bags, and cruise control.”⁷⁷ He looks to the way the courts have historically handled these three technologies and suggests that, while complex, autonomous vehicles function similarly to technologies such as cruise control, and the use of cameras and record-keeping devices in the vehicles will lead to cheaper and speedier trials.⁷⁸ Another scholar, Kyle Graham, also takes an optimistic view regarding how tort law will impact autonomous vehicles.⁷⁹ He predicts that “[e]arly claims likely will resemble contemporary lawsuits that allege negligent vehicle use,”⁸⁰ and that new causes of action will emerge over time as the courts establish basic ground rules.⁸¹ He predicts that the early lawsuits will mostly argue under a failure-to-warn theory rather than alleging a design defect, mostly because it will be difficult for plaintiffs to sift through code to find

71. *Id.* at 13.

72. *Id.* at 14; *see* Nichols, *supra* note 49.

73. Villasenor, *supra* note 66, at 15.

74. *Id.*

75. *Id.* at 17.

76. *Id.*

77. Andrew P. Garza, “Look Ma, No Hands!”: Wrinkles and Wrecks in the Age of Autonomous Vehicles, 46 NEW ENG. L. REV. 581, 595 (2012).

78. *Id.* at 616.

79. Kyle Graham, *Of Frightened Horses and Autonomous Vehicles: Tort Law and Its Assimilation of Inventions*, 51 SANTA CLARA L. REV. 1241, 1270 (2012).

80. *Id.* at 1269.

81. *Id.* at 1270.

errors in the car's programming.⁸² On the whole, he doubts that tort litigation will prove too problematic for the autonomous vehicle industry.⁸³

While these scholars provide thoughtful, detailed analysis, the hypotheticals and examples they use to illustrate how existing tort and contract law can address potential problems with autonomous vehicles are fairly basic, and they do not account for many of the added complexities that arise when artificial intelligence is introduced. Regular, non-autonomous vehicles can suffer from the same brake failures and various manufacturing and design defects that Villasenor describes, or the failure-to-warn issues that Graham suggests. These examples may work well when applied to semi-autonomous and autonomous features of regular cars, but they break down when applied to fully autonomous vehicles with artificial intelligence, which may have to make decisions about how to react to circumstances. This is exactly the issue that scholars such as Ryan Calo are concerned about.⁸⁴ Even if courts are comfortable applying existing tort and contract law to autonomous vehicles, there are numerous concerns and complications that can and probably will prove problematic to both manufacturers and consumers. Furthermore, state law, especially with regard to automobile regulations, can vary wildly, and this could become a practical impediment to the implementation of autonomous vehicles.⁸⁵

C. AUTONOMOUS VEHICLES DO NOT FIT WITHIN EXISTING LEGAL FRAMEWORKS

Broadly speaking, if society applies existing tort and contract law to autonomous vehicles, liability for accidents will rest either with the manufacturer of the vehicle or with the driver. Experts and scholars have generally suggested that either products liability or assumption of risk may be the best solutions to the problem of assessing liability in this context.

1. *Products Liability*

The use of artificial intelligence and neural networks in autonomous vehicles may create surprising and unexpected complications in determining liability, and courts may not know exactly how to approach these problems. In the context of autonomous vehicles, where the vehicle, as opposed to the driver, is presumed to be in control, products liability theoretically fits.⁸⁶

82. *Id.* at 1270.

83. *Id.*

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

85. See *infra* Section II.D.

86. See Villasenor, *supra* note 66.

After all, the car is a product, manufactured and designed by a third party, and if that product has a flaw that results in an accident, it seems logical to hold the manufacturer liable. And indeed, this is exactly what Volvo plans to do with their vehicles.⁸⁷ But autonomous vehicles will likely not all be fully autonomous, and it may be difficult to determine the exact cause of an accident when a human actor assumes control. Furthermore, the kinds of products liability issues that self-driving cars are likely to face may stump the courts. Autonomous vehicles can be more or less thought of as robots that look like cars;⁸⁸ they are complex systems of sensors and hardware controlled by a dizzying variety of software systems, some of which may even be nondeterministic.⁸⁹ Essentially, the car itself will need to detect problems and make decisions in a variety of situations that cannot be specifically predicted by the software manufacturer, and scholars are worried about how the courts will handle this.⁹⁰

Ryan Calo, one of the preeminent authorities on artificial intelligence and the law, has written on this very issue.⁹¹ Drawing analogies to how the rise of the Internet led to tension in the law that disrupted existing legal frameworks, Calo writes that the rise of robotics will “muddy anew the waters, . . . posing distinct challenges for law and legal institutions.”⁹² He discusses how robotics is rapidly becoming the next big thing—Google has purchased several robotics companies for billions of dollars and released their driverless cars,⁹³ Amazon.com has been experimenting with using drones to deliver packages,⁹⁴ and venture capital firms typically associated with software companies are diverting capital to hardware, funding

87. Ziegler, *supra* note 50.

88. This Note uses the term “AI” here to generally describe complex software systems that independently evaluate incoming data and make decisions based on that data.

89. See Lyle N. Long et al., *A Review of Intelligent Systems Software for Autonomous Vehicles*, Proceedings of the 2007 IEEE Symposium on Constitutional Intelligence in Security and Defense Applications. The term “nondeterministic” in the programming context refers to systems that, given a certain input, give an unexpected and unpredictable output.

