

FREEDOM FROM CONTROL, FREEDOM FROM CHOICE? HOW WILL TORT LAW DEAL WITH AUTONOMOUS VEHICLES?

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INTRODUCTION

When the author was a young child he was transfixed by a New York City-based police drama series on ABC. Each episode closed with this solemn admonition: “There are eight million stories in the naked city. This has been one of them.”¹

Here is another.

Shortly before the United States entered World War II, a man was mugged while relieving himself in an alleyway near the intersection of 26th Street and Third Avenue in Manhattan. The mugging led to a series of events expressively described by Justice Frank A. Carlin of the City Court of New York several months later. Justice Carlin had previously represented Manhattan’s fifth district in the state Assembly and was evidently a colorful rhetorician. He described the facts of the case as follows:

[The muggers] induced [their victim] to relinquish his possessions by a strong argument ad hominem couched in the convincing cant of the criminal and pressed at the point of a most persuasive pistol. Laden with their loot, but not thereby impeded, they took an abrupt departure and he, shuffling off the coil of that discretion which enmeshed him in the alley, quickly gave chase through 26th Street toward 2d Avenue, whither they were resorting ‘with expedition swift as thought’ for most obvious reasons. Somewhere on that thoroughfare of escape they indulged the stratagem of separation ostensibly to disconcert their pursuer and allay the ardor of his pursuit. He then centered on for capture the man with the pistol whom he saw board defendant’s taxicab, which quickly veered south toward 25th Street on 2d Avenue where he saw the chauffeur jump out while the cab, still in motion, continued toward 24th Street; after the chauffeur relieved himself of the cumbersome burden of his fare the latter also is said to have similarly departed from the cab before it reached 24th Street. The chauffeur’s story is substantially the same except that he states that his uninvited guest boarded the cab at 25th Street while it was at a standstill waiting for a less colorful fare; that his ‘passenger’ immediately advised him ‘to stand not upon the order of his going but to go at once’ and added finality to his command by an appropriate gesture with a pistol addressed to his sacro iliac. The chauffeur in reluctant acquiescence proceeded about fifteen feet, when his hair, like unto the quills of the fretful porcupine, was made to stand on end by the hue and cry of the man despoiled accompanied by a clamorous concourse of the law-abiding which paced him as he ran; the concatenation of ‘stop thief’, to which the patter of persistent feet did maddingly beat time, rang in his ears as the pursuing posse all the while gained on the receding cab with its

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¹ Grant Wythoff, *There are Eight Million Stories in the Naked City; This has been One of Them’: Procedurality and the Naked City*, IN MEDIA RES (Mar. 11, 2010, 12:44 AM), <http://mediacommons.futureofthebook.org/imr/2010/03/10/there-are-eight-million-stories-naked-city-has-been-one-them-procedurality-and-naked-city>.

quarry therein contained. The hold-up man sensing his insecurity suggested to the chauffeur that in the event there was the slightest lapse in obedience to his curt command that he, the chauffeur, would suffer the loss of his brains, a prospect as horrible to an humble chauffeur as it undoubtedly would be to one of the intelligentsia. The chauffeur apprehensive of certain dissolution from either Scylla, the pursuers, or Charybdis, the pursued, quickly threw his car out of first speed in which he was proceeding, pulled on the emergency, jammed on his brakes and, although he thinks the motor was still running, swung open the door to his left and jumped out of his car. He confesses that the only act that smacked of intelligence was that by which he jammed the brakes in order to throw off balance the hold-up man who was half-standing and half-sitting with his pistol menacingly poised. Thus abandoning his car and passenger the chauffeur sped toward 26th Street and then turned to look; he saw the cab proceeding south toward 24th Street where it mounted the sidewalk. The plaintiff-mother and her two infant children were there injured by the cab which, at the time, appeared to be also minus its passenger who, it appears, was apprehended in the cellar of a local hospital where he was pointed out to a police officer by a remnant of the posse, hereinbefore mentioned.²

Fortunately, the injuries sustained by mother and daughter were slight. They (and their husband/father) nonetheless sued the employer of the cabbie—the mugger, once deprived of his booty, was evidently judgment-proof. Note that this was no battery suit—the cabbie did not deliberately run down the victims. The cabbie was sued for negligence only—plaintiffs alleged that he took insufficient care of his vehicle.

Justice Carlin ruled that the plaintiffs produced no evidence of negligence. The cabbie’s application of the brakes and escape efforts were reasonable, even if they were not heroic. As the Justice explained:

The learned attorney for the plaintiffs concedes that the chauffeur acted in an emergency but claims a right to recovery upon the following proposition taken verbatim from his brief: ‘It is respectfully submitted that the value of the interests of the public at large to be immune from being injured by a dangerous instrumentality such as a car unattended while in motion is very superior to the right of a driver of a motor vehicle to abandon same while it is in motion even when acting under the belief that his life is in danger and by abandoning same he will save his life.’ To hold thus under the facts adduced herein would be tantamount to a repeal by implication of the primal law of nature written in indelible characters upon the fleshy tablets of sentient creation by the Almighty Lawgiver, ‘the supernal Judge who sits on high.’ There are those who stem the turbulent current for bubble fame, or who bridge the yawning chasm with a leap for the leap’s sake or who ‘outstare the sternest eyes that look outbrave the heart most daring on the earth, pluck the young sucking cubs from the she-bear, yea, mock the lion when he roars for prey’ to win a fair lady and these are the admiration of the generality of men; but they are made of sterner stuff than the ordinary man upon whom the law places no duty of emulation.³

The reasonable man, dixit Carlin, is one who takes decent care for others but who still values his own life.⁴ Quoting the famous case of *Laidlaw v. Sage*,⁵ Carlin confirmed that “this rule seems to be founded upon the maxim that self-preservation is the first law of nature, and that, where it is a question

² *Cordas v. Peerless Transp. Co.*, 27 N.Y.S.2d 198, 199–200 (City Ct. 1941).

