Yale Journal of Law and Technology

Volume 17
Issue 1 *Yale Journal of Law and Technology*

Article 4

2015

The Costs of Self-Driving Cars: Reconciling Freedom and Privacy with Tort Liability in Autonomous Vehicle Regulation

Jack Boeglin
Yale Law School

The Costs of Self-Driving Cars: Reconciling Freedom and Privacy with Tort Liability in Autonomous Vehicle Regulation

Cover Page Footnote
17 Yale J.L. & Tech. 171

THE COSTS OF SELF-DRIVING CARS: RECONCILING FREEDOM AND PRIVACY WITH TORT LIABILITY IN AUTONOMOUS VEHICLE REGULATION

Jack Boeglin[†]

17 Yale J.L. & Tech. 171 (2015)

ABSTRACT

Nearly all of the literature on self-driving cars explores either their impact on social values, like freedom and privacy, or the questions they pose for legal liability. These lines of inquiry have developed largely in isolation, with little effort to examine how they might intersect and inform each other. This Article advances an integrated approach: regulators should consider freedom, privacy, and liability as interlocking pieces—not independent elements—of the puzzle of self-driving car regulation.

Explorations into the laws of agency and product liability demonstrate that an actor's post-sale control of and access to an autonomous vehicle may determine that actor's liability for its accidents. As a result, the more that users want to preserve their freedom and privacy, the more liability they may end up retaining for the behavior of their self-driving cars. This Article then provides the first sustained inquiry into how different liability regimes for autonomous vehicles might generate sizable efficiencies in liability and insurance administration.

The Article closes by making a normative appeal to regulators: only allow autonomous vehicles to infringe on user freedom and privacy to the extent that (1) reductions in freedom and privacy lead to equivalent reductions in liability for the users of self-driving cars; and (2) the social costs incurred by forfeiting these values will be outweighed by administrative efficiencies or other identifiable social benefits. By tying the reduction of user freedom and privacy to improvements in both individual and social welfare, this Article charts a possible course for regulators to reconcile freedom and privacy with tort liability in autonomous vehicle regulation.

[†] J.D. Candidate, Yale Law School, Class of 2016.

TABLE OF CONTENTS

INTRODUCTION

Imagine the night of your wedding anniversary ten years from now: your car, driving itself, heads over to the babysitter's house while you and your spouse get dressed, returns in time to chauffeur you downtown, and then parks while you head into the restaurant for dinner. Sound fanciful? Maybe so, but the Center for Automotive Research predicts that the first commercially available, fully autonomous vehicles[1] could come to a dealership near you as early as 2019.[2]

California, Florida, Michigan, and Nevada have already passed laws that allow the testing of autonomous vehicles (AVs) on public roads, with more states currently considering

---

[1] I will refer to a vehicle as autonomous or self-driving if the National Highway Traffic Safety Administration would rank it Level 4. *See* NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., PRELIMINARY STATEMENT OF POLICY CONCERNING AUTOMATED VEHICLES 5 (2013), http://www.nhtsa.gov/staticfiles/rulemaking/pdf/Automated_Vehicles_Policy.pdf (explaining that level 4 vehicles are "designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip" and that "[s]uch a design anticipates that the driver will provide destination or navigation input, but is not expected to be available for control at any time during the trip"). Moreover, I limit my discussion to consumer vehicles. Though autonomous vehicle technology will undoubtedly be of great interest to the trucking industry, delivery services like FedEx, and other commercial enterprises, user freedom and privacy are of less concern in these contexts and will not be taken up in this Article.

[2] Josh Sanburn, *Self-Driving Cars Available by 2019, Report Says*, TIME, Aug. 16, 2012, http://business.time.com/2012/08/16/self-driving-cars-available-by-2019-report-says.

similar legislation.[3] The stakes could hardly be higher: over ten million car crashes occur in this country each year,[4] many of which result in tragic injuries and expensive lawsuits that burden the nation's hospitals and court systems. Predictions that self-driving cars may be able to prevent many of these accidents have led some commentators to wholeheartedly endorse the impending arrival of AVs onto our nation's roadways.[5]

Not everyone views the arrival of AV technology quite so positively. Serious concerns about self-driving cars have also been raised, largely focusing on the impact these vehicles could have on three key issues: freedom, privacy, and liability.[6] Though the automobile has stood as a symbol of freedom and personal autonomy for generations,[7] some fear that legal and economic pressures might eventually restrict the frequency and scope of human driving.[8] While both Nevada and California currently require that self-driving cars cede operational authority to human users whenever a human user requests control,[9] it is hard to predict whether this rule will be preserved if AV technology becomes more commonplace.

Regulators have been even more concerned with the threat self-driving cars pose to their users' privacy. For example,

---

3 Gabriel Weiner & Bryant Walker Smith, *Automated Driving: Legislative and Regulatory Action*, THE CTR. FOR INTERNET AND SOC., http://cyberlaw.stanford.edu/wiki/index.php/Automated_Driving:_Legislative_and_Regulatory_Action (last visited Nov. 25, 2014).

4 U.S. CENSUS BUREAU, STATISTICAL ABSTRACT OF THE UNITED STATES: 2012, at 693 tbl. 1103 (2012), http://www.census.gov/compendia/statab/2012/tables/12s1103.pdf.

5 Tom Simonite, *Data Shows Google's Robot Cars Are Smoother, Safer Drivers than You or I*, MIT TECH. REV., Oct. 25, 2013, http://www.technologyreview.com/news/520746/data-shows-googles-robot-cars-are-smoother-safer-drivers-than-you-or-i (favorably comparing the safety of automated drivers to their human counterparts).

6 *See, e.g.*, Andrew English, *Autonomous Cars—Is This the End of Driving?*, THE TELEGRAPH, Jan. 16, 2014, http://www.telegraph.co.uk/motoring/road-safety/10570935/Autonomous-cars-is-this-the-end-of-driving.html (discussing the implications of self-driving cars on driver freedom); Camille Francois, *Self-Driving Cars Will Turn Surveillance Woes into a Mainstream Worry*, WIRED (May 30, 2014), http://www.wired.com/2014/05/self-driving-cars-will-turn-surveillance-woes-into-a-mainstream-issue (discussing concerns about the effect of self-driving cars on user privacy); Alexis C. Madrigal, *If a Self-Driving Car Gets in an Accident, Who—or What—Is Liable?*, THE ATLANTIC, Aug. 13, 2014, http://www.theatlantic.com/technology/archive/2014/08/if-a-self-driving-car-gets-in-an-accident-who-is-legally-liable/375569 (discussing who should be held liable for self-driving car accidents).

7 *See The Automobile Age*, 10 WILSON Q. 64 (1986).

8 *See* Philip E. Ross, *Driverless Cars: Optional by 2024, Mandatory by 2044*, IEEE SPECTRUM (May 29, 2014), http://spectrum.ieee.org/transportation/advanced-cars/driverless-cars-optional-by-2024-mandatory-by-2044.

9 CAL. VEH. CODE § 38750(c)(1)(D) (West 2013); NEV. ADMIN. CODE § 482A.190(2)(g) (2012).

California demands that the "manufacturer of the autonomous technology installed on a vehicle shall provide a written disclosure to the purchaser of an autonomous vehicle that describes what information is collected by the autonomous technology equipped on the vehicle."[10] Other measures might have the unintended consequence of diminishing user privacy: California also requires that all AVs preserve detailed records of the thirty seconds leading up to an accident.[11] Though intended to help determine fault in the event of an accident, this regulation could open the door to more continuous and invasive monitoring of AV behavior in the future. Some have even suggested that AV technology's potential to infringe on privacy is so grave that self-driving cars should be prohibited altogether.[12]

California's decision to use the sensors installed on AVs to determine fault raises another concern: who should be held liable for crashes involving AVs? Though manufacturers, insurers, news outlets, and academics have all posed this question, they have not found easy answers. While some academics assert that the manufacturers of AVs should be held liable for their crashes under a products liability model,[13] others claim that products liability would strangle the introduction of self-driving cars and advocate for "strict liability to autonomous car owners."[14] And though California originally stipulated that "the conversion of vehicles originally manufactured by a third party shall control issues of liability arising from the operation of the autonomous vehicle," the legislature struck this provision on reconsideration.[15] This

---

10 CAL. VEH. CODE § 38750(b)(1) (West 2013).

11 *Id.*

12 Joseph B. White, *The Big Worry About Driverless Cars? Losing Privacy*, WALL ST. J. BLOG (June 3, 2013), http://blogs.wsj.com/drivers-seat/2013/06/03/the-big-worry-about-driverless-cars-losing-privacy (demonstrating the extent of public worry about how self-driving cars will affect privacy). *But see* Timothy B. Lee, *Self-Driving Cars Are a Privacy Nightmare. And It's Totally Worth It*, WASH. POST BLOG (May 21, 2013), http://www.washingtonpost.com/blogs/wonkblog/wp/2013/05/21/self-driving-cars-are-a-privacy-nightmare-and-its-totally-worth-it (suggesting that the very real threat self-driving cars pose to user privacy is outweighed by other benefits they provide).