90. See Calo, *Robotics and the Lessons of Cyberlaw*, *supra* note 84 (arguing that courts may struggle to determine liability in autonomous vehicle accidents); Gary E. Marchant & Rachel A. Lindor, *The Coming Collision Between Autonomous Vehicles and the Liability System*, 52 SANTA CLARA L. REV. 1321 (2012) (analyzing possible ways that courts may assign liability and how that could have a deterrent effect on the industry). *But see* Villasenor, *supra* note 66 (arguing that courts will be able to adequately handle autonomous vehicles).

91. Calo, *Robotics and the Lessons of Cyberlaw*, *supra* note 84.

92. *Id.* at 516.

93. *Id.* at 527.

94. *Id.*

numerous robotics startups.⁹⁵ Even law firms are taking notice of this rise, with entirely new practice groups devoted to robotics and AI.⁹⁶ But the courts may have trouble keeping up with these new emerging technologies.

Calo argues that what differentiates robotics from other technologies is what he terms the “sense-think-act paradigm.”⁹⁷ Robots can be described as “artificial objects or systems that sense, process, and act upon the world to at least some degree,”⁹⁸ which leads to “unpredictably useful behavior.”⁹⁹ The problem that courts will have to face, especially when it comes to liability, is who is actually responsible when something bad happens. Robots depend to a large extent on software programming, which can be so extraordinarily complex that it is impossible to predict a robot’s behavior.¹⁰⁰ “[A]nticipating and accounting for robot behavior” may be an extraordinarily difficult task.¹⁰¹ Scholars and journalists are concerned about exactly this issue—“should an autonomous vehicle sacrifice its occupant by swerving off a cliff to avoid killing a school bus full of children?”¹⁰² The car’s code may determine how it approaches these kinds of decisions, but the exact reasoning and circumstances behind the result (and therefore the level of negligence) may not be so clear, especially when dealing with neural networks, where the robot learns how to react rather than being explicitly told what to do.¹⁰³

Calo succinctly identifies the problem with applying products liability to robotics generally: “products as understood by contemporary product liability law are by definition tangible—intangible products do not generally give rise to product liability actions.”¹⁰⁴ Calo argues that the software code conveyed to a consumer necessarily cannot be defective for purposes of product liability because by definition, “it is not even a product.”¹⁰⁵ To resolve this issue, courts have used the economic loss doctrine to limit

95. *Id.*

96. *Id.*

97. *Id.* at 529.

98. *Id.* at 531.

99. *Id.* at 532.

100. *Id.*

101. *Id.* at 534.

102. Keith Naughton, *Should a Driverless Car Decide Who Lives or Dies?*, BLOOMBERG BUS. (June 25, 2015), <http://www.bloomberg.com/news/articles/2015-06-25/should-a-driverless-car-decide-who-lives-or-dies-in-an-accident-> [https://perma.cc/P3QJ-RCEQ].

103. See, e.g., Dean Al Pomerleau, *Neural Network Vision for Robotic Driving*, in THE HANDBOOK OF BRAIN THEORY AND NEURAL NETWORKS 161 (Michael A. Arbib ed., 1995).

104. Calo, *Robotics and the Lessons of Cyberlaw*, *supra* note 84, at 535.

105. *Id.* at 536.

liability when an economic loss is suffered due to software failure¹⁰⁶ but have also allowed tort actions to proceed when software glitches lead to actual physical harm.¹⁰⁷ Moving forward, Calo believes the law will often face and struggle with the issue of how to approach these kinds of problems, which may result in either “soften[ing] or strengthen[ing] existing doctrines, import[ing] doctrines across subject matter, or resurrect[ing] doctrines long forgotten.”¹⁰⁸ Either way, it could be very difficult.

Practically speaking, if courts apply products liability law to autonomous vehicles, the various manufacturers will potentially face enormous liability. Plaintiffs in tort actions generally sue parties with money, and if there is an accident involving an autonomous vehicle, they will likely try to recover damages from big name players such as Google, Tesla, and other manufacturers. An upswing in lawsuits immediately after autonomous vehicles become commercially available is also likely. One scholar, Kyle Colonna, notes that this is usually the case when new technologies emerge; he predicts that autonomous vehicles will be no exception.¹⁰⁹ Tort claims for accidents caused by human error (such as drunkenness or distraction) will quickly be replaced by products liability for software or other mechanical failure, and manufacturers “will incur more liability than they are currently accustomed.”¹¹⁰ If not mitigated, this increase in litigation has the potential to halt the innovation and public sale of autonomous vehicles.

In fact, this exact problem has been observed in other contexts. In the United States biotechnology industry, which produces vaccines and other pharmaceuticals, lawsuits for products liability increased by 813% between 1980 and 1988.¹¹¹ The average jury verdict in these cases also dramatically increased, jumping from \$400,000 in 1975 to \$1.8 million in 1986.¹¹² Colonna argues that this correlates with the twenty-five percent decrease in the number of public U.S. biotechnology companies between 2007 and 2010.¹¹³ The International Trade Administration has identified that “products liability law is a ‘severe’ barrier for innovation in the biotechnology

106. *Id.* at 537.

107. *Id.*

108. *Id.*

109. Kyle Colonna, *Autonomous Cars and Tort Liability*, 4 J.L. TECH. & INTERNET 81, 115 (2012) (“When a new technology emerges, there is usually an increase in general negligence claims and liability.”).