³ *Id.* at 200–201.

⁴ *Id.* at 201.

⁵ 52 N.E. 679, 685 (N.Y. 1899).

whether one of two men shall suffer, each is justified in doing the best he can for himself.”⁶

*Cordas v. Peerless Transp. Co.*⁷ confirms that in an emergency, some care for others, if accompanied by a dollop of self-preference, satisfies Hillel’s admonition.⁸ But this desperate act by an unnamed cabbie was possible only because he was in control of his vehicle’s steering and stopping mechanisms. What if those mechanisms operated independently? The mother and child in *Cordas* were unsuccessful in their challenge to the cabbie’s choices, but how much control should the cabbie even have over the trajectory of his vehicle? If control is abdicated, as vehicles become autonomous, what decisions should those who program these vehicles make about our safety? What if the programmers make choices we would not have made? What if they make mistakes?

Part I of this Article is a brief primer on self-driving cars and their levels of automation ranging from ‘driver assist’ to ‘full automation.’ Part I also discusses the testing status, road record or anticipated introduction, and benefits and costs of each level of automated vehicle. Part II of this Article discusses the application of tort principles to autonomous vehicle technologies. Courts will confront questions regarding the type of defects that may arise from automation, the proper level of care that manufacturers should be held to, and evaluation of the moral judgments made by autonomous vehicle programmers. Part III surveys congressional attempts to interject itself in state products liability law in other instances and concludes that state common law is best equipped to handle novel technologies and determine the best autonomous vehicle designs and warnings. However, if state common law is not preferred as a means of allocating the risks and benefits of autonomous vehicles, it would be better to rely on federal preemption through detailed regulations controlling the design and information content autonomous vehicles to prevent ill-advised state regulatory forays into a product that is made to cross state lines.

I. ON THE AUTOMATION OF AUTOMOBILES

In April 2017 it was announced that the 2018 Subaru Crosstrek will continue to be made available with a manual transmission.⁹ Each year “save

⁶ *Cordas*, 27 N.Y.S.2d at 201.

⁷ 27 N.Y.S.2d 198 (1941).

⁸ Hillel’s admonition states: “If I am not for myself, who will be for me? But if I am only for myself, who am I? If not now, when?” Yaakov Astor, *Me, Myself, and I: Ethics of the Fathers 1:14*, AISH.COM, <http://www.aish.com/sp/pg/48893292.html>.

⁹ Joel Stocksdale, *2018 Subaru Crosstrek Still Gets a Manual Transmission in the US*, AUTOBLOG (Apr. 3, 2017, 10:30 AM), <https://www.autoblog.com/2017/04/03/2018-subaru-crosstrek-still-gets-a-manual-transmission-in-the-us/>.

the manuals”¹⁰ enthusiasts cringe as the drip, drip, drip of models no longer featuring stick shifts are announced.¹¹ Each survival of driver responsibility for gear selection, such as on the 2018 Crosstrek, is a ray of hope to this group. Alas, it seems that the overwhelming majority of American motorists prefer some form of automatic transmission, which increasingly selects the most important gear both more quickly¹² and more efficiently¹³ than manual transmissions, but also occasionally selects the wrong engine speed (just before ascending or descending a hill, for example). In such circumstances, and until drivers retake control by changing speeds manually, cars equipped with an automatic transmission may drive too sluggishly or fail to implement engine braking. There is no realistic likelihood of programmer liability here, as suboptimal gear selection is easily overcome by an alert driver.

But sometimes regaining control is not so easy. From automatic headlights that dim high beams when they sense an oncoming vehicle, to anti-lock brakes that “self-pump” in low-traction situations, to stability control that actuates both accelerator and brakes when the vehicle approaches limits of adhesion, to lane departure correction systems that nudge a vehicle back on track when it drifts across a divider line, to collision avoidance systems that brake automatically to avoid hitting an immobile object, to automated parallel (or perpendicular, or angular) parking systems, each year more and more drivers purchase vehicles that accomplish for them a task heretofore incumbent on the driver herself and which may take considerable effort to countermand. And sometimes the “countermander” is careless: if a sleepy driver fails to cancel cruise control and hits the vehicle ahead of him, should the programmer who made it possible for the driver to fall asleep while maintaining a high speed, even though his foot is off the gas, be liable? In 1958 a writer characterized cruise control as “ominous” because it would certainly lead to deaths of third parties, though it would reduce drivers’ foot cramps and fatigue during long trips.¹⁴ In the same vein, Americans’

¹⁰ *Car and Driver* magazine has organized a “save the manuals” interest and lobby group. See Brad Tuttle, *Stick Shift Extinction? The Battle to Save the Manual Transmission*, TIME (Mar. 28, 2012), business.time.com/2012/03/28/stick-shift-extinction-the-battle-to-save-the-manual-transmission/.

¹¹ Alfa Romeo, Buick, Chrysler, Ferrari, Lamborghini, Lexus, Mercedes-Benz, and Volvo no longer offer a single model with manual transmission. Audi, Cadillac, GMC, and Jaguar offer only one. Only 3% of newly sold cars have manual transmissions in America today. See Charles Fleming, *The Disappearing Stick Shift*, L.A. TIMES (Nov. 15, 2016, 10:00 AM), <http://www.latimes.com/business/autos/laautoshow/la-fi-hy-disappearing-stick-shift-20161115-story.html>.

¹² See, e.g., Lee Sibley, *Seven Reasons PDK Is Better Than Manual*, TOTAL 911 (Feb. 11, 2014), <https://www.total911.com/seven-reasons-pdk-is-better-than-manual/> (stating that dual clutch automatic transmission in Porsche models shifts faster than any human being).