13 *See* Jeffrey K. Gurney, *Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles*, 2013 U. ILL. J.L. TECH & POL'Y 247; Kevin Funkhouser, Note, *Paving the Road Ahead: Autonomous Vehicles, Products Liability, and the Need for a New Approach*, 2013 UTAH L. REV. 437.

14 Sophia H. Duffy & Jamie Patrick Hopkins, *Sit, Stay, Drive: The Future of Autonomous Car Liability*, 16 SMU SCI. & TECH. L. REV. 453, 453 (2013).

15 LEGISLATIVE COUNCIL: STATE OF CAL., LEGISLATIVE COUNCIL'S DIGEST, div. 16.6(a)(4)(B) (Feb. 23, 2012), *available at* http://www.leginfo.ca.gov/pub/11-12/bill/sen/sb_1251-1300/sb_1298_bill_20120820_amended_asm_v94.html.

vacillation only hints at the uncertainty surrounding the complex liability issues for crashes involving AVs, which, in many ways, defy the traditional conceptions of fault and agency at play in automobile accidents.

Nearly all of the literature on self-driving cars explores either their impact on social values like freedom and privacy[16] *or* the questions they pose for legal liability.[17] These lines of inquiry have developed largely in isolation, with little effort to examine how they might intersect and inform each other.[18] This Article advances an integrated approach: regulators should consider freedom, privacy, and liability as interlocking pieces—not independent elements—of the puzzle of self-driving car regulation. Unlike much of the existing literature on self-driving cars, which suggests a one-size-fits-all framework for assessing liability,[19] I propose a more effective regime, in which

---

[16] *See* Dorothy J. Glancy, *Privacy in Autonomous Vehicles*, 52 SANTA CLARA L. REV 1171, 1177 (2012); Rachael Roseman, *When Autonomous Vehicles Take over the Road: Rethinking the Expansion of the Fourth Amendment in a Technology-Driven World*, 20 RICH. J.L. & TECH. 1 (2014); Francesca Svarcas, *Turning a New Leaf: A Privacy Analysis of Carwings Electric Vehicle Data Collection and Transmission*, 29 SANTA CLARA COMPUTER & HIGH TECH. L.J. 165 (2013).

[17] *See, e.g.*, Gurney, *supra* note 13; Gary E. Merchant & Rachel A. Lindor, *The Coming Collision Between Autonomous Vehicles and the Liability System*, 52 SANTA CLARA L. REV. 1321 (2012); Robert W. Peterson, *New Technology—Old Law: Autonomous Vehicles and California's Insurance Framework*, 52 SANTA CLARA L. REV. 1341 (2012); Funkhouser, *supra* note 13; Julie Goodrich, Comment, *Driving Miss Daisy: An Autonomous Chauffeur System*, 51 HOUS. L. REV. 265 (2013).

[18] However, groundbreaking articles by Eugene Volokh and Bryant Walker Smith have begun to analyze the tension inherent between consumer privacy and certain common law tort standards. Volokh proposes that an invasion of consumer privacy should be weighed against increased safety; Smith suggests that this dynamic will usher "in a new age of product stewardship." Bryant Walker Smith, *Proximity-Driven Liability*, 102 GEO. L. REV. 1777, 1779 (2014) ("[G]rowing proximity [between buyers and sellers] could significantly expand sellers' point-of-sale and post-sale obligations toward people endangered by their products."); Eugene Volokh, *Tort Law vs. Privacy*, 114 COLUM. L. REV. 879, 883 (2014) ("[W]hen the technologies become cheap enough, it becomes plausible to claim that a manufacturer is negligent for designing a deadly machine that fails to inexpensively surveil its operator for signs of dangerous driving and to inexpensively report the operator's dangerous driving to the authorities.").

[19] *See* Duffy & Hopkins, *supra* note 14, at 453 (advocating for "strict liability to autonomous car owners"); Andrew P. Garza, *"Look Ma, No Hands!": Wrinkles and Wrecks in the Age of Autonomous Vehicles*, 46 NEW ENG. L. REV. 581, 581 (2012) ("Products liability law is capable of handling the advent of autonomous vehicles just as it handled seat belts, air bags, and cruise control."); Dylan LeValley, *Autonomous Vehicle Liability—Application of Common-Carrier Liability*, 36 SEATTLE U. L. REV. SUPRA 5, 6 (2013) (arguing that AV manufacturers should be treated like "common carriers" who owe "the public the highest duty of care [and are] liable for even the slightest negligence").

an AV user's legal responsibility for the behavior of her AV varies in response to the degree of user freedom and privacy her AV protects.

In Part I, I examine the freedom and privacy interests at stake with AV technology and demonstrate that the degree to which self-driving cars protect these values will be determined by where the vehicles fall on the *discretionary-nondiscretionary* and *communicative-uncommunicative* spectrums (defined below). In coining these terms, I hope to provide a functional language for understanding whether a particular model of self-driving car will infringe on its user's freedom and privacy. In Part II, I explore how the application of existing common law doctrine could shift liability away from the users of AVs toward third parties like manufacturers or government entities as AVs become less *discretionary* and/or more *communicative*. The Article also provides the first sustained inquiry into how different liability regimes for AVs might in turn generate sizable efficiencies in liability and insurance administration. In Part III, I make a normative appeal to regulators: only allow AVs to infringe on user freedom and privacy if: (1) reductions in freedom and/or privacy lead to equivalent reductions in liability for the users of self-driving cars, and (2) administrative efficiencies or other identifiable social benefits outweigh the social costs incurred by forfeiting these values. By tying the reduction of user freedom and privacy to improvements in both individual and social welfare, this Article charts a possible course for regulators to reconcile freedom and privacy concerns with tort liability in AV regulation.

I. FREEDOM AND PRIVACY

Though some assume that self-driving cars will inevitably compromise their users'[20] freedom and privacy, AVs could take a variety of forms, each of which would affect these two values

[20] I choose to examine freedom, privacy, and liability from the perspective of the "user" instead of alternatives such as "owner" or "driver" for a number of reasons. First, personal ownership of self-driving cars may not always be the norm. *See* Jonathan Keane, *Google Thinks Self-Driving Cars Will Reduce Car Ownership*, PASTE (July 7, 2014), http://www.pastemagazine.com/articles/2014/07/google-thinks-self-driving-cars-will-reduce-carow.html. Second, referring to an individual using a self-driving car as a "driver" could well become a misnomer, especially if she does not or cannot operate the vehicle herself. *See* OPEN ROBOETHICS INITIATIVE, *Kids with Wheels: Should the Unlicensed Be Allowed to "Drive" Autonomous Cars?*, ROBOHUB (May 26, 2014), http://robohub.org/kids-with-wheels-should-the-unlicensed-be-allowed-to-drive-autonomous-cars (asking whether unlicensed drivers such as children should be permitted to use self-driving cars in the future).

differently. [21] Intelligent highways, [22] for example, could compromise user freedom and privacy by controlling and communicating with all cars simultaneously via an external authority; self-contained vehicles could protect user privacy by storing all maps, hardware, and data necessary to operate on-board; [23] and Google's latest prototype could reduce user freedom by preventing users from exerting direct control over the car.[24]

Of course, regulators need not accept private companies' decisions on how much freedom or privacy self-driving cars will preserve. Regulators can, and often do, provide guidelines that help shape emerging technologies in ways that protect cherished values. [25] Take the Privacy by Design (PBD) movement, spearheaded by the Information and Privacy Commissioner of Ontario. By employing a variety of prophylactic measures during a product's development, PBD induces manufacturers to limit their invasions of user privacy to the bare minimum at each level of product functionality. [26] Numerous companies worldwide, from Google to Intel, have voluntarily allowed PBD to steer their development of potentially privacy-threatening technology.[27] In fact, privacy scholar Dorothy Glancy has advanced AV technology as an ideal candidate for just this treatment.[28]

As regulators debate and enact policies for freedom and privacy protection, they will influence the ultimate form self-driving cars assume. In this Part, I propose that attempts to protect user freedom will determine how *discretionary* a vehicle must be, while attempts to protect user privacy will limit how *communicative* a vehicle can be. I then examine a few ways in which these values may intersect with one another. After assessing how and why regulators might embed these two

---

21 Because I am interested in issues of user freedom and privacy, I will examine self-driving vehicles as if they will always have human users and/or passengers, although this may not always be the case.

22 *Vehicle-to-Infrastructure (V2I) Communications for Safety*, U.S. DEP'T OF TRANSP.: INTELLIGENT TRANSP. SYS. JOINT PROGRAM OFF., http://www.its.dot.gov/safety/v2i_comm_safety.htm (last updated Jan. 22, 2015).

23 Glancy, *supra* note 16, at 1177.

24 Brandon Griggs, *Google's New Self-Driving Car Has No Steering Wheel or Brake*, CNN, May 28, 2014, http://www.cnn.com/2014/05/28/tech/innovation/google-self-driving-car.

25 *See* Batya Friedman, *Value-Sensitive Design*, INTERACTIONS, Nov.-Dec. 1996, at 16, 17.

26 Ann Cavoukian, *7 Foundational Principles*, PRIVACY BY DESIGN, http://www.privacybydesign.ca/index.php/about-pbd/7-foundational-principles (last visited Nov. 25, 2014).