110. *Id.* at 117.

111. *Id.* at 110.

112. *Id.*

113. *Id.* However, this is not to say that the size of the pharmaceutical industry itself decreased.

industry.”¹¹⁴ Many drug companies are hesitant to produce new vaccines and potentially safer vaccines because of the sheer number of lawsuits that erupt when those new products are released.¹¹⁵ And this is not part of a constructive process—vaccines and other drugs have enormous social utility. They “prevent disease, lower healthcare costs, and generally advance humanity.”¹¹⁶ But despite this utility, biotechnology companies are so concerned with the unpredictable and excessive liability damages that innovation in the field is stifled.¹¹⁷

If the same thing happens in the autonomous vehicles industry, the field may see innovation similarly chilled. Undoubtedly there will be some problems with autonomous vehicles, especially the earlier iterations.¹¹⁸ But like vaccines, autonomous vehicles have enormous social utility. They are projected to save thousands of lives by reducing accidents due to human error,¹¹⁹ increase fuel and time efficiency for commutes,¹²⁰ and provide numerous other predicted benefits. But these benefits may never be realized if an overwhelming number of initial lawsuits makes it financially unrealistic to produce autonomous vehicles. If courts use a strict products liability regime, we may disincentivize manufacturers from innovating and taking risks that may pay off for society later. But if the social utility of autonomous vehicles outweighs the danger, society may not want manufacturers to be chilled by expensive product liabilities lawsuits.

2. *Assumption of Risk*

Another option for dealing with autonomous vehicle torts under existing law is to ask consumers to sign waivers that accept the risks of autonomous vehicles and take personal responsibility for accidents. If consumers waive their right to sue the manufacturers (at least up to a certain point), a large percentage of initial products liability lawsuits may be reduced or mitigated. Without the fear of crippling lawsuits, these manufacturers may be more encouraged to innovate freely and more quickly develop and release improved autonomous vehicles. But such a system would transfer all of the risk from the manufacturer to the consumer—and it may not be fair or even desirable to ask the less powerful parties in an agreement to shoulder potentially tremendous liability. Additionally, it is

114. *Id.*

115. *Id.*

116. *Id.*

117. *Id.* at 111.

118. *See* Marchant & Lindor, *supra* note 90, at 1339.

119. Colonna, *supra* note 109, at 111.

120. *Id.* at 112–13.

possible that manufacturers may not take as great care in designing their vehicles if they know they will not be held liable for problems later.

An additional problem with the assumption of risk approach is that it would require the manufacturers to “fully disclose the potential risks of the vehicle, including the likely failure modes and some approximate sense of their probability.”¹²¹ Considering the unpredictable nature of artificial intelligence, manufacturers may not be able to foresee all of the potential risks, and if anything happened that was not previously disclosed, liability would likely revert to the manufacturer.¹²² And even if the manufacturer is able to discover and disclose all potential risks, consumers might be driven away by a long list of scary risks that are possible in an already uncertain technology, and this could hinder growth in the industry before it has the chance to fully emerge.

One potential way of dealing with this problem may be to let insurance companies mitigate much of this risk. Insurance companies can assess the safety and risks of autonomous vehicles, and then adjust consumer insurance rates accordingly.¹²³ In theory, the safer the vehicle, the less expensive the insurance premiums will be.¹²⁴ In fact, the insurance industry has already done some preliminary assessments on autonomous vehicles, finding that the rate of accidents may drop by up to eighty percent, but the costs of future accidents may double both due to the severity of those accidents and the high price of the component parts of autonomous vehicles.¹²⁵ Fundamentally, “lower losses lead to [a] lower premium,” and if manufacturers of autonomous vehicles can achieve lower accident rates, insurance premiums should decrease, and consumers will happily pay lower costs.¹²⁶ Insurance companies often have the most up-to-date information about vehicle safety and accident probability in the market, and they can most accurately assess the risks associated with different brands of autonomous vehicle, as they currently do with human-driven automobiles.¹²⁷ They can then use that data to charge a premium on cars that are unsafe, which would push customers away from those cars and towards safer cars.¹²⁸ Because customers will likely try to purchase cars with cheaper insurance, manufacturers may be incentivized to produce safer and

121. Marchant & Lindor, *supra* note 90, at 1336.

122. *Id.*

123. See KPMG, *supra* note 9.

124. See ANDERSON, *supra* note 25, at 115.

125. KPMG, *supra* note 9.

126. *Id.*

127. See ANDERSON, *supra* note 25, at 115.

128. See *id.*

thus cheaper cars—unsafe cars might have expensive insurance premiums and in theory, consumers will avoid them.¹²⁹

D. STATES CURRENTLY DO NOT HAVE UNIFORM VEHICLE LAWS

Another issue that impacts the question of tort liability is how varying state law will impact autonomous vehicle regulation. The current laws pertaining to automobiles are largely decided by individual states.¹³⁰ Although the National Highway Traffic Safety Administration has issued a set of federal safety standards and regulations that all states must adhere to,¹³¹ most traffic laws, that is, laws that regulate driving behavior, are implemented by specific state statutes.¹³² It may be difficult to design a self-driving car that can comply with certain state laws, and many laws may be such a bad fit for autonomous vehicles that it would be impractical and illogical to ask drivers to adhere to them.