¹³ Gas mileage for modern automatics is typically as good as or better than for manuals. Gearless Continuously Variable Transmissions are almost always more efficient than manuals. See, e.g., Carroll Lachnit, *Five Myths About Stick Shifts: Manual vs Automatic Transmissions*, EDMUNDS (July 17, 2012), <http://www.edmunds.com/fuel-economy/five-myths-about-stick-shifts.html> (last updated Sept. 26, 2013).

¹⁴ Frank Rowsome Jr., *1958 Imperial: What It's Like To Drive An Auto-Pilot Car*, IMPERIAL WEB PAGES (Apr. 1958), <http://www.imperialclub.com/~imperialclub/Articles/58AutoPilot/index.htm>.

ubiquitous automatic transmissions save clutches and allow drivers to keep two hands on the wheel at all times—but they also free up that right hand to facilitate driving while texting, or dialing, or drinking. Abdicating control to a machine creates the potential for near-perfection but also generates moral hazards.

There’s little risk of encountering Christine (a killer Plymouth Fury with a mind of its own)¹⁵ anytime soon. But Tesla vehicles are upgraded automatically and electronically repaired at night while their owners sleep.¹⁶ The 2014 BMW X5, if equipped with the “Traffic Jam” option, can drive itself up to 25 miles per hour so long as the “custodian” keeps one hand on the steering wheel.¹⁷

The Society of Automotive Engineers (“SAE”) has developed standard classifications of automation that have been referred to by the National Highway Traffic Safety Administration (“NHTSA”), which has its own five-category list.¹⁸

- Level zero is “no automation.”¹⁹ At level zero, automated systems control nothing but gear selection, and may issue warnings to the driver. Level zero automation systems include automatic transmission, blind spot monitoring, and lane departure warnings.
- Level one is “driver assistance.”²⁰ At this level, automated systems include individual features such as Adaptive Cruise Control (slowing the car automatically to match the speed of forward traffic), Parking Assist with automated steering (with the requirement that the driver remain at the wheel), Automatic High Beam activation/deactivation, and Lane Departure Correction (not just warning) systems. Each automated system at this level handles only one function, and the driver must be ready and able to take control at any time.
- Level two is “partial automation.”²¹ Here an automated system executes *combined* functions, such as accelerating, braking, and

¹⁵ Richard Abowitz, *Killer Car Comes to Carlisle: Movie Star Christine, a 1958 Plymouth Fury*, PENN LIVE (July 13, 2013, 9:03 AM), http://www.pennlive.com/entertainment/index.ssf/2013/07/killer_car_comes_to_carlisle_m.html.

¹⁶ Jon Fingas, *Tesla Quietly Upgrades Autopilot Hardware In New Cars*, ENGADGET (Aug. 9, 2017), <https://www.engadget.com/2017/08/09/tesla-autopilot-2-5-hardware/>.

¹⁷ Jim Travers, *BMW Traffic Jam Assistant Puts Self-Driving Car Closer Than You Think*, CONSUMER REPORTS (June 11, 2013, 3:38 PM), <https://www.consumerreports.org/cro/news/2013/06/bmw-traffic-jam-assistant-puts-self-driving-car-closer-than-you-think/index.htm#>.

¹⁸ U.S. DEP’T OF TRANSP., NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., AUTOMATED DRIVING SYSTEMS 2.0: A VISION FOR SAFETY 4 (Sept. 6, 2017), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf.

¹⁹ *Id.*

²⁰ *Id.*

²¹ *Id.*

steering.²² The system will deactivate immediately upon takeover by the driver. The driver is obliged to be alert to objects and events and to respond if the automated system fails to respond properly. With its “AutoPilot 1.0,” the Tesla Model S attained level two, with its computers completing 0.256 trillion operations per second (“TOPS”).²³

- Level three is “conditional automation.”²⁴ Like level two, but within limited environments (such as on freeways) the driver can safely turn her attention away from the task at hand, though she must still be prepared to take control if needed. Otherwise the driver can read, or text, or do whatever she wants, apart from sleeping. Level three requires much more computing capacity (at least 2 TOPS) than level two.²⁵
- Level four is “high automation.”²⁶ At level four, the vehicle is capable of performing all driving functions under most, but not all, conditions. Outside those conditions the vehicle will enter a safe fallback mode (e.g., it will be programmed to pull to the side of the road) unless the driver retakes control. At NVIDIA Corporation’s March 2017 meeting in Berlin, the artificial intelligence company announced that it would provide the technology needed for level four autonomous driving by the end of 2018, reaching 30 TOPS while using only 30 watts of power.²⁷
- Level five is “full automation.”²⁸ This is the most advanced category. Other than setting the destination and starting the system, no human intervention is required. The automatic system can drive to any location where it is legal to drive and make its own decisions. The driver may or may not have the option to control the vehicle. At level five, there is no “driver,” only passengers who are free to sleep or watch a ballgame.

Levels two and three are currently being used on public roads, and levels four and five are being worked on in a private course setting.²⁹ Alphabet (Google’s parent company), Tesla, and Uber are testing vehicles that provide

²² *Id.*

²³ Fred Lambert, *Tesla Has a New Autopilot ‘2.5’ Hardware Suite with More Computing Power for Autonomous Driving* ELECTREK (Aug. 9, 2017, 12:42 PM), <https://electrek.co/2017/08/09/tesla-autopilot-2-5-hardware-computer-autonomous-driving/>.

²⁴ U.S. DEP’T OF TRANSP., *supra* note 18.

²⁵ Lambert, *supra* note 23.

²⁶ U.S. DEP’T OF TRANSP., *supra* note 18.

²⁷ Danny Shapiro, *NVIDIA and Bosch Announce AI Self-Driving Car Computer*, NVIDIA (Mar. 16, 2017), <https://blogs.nvidia.com/blog/2017/03/16/bosch/>.