27 *See* Kashmir Hill, *Why 'Privacy by Design' Is the New Corporate Hotness*, FORBES, July 28, 2011, http://www.forbes.com/sites/kashmirhill/2011/07/28/why-privacy-by-design-is-the-new-corporate-hotness.

28 Glancy, *supra* note 16, at 1235.

values into self-driving cars, I will analyze the liability repercussions of various value-sensitive designs.

A. *Freedom: Discretionary Vehicles*

Some drivers might find it "dehumanizing" to lose "choice and control" when behind the wheel (if there even is one) of a self-driving car.[29] As one commentator wrote, "miserable as Americans are behind the wheel, they still love cars because they love being in complete control of a powerful machine. Take away the wheel and the pedals, and you've taken away whatever joy there is to driving."[30] Technology that strips cars of this symbolic and emotional value will, consequently, face resistance from diverse groups like automobile enthusiasts, rebellious teenagers, and those distrustful of big government.

Inherent in the very name of autonomous vehicles is the idea that they will, to some degree, take autonomy away from a human user. Even the most basic AV technology undermines user autonomy to some extent: lane-maintenance technology, adaptive cruise control (ACC),[31] and electronic stability control (ESC)[32] all make driving decisions independent of human users. More broadly, the very decision to *use* autonomous technology implicates a driver's freedom, and that decision might not always remain in an individual's hands.

Though all AV technology bears in one way or another on a user's autonomy, there is a real difference between what I call *discretionary vehicles*, which would grant individuals maximum discretion over when, where, why, and how their vehicles drive, and *nondiscretionary vehicles*, which would assume almost all operational autonomy from the human driver.

---

[29] Dorothy J. Glancy, *Privacy and Intelligent Transportation Technology*, 11 SANTA CLARA COMPUTER & HIGH TECH. L.J. 151, 155 (1995).

[30] Ben Walsh, *Self-Driving Cars Are Still Cars—Which Means They Won't Improve Your Commute*, NEW REPUBLIC, May 29, 2014, http://www.newrepublic.com/article/117943/googles-self-driving-cars-miss-problem-mobility-america.

[31] Adaptive Cruise Control (ACC) allows the user of a vehicle to input a desired speed and following distance. ACC then adjusts the speed of the vehicle according to the location of other cars on the road, returning to the desired speed once safe to do so. *Adaptive Cruise Control and Collision Warning with Brake Support*, FORD (July 2012), http://corporate.ford.com/doc/Adaptive_Cruise.pdf.

[32] Electronic Stability Control (ESC) "continuously compares the driver's steering wheel position to the direction of travel of the vehicle. When the control unit detects a difference, ESC operates by independently applying the brakes to individual wheels. In some cases, it will reduce the engine power as well." *ESC*, NAT'L ROADS & MOTORISTS' ASS'N, http://www.mynrma.com.au/motoring-services/buy-sell/buying-advice/features/stability-control.htm (last visited Nov. 25, 2014).

Discretionary vehicles would maintain the freedom and personal autonomy of their users to the greatest extent possible, allowing users to turn the self-driving function on and off, adjust its driving profile, or override its choice of route. In a situation familiar to any user of Google Maps, the user of a discretionary vehicle might be presented with a default route between *A* and *B*, but have the option to alter the path as she saw fit (to avoid tolls or heavily trafficked roads, for instance). Further, a user of a discretionary vehicle might have the ability to alter her vehicle's driving profile.[33] A user might want to ask her self-driving car to drive aggressively when she is late for a job interview, but leisurely when driving down a beautiful stretch of coastal highway. Because users would retain the ability to turn the automated driver on and off at will, AV technology in a discretionary vehicle resembles an advanced form of driving assistance—that is, the technology is a useful feature that removes some of the stress and danger of driving, but to which autonomy is ceded on a discretionary basis.

As of this writing, regulators seem to prefer discretionary vehicles, with California and Nevada mandating that self-driving cars return driving authority to their users whenever requested.[34] Given this current regulatory preference, it is perhaps unsurprising that most in-development AVs, like those being worked on by Toyota, Nissan, Volvo, and Honda, appear to be discretionary in their basic contours.[35]

Nondiscretionary vehicles, in contrast, would limit their users' autonomy by precluding them from determining their own route, choosing their preferred driving style, engaging and disengaging the automated-driver at will, and/or driving in certain places or at certain times of day. A nondiscretionary vehicle might refuse to travel on unsafe and unpaved roads, or when weather conditions are too severe.[36] It is not difficult to imagine fleets of unmanned, nondiscretionary taxis roaming the streets of major metropolitan areas and offering limited passenger input.[37]

---

[33] Eric Jaffe, *Will Self-Driving Cars Have Road Rage?*, THE ATLANTIC, May 30, 2014, http://www.citylab.com/tech/2014/05/will-self-driving-cars-have-road-rage/371709 (discussing the pros and cons of allowing users to choose their vehicles' driving behavior).

[34] CAL. VEH. CODE § 38750(c)(1)(D) (2013); NEV. ADMIN. CODE § 482A.190(2)(g) (2012).

[35] Sanburn, *supra* note 2 (listing the companies with self-driving technology in development and giving a brief explanation of how they function).

[36] Adam Clark Estes, *What's Keeping Self-Driving Cars Off the Road?*, GIZMODO, Oct. 24, 2013, http://gizmodo.com/whats-keeping-self-driving-cars-off-the-road-1450916024 (describing the difficulty self-driving cars have in navigating roads with inclement weather).

[37] William White, *GOOG: Will the Google Self-Driving Car Kill Taxi Business?*, INVESTORPLACE, June 23, 2014, http://investorplace.com/2014

If nondiscretionary vehicles seem farfetched, keep in mind that Google has recently revealed the prototype of a self-driving car with no steering wheel, gas pedal, or driver-accessible brake.[38] A vehicle like this could realize the fears of those who worry that self-driving cars will eventually place serious restrictions on user freedom. Furthermore, certain proposed uses of AV technology might require that *all* self-driving cars be nondiscretionary. Most notably, intelligent highways would need universal compliance in order to simultaneously control a full road of cars.[39]

B. *Privacy: Communicative Vehicles*

Though situated within a broader national discussion about the privacy implications of disruptive technologies (such as smartphones, social media platforms, and surveillance satellites), roadway privacy presents singular challenges that have been discussed in both courts[40] and the academic literature.[41] Some privacy-threatening roadway technology is already in widespread use. Traffic signals increasingly come equipped with video cameras, toll tag transponders make a note each time a driver passes by their sensors, and event data recorders store the performance of a vehicle in the seconds

---

/06/goog-google-google-self-driving-car (suggesting that self-driving cars may become direct competitors to taxi services).

38 Griggs, *supra* note 24.

39 An intelligent highway:

> is an intelligent transportation system, in which vehicles and highways will exchange information through a two-way communication system. The automated highways will have a set of lanes on which vehicles with specialized sensors and wireless communications systems could travel under computer control at closely spaced intervals . . . . [T]he system can coordinate traffic flow more efficiently, reduce speed fluctuations, monitor unsafe vehicle operation, and traffic shock waves, maximize highway capacity and minimize avoidable traffic congestion.

Alberto Martin, Hector Marini & Sabri Tosunoglu, Intelligent Vehicle/Highway System: A Survey, Presentation at the Florida Conference on Advances in Robotics (Apr. 29-30, 1999), *available at* http://www.eng.fiu.edu/mme/Robotics/elib/IVHS%20Part%201%20v2.pdf. This level of massive coordination could probably only be achieved if the intelligent highway system simultaneously controlled every car on the highway, or at least those cars with access to the lanes governed by the intelligent highway.

40 *See, e.g.*, United States v. Jones, 132 S. Ct. 945 (2012) (adjudicating the legality of unwarranted GPS tracking of vehicles).

41 *See, e.g.*, Lisa Belrose, *Do Automobile Passengers Have a Legitimate Expectation of Privacy?*, 28 TOURO L. REV. 771 (2012) (discussing reasonable expectations of privacy in vehicles); Stephen A. Josey, Note, *Along for the Ride: GPS and the Fourth Amendment*, 14 VAND. J. ENT. & TECH. L. 161 (2011) (discussing the Fourth Amendment implications of using a GPS to track vehicles).

leading up to a collision.[42] But AV technology might bring other, potentially more intrusive, invasions of privacy.

Self-driving cars could compromise their users' privacy by transmitting not only "[t]he present location of an autonomous vehicle user [and] that person's past travel patterns," but also "his or her future travel plans," which could be employed for "targeted marketing," "law enforcement," or "surveillance."[43] Whether or not a vehicle is likely to threaten its passengers' privacy can largely be reduced to the question of whether or not that vehicle is *communicative*. A communicative vehicle generally will engage in at least one of the following behaviors: relaying vehicle information to third parties; receiving driving instructions or other data from external sources; or speaking with other self-driving cars in its vicinity. Though on-site hacking is always a possibility, a vehicle that does not participate in any of these communicative functions will better protect user privacy than one that does. This is in part because vehicles that do not communicate will be less likely to collect extensive information about its users in the first place. Communicative vehicles could take a number of different forms, though a few especially important possibilities are worth noting.