As Bryant Walker Smith notes in his analysis of the current legal status of autonomous vehicles, New York law requires that drivers keep at least one hand on the steering wheel of their car at all times.¹³³ This would not necessarily be a difficult law to comply with from the manufacturer's perspective, but it may be entirely superfluous for the occupant of an autonomous vehicle—if the car is essentially the driver, there would be no need for someone in the car to be holding the steering wheel.

But some state laws may hinder the development of autonomous vehicles. For example, New Jersey has a law requiring drivers to honk their horn when passing other vehicles, bicyclists, skateboarders, and skaters.¹³⁴

129. But note that humans are notoriously irrational, and some people may choose to pay three times as much a month in insurance for a self-driving Aston Martin, even if it is twice as likely to run over small children as a Volvo. Aston Martin specifically requested to be exempted from U.S. safety regulations, and yet despite this lack of safety compliance, consumers continue to purchase cars from this luxury brand. See Chris Bruce, *Aston Martin Requests Exemption from Stringent US Safety Regulations*, AUTOBLOG (Apr. 18, 2014), <http://www.autoblog.com/2014/04/18/aston-martin-nhtsa-safety-exemption-db9-vantage> [<https://perma.cc/DP5W-SA46>].

130. See *Automated Driving: Legislative and Regulatory Action*, CTR. FOR INTERNET & SOC'Y, http://cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action [<https://perma.cc/9M5P-WD55>].

131. *Federal Motor Vehicle Safety Standards*, U.S. DEP'T TRANSP., <http://www.nhtsa.gov/cars/rules/import/FMVSS/> [<https://perma.cc/LAU9-VVTE>].

132. See *Motor Vehicles—State Statutes*, LEGAL INFO. INST., https://www.law.cornell.edu/wex/table_motor_vehicles [<https://perma.cc/UU24-EMAM>].

133. Smith, *supra* note 54, at 413.

134. Mitch Lipka, *Honk! State Driving Law is Largely Ignored*, PHILLY.COM (Mar. 13, 2003), http://articles.philly.com/2003-03-13/news/25472340_1_legislature-strikes-law-horn [<https://perma.cc/UXR3-LEQ8>].

This law—enacted in 1928—is almost never enforced, but the legislature has never stricken it from the books. It is still in the New Jersey driving manual, and questions about this law occasionally appear in New Jersey DMV practice tests.¹³⁵ This raises an interesting and important question for manufacturers of autonomous vehicles—do they need to design their vehicles to adhere to this state law, even if it is rarely enforced? Consider Pennsylvania’s law on the matter, which mandates that drivers “NEVER honk [their] horn at bicyclists”¹³⁶ because it may startle them and cause an accident. Which law should manufacturers follow? Will they be required to design their vehicles to detect when they enter New Jersey and then enable auto-honking when they pass other vehicles, and disable the honking when they enter Pennsylvania? In Vermont, it is legal to pass vehicles on a double-yellow line, while it is illegal almost everywhere else.¹³⁷ Will the car need to be programmed to change how it operates and behaves in every state? The answers here are not completely clear.

Many other state vehicle laws make no sense when applied to autonomous vehicles. California is currently the only state that allows motorcycles to lane-split around cars in traffic.¹³⁸ Google, headquartered in California, has been working on programming defensive driving techniques that include evading lane-splitting motorcycles and electric skateboards.¹³⁹ But what of manufacturers not located in California? Will they also have to program their vehicles to anticipate and react to motorcycles driving very close to the car? In Oklahoma, it is illegal to read comic books while driving, presumably because reading while driving is very dangerous in general.¹⁴⁰ Wearing headphones while driving is legal in thirty-three states, illegal in

135. *Id.*

136. *Id.*

137. *Vermont, Passing Safely on Two-Lane Roads*, DEP’T MOTOR VEHICLES, http://dmv.vermont.gov/sites/dmv/files/pdf/DMV-Enforcement-SM-Passing_safely_on_2_lane_roads.pdf [https://perma.cc/9FKH-PBCV].

138. Zusha Elinson, *Motorcycle Lane-Splitting Could Move Beyond California*, WALL ST. J. (Mar. 6, 2015), <http://www.wsj.com/articles/motorcycle-lane-splitting-could-move-beyond-california-1425678764> [https://perma.cc/H97M-37QL]. But other states are considering allowing lanesplitting as well.

139. Lance Whitney, *Google’s Self-Driving Cars Hit the Roads in Austin, Texas*, CNET (July 7, 2015), <http://www.cnet.com/news/googles-self-driving-cars-hit-the-roads-in-austin-texas/> [https://perma.cc/Z7US-8ZG7]; *Google Self-Driving Car Project* (June 3, 2015), <https://static.googleusercontent.com/media/www.google.com/en//selfdrivingcar/files/reports/report-0615.pdf> [https://perma.cc/4R7A-KGN6].