²⁸ U.S. DEP’T OF TRANSP., *supra* note 18.

²⁹ U.S. DEP’T OF TRANSP., NAT’L HIGHWAY TRAFFIC SAFETY ADMIN., *HUMAN FACTORS EVALUATION OF LEVEL 2 AND LEVEL 3 AUTOMATED DRIVING CONCEPTS 93* (July 2014), https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/812043_hf-evaluationlevel2andlevel3automateddrivingconcepts2.pdf.

levels three through five automation.³⁰ Clemson University's International Center for Automotive Research ("ICAR") in Greenville, South Carolina is now using a level four automated vehicle on its private campus.³¹ Going further, in early October 2017 the Federal Highway Administration ("FHWA") awarded a four million dollar grant to Greenville County for automated taxis.³² County officials will use the funds to deploy "'taxi-shuttles,' known locally as 'A-Taxis,' on public roads."³³ These are driverless taxis providing shuttle service to and from employment centers, which are expected to improve access to transportation for handicapped and elderly residents.³⁴ Testing is progressing apace (notwithstanding a heated legal dispute between Alphabet and Uber about allegedly stolen trade secrets).³⁵ The ICAR vehicle "needs some tweaking" but will evidently read traffic signs, yield the right of way to other cars, and react to unpredictable behavior of other vehicles.³⁶ It has a steering wheel, as is required by current South Carolina law, but this is superfluous to the technology.³⁷

The potential safety benefits of self-driving cars are tremendous. Self-driving cars do not rubberneck or get drunk. They do not talk on cell phones or turn their heads to comfort screaming children in the back seat. A convoy of them can accelerate from a stoplight simultaneously and maintain very short distances between vehicles, greatly increasing the load capacity of roads and substantially shortening commutes through the elimination of the "accordion effect."³⁸ One prominent study predicted an eventual 90% reduction in collisions, saving tens of thousands of lives and hundreds of

³⁰ Shapiro, *supra* note 27.

³¹ Rudolph Bell, *Self-Driving Vehicles Come to ICAR*, UPSTATE BUS. J. (Aug. 15, 2017), <https://upstatebusinessjournal.com/self-driving-vehicles-coming-icar/>.

³² U.S. DEP'T OF TRANSP., FHWA AWARDS \$4 MILLION GRANT TO SOUTH CAROLINA'S GREENVILLE COUNTY FOR AUTOMATED TAXI SHUTTLES (Oct. 4, 2017), <https://www.fhwa.dot.gov/pressroom/fhwa1717g.cfm>.

³³ *Id.* (internal quotation marks omitted).

³⁴ *Id.*

³⁵ Mark Bergen & Kartikay Mehrotra, *Alphabet's Waymo Alleges Uber Stole Self-Driving Secrets*, BLOOMBERG TECH. (Feb. 23, 2017), <https://www.bloomberg.com/news/articles/2017-02-23/alphabet-s-waymo-sues-uber-for-stealing-self-driving-patents>.

³⁶ Jackeline Rios-Torres & Andreas A. Malikopoulos, *A Survey on the Coordination of Connected and Automated Vehicles at Intersections and Merging at Highway On-Ramps*, 18 IEEE TRANSACTIONS ON INTELLIGENT TRANSP. SYS. 1066, 1071–73 (2017).

³⁷ Gary Gastelu, *Clemson's Deep Orange 5 Designed to Excite Generation Z*, FOX NEWS (Apr. 29, 2015), <http://www.foxnews.com/auto/2015/04/29/clemsons-deep-orange-5-designed-to-excite-generation-z.print.html>. Should South Carolina be able to impose its vision that steering wheels are compulsory? This question is briefly addressed in Part III.

³⁸ Kristen Lee, *Here's a Simple Explanation on How Self-Driving Cars Could Eliminate Traffic*, JALOPNIK (Aug. 31, 2016, 11:09 AM), <https://jalopnik.com/here-s-a-simple-explanation-of-how-self-driving-cars-co-1785996633>.

billions of dollars in losses in the United States alone.³⁹ NHTSA estimates that 94% of traffic fatalities are predominantly the result of driver error.⁴⁰ The Department of Transportation (“DOT”) announced a Value of Statistical Life of \$9.2 million in 2014;⁴¹ saving 40,000 lives per year would enrich our country to the tune of \$384 billion.

II. LEGAL ISSUES WITH SELF-DRIVING CARS

Of course, driving may become boring and tedious for “save the manual” fans, so this technological progress may not necessarily come with undiluted enthusiasm. But this Article is concerned with a different problem. What happens when real harm is *caused* by the new technology? To be sure, in the interim period when both automated and “manual” cars are on the road, most accidents involving autonomous vehicles will be the fault of “the other guy.”⁴² But in some cases a human driver might be able to react more quickly to “the other guy’s” negligence than would the car that had not been programmed to fully anticipate it. And on occasion the autonomous vehicle itself will clearly take the rap. The recent death of a cyclist in Arizona may well be the “fault” of the autonomous Volvo XC90 Uber vehicle that struck her.⁴³

There are potentially three categories of such “defects” that may affect autonomous cars at all levels and expose their manufacturers and retailers to liability.

“Manufacturing defects” will exist when the vehicle does not function as it was designed to. Humans, after all, manufacture autonomous vehicles (or manufacture the machines that manufacture the vehicles, or the machines that manufacture the machines that manufacture the vehicles, etc.), and humans are not infallible. Manufacturing defects may lead a self-braking car not to brake when it is “supposed” to, for example. Lemons are rare, but even Tesla’s lemon grove yields fruit occasionally.⁴⁴

Next are “informational defects,” or cases where the vehicle is dangerous because the user is poorly instructed about its operation. The

³⁹ Mike Ramsay, *Self-Driving Cars Could Cut Down on Accidents, Study Says*, WALL STREET J. (Mar. 5, 2015), <https://www.wsj.com/articles/self-driving-cars-could-cut-down-on-accidents-study-says-1425567905>.