Vehicle-to-vehicle (V2V) technology would enable the "dynamic wireless exchange of data between nearby vehicles."[44] This exchange would allow self-driving cars to "sense threats and hazards . . . calculate risk . . . or take pre-emptive actions to avoid and mitigate crashes."[45] Because V2V technology sends "internal vehicle status information to or through an external network," users face an increased risk of having this information compromised or improperly used.[46] A rash of over 300,000 wireless router hacks earlier this year highlights the vulnerability of such networks.[47]

Communicative vehicles might also relay "vehicle status data in real time to roadside infrastructure for use by traffic management centers, toll collection agencies, or law

---

42 *See* Aleecia M. McDonald & Lorrie Faith Cranor, *How Technology Drives Vehicular Privacy*, 2 J.L. & POL'Y INFO. SOC'Y. 3 (2006) (discussing the technological threats to vehicular privacy already present on the road).

43 Glancy, *supra* note 16, at 1196.

44 *See Vehicle-to-Vehicle (V2V) Communications for Safety*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., http://www.nhtsa.gov/Research/Crash+Avoidance /Vehicle-to-Vehicle+Communications+for+Safety (last visited Feb. 16, 2015).

45 *Id.*

46 Glancy, *supra* note 16, at 1177.

47 Dan Goodin, *Hackers Hijack 300,000-Plus Wireless Routers, Make Malicious Changes*, ARS TECHNICA, Mar. 3, 2014, http://arstechnica.com /security/2014/03/hackers-hijack-300000-plus-wireless-routers-make-malicious-changes.

enforcement." [48] Judging by the uproar occasioned by the comparatively unobtrusive introduction of red light cameras,[49] many AV users would probably be averse to having their vehicles' behavior systematically relayed to local police and/or other government entities. Finally, the central computing unit of an intelligent highway might need to know information about each individual car, like its make, its intended destination, and whether it is an emergency vehicle. The potential for intelligent highways to facilitate widespread surveillance is obvious and, depending on one's viewpoint, frightening.[50]

An autonomous vehicle that either refuses to or is incapable of transmitting such information is *uncommunicative*. Many vehicles currently in development, including the original Google Car, more or less follow this self-contained, uncommunicative model. These vehicles store all hardware and software necessary to operate on-board, relying on detailed maps that they supplement with 360-degree sensors and powerful computer processors to find their way around.[51] As long as uncommunicative vehicles are engaged in practices that would prevent on-site information theft, like data deletion and encryption, they could theoretically protect personal information privacy just as well as non-automated cars can.

There is one important caveat: it appears that all self-contained AVs currently in development engage in at least one communicative function. Namely, they receive GPS coordinates from a transponder to help determine their location.[52] As long as uncommunicative AVs use passive GPS receivers—which do not transmit their own location, and cannot be tracked by third

---

48 Glancy, *supra* note 16, at 1178.

49 *See, e.g.*, Stephen Hudak, *Red Light Camera Furor: Clermont Tosses 150 Tickets*, ORLANDO SENTINEL, Feb. 23, 2012, http://articles.orlandosentinel.com/2014-02-23/news/os-clermont-throws-out-red-light-tickets-20140223_1_councilman-ray-goodgame-clermont-police-red-light-camera-program (detailing local distaste for automated-ticketing and its temporary suspension from use in Orlando, Florida).

50 *See* Sheri A. Alpert, *Privacy and Intelligent Highways: Finding the Right of Way*, 11 SANTA CLARA COMPUTER & HIGH TECH. L.J. 97 (1995) (discussing the potential privacy implications of intelligent highways and how these concerns might be abated).

51 Erico Guizzo, *How Google's Self-Driving Car Works*, IEEE SPECTRUM (Oct. 18, 2011), http://spectrum.ieee.org/automaton/robotics/artificial-intelligence/how-google-self-driving-car-works (exploring the design and function of Google's self-driving car).

52 *The Economist Explains: How Does a Self-Driving Car Work*, THE ECONOMIST, Apr. 29, 2013, http://www.economist.com/blogs/economist-explains/2013/04/economist-explains-how-self-driving-car-works-driverless ("Ultrasonic detectors . . . [g]yroscopes, accelerometers and altimeters provide more accurate positioning than is possible using global-positioning system (GPS) satellites alone. Google's cars scan their surroundings to build [and] update [a] 3D map.").

parties—the privacy risks at play in using the GPS system should be kept to a minimum.[53]

Notably, the degree to which communicative vehicles affect their users' privacy will be determined in large part by the ongoing national debate over location privacy. Importantly, federal courts have yet to indicate decisively when an individual's location data can be accessed by law enforcement and how it can be used. In 2012, the Supreme Court determined in *United States v. Jones* that installing a GPS tracker onto a vehicle without a warrant violates a suspect's Fourth Amendment rights.[54] In June 2014, the 11th Circuit, following *Jones*, ruled that it was unconstitutional for law enforcement to use and obtain a suspect's cellphone location data without a warrant.[55] However, three months later, the Circuit granted a petition for rehearing *en banc*,[56] vacated the previous decision, and cast serious doubts on what constitutional protections Americans have over their location privacy.

C. *The Intersection of Freedom and Privacy*

Though this Article has thus far made a clean distinction between freedom and privacy, these two values intersect in a number of meaningful ways. The idea that systematically depriving an individual of her privacy greatly restricts her autonomy famously motivated Jeremy Bentham to propose the Panopticon, a prison in which every single room, nook, and cranny can be seen from a single elevated guard post.[57] Bentham believed the inmates of this Panopticon, not knowing whether or not anyone was occupying the guard post at any given time, would alter their behavior out of fear of being seen. A world in which communicative self-driving cars allow

---

[53] *See, e.g.*, Leslie Baehr, *How Does GPS Work?*, BUS. INSIDER, July 23, 2014, http://www.businessinsider.com/how-does-gps-work-2014-7.

[54] United States v. Jones, 132 S. Ct. 945 (2012).

[55] United States v. Davis, 754 F.3d 1205, *vacated en banc*, United States v. Davis, 2014 WL 4358411 (11th Cir. 2014).

[56] United States v. Davis, No. 12-12928, 2014 WL 4358411 (11th Cir. Sept. 4, 2014).

[57] JEREMY BENTHAM, THE PANOPTICON WRITINGS 29-95 (Miran Bozovic ed., 1995) ("It is obvious that, in all these instances, the more constantly the persons to be inspected are under the eyes of the persons who should inspect them, the more perfectly will the purpose X of the establishment have been attained. Ideal perfection, if that were the object, would require that each person should actually be in that predicament, during every instant of time. This being impossible, the next thing to be wished for is, that, at every instant, seeing reason to believe as much, and not being able to satisfy himself to the contrary, he should *conceive* himself to be so.").

constant surveillance by law enforcement authorities could similarly constrain user freedom.[58]

Conversely, uncommunicative vehicles might restrict their users' freedom if users desire their cars to transmit information to third parties. Families driving two cars on a cross-country road trip might want the cars to communicate location data with one another so as to coordinate driving decisions.[59] This dynamic can already be seen in cell phone use: iPhone apps like Find my Friends allow users to meet up more easily by transmitting their location data to one another.[60]

Though less obvious, an AV user's ability to exercise autonomy could also affect her privacy. A user's ability to vary her route could make her harder for stalkers, law enforcement agencies, or the paparazzi to track. The inability to tell one's AV to drive stealthily might reduce a user's privacy by preventing her from driving undetected—for example, imagine a teenager trying to sneak the car home late at night after her curfew. On the other hand, an individual's inability to input driving preferences might actually enhance her privacy, because she would not have to reveal her familiar routes, driving style, or driving skill.

Despite their considerable overlap, freedom and privacy are nonetheless distinct values worth examining independently. The two values do not map clearly onto one another: as evidenced by the discussion above, the lack (or presence) of one value may strengthen *or* weaken the other, depending on the particular AV design. In addition, not all of the concerns raised above are likely to come to fruition. Even if an AV broadcasts its user's information to a third party, the transmission is only likely to adversely impact the user's freedom if the third party holds financial or legal leverage over her (e.g., vehicles that transmit driving behavior to law enforcement would probably constrain behavior more than those that transmit aggregate driving statistics to a non-profit research institution). Moreover, the privacy concerns raised by restricting user freedom are mostly either abstract or non-threatening, and pale in comparison to the privacy harms that could potentially be incurred by data communication. Finally, as Part II demonstrates, freedom and privacy provide distinct doctrinal routes for determining a user's liability for accidents caused by

---

[58] *See* Jeffrey H. Reiman, *Driving to the Panopticon: A Philosophical Exploration of the Risks to Privacy Posed by the Highway Technology of the Future*, 11 SANTA CLARA COMPUTER & HIGH TECH. L.J. 27 (1995).

[59] This strategic interaction would be even more prevalent with respect to commercial vehicle use, where the stakes of coordination are higher and privacy concerns likely far lower.

[60] *Find My Friends*, APPLE: ITUNES PREVIEW, https://itunes.apple.com/us/app/find-my-friends/id466122094 (last visited Nov. 25, 2014).

a self-driving car, making this analytical separation useful from a legal perspective as well.