140. *The Top 10 Strangest Driving Laws in the U.S.*, DIRECT AUTO & LIFE INS., <https://www.directgeneral.com/news-and-events/2014/05/strangest-driving-laws-in-the-us> [https://perma.cc/5W56-ZN4X].

four states, and complicated in the remaining thirteen.¹⁴¹ In some states, there are only certain places in a vehicle where it is legal to attach a GPS.¹⁴² Several states prohibit talking on a cellphone or texting while driving.¹⁴³

These are only a few examples of traffic laws that differ by state, but there are many other state-specific laws, both reasonable and unreasonable, that may not make sense for autonomous vehicles, or may make full nationwide implementation difficult. Even maximum speed limit laws¹⁴⁴ or following-distance laws, which differ by state, could prove tricky. Even though an autonomous vehicle may fairly easily detect the state in which it is located, will it be legally obligated and technically able to react accordingly? Some states or localities may even need specific autonomous vehicle modifications to address unique terrain or other distinctive needs, and it may be difficult for manufacturers to know which needs to address before commercial release.¹⁴⁵

State vehicle laws are simply not uniform, and this may pose problems for autonomous vehicle manufacturers. Each individual state could try to individually go through their laws and decide which ones should apply to autonomous vehicles, but technology may move much faster than the rate at which laws are repealed or changed.¹⁴⁶ Even if they are modified in a timely fashion, we probably cannot expect the changes to be uniform across the country. Even now, the current legislation on autonomous vehicles, sparse as it may be, is different in different states.¹⁴⁷

141. Jason Siu, *Wearing Headphones While Driving Legal in Most States*, AUTOGUIDE (Apr. 29, 2012), <http://www.autoguide.com/auto-news/2012/04/wearing-headphones-while-driving-legal-in-most-states.html> [https://perma.cc/G73H-553C].

142. See Scott J. Wilson, *Five California Traffic Laws That Drivers May Be Confused About*, L.A. TIMES (Dec. 18, 2011), <http://articles.latimes.com/2011/dec/18/business/la-fi-five-carlaws-20111218> [https://perma.cc/6FQK-9AUJ].

143. See *Distracted Driving*, INS. INST. FOR HIGHWAY SAFETY HIGHWAY LOSS DATA INST., <http://www.iihs.org/iihs/topics/laws/cellphonelaws/maphandheldcellbans> [https://perma.cc/SF9C-Y4H9].

144. See *State Speed Limits Chart*, NAT'L MOTORISTS ASS'N, <https://www.motorists.org/issues/speed-limits/state-chart/> [https://perma.cc/22UE-FLJT].

145. Autonomous vehicle testing is mostly done in California and other fair-weather states. See Doron Levin, *The Cold, Hard Truth About Autonomous Vehicles and Weather*, FORTUNE (Feb. 2, 2015), <http://fortune.com/2015/02/02/autonomous-driving-bad-weather> [https://perma.cc/MG3K-H4U2] (discussing how Google's car has not yet been tested in the snow, and its sensing technology may be inoperative in a snowstorm).

146. See, e.g., Vivek Wadhwa, *Laws and Ethics Can't Keep Pace with Technology*, MIT TECH. REV. (Apr. 15, 2014), <http://www.technologyreview.com/view/526401/laws-and-ethics-cant-keep-pace-with-technology> [https://perma.cc/TCW2-4DUQ].

147. *Automated Driving*, CTR. FOR INTERNET & SOC'Y, *supra* note 130.

III. PENDING REGULATIONS AND PROPOSED SOLUTIONS FOR REGULATING AUTONOMOUS VEHICLES

As autonomous vehicles move closer to market release, certain actions may help facilitate a smooth introduction. Several states have already passed or are considering autonomous vehicle legislation, and legal scholars have weighed in on the matter and offered a series of proposed solutions.

A. LAWS SPECIFIC TO AUTONOMOUS VEHICLES

Eight states have already passed and enacted laws regulating autonomous vehicles.¹⁴⁸ In 2011, Nevada became the first state to pass such a law when it passed two pieces of legislation directing the DMV to adopt regulations for licensing and operation of autonomous vehicles,¹⁴⁹ as well as permitting occupants of autonomous vehicles to use cell phones while “driving.”¹⁵⁰ In 2012, Florida adopted very similar legislation that established the legality of testing autonomous vehicles¹⁵¹ and prohibited cellphone use but exempted operators of vehicles that function in autonomous mode.¹⁵² California also passed its own legislation in 2012 that added special oversight of vehicles without drivers and compelled manufacturers of autonomous vehicles to provide a written disclosure describing what information is collected by the vehicle.¹⁵³ The District of Columbia,¹⁵⁴ Michigan,¹⁵⁵ and most recently Tennessee¹⁵⁶ have also passed their own legislation. Further, nineteen additional states currently have similar bills under consideration.¹⁵⁷

But Bryant Walker Smith foresees complications with the implementation of these laws.¹⁵⁸ He notes that there are different definitions of “driver,” “control,” and “autonomous” under various federal and state laws, and thus he suggests that regulatory bodies should strive to use a common vocabulary.¹⁵⁹ Furthermore, he suggests that federal and state

148. *Id.*

149. A.B. 511 (Nev. 2011).

150. S.B. 140 (Nev. 2011).

151. C.S./H.B. 1207 (Fla. 2012).

152. S.B. 52 (Fla. 2013).

153. S.B. 1298 (Cal. 2012).

154. B19-0931 (D.C. 2012).

155. S.B. 0169; S.B. 0663 (Mich. 2013).

156. H.B. 0616; S.B. 0598 (Tenn. 2015).

157. Smith, *supra* note 54, at 500. This is as of December 2015.

158. *Id.* at 516.

159. *Id.* at 517.

legislatures should sift through current laws and decide which existing laws should apply to autonomous vehicles, and which they should be exempted from.¹⁶⁰ But while the existing laws may be sufficient to permit testing of autonomous vehicles for the time being, it may prove quite problematic to fully introduce self-driving cars while still maintaining the existing legal framework for human-driven vehicles. The lack of uniformity in state vehicle codes and the uncertain question of how liability will be distributed compounds this issue.