⁴⁰ U.S. DEP’T OF TRANSP., *supra* note 18, at i.

⁴¹ Letter from Peter Rogoff, Acting Under Secretary for Policy, and Kathryn Thomson, General Counsel, Dep’t of Transp., to Secretarial Officers and Modal Administrators (June 13, 2014), https://www.transportation.gov/sites/dot.gov/files/docs/VSL_Guidance_2014.pdf.

⁴² See, e.g., Alex Davies, *Uber’s Self-Driving Crash Proves We Need Self-Driving Cars*, WIRED, (Mar. 25, 2017, 3:10 PM), <https://www.wired.com/2017/03/uber-self-driving-crash-tempe-arizona/>.

⁴³ Jeremy Korzeniewski, *Uber suspends autonomous vehicle testing after bicyclist is killed*, AUTOBLOG (Mar. 19, 2018), <https://www.autoblog.com/2018/03/19/uber-autonomous-volvo-fatality/>.

⁴⁴ Kyle Cheromka, *Brand New Tesla Model S Delivered with Cracked A-Pillar*, THE DRIVE (Apr. 7, 2017), <http://www.thedrive.com/tech/9093/brand-new-tesla-model-s-delivered-with-cracked-a-pillar>.

operator of a level three or level four autonomous vehicle, for example, might not be informed about the vehicle's use or maintenance. Alternatively, she may not have correctly understood the information that had been inexpertly provided concerning the proper operation of the vehicle. Information is costly, of course. Information of "perfect" quality and quantity (for example, individualized expert tutors who would accompany owners in the vehicles) is prohibitively expensive to provide. And so "imperfect" information may be provided instead. For more expert users the imperfect information may be sufficient, but for neophytes it may be dangerously lacking. The result might be incorrect operation of an autonomous vehicle, and therefore lead to potential collisions. If sufficiently imperfect, the vehicle itself may be unreasonably dangerous and therefore "defective."

Manufacturing defects affect only a tiny subset of production, and informational defects will affect only a fraction of users. But "design defects" are most serious, because an entire production run will be affected. Of course, design choices are intrinsic to all manufacturing, and every design choice involves tradeoffs between costs and benefits of alternate designs. There is no such thing as a "totally safe" design; such a design would cost so much money that no one could afford it. And it is not always clear that a given design choice is "defective." Current vehicles permit drivers to make choices, but those choices will be pre-programmed in autonomous vehicles. Should manufacturers be liable only if their design is deemed to be a negligent one?⁴⁵ Or should they be "strictly liable" any time a design is deemed to fall below some standard of optimality, or even perfection, that has been set by a jury?⁴⁶

A few examples illustrate two potential problems. First, what is the proper "level of care" to be taken by an autonomous vehicle? Should such vehicles be programmed to never exceed the speed limit? A reasonable driver today might exceed speed limits, on clear days with no traffic or in emergency avoidance situations, for example. What if an autonomous vehicle will not "speed" in an emergency (say, to avoid a charging moose on a rural highway) and a fatal collision results? What if the driver needs to get his pregnant wife to the hospital double-quick and cannot do so on a clear traffic-free day because of the design limitations of his vehicle? What if (as apparently just happened with Las Vegas's experimental driverless shuttle bus) an 18-wheeler doesn't spot the shuttle and negligently reverses towards it? A human driver of the shuttle might look in his rearview mirror and, if feasible, himself reverse to avoid the reversing truck. What if the autonomous vehicle has not been programmed to "escape" in this fashion and a collision ensues? Should the negligent truck driver be able to invoke the "contributory negligence" of the "defectively programmed" shuttle?⁴⁷

⁴⁵ See RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2(a)–(b) (AM. LAW INST. 1998).

⁴⁶ See RESTATEMENT (SECOND) OF TORTS § 402A (AM. LAW INST. 1965).

⁴⁷ Jeff Zurschmeide, *I Was on the Self-Driving Bus That Crashed in Vegas. Here's What Really Happened*, DIGITAL TRENDS (Nov. 9, 2017, 9:25 AM), <http://www.digitaltrends.com/cars/self-driving->

Second, what comes of *Cordas v. Peerless Transp. Co.* problems? What if the driver of a vehicle is presented with a split-second tragic option of hitting a large obstacle like a moose (likely killing the driver) or swerving onto a sparsely occupied sidewalk to avoid it (endangering pedestrians but saving the driver)? Will the programmers have foreclosed the escape option even though the average driver might have non-negligently availed herself of it? If so, what if the driver dies? Will programmers incorporate self-preference or insist on maximizing societal wealth in Trolley problem cases?⁴⁸ Will they inform buyers of programming choices in the owner's manual? Will those choices be modifiable by owners? If society is made "better off" if some die to save others, is that a reason to prevent buyers from purchasing vehicles that allow for owner self-preference? Property rights are said to trump Kaldor-Hicks utility improvements⁴⁹—what will the owner's "rights" be in her automated vehicle? Should programmers allow for "altruistic" and "selfish" programming options to be chosen at the dealership? Should governments mandate altruistic programming, or should they give buyers a choice? If the latter, should governments offer tax breaks to those who purchase "altruistically" programmed vehicles, as many states do for those who donate a kidney?⁵⁰

The common law of tort determines when injury costs should be shifted from a victim to someone else. How should tort law deal with these three kinds of defects? The answer follows from a sound understanding of America's often-disordered products liability law.