II. LIABILITY SHIFTS

Some users might prefer freedom to privacy, some privacy to freedom, some might treasure both equally, and others might not be particularly concerned about either. Accordingly, this Part examines four different self-driving car paradigms, each expressing a unique vector of freedom and privacy preferences: discretionary-uncommunicative, discretionary-communicative, nondiscretionary-uncommunicative and nondiscretionary-communicative. Though the degree to which a vehicle is discretionary or communicative clearly falls along a spectrum, moving between these neat categories will give us better insight into how legal liability might shift in response to different preferences for freedom and privacy protection. By examining these paradigms in roughly ascending order of freedom and privacy invasion, I demonstrate how the forfeiture of these values might (1) shift liability away from the user of a self-driving car, and (2) facilitate the use of increasingly novel and efficient forms of liability and insurance administration.

The parties most likely to be held liable for an accident caused by a self-driving car would be the user, the owner (who may or may not be the user), the manufacturer of the car, the manufacturer of the AV components (which may or may not be different from the car manufacturer), [61] or a government entity.[62] In the ensuing discussion, however, I will limit my analysis to users, manufacturers, and government entities.[63] An emerging body of literature has discussed the difficulty of assigning liability between various manufacturers for a malfunction that occurred while their respective products were interacting. [64] As these parts become increasingly

---

[61] California law currently considers the "manufacturer" of an AV, for legal purposes, to be the entity that modifies the vehicle by installing autonomous technology. CAL. VEH. CODE § 38750 (West 2015).

[62] Merchant & Lindor, *supra* note 17, at 1328 ("If an autonomous vehicle malfunctioned and caused an accident, one or more of several entities could be held liable. The list of potential parties includes the vehicle manufacturer, the manufacturer of a component used in the autonomous system, the software engineer who programmed the code for the autonomous operation of the vehicle, and the road designer in the case of an intelligent road system that helps control the vehicle.").

[63] The possible role of government entities—either as regulators or as the actors controlling the AVs' actions—is discussed most comprehensively in Part II.D.

[64] *See* M. Ryan Calo, *Open Robotics*, 70 MD. L. REV. 571, 597 (2011) ("It is extremely difficult to discover whether software, as opposed to hardware, is responsible for the glitch that led to an accident. If the software is responsible, it would be hard to determine whether the precise cause was the operating system or the application and, if the latter, which application."); Merchant & Lindor, *supra* note 17, at 1328-29 ("The

interdependent, teasing out responsibility may become nearly impossible. However, because this Article focuses on how forfeiting privacy and freedom leads to a transfer of liability away from individuals and towards third parties like manufacturers or government entities, I will not be overly concerned with the fine details of which particular manufacturer should be held liable for AV accidents. For similar reasons, and because statutory and common law doctrines already cover many of the questions concerning whether the private owner of a vehicle or the individuals she authorizes to use her vehicle are liable for its accidents,[65] I will not distinguish between owners and users of AVs for liability purposes.

Before discussing liability in greater depth, it is important to clarify why I propose to view liability for self-driving cars primarily through the principles of the law of agency rather than the law of product liability, [66] an approach that has been popular in the literature.[67] While courts do not currently imbue robots with legal personhood, [68] scholarship focusing on assigning tort liability for the behavior of robots often appeals to the principles of agency law.[69] Furthermore, Congress has

---

various component parts and their respective roles in causing a malfunction may be hard to discern and separate for the purpose of assigning responsibility. In most cases, it will be the vehicle manufacturer who will, for both practical and doctrinal reasons, be the party held liable for a crash involving an autonomous vehicle.").

65 Potential liability questions could develop, for example, if the owner of an AV set the AV-driver to an unsafe driving profile, which caused an accident while the car was nominally under the control of a permissive user. These novel questions will not be explored further here, however.

66 If my appeal to agency law proves unconvincing, keep in mind that, as a product infringes more upon the freedom and privacy of its user, those manufacturers are more likely to incur liability for accidents under a product liability regime due to their increased "proximity" to users. *See* Smith, *supra* note 18.

67 *See* Gurney, *supra* note 13; Funkhouser, *supra* note 13.

68 Because courts have been reluctant to treat robots as entities that can express agency, this approach might necessitate legislative action. Peterson, *supra* note 17, at 1359 (noting that a "small step, which may require legislation, might involve accepting an analogy to agency law."); Samir Chopra, *Computer Programs Are People, Too*, THE NATION, May 29, 2014, http://www.thenation.com/article/180047/computer-programs-are-people-too (suggesting that legal personhood should be extended to robots much like it was extended to corporations, and asking whether AVs should "be treated like a pet or a child or something else?").

69 *See, e.g.*, Samir Chopra & Laurence White, *Artificial Agents and the Contracting Problem: A Solution via an Agency Analysis*, 2009 U. ILL. J.L. TECH. & POL'Y 363, 392 (advocating for the adoption of an "agency law approach to artificial agents [because it] would permit the legal system to distinguish clearly between the operator of the agent . . . and the user of the agent"); Stephen T. Middlebrook & John Muller, *Thoughts on Bots: The Emerging Law of Electronic Agents*, 56 BUS. LAW. 341, 354 (2000) ("Given that we would turn to the law of agency in order to understand

already passed legislation clarifying that individuals can be held to contracts entered into by their "electronic agents," and could perhaps take a similar step in regards to self-driving cars.[70]

What distinguishes robotic devices like AVs from normal cars is that AVs exercise, or appear to exercise, autonomy in interacting with their human users. In order to locate the least-cost avoider of accidents involving AVs,[71] an examination should be made into who could most cheaply avoid the decision-making process that led to an accident: a user, a manufacturer, or a government entity. Treating AVs as entities with agency provides a better framework for assessing the varying gradients of control that users, manufacturers, and government entities can exercise than would treating AVs like garden-variety products.[72]

Another reason not to evaluate AVs exclusively under a product liability regime is that product liability suits are often prohibitively expensive and may be a bad fit for the frequent litigation that car accidents instigate. This is not to say product liability should play no role in assigning liability for discretionary-uncommunicative vehicles: AV accidents that are caused by obvious software malfunction or blatant design defect, for instance, may be fairly attributed to manufacturers under a standard product liability regime. Still, product liability cases of the level of complexity likely to be found in those involving self-driving cars typically cost more in legal

---

the relationship between a person and a human servant, it seems prudent to look to the same body of law to inform, although perhaps not to govern absolutely, the relationships between people and their software servants.").

70 15 U.S.C. § 7001(h) (2000) ("A contract or other record relating to a transaction in or affecting interstate or foreign commerce may not be denied legal effect, validity, or enforceability solely because its formation, creation, or delivery involved the action of one or more electronic agents so long as the action of any such electronic agent is legally attributable to the person to be bound.").

71 For a discussion of the concept of least-cost avoiders, see generally GUIDO CALABRESI, THE COSTS OF ACCIDENTS (1970).

72 Moreover, a rubric for evaluating responsibility for accidents involving AVs that does not try to determine the faulty decision-maker (human or robot) may consequently be unable to properly align incentives for safer driving, one of the preeminent justifications for the existence of agency relationships in assigning tort liability at common law. Alan O. Sykes, *An Efficiency Analysis of Vicarious Liability Under the Law of Agency*, 91 YALE L.J. 168, 172 (1981). For instance, if a manufacturer retains no ability post-sale to control the use of its AV technology, holding it responsible for the reckless use of an AV would not properly align incentives for accident cost reduction. If the user could not control the operation of her AV, assigning her liability would not sufficiently incentivize safer use of the vehicle.

fees than the victim receives in compensation.[73] And, as a recent case concerning the alleged malfunction of Toyota's electronic throttle control system demonstrated, juries are willing to give massive judgments against the manufacturers of automated technology.[74] Allowing principles of agency law to at least partially guide AV liability would help avoid the expense and inefficiency of product liability suits.

A. *Discretionary-Uncommunicative Vehicles*

A discretionary-uncommunicative AV would preserve, to the greatest degree possible, a user's freedom and privacy. A vehicle along the lines of the self-contained Google car (which keeps all necessary software and hardware on-board and does not communicate regularly with any third parties) offers a suitable example for the reader. In this incarnation, AVs look a lot like chauffeurs—so much so, in fact, that this comparison has been offered up countless times both by commentators[75] and Google itself, which refers to the software that powers its flagship AV as "Google Chauffeur."[76] A user can tell discretionary-uncommunicative vehicles which route to take and can take the wheel back if she wants to drive. Further, discretionary-uncommunicative vehicles do not report back to any superiors (except the user) about their driving behavior.

Common law tort liability for accidents caused by chauffeurs is assigned to the chauffer's principal under the doctrine of *respondeat superior*.[77] Respondeat superior holds a

---

[73] A. Mitchell Polinsky & Steven Shavell, *The Uneasy Case for Product Liability*, 123 HARV. L. REV. 1437, 1438 (2010) ("Notably, the transfer of a dollar to a victim of a product accident via the liability system requires more than a dollar on average in legal expenses. Given the limited benefits and the high costs of product liability, we come to the judgment that its use is often unwarranted. This is especially likely for products for which market forces and regulation are relatively strong, which includes many widely sold products.").

[74] Junko Yoshida, *Toyota Case: Single Bit Flip that Killed*, EETIMES: NEWS & ANALYSIS (Oct. 25, 2013), http://www.eetimes.com/document.asp?doc_id=1319903.