B. SCHOLARLY PROPOSALS FOR REGULATING AUTONOMOUS VEHICLES

Although Villasenor argues that a federal tort law would be a very bad idea because it would infringe upon states' rights,¹⁶¹ many other scholars disagree and believe that the federal government should intervene. In a 2014 RAND report, the authors argue that federal tort preemption may be a good way to prevent inconsistent state laws from governing in liability cases.¹⁶² Although preemption in general is a controversial doctrine, many think that federal agencies are better at making regulatory decisions than juries, and it may be "unfair to subject product manufacturers to potentially fifty-one different and sometimes conflicting sets of requirements, depending on the particular holdings of juries in fifty-one jurisdictions."¹⁶³ Additionally, federal preemption exists in other areas of the law, even in the automotive context. In 2000, the Supreme Court found that the National Traffic and Motor Vehicle Safety Act preempted a state tort law that would have found a manufacturer negligent for failing to equip pre-1978 vehicles with airbags.¹⁶⁴ Congress has also passed technology-specific preemption in a variety of other industries over the past century,¹⁶⁵ so it may not be unreasonable to do so again with such a new and potentially dangerous technology like autonomous vehicles. Marchant and Lindor note that although NHTSA has not yet adopted a set of Federal Motor Vehicle Safety Standards, they may "if autonomous vehicles are likely to become prevalent and raise unique safety issues."¹⁶⁶

160. *Id.*

161. Villasenor, *supra* note 66, at 16.

162. ANDERSON, *supra* note 25, at 129.

163. *Id.*

164. *Id.* at 130 (citing *Geier v. Am. Honda Motor Co.*, 529 U.S. 861 (2000)). But note that this case was very narrowly decided (5 to 4).

165. *Id.* at 131.

166. Marchant & Lindor, *supra* note 90, at 1339.

To deal with the specific concern of manufacturer liability chilling autonomous vehicle innovation, Kyle Colonna suggests that Congress adopt a model similar to that of the 1957 Price-Anderson Act, which was enacted both to “compensate those injured as a result of a nuclear accident” and limit the liability of individual nuclear reactors.¹⁶⁷ This Act mandated a two-tier insurance program that worked to prevent excessive liability.¹⁶⁸ Each nuclear reactor was individually required to “obtain a ‘first tier’ insurance policy,” and then each nuclear reactor in the industry contributed a certain amount to a secondary insurance pool, which would be drawn from if the first tier became exhausted.¹⁶⁹ This spreads the risk across many manufacturers and insurance companies and prevents individual companies from going bankrupt.¹⁷⁰ Colonna suggests that such a model could be applied to autonomous vehicles, which may be high-risk, much like nuclear reactors.¹⁷¹ This would ensure that individual manufacturers would “not have to worry about the risk of liability affecting their profits because there [would] be two tiers of insurance and a ceiling on damages.”¹⁷²

But it may be necessary to go even further than that. Rather than passing a set of federal tort preemption laws or an insurance act, Congress may wish instead to establish a governmental agency to handle regulations and standards. Ryan Calo thinks this may be a good choice and has argued at length in favor of a federal robotics commission.¹⁷³ Historically, Congress has created agencies for new, emergent technologies. In 1926, Congress formed the Federal Radio Commission “to manage the impact of radio on society.”¹⁷⁴ That agency is now the Federal Communications Commission (FCC), and deals with a variety of new technologies related to mobile networks and communications devices.¹⁷⁵ Similarly, the emergence of trains led to the Federal Railroad Administration (now the Department of Transportation),¹⁷⁶ vaccines led to the Centers for Disease Control and

167. Colonna, *supra* note 109, at 122.

168. *Id.*

169. *Id.* at 123.

170. *Id.* at 124.

171. *Id.*

172. *Id.* at 125.

173. See Ryan Calo, *The Case for a Federal Robotics Commission*, BROOKINGS INST. (Sept. 2014), http://www.brookings.edu/~media/Research/Files/Reports/2014/09/case-for-federal-robotics-commission/RoboticsCommissionR2_Calo.pdf [<https://perma.cc/PF4C-T3KV>].

174. Calo, *Robotics and the Lessons of Cyberlaw*, *supra* note 84, at 556.

175. *Id.*

176. *Id.* at 556–57.

Prevention (now part of the Department of Health and Human Services),¹⁷⁷ and airplanes necessitated the formation of the Federal Aviation Administration.¹⁷⁸ Calo notes that agencies are more or less created to “foster justice and efficiency through the development of expertise,” and considering current uncertainties about the immediate impact and fallout of autonomous vehicles, an agency might be the best choice to ensure that the best decisions are being made.¹⁷⁹

Other scholars have suggested entirely new ways of approaching this problem. Sophia Duffy and Jamie Patrick Hopkins put forth an unorthodox and yet startlingly intuitive legal theory—perhaps instead of looking at products liability and driver liability, we should be analogizing to canine liability.¹⁸⁰ They argue that “both dogs and autonomous cars think and act independently from their human owners, and these independent acts have similar consequences of inflicting personal injury or property damage.”¹⁸¹ If autonomous cars are treated as chattel under tort law, then liability will be based strictly on ownership rather than on the specific actions of a person,¹⁸² and the actions of the victim, if they contributed to the accident, “can negate or alleviate the strict liability.”¹⁸³ While Duffy and Hopkins’ argument is not bulletproof (they either overlook or dismiss the possibility of products liability entirely), their theory shows that the law is perhaps capable of adapting to novel situations, and the solutions to these liability questions may lie in unexpected places.