Manufacturers of autonomous vehicles should be strictly liable to victims for accidents caused by manufacturing defects. As the author has explained elsewhere, this liability is based on misrepresentation.⁵¹ For when someone is harmed by a manufacturing defect, she will have been harmed by a product that did not perform as was advertised.⁵² This misrepresentation provides both a moral justification for liability and the appropriate economic incentive to implement efficient quality control. Efficient quality control is

bus-crash-vegas-account/. Note that the *Washington Post* disputes this eye-witness report, and claims the bus had insufficient space to back up. Hayley Tsukayama, *A Driverless Bus Got into a Crash During its First Day on the Job*, WASH. POST (Nov. 9, 2017), <https://www.washingtonpost.com/news/innovations/wp/2017/11/09/a-driverless-bus-got-into-a-crash-on-its-first-day/>.

⁴⁸ Judith Jarvis Thomson, *Killing, Letting Die, and the Trolley Problem*, 59 THE MONIST 204, 206–07 (1976).

⁴⁹ Michael Krauss, *Property Rules versus Liability Rules*, INT'L ENCYCL. L. & ECON. 782, 787–88 (1999), <http://reference.findlaw.com/lawandconomics/3800-property-rules-vs-liability-rules.pdf>.

⁵⁰ About a third of states offer such tax breaks, which apparently have not been high enough to succeed in making folks more altruistic. See Richard Knox, *Tax Breaks For Organ Donors Aren't Boosting Transplant Supply*, NAT'L PUB. RADIO (Aug. 31, 2012), http://www.npr.org/sections/health-shots/2012/08/30/160338259/tax-breaks-for-organ-donors-arent-boosting-transplant-supply?ps=sh_sthdl.

⁵¹ MICHAEL I. KRAUSS, PRINCIPLES OF PRODUCTS LIABILITY 58–61 (2d ed. 2013).

⁵² RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY, § 2(a) (AM. LAW INST. 1998).

not *perfect* quality control, of course. At some point marginal improvements in quality control are not cost-effective, and manufacturers will rationally prefer to pay liability costs.⁵³ And the costs of quality control will of course be factored into the purchase price of these vehicles. But as indicated above, the benefits of efficient automation, by definition, dwarf the costs.

In the case of informational defects (also known as “failure-to-warn” problems), manufacturers should be liable *if they were negligent* (that is, if a reasonable manufacturer would have provided better information to the user of the autonomous vehicle). This would allow industry custom to achieve the optimal amount of warning. This would allow *ex ante* allocation of costs and benefits of each warning rather than allowing warnings to be driven by hindsight, potentially leading to “warning pollution.” The Texas Supreme Court offers perhaps the best summary of the dilutive effects of over-warning:

Every warning can always be made bigger, brighter and more obvious. . . . It can always be argued that a single instruction should have been given more prominence and if it had, an accident might have been prevented. This argument, however, must be considered in the context of the product involved. When, as here, it is important to give a number of instructions concerning the operation of a vehicle, not all of them can be printed on the dashboard. Indeed, the more instructions and warnings that are printed in one place—on the dashboard, on a doorplate, or in the owner’s manual—the less likely that any one instruction or warning will be noticed.

. . . [T]he issue is whether the warning where it was actually placed was sufficient to give reasonable notice against overloading. . . . In these circumstances, plaintiffs’ contention that the warning could have been more prominent does not entitle them to the presumption that it would then have been followed.⁵⁴

If, as seems likely, legislation or regulations will mandate the warnings an autonomous vehicle should contain and the driver training that must be accomplished by the purchaser,⁵⁵ manufacturers will argue that compliance with such law or regulation should exclude liability, just as (for example) for the mandated warnings on prescription drugs.⁵⁶ One cost of legislative preemption of common law warnings is “regulatory capture.”⁵⁷

Finally, in the case of design defects, the Third Restatement’s negligence rule should prevail over the Second Restatement’s strict liability

⁵³ See, e.g., KRAUSS, *supra* note 51, at 343–50.

⁵⁴ Gen. Motors Corp. v. Saenz, 873 S.W.2d 353, 360–61 (Tex. 1993).

⁵⁵ U.S. DEP’T OF TRANSP., *supra* note 18, at 15.

⁵⁶ John Graham, *Product Liability Law, FDA Pre-Emption, and Public Opinion*, PAC. RES. INST. (Nov. 11, 2008), <https://www.pacificresearch.org/product-liability-law-fda-pre-emption-and-public-opinion/>.

⁵⁷ Regulatory capture is a form of government failure that occurs when a regulatory agency, created to act in the public interest, instead procures rents for those who wish to avoid the decentralized control offered by common law adjudication. See George J. Stigler, *The Theory of Economic Regulation*, 2 BELL J. ECON. & MGMT. SCI. 3, 4–5 (1971).

rule. Under the Second Restatement, a manufacturer or seller's evidence that the design is non-negligent would be inadmissible.⁵⁸ Under this paradigm, the designer or manufacturer could not even make out a case that no alternative design was *reasonable*, so long as such a design was *possible*. The Third Restatement is the only honest way to address novel and evolving technology. The Third Restatement recognizes this, rejecting strict liability for design defect and replacing it with a negligence rule. Thus, to establish a design defect, a plaintiff would have to present evidence of a reasonable alternative autonomous vehicle design that would have reduced the risk of the complained of accident.⁵⁹ For example, a level five vehicle that did not reverse (when feasible to do so) to avoid a negligently reversing truck would almost certainly be adjudged to be defectively designed by a properly instructed jury—human drivers would have done this, and a few hundred more lines of code are likely not prohibitively expensive. A negligence based regime would allow for practical solutions to evolve that apply traditional principles to a novel situation rather than imposing an “innovation penalty” on autonomous vehicle manufacturers and designers.