[75] *See, e.g.*, Megan Rose Dickey, *Get Ready for Self-Driving Cars that Chauffeur Us Around*, BUS. INSIDER, Jan. 16, 2013, http://www.businessinsider.com/get-ready-for-self-driving-cars-that-chauffeur-us-around-2013-1; Martin LaMonica, *Google Self-Driving Car Chauffeurs Legally Blind Man*, CNET, Mar. 29, 2012, http://www.cnet.com/news/google-self-driving-car-chauffeurs-legally-blind-man.

[76] Adam Fisher, *Inside Google's Quest to Popularize Self-Driving Cars*, POPULAR SCI., Sept. 18, 2013, http://www.popsci.com/cars/article/2013-09/google-self-driving-car.

[77] *See, e.g.*, Perez v. Von Groningen & Sons, Inc., 41 Cal. 3d 962, 967 (1986) (holding that an employer could be held liable for a tractor accident caused by one of his employees because under "the doctrine of respondeat superior, an employer is vicariously liable for his employee's torts committed within the scope of the employment"); King v. Stuart Motor Co., 52 F. Supp. 727, 728 (N.D. Ga. 1943) (holding that an owner was

principal responsible for the torts that her agent causes while acting within the scope of employment. Simple enough, but the question then becomes: Is a discretionary-uncommunicative AV the agent of the user or the manufacturer?

Because discretionary-uncommunicative vehicles grant their users the maximum degree of control, discretion, and autonomy over their operation, a discretionary-uncommunicative vehicle should generally be considered the agent of its user, not its manufacturer.[78] Though some commentators have questioned the fairness of assigning liability to a self-driving car's user for an accident that occurred while the vehicle was in autonomous-driving mode, noted tort scholar Robert Peterson has pushed back against such criticism, writing that an "autonomous automobile is very much like a driver hired by the owner . . . and if the car violates the rules of the road . . . perhaps the owner . . . should be liable . . . Name the car 'Jeeves,' and the step may be easier to accept."[79]

Assigning liability to users for accidents in which their discretionary-uncommunicative vehicle was at fault would lead AV owners to channel this risk through the private insurance market, a development the insurance industry seems ready and willing to accommodate. Some insurance companies have already stepped into this arena by offering premium discounts

---

responsible for the acts of her chauffer "under the principle of respondeat superior"); *Agency—Master and Servant—Automobiles—Liability of the Owner of a Family Car*, 36 HARV. L. REV. 102, 103 **(**1922) ("Where one member of the family, or the chauffeur, drives another member of the family, *respondeat superior* clearly applies.").

78 Courts look to who has "control" over a chauffeur when deciding who the chauffeur's principal is. *See, e.g.*, Shevlin v. Schneider, 193 A.D. 107, 111 (N.Y. App. Div. 1920) (holding the employer of a chauffeur responsible for an accident that occurred while the chauffeur drove the employer's brother because the "chauffeur, in carrying out his employer's orders to take the employer's brother out that night, and in effect to go where told by the brother, was engaged in the performance of duty for his employer, and no change of employment was intended, and no change thereof resulted by operation of law"); Dunmore v. Padden, 105 A. 559, 560 (Pa. 1918) (exempting the employer of a chauffeur for an accident that occurred while the chauffeur was driving another man, because there "can be no question that at the time the automobile was being operated along this highway it was, temporarily at least, a car under the control and dominion of [the other man] and not of the owner").

79 Peterson, *supra* note 17, at 1359. If analogizing discretionary-uncommunicative vehicles to chauffeurs proves unappealing, treating an automated driver as a "permissive user" would similarly make the owner liable in many states for accidents caused by her self-driving car. *Id.* at 1358-59 ("Present law in California makes the owner of a vehicle responsible, up to the minimum required coverage for liability insurance, for accidents caused by the fault of any permissive user of the automobile. Thus, when the actual driver is at fault, the owner is liable without fault for the driver's actions.").

for cars that have semi-autonomous technology like ESC and ACC installed.[80] Considering that automobile insurance companies have long charged customers different prices based on assumptions about the safety of their driving, charging cars with AV technology a different rate would constitute a modest, rather than a revolutionary, change to the existing insurance system.

Above all, manufacturers of self-driving cars have indicated that they desire certainty in liability rules,[81] and discretionary-uncommunicative vehicles would probably cause minimal destabilization of the existing insurance and liability regimes. There is a fitting symmetry here, since discretionary-uncommunicative vehicles would similarly cause minimal destabilization of the current freedom and privacy equilibriums. As we move forward, this will serve as the baseline against which the liability and insurance methods explored in the following sections should be contrasted.

B. *Discretionary-Communicative Vehicles*

Discretionary-communicative vehicles would be designed to protect user freedom, but would sacrifice user privacy to the extent necessary to perform communicative functions.[82] These vehicles might be in regular contact with insurers, manufacturers, government agencies, law enforcement, and/or other third party sources concerning in-vehicle information like who is driving, how they are driving, when they are driving, where they are heading, and how far they have already travelled. This increased back-and-forth between the vehicle and third parties could, in turn, have significant repercussions for liability and risk assessment.

For example, the increased information flows occasioned by shifting toward a communicative model of self-driving cars should expand the permissible scope of a product liability framework. Because discretionary-communicative vehicles might grant manufacturers "information about [and] access to" their vehicles post-sale, the standards that these manufacturers face for traditional tort requirements like

---

[80] *See, e.g.*, *Car Insurance Discounts*, LIBERTY MUTUAL INSURANCE, http://www.libertymutual.com/auto-insurance/auto-insurance-coverage/auto-insurance-discounts (last visited Nov. 25, 2014).

[81] Ryan Nakashima, *Carmakers at Nevada Show: Driverless Cars Need Legal Framework*, INS. J., Jan. 13, 2014, http://www.insurancejournal.com/news/west/2014/01/13/316913.htm. Consumers would likely also appreciate and benefit from certainty in liability rules.

[82] As discussed in Part I, communicative capabilities might significantly hamper a user's freedom, influencing his or her behavior by exposing it to third-party sources. In this sense, discretionary-communicative vehicles may never be able to protect freedom as well as discretionary-uncommunicative vehicles could.

foreseeability, duty-to-warn, and negligence should shift as well.[83] Bryant Walker Smith dubs this phenomenon "proximity-driven liability" and "posits a spiral of proximity and liability" that might deepen the ongoing obligations of a seller toward his buyers.[84] A manufacturer's increased visibility into the real-time behavior of a discretionary-communicative AV might obligate the manufacturer to warn the user that she is heading directly into inclement weather, a traffic jam, an unpaved road, or an area where the manufacturer's vehicles performed poorly in the past.[85] At least in some cases, therefore, the manufacturer of a discretionary-communicative vehicle should likely be held liable for accidents that the user would have been responsible for in a discretionary-uncommunicative vehicle.

Many roadway accidents involving discretionary-communicative vehicles probably would not fall under these expanded conceptions of foreseeability, duty-to-warn, and negligence, however. The near infinite variety of situations that result in car accidents make it unlikely that every collision would be foreseeable or something that a manufacturer should have known to avoid or warn a customer about.[86] Moreover, although

> virtually every untoward consequence can theoretically be foreseen with the wisdom born of the event, negligence law draws a line between remote possibilities and those that are reasonably foreseeable; no person can be

---

[83] Smith, *supra* note 18, at 1819.

[84] *Id.*

[85] Liability due to foreseeability might increase for manufacturers because

> [i]ncreased flow of information . . . will render wholly expectable much of what was previously unexpected . . . . An aerial drone manufacturer might know from GPS data that one of its planes regularly passes over a school. An online retailer might suspect from sales data that the customer buying paint thinner is in the midst of a complicated pregnancy. The supplier of digital maps for automated vehicles may be able to discern from those very maps that children on one block have constructed a zipline at truck level over the street.

Id. at 1797.

[86] Though human error "contributes to as much as 75% of all roadway crashes," few scholars appear to believe that self-driving cars will completely eliminate automobile accidents. *See* Paul Salmon, Michael Regan & Ian Johnston, HUMAN ERROR AND ROAD TRANSPORT: PHASE ONE—LITERATURE REVIEW, ACCIDENT RES. CENTRE 1 (2005), http://www.monash.edu.au/miri/research/reports/muarc256.pdf. For instance, even in a world far more technologically advanced than the present, a power outage could suddenly reduce street level visibility, an earthquake could split the ground, or a nearby car could suddenly malfunction and swerve into an AV's lane.

> expected to guard against harm from events which are so unlikely to occur that the risk would commonly be disregarded.[87]

AV manufacturers consequently would not be required to foresee every imaginable risk and warn users about them; they would be subjected to a standard reasonableness test.

In cases where the manufacturer should not reasonably have foreseen a danger, or did not have a duty to warn the user about it, the user should be held liable for accidents caused by her AV.[88] In other words, the communicative nature of a discretionary-communicative AV should not, in general, preclude the AV from being considered its user's agent. This arrangement would naturally lend itself to a system similar to the one that governed the discretionary-uncommunicative vehicles of the previous section, characterized by user liability and private insurance.