IV. MOVING FORWARD: WHERE WE GO FROM HERE

While the above scholars provide a variety of plausible suggestions, Volvo’s CEO has likely proposed the best solution for the short-term. As Samuelsson argues, we probably need a uniform set of state traffic laws for autonomous vehicles, if not tort laws.¹⁸⁴ He notes that “the absence of one set of rules means that car makers cannot conduct credible tests to develop cars that meet all the different guidelines of all 50 states.”¹⁸⁵ Most states have not created legislation surrounding autonomous vehicles yet, and this may

177. *Id.*

178. *Id.*

179. *Id.* at 557.

180. Sophia H. Duffy & Jamie Patrick Hopkins, *Sit, Stay, Drive: The Future of Autonomous Car Liability*, 16 SMU SCI. & TECH. L. REV. 101, 113 (2013).

181. *Id.*

182. *Id.* at 117.

183. *Id.* at 116.

184. *See* Ziegler, *supra* note 50.

185. *Id.*

leave testing “in a legal gray zone.”¹⁸⁶ To ensure that these vehicles can enter the market and can operate legally across the country, manufacturers need to know which laws they need to program the cars to follow. It may be impossible to design a vehicle that can adhere to every single law in all fifty-one jurisdictions, so perhaps states need to work together to form a consistent and cohesive vehicle code that will regulate the testing and eventually the release and commonplace use of autonomous vehicles.

State traffic and tort laws are not uniform, and the few state laws applying to autonomous vehicles that have already passed or are being considered continue to be non-uniform.¹⁸⁷ This could be very problematic as the release date for commercially available autonomous vehicles draws ever nearer. Most of the laws that have been passed so far have been fairly reasonable,¹⁸⁸ but there is no guarantee that states will continue to make logical choices about autonomous vehicles, and many states have not even begun to discuss how they will handle the introduction of such vehicles.¹⁸⁹ As time passes and more bills are pushed through state legislatures, laws may start to wildly differ by state. Allowing individual states to continue to make laws about these vehicles is probably not the best course of action.

Since tort law already varies by state, differing liability laws might incentivize forum shopping. Consumers may choose to litigate in states that require strict liability for manufacturers, and manufacturers may want to litigate in states that tend to consider contributory or comparative negligence. Five states have already passed laws regarding liability for autonomous vehicles, though these laws have generally focused on liability to original manufacturers when third-party autonomous vehicle technology has been installed on existing cars.¹⁹⁰

As Smith discusses at length in his article, varying laws may make it troublesome to successfully introduce autonomous vehicles into the market.¹⁹¹ Currently, all states require drivers to be licensed,¹⁹² but if the car itself is the driver, will human occupants still need to be licensed? Some states have issued special licenses for testing autonomous vehicles, but the laws will likely need to be clarified in this area. Textual obstacles might

186. *Id.*

187. *Id.*

188. For example, laws allowing cellphone use and establishing the legality of testing autonomous vehicles are not unreasonable.

189. *Automated Driving*, CTR. FOR INTERNET & SOC'Y, *supra* note 130.

190. *Id.* (indicating that California, the District of Columbia, Florida, Michigan, and Nevada have passed third-party liability laws).

191. Smith, *supra* note 54, at 517.

192. *Id.* at 480.

emerge from state laws that could require drivers to be present in the vehicle,¹⁹³ and laws that impose an “obligation of prudence”¹⁹⁴ on drivers, requiring both the driver and the vehicle to drive safely and responsibly. As written, many state laws do not anticipate autonomous vehicles, and law enforcement personnel might be confused about whether an autonomous vehicle is operating legally.¹⁹⁵

Varying state laws may also impose burdens on software developers, who could have to tailor the already complex software in autonomous vehicles to adhere to specific laws in specific regions. As many laws on the books are not enforced,¹⁹⁶ it may be tedious and difficult work to go through all of the vehicle codes for every state and individually determine which laws should be integrated into the software. And even if developers do manage to successfully program autonomous vehicles to follow every single state law perfectly, law enforcement officers, using their discretion, might still decide that an occupant of an autonomous behavior is engaging in reckless or unsafe behavior and issue a ticket.¹⁹⁷ Because of this difficulty, manufacturers may choose instead to design their vehicles to comply with the laws of the most restrictive states. This has happened in other technology industries that extend across state borders. Professor Peter Menell has written about this phenomenon in the context of regulating spyware and adware, finding that “the lack of harmonization of, and uncertainty surrounding, state unfair competition law produces costly, confusing, multi-district litigation and pushes enterprises to adhere to the limits of the most restrictive state.”¹⁹⁸ This, in turn, “unduly hinders innovation”¹⁹⁹ Because of the difficulty of adhering to various state laws

193. *Id.* at 482–87.

194. *Id.* at 487.

195. For example, police in Mountain View, CA were perplexed when they pulled over a Google car for driving nine miles below the speed limit. After finding no driver, they lectured the car’s passenger about impeding traffic and ultimately decided that the car was not breaking any laws, and they did not issue a ticket. Don Melvin, *Cop Pulls Over Google Self-Driving Car, Finds No Driver to Ticket*, CNN (Nov. 13, 2015), <http://www.cnn.com/2015/11/13/us/google-self-driving-car-pulled-over> [<https://perma.cc/H4VX-3U2V>].