Negligence principles are particularly adept at handling new technologies. Was the design of the autonomous feature by the manufacturer or its subcontractor a good one, all things considered? As noted above, important moral issues arise here, and informed consent of the new risks imposed on owners by programming should be required. Indeed, this is where design and information issues merge. For instance, should operators of automated cars be informed that they might be “sacrificed for the greater good,” by hitting a brick wall instead of swerving and possibly risking colliding with a pedestrian? Should owners of automated vehicles have the option of disabling the “Kaldor-Hicks-efficient” button in favor of a “legitimate self-preference” button?

In a products liability context, decisions about design defects are in principle currently left to juries. Such regulation about altruistic programming would presumably be the object of a vigorous and ethically interesting public debate. If pre-emptive regulation does not occur, the issue of design defect could be left to properly instructed juries' evolving notions of consumer expectations under the common law. Manufacturers who design their vehicles to maximize social welfare at the possible expense of the owner would presumably argue that a “risk-utility” test is preferable to a “consumer expectations” test.⁶⁰ In that case, however, it seems hard to argue that the manufacturer should have kept the operator in the dark about programming that might sacrifice her for the public good. Regulation might authorize

⁵⁸ RESTATEMENT (SECOND) OF TORTS § 402A (AM. LAW INST. 1965).

⁵⁹ RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2(a)–(b) (AM. LAW INST. 1998).

⁶⁰ See, e.g., Joseph W. Little, *The Place of Consumer Expectations in Product Strict Liability Actions for Defectively Designed Products*, 61 TENN. L. REV. 1189, 1191, 1197 (1994).

hiding the truth, as was done for certain vaccinations.⁶¹ Such concealment is both inconsistent with common law theory and morally obnoxious in this author's opinion.

III. POTENTIAL NON-COMMON LAW SOLUTIONS

The federal government has interfered with state products liability law in several areas, and it is worthwhile briefly exploring whether these departures from common law are relevant precedents for future litigation involving autonomous vehicles.

In 1986, Congress passed The National Childhood Vaccine Injury Act⁶² (“NCVIA”) to provide a federal no-fault system for compensating vaccine-related injuries or death by establishing a claim procedure involving the United States Court of Federal Claims and special masters.⁶³ The Act bars civil liability to manufacturers from unavoidable side effects and failure to provide direct warnings to the injured party.⁶⁴ Instead, scheduled amounts are payable from a fund established by vaccine manufacturers (and obviously integrated into the price of vaccines).⁶⁵ The payments are less than would be payable in tort. The nation's vaccine supply was purportedly in danger of collapsing unless this act was adopted.⁶⁶ It is far from clear whether that was the case, or whether many contemporary findings of liability were even just.⁶⁷ In any case, there is clearly no parallel need for pre-empting products liability for autonomous vehicles—they are not in short supply and dozens of manufacturers are developing them.⁶⁸

In 2002, Congress passed The Terrorism Risk Insurance Act⁶⁹ as a response to the September 11 attacks on our country. This Act did not alter

⁶¹ Public health authorities selected Sabin polio vaccine for many years because of its “vicarious immunization” effects, even though they knew that this would result in some people (mostly, but not exclusively, mothers of immunized infants) contracting the disease. The Salk polio vaccine protected the vaccinated child just as well and presented no risk to third parties, but only immunized those vaccinated. Smithsonian National Museum of American History, *Sabin and Salk*, <https://amhistory.si.edu/polio/virus/vaccine/vacraces2.htm> (last visited Dec. 18, 2017). Recipients were typically not informed that they were putting their mothers and others at risk in return for procuring “herd immunity” for unvaccinated children. KRAUSS, *supra* note 51, at 161.

⁶² 42 U.S.C. §§ 300aa-1-34 (2012).

⁶³ *Id.* § 300aa-15.

⁶⁴ *Id.* § 300aa-22.

⁶⁵ *Id.* § 300aa-15; 26 U.S.C. § 9510 (2012).

⁶⁶ KRAUSS, *supra* note 51, at 166.

⁶⁷ Comment k of § 402A expressly exempts from design defect liability unavoidable vaccine risks. RESTATEMENT (SECOND) OF TORTS § 402A cmt. k (AM. LAW INST. 1965).

⁶⁸ Jack Stewart, *Mapped: The Top 263 Companies Racing Toward Autonomous Cars*, WIRED (May 10 2017), <https://www.wired.com/2017/05/mapped-top-263-companies-racing-toward-autonomous-cars/>.

⁶⁹ Terrorism Risk Insurance Act of 2002, Pub. L. No. 107-297 (2002).

liability rules, but rather provided a re-insurance backup for terrorism claims.⁷⁰ The Act expired in 2014.⁷¹ This federal reinsurance backup seems to be of little relevance for autonomous vehicles, for which claims will be neither exogenous (caused by outside parties) nor likely massive.

The General Aviation Revitalization Act (“GARA”)⁷² helped rescue America’s domestic general aviation (small aircraft) industry from near-death by litigation. GARA established a statute of repose (a deadline after production, beyond which time no products liability suit against an aircraft manufacturer could be filed) for small aircraft.⁷³ For a couple of reasons the GARA model does not apply to autonomous vehicle liability. First, unlike general aviation companies in the 1990’s, autonomous vehicle makers are not at death’s door; as of this writing, Tesla’s market value is greater than that of Ford.⁷⁴ Second, products liability issues for autonomous cars are not problems of very gradual wear and tear, as was largely the case for Cessnas and Beechcrafts; defects are likely to spring up quite early, as the technology itself is developing and being implemented, not after 25 years’ use.

These federal suppressions of state products liability thus seem inapposite in regard to autonomous vehicles. Indeed, the common law would allow for greater flexibility to confront the unforeseeable liability problems that autonomous vehicle technologies are sure to raise. If the market is seen as the superior determiner of the best designs and warnings, as this author believes, judges and juries should be the initial locus of decision.