Determining liability for accidents involving discretionary-communicative vehicles would be cheaper and more accurate than it would be for discretionary-uncommunicative vehicles. By reviewing the 360-degree footage of the vehicle's surroundings, which a discretionary-communicative vehicle could record and transmit, courts would no longer have to rely on inconsistent human recollections to determine fault.[89] Moreover, these vehicles could generate a continuous log of their internal operations, which would indicate when a mechanical malfunction, rather than operator error, caused an accident.[90]

Perhaps more importantly, a private insurance system could use the information relayed by discretionary-communicative vehicles to decrease reliance on stereotypes and generalizations, to incentivize users to employ autonomous driving systems, and to reduce moral hazard for the insured.

Historically, insurance companies have factored categories like gender and race into their risk assessment formulas.[91] While this practice is now controversial, and insurance companies can no longer charge customers differentially by

---

87 *See* AMERICAN LAW OF PRODUCTS LIABILITY 3D § 10:10 (Russell J. Davis et al. eds., 1987-2014).

88 *See* Part II.A, *supra*. With the exception of the proximity-related liability that manufacturers assume due to communicative functions, users should still be liable for accidents involving their discretionary-communicative vehicles.

89 For an account of the inaccuracies of eyewitness testimony, see Robert Buckhout, *Eyewitness Testimony*, 15 JURIMETRICS J. 171 (1975).

90 As with discretionary-uncommunicative vehicles, clear examples of AV technology malfunctioning could make the manufacturer liable.

91 *See, e.g.*, Gary Williams, *"The Wrong Side of the Tracks": Territorial Rating and the Setting of Automobile Liability Insurance Rates in California*, 19 HASTINGS CONST. L.Q. 845 (1992).

race, they still regularly ask applicants about gender, age, marital status, and zip code (which has often been employed as a proxy for race).[92] Many scholars have challenged the fundamental fairness of assigning insurance rates based on these generalizations.[93] By allowing insurance companies to consider actual driving behavior, which discretionary-communicative vehicles could continuously transmit, into their premiums, the insurance industry may be able to reduce its reliance on demographics.[94]

While usage-based insurance programs like Progressive Snapshot and Allstate Drivewise have already begun installing monitoring devices into vehicles,[95] self-driving cars will come equipped with hardware and software capable of generating far more sophisticated records of a vehicle's operation. Instead of the crude measures that programs like Snapshot currently capture (like stopping speed, acceleration, and turning radius), insurers examining the output of a self-driving car could see (with the assistance of 360-degree visuals) whether a safe braking distance was observed, whether the laws of the road were followed, how smoothly turns were handled, and other factors of driving performance. These vehicular telematics could also provide a telling comparison between the driving behaviors of the human driver and her automated companion.

Because telematics would allow insurers of discretionary-communicative vehicles to know whether the autonomous-driver was activated at any given time, insurance companies could charge customers different rates based on how often they gave the autonomous-driver control of the vehicle. More concretely, a person's insurance rate for the month might look something like *Monthly Rate = (Risk-adjusted Miles Driven by AV)(Per-Mile Insurance Rate for AV) + (Risk-adjusted Miles Driven by Human)(Per-Mile Insurance Rate for Human).* Separating the pricing schemes for the human and machine drivers would allow the user of a discretionary-communicative vehicle to know whether she or the automated driver was safer

---

92 *Id.* at 849-52.

93 *See, e.g.*, John O. Calmore, *Spatial Equality and the Kerner Commission Report: A Back-to-the-Future Analysis*, 71 N.C. L. REV. 1487 (1993); Willy E. Rice, *Race, Gender, "Redlining," and the Discriminatory Access to Loans, Credit, and Insurance: An Historical and Empirical Analysis of Consumers Who Sued Lenders and Insurers in Federal and State Courts, 1950-1995*, 33 SAN DIEGO L. REV. 583 (1996); Williams, *supra* note 91.

94 Though insurers already ask for driving records, fine-tuned measures of driving behavior have the potential to give insurers a much better idea of the probability that a given driver will get in an accident in the future. Insurers clearly believe this to be true; this justification is the *raison d'etre* of monitoring-based insurance programs like Progressive Snapshot and Allstate Drivewise.

95 *Snapshot Common Questions*, PROGRESSIVE, http://www.progressive.com /auto/snapshot-common-questions (last visited Nov. 25, 2014).

in the eyes of the insurer. The price difference would then affect her decision whether or not to delegate driving authority to the AV.

Finally, discretionary-communicative vehicles could reduce the moral hazard that automobile insurance currently engenders. Moral hazard arises because an insured individual does not always pay higher rates for driving more and does not bear the full cost of an accident, thereby incentivizing her to drive more often and less safely than she would otherwise.[96] Differential insurance rates could reduce moral hazard, since an AV user would have to pay extra for driving herself where the AV was safer, and would save if she made the decision to drive where the autonomous driver was more dangerous. Additionally, since her driving skill would be more heavily scrutinized, she would be less inclined to indulge in accident-causing behavior[97] and more inclined to forego unnecessary driving.

C. *Nondiscretionary-Uncommunicative Vehicles*

Nondiscretionary-uncommunicative vehicles are the mirror images of the discretionary-communicative vehicles discussed in the last Section: while they would protect user privacy by prohibiting systematic communication between the vehicle and third parties, they would afford their users little control over the AV's operation. Think of the self-contained, uncommunicative Google car from the first section, and then take away the steering wheel, gas pedal, and brake.

Or, more tellingly, just think of a taxi.[98] Like the passenger in a taxicab, a user's control over a nondiscretionary-uncommunicative vehicle might start and end with giving a final destination. Analogizing nondiscretionary-uncommunicative vehicles to taxis helps conjure a different principal-agent relationship than the one explored with the discretionary-uncommunicative vehicles of Part II.A. As noted

---

96 *See* Steven Shavell, *On Moral Hazard and Insurance*, 93 Q. J. ECON. 541 (1979) ("Moral hazard refers here to the tendency of insurance protection to alter an individual's motive to prevent loss . . . . If the insurer's observations [of the care the insured takes to prevent loss is] perfectly accurate [the moral hazard of insurance is eliminated].").

97 *See* Omri Ben-Shahar & Kyle D. Logue, *Outsourcing Regulation: How Insurance Reduces Moral Hazard*, 111 MICH. L. REV. 197 (2012) (exploring how increased information flows might help reduce the insured's moral hazard).

98 Though, admittedly, taxi drivers are usually in regular contact with a dispatcher (a communicative function), this does not greatly impact passenger privacy. The communication between the cab and dispatcher serves internal business needs and is not used to gather any personal information about customers. A taxi driver usually knows little personal information about his passengers and typically does not ask for identifying information.

above, at common law, "who[ever had] control of the [hired driver] during the time he [drove] the automobile" was responsible for the hired driver's behavior.[99] Unlike chauffeurs, tort law generally treats taxi drivers as the agents of the dispatching company, not of the paying passenger. [100] Analogizing AV manufacturers to the dispatching company[101] suggests that manufacturers will largely adopt responsibility for accidents involving nondiscretionary-uncommunicative vehicles. Shifting liability for the behavior of a nondiscretionary-uncommunicative vehicle towards its manufacturer tracks the intuition that, with the loss of user input into the operation of a nondiscretionary-uncommunicative vehicle, the manufacturer is increasingly likely to be the lower cost-avoider of accidents than the user.[102]

Before I explore the efficiency implications of this reduction in user freedom, a more thorough discussion of how nondiscretionary-uncommunicative vehicles might achieve uniform driving behavior is in order. Whereas current licensing requirements for drivers only test basic driving skills and knowledge, AVs could be programmed to abide by the law in a way that would be impracticable for flesh and blood people. Self-driving cars might be prohibited by their programming from exceeding the speed limit, going the wrong way down a one-way street, rolling through stop signs, running red lights, and any number of other legally prohibited behaviors that remain common to human drivers. [103] AVs might also be required to conform to optimal performance specifications, which could further standardize their behavior and guarantee their compliance with accepted best practices. [104] In fact, existing semi-autonomous technology (like ACC and ESC)

---

[99] *Chauffeur in General Employment of Owner as Servant for Time Being of Owner, or of Borrower of Car*, 42 A.L.R 1446 (1926).

[100] *See, e.g.*, Montague v. Goolsby, 237 F.2d 776 (D.C. Cir. 1990); Smith v. Deutsch, 200 P.2d 802 (Cal. Dist. Ct. App. 1948); Ass'n of Indep. Taxi Operators v. Kern, 13 A.2d 374 (Md. 1940); William D. Bremer, *Liability of Taxicab Company for Cabdriver's Negligence*, *in* 41 AM. JUR. PROOF OF FACTS 2D 239 (1985).

[101] A dispatcher, like an AV manufacturer, provides drivers to consumers. The consistency and quality of these drivers makes up their "brand."

[102] Of course, in the event of tampering or unauthorized altering of an AV, the user could still be held liable for accidents that her vehicle caused. *See, e.g.*, Ellsroth v. Johnson & Johnson, 700 F. Supp. 151 (S.D.N.Y. 1988) (holding a manufacturer not liable for deaths caused by drugs it manufactured but that were tampered with).

[103] Some predict that too strict observance of speed limits and other laws could cause problems for self-driving cars. *See, e.g.*, Brad Templeton, *Should Self-Driving Cars Obey Speed Limits?*, SLATE, Oct. 15, 2013, http://www.slate.com/articles/technology/future_tense/2013/10/robocars_do_they_need_speed_limits.html.