196. See Ziegler, *supra* note 50.

197. Aaron M. Kessler, *Hands-Free Law Takes the Wheel, and Law Isn’t Stopping Them*, N.Y. TIMES (May 3, 2015), <http://www.nytimes.com/2015/05/03/business/hands-free-cars-take-wheel-and-law-isnt-stopping-them.html> [<https://perma.cc/7LXB-2Z82>] (“If a police officer sees you driving down the road with no hands, he could determine that’s reckless and still give you a ticket.”).

198. Peter S. Menell, *Regulating “Spyware”: The Limitation of State “Laboratories” and the Case for Federal Preemption of State Unfair Competition Laws*, 20 BERKELEY TECH. L.J. 1363, 1372 (2005).

199. *Id.*

and the consequences of doing so, allowing states to individually legislate autonomous vehicles may actually impede the introduction and spread of this technology.

In fact, this may already be happening in California, where the DMV has suggested a series of proposals that would seriously slow innovation.²⁰⁰ These proposals require that all autonomous vehicles have a human operator that can take over in the event of a technology failure or emergency.²⁰¹ Such a requirement would slow the development of autonomous taxis and systems aimed at providing transportation to the elderly and handicapped, as these companies may have to test in more “innovation-friendly states (or countries).”²⁰² Donald Norma, a technology design expert, notes that there are “decades of research and experience demonstrat[ing] [that] ‘people are incapable of monitoring something for long periods and then taking control when an emergency rises.’”²⁰³ Thus, not only are these proposals overly restrictive, they may not even make sense.

Autonomous vehicle regulation may also become vulnerable to obstructive lobbying by incumbents fearful of new technology or regulatory capture by the autonomous vehicle manufacturers, as seen in other controversial industries. Currently (excluding the DMV’s latest proposals), California laws are fairly pro-Google and pro-autonomous vehicle,²⁰⁴ but California has a great economic interest in Google’s success. Other states with less robust autonomous vehicle industries may not be as motivated to be friendly to autonomous vehicles. And states that derive large economic boosts from traditional non-autonomous auto manufacturers, such as Michigan, may be vulnerable to anti-autonomous vehicle lobbying.²⁰⁵ Additionally, for many states, particularly in the Midwest, trucking is a significant part of the economy.²⁰⁶ Many towns exist largely to provide truckers with services like food and lodging. States with many such towns

200. Chunka Mui, *California Wrongfully Slams the Brakes on California’s Driverless Car*, FORBES (Dec. 18, 2015), <http://www.forbes.com/sites/chunkamui/2015/12/18/california-slams-the-brakes-on-googles-driverless-car/#65827f155e8c> [<https://perma.cc/5HTF-A6MJ>].

201. *Id.*

202. *Id.*

203. *Id.*

204. John Frank Weaver, *Autonomous Car Legislation Backs Google’s Vision of the Future Over Ford’s . . . For Now*, SLATE (Nov. 22, 2013), http://www.slate.com/blogs/future_tense/2013/11/22/autonomous_car_legislation_backs_google_s_vision_of_the_future_over_ford.html [<https://perma.cc/6XL7-S6KG>].

205. As a related example, car manufacturers have been known to relentlessly lobby over emissions standards. See Mike Yuille, *Car Makers Accused of “Obstructive Lobbying” Over Emissions*, EXARO NEWS (Nov. 12, 2015), <http://www.exaronews.com/articles/5702/car-makers-accused-of-obstructive-lobbying-over-emissions> [<https://perma.cc/3X5F-5J86>].

206. See Santens, *supra* note 11.

may be incentivized to pass laws restricting autonomous vehicles so as to preserve their rural service sectors.

V. CONCLUSION

Although autonomous vehicles are probably legal under existing law, many potential hurdles may prevent them from becoming an everyday reality. Disparate traffic laws may make designing and programming the cars difficult, and uncertain liability frameworks may create economic obstacles for manufacturers or consumers, depending on where liability will fall. States could perhaps work together to create a uniform set of traffic laws before autonomous vehicles become commercially available, but tort liability may need to be decided *ex post*, after it becomes more clear what kinds of problems and accidents these vehicles will face. At the same time, it may not be wise to let states create a variety of reactionary liability laws that could differ drastically by jurisdiction. It may be best for the federal government to step in and preempt state tort law in some fashion, though ideally in a way that will be as minimally intrusive to states' rights as possible.

Technology is changing rapidly, and the law has historically been very slow to react. As Calo points out, cyberlaw serves as a poignant example of how courts and legislatures struggle to regulate things that they do not fully understand and that evade traditional legal categories.²⁰⁷ But the law is also surprisingly adaptive, and it may be possible to draw on centuries of legal precedent and find bits and pieces of existing law or resuscitate older laws to successfully regulate new technologies. But even so, the root of the problem remains—robotics and artificial intelligence are unlike anything the law has dealt with before, and figuring out how to best regulate them will likely involve much trial and error, and probably many mistakes along the way. Finding the answer to autonomous vehicle regulation may shed light on how we should regulate artificial intelligence as a whole, and it may ease society's transition to a new, automated technological era.

207. See Calo, *Robotics and the Lessons of Cyberlaw*, *supra* note 84.