But if the common law is, for some reason, not preferred as a means to determine allocation of risks, and if the risk of regulatory capture is deemed acceptable, it is likely that we will see federal preemption through detailed regulations controlling the design and information content of vehicles. California is currently allowed to impose tougher-than-federal emissions standards, but smaller states would not be able to require steering wheels, for instance, unless they banded together with other states.⁷⁵ To avoid the

⁷⁰ *Id.* § 107(b).

⁷¹ The Act was originally set to expire December 31, 2005, was extended for two years in December 2005, and was extended again on December 26, 2007. The Terrorism Risk Insurance Program Reauthorization Act expired on December 31, 2014. U.S. Dep’t of Treasury, *Terrorism Risk Insurance Program*, <https://www.treasury.gov/resource-center/fin-mkts/Pages/program.aspx> (last updated Nov. 18, 2017).

⁷² The General Aviation Revitalization Act of 1994, Pub. L. No. 103–298 (1994).

⁷³ Alan J. Stolzer, *The General Aviation Revitalization Act of 1994: An Overview of Tort Reform*, 8 J. AVIATION/AEROSPACE EDUC. & RES. 45, 45 (1998).

⁷⁴ Shares of Tesla drove that company’s market cap past rival Ford for the very first time in April 2017, even though Tesla sold 76,000 cars in 2016 compared to 6.7 million sales for Ford. *See* Jeff Bukhari, *Tesla Worth More Than Ford, Says Stock Market*, FORTUNE (Apr. 3, 2017), <http://fortune.com/2017/04/03/tesla-ford-market-cap/>.

⁷⁵ Deborah Zabarenko, *US EPA Approves California Auto Emissions Standard*, REUTERS (June 30, 2009, 12:21 PM), <https://www.reuters.com/article/autos-epa-california/update-2-us-epa-approves-california-auto-emissions-standard-idUSN3044688920090630>. The following states have adopted California standards: Connecticut, Delaware, Maine, Maryland, Massachusetts, New Jersey, New Mexico (2011

confusion surrounding preemption in current products liability law,⁷⁶ Congress could make it clear through an express preemption clause that state products liability is preempted by NHTSA autonomous vehicle regulations, and that the savings clause of the National Traffic and Motor Vehicle Safety Act does not apply.⁷⁷ This suppression of the savings clause would ensure that the federal government has totally occupied the field of autonomous vehicle safety to the exclusion of state courts and legislators. Note that complete federal regulatory preemption would mean that central regulators (often captured by industry) will make broad and prospective rules that may not be able to anticipate the novel challenges posed by autonomous vehicles. The regulatory process can be arduous and unresponsive to advances in technology.⁷⁸

CONCLUSION

Some of us are still shifting gears ourselves, but it looks like we are living on borrowed time. Teenagers do not massively acquire drivers' licenses like they used to.⁷⁹ Uber, which is already a self-driving car from the client's perspective, is increasingly favored over private control.⁸⁰ Bob Lutz, former vice chairman and head of product development at General Motors, and a former high-ranking executive with Ford, Chrysler, BMW, and Opel, has forecast the near-term end of the automotive era.⁸¹ Clearly the preference for personal control and choice may not be long for this world. Many will

model year), New York, Oregon, Pennsylvania, Rhode Island, Vermont, Washington, and the District of Columbia. See Stephen Edelstein, *Which States Follow California's Emission and Zero-Emission Rules?*, GREEN CAR REPORTS (Mar. 7, 2017), http://www.greencarreports.com/news/1109217_which-states-follow-californias-emission-and-zero-emission-vehicle-rules. Such states are frequently referred to as "CARB states" in automotive discussions because the regulations are defined by the California Air Resources Board. See, e.g., Lauren Tyler, *CARB: State Seeks Applications for Cleaner, Zero-Emission School Buses*, NGT NEWS (Feb. 7, 2017), <https://ngtnews.com/carb-california-seeks-applications-for-cleaner-zero-emission-school-buses>.

⁷⁶ KRAUSS, *supra* note 51, at 225–39. See also Wesley E. Weeks, *Picking Up the Tab for Your Competitors: Innovator Liability After Pliva, Inc. v. Mensing*, 19 GEO. MASON L. REV. 1257, 1276 (2012).

⁷⁷ 49 U.S.C. § 30103(b)(1) (2012). A savings clause in a statute is a provision that restricts the ambit of federal preemption and explicitly preserves state common law. Most federal regulatory statutes contain both pre-emption clauses and savings clauses, muddying the waters of products liability claims.

⁷⁸ Deb Fischer & Angus King, *FDA's Slow Process Hurts Innovation*, USA TODAY (Feb. 15, 2014, 7:23 AM), <https://www.usatoday.com/story/opinion/2014/02/15/fischer-king-health-information-technology/5464693/>.

⁷⁹ Tim Henderson, *Why Many Teens Don't Want to Get A Driver's License*, PBS NEWSHOUR (Mar. 6, 2017, 4:55 PM), <http://www.pbs.org/newshour/updates/many-teens-dont-want-get-drivers-license/>.

⁸⁰ Natasha Lomas, *Pew Study Finds Younger Adults Driving Growth of Ride-Hailing Apps*, TECHCRUNCH (May 19, 2016), <https://techcrunch.com/2016/05/19/pew-study-finds-younger-adults-driving-growth-of-ride-hailing-apps/>.

⁸¹ Bob Lutz, *Kiss the Good Times Goodbye: 'Everyone Will Have 5 Years to Get Their Car off the Road or Sell it for Scrap'*, AUTOMOTIVE NEWS (Nov. 6, 2017, 12:01 AM), http://www.autonews.com/article/20171105/INDUSTRY_REDESIGNED/171109944/bob-lutz%3A-kiss-the-good-times-goodbye.

derive convenience from this loss of control, while others will be deprived of pleasure. A few may lose their lives as a result. Tort law will adapt to this change, as it did to the advent of horseless carriages, even if old-timers do not.