[104] For an early effort at promulgating guidelines for self-driving cars, see NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., *supra* note 1.

already acts directly on a vehicle's internals with a level of sensitivity and control far beyond what human drivers can achieve. To reinforce the legal analogy used above, keep in mind that both taxicab companies and their drivers require special licensing in most states to ensure a tolerable level of uniformity.[105] There can be little doubt, though, that the standardization achievable for human drivers pales in comparison to what AV technology could accomplish.

This potential for uniformity is central to nondiscretionary-uncommunicative vehicles' bid for more efficient liability administration. Recall that there were two drivers (the human and the machine) in both discretionary-uncommunicative and discretionary-communicative vehicles, and that the user could choose which would be behind the wheel at any given time. This gave each self-driving car a unique behavioral profile, comprised of the particular mix of human and automated driving that an individual user preferred. While allowing individuals to choose whether or not to drive keeps the number of driver profiles unknowable and diverse, mandating the installation and use of AV technology could theoretically reduce the number of unique drivers to the number of unique AV products.[106]

Reducing the number of driver categories would not necessarily tell us which car was at fault in any particular accident, but it might not even be necessary to maintain the fault system for accidents involving nondiscretionary-uncommunicative vehicles. If each self-driving car from the same manufacturer were sufficiently uniform, proportional share liability might be feasible.[107] Rather than determining fault for individual accidents, liability could be split based on the per-mile accident costs incurred by each AV product. A simple equation for Car A's share of the liability in an accident with Car B could look something like:

---

[105] *See, e.g.*, *Licensing*, NYC TAXI & LIMOUSINE COMM'N, http://www.nyc.gov/html/tlc/html/industry/licenses_main.shtml (last visited Nov. 25, 2014).

[106] Peterson, *supra* note 17, at 1377 ("This simply illustrates again why the insured's driving record is irrelevant as a rating factor."). There are exceptions, of course, like vehicles that would make you drive at some times and require you to let them drive at others.

[107] Proportional share liability, introduced by Allen Rostron, shares many features with market-share liability, a means of assigning industry-wide liability without assessing individual fault. The major difference is that proportional share liability assigns liability based on a different variable than market-share (in this case, accident costs per mile). *See* Allen Rostron, *Beyond Market Share Liability: A Theory of Proportional Share Liability for Nonfungible Products*, 52 UCLA L. REV. 151 (2004). Market-share liability is discussed further in Part II.D, *infra*.

$$\frac{\frac{\Sigma(\text{Accident Costs Involving Type A Cars})}{\Sigma(\text{Miles Driven by Type A Cars})}}{\left(\frac{\Sigma(\text{Accident Costs Involving Type A Cars})}{\Sigma(\text{Miles Driven by Type A Cars})} + \frac{\Sigma(\text{Accident Costs Involving Type B Cars})}{\Sigma(\text{Miles Driven by Type B Cars})}\right)}$$

Of course, the model would need to take into account additional factors (for instance, the "Amount of Miles Driven" could be risk-adjusted if certain models of self-driving cars are used more often in congested cities or rural country roads than others).[108] Nevertheless, the advantage of such a model is that it would charge, in the aggregate, each AV manufacturer for the proportion of accident costs in which its cars were involved without having to determine fault in any individual case. The administrative efficiencies of such a liability approach could prove to be tremendous.

Though some states already require drivers to report their annual mileage to insurers, some AV users might find reporting this information too communicative for their tastes. Even in the absence of adopting the above liability proposal, the uniform nature of each self-driving car model's risk profile would still vastly cheapen and simplify the business of insuring nondiscretionary-uncommunicative vehicles. To begin with, insurers would no longer need to use imprecise proxies like age, sex, and geographical location to estimate a driver's risk profile. They could instead simply charge based on how often a particular model of self-driving car actually gets in accidents. Furthermore, intra-brand uniformity would lower premiums by militating against the costly practice of crafting individualized insurance rates. Finally, the shift in liability from user to manufacturer would likely lower rates, since manufacturers can either self-insure or reduce transaction costs by bargaining to insure all of their self-driving cars at once.[109] By cutting down on actuarial work and negotiation costs, the uniformity of nondiscretionary-uncommunicative vehicles might generate significant administrative efficiencies in the private insurance system.

---

[108] These factors already influence insurance rates. *See, e.g.*, *Car Insurance Discounts*, LIBERTY MUTUAL INS., http://www.libertymutual.com/auto-insurance/auto-insurance-coverage/auto-insurance-discounts (last visited Nov. 25).

[109] Peterson, *supra* note 17, at 1342 ("It also should be more efficient for the manufacturer to purchase one policy covering 10,000 automobiles than for drivers to purchase 10,000 policies, each covering only one automobile.").

D. *Nondiscretionary-Communicative Vehicles*

Lastly, we come to nondiscretionary-communicative vehicles, which are designed to protect neither their users' freedom nor privacy. AV technology might become mandatory for all drivers in a world that permits nondiscretionary-communicative vehicles, and, in any event, will be engaged on a nondiscretionary basis when present. Further, these self-driving cars might communicate with other vehicles, insurers, manufacturers, and/or government agencies. Based on current proposals, nondiscretionary-communicative vehicles would probably fall into one of two camps: interactive or remote-controlled. As distinct as these two forms appear, a closer examination demonstrates that they may pose similar repercussions for the liability and insurance systems.

In the interactive incarnation, nondiscretionary-communicative vehicles would have V2V technology installed, which would allow them to "speak" to each other and coordinate their movements. For instance, one vehicle might signal to another that it intends to enter the other's lane, leading the receiving vehicle to automatically slow down in order to accommodate the merge. Or, local authorities could use V2V messages to require cars to move aside for ambulances or pull over when tagged by police officers.[110] Rules governing what type of information vehicles would need to exchange and how they should react upon receiving it would almost certainly need to be produced. This form of technological standardization has been achieved successfully in arenas such as the cell-phone industry, where the International Telecommunication Union issues regulations that all networks must follow.[111] A similar, government-sanctioned entity would be a natural candidate for propagating standards for V2V technology as well.

Another possible nondiscretionary-communicative vehicle system is the remote-controlled, or "intelligent highway," approach. As opposed to V2V technology, which relies on predetermined standards to guide inter-vehicle interactions, intelligent highways would beam driving instructions directly to vehicles. While no plans presently exist to implement an intelligent highway system on public roads, related traffic coordination methods have been in development by the USDOT[112] for many years.

---

[110] *See* John W. Whitehead, *Putting Big Brother in the Driver's Seat: V2V Transmitters, Black Boxes & Drones*, THE RUTHERFORD INST. (Feb. 10, 2014), https://www.rutherford.org/publications_resources/john_whitehead s_commentary/putting_big_brother_in_the_drivers_seat_v2v_transmitters _black_boxes_d.

[111] *About ITU*, INT'L TELECOMM. UNION, http://www.itu.int/en/about/Pages /default.aspx (last visited Nov. 25, 2014).

[112] *Vehicle-to-Infrastructure (V2I)*, *supra* note 22.

What both the interactive and remote-controlled models of nondiscretionary-communicative vehicles have in common is that, in many cases, neither the user nor the manufacturer will cause its accidents. Because decision-making would either be guided by pre-established standards (in the interactive scenario) or determined externally by an overseer program (in the remote-controlled scenario), either the standards or the overseer may often be the cause of accidents. But, in that case, who should be held liable?

Because the government might well be either the promulgator of V2V standards and/or the administrator of intelligent highways,[113] one possibility in the event of an accident would be to sue the relevant government authority. Indeed, it might be tempting to analogize intelligent highways to subway systems or other forms of municipal transportation. I think, however, that it is important to resist this temptation. Sovereign immunity, which immunizes the state against civil and/or criminal suits, has often been invoked to negate suits for accidents that occur on public transit systems or as a result of regulatory decision-making.[114] Because car accidents would likely continue at a reasonable pace even if nondiscretionary-communicative vehicles were in widespread use,[115] denying so

---

[113] Of course, private entities could also be responsible for either of these tasks, and movements toward industry self-regulation and public-private partnerships in infrastructure management have been on the rise in recent decades. Jedidiah Bracy, *Will Industry Self-Regulation Be Privacy's Way Forward*, THE PRIVACY ADVISOR (June 24, 2014), https://privacy association.org/news/a/will-industry-self-regulation-be-privacys-way-forwa rd (asking whether industry self-regulation will more likely generate privacy protections than gridlocked government entities); Eduardo Engel, Ronald Fischer & Alexander Galetovic, *Public-Private Partnerships to Revamp U.S. Infrastructure*, THE HAMILTON PROJECT (Feb. 2011), http:// www.brookings.edu/~/media/Research/Files/Papers/2011/2/partnerships engel fischer galetovic/02_partnerships_engel_fischer_galetovic_paper.pdf ("The use of [Public-Private Partnerships] to provide U.S. infrastructure increased fivefold between 1998-2007 and 2008-2010.").

[114] *See, e.g.*, Whittington v. U.S., 99 Fed. Appx. 56, 56 (6th Cir. 2004) (holding that the federal government lawfully invoked sovereign immunity to avoid liability for a plane crash that might have been caused by the Federal Aviation Association's decision to approve an "airport layout plan that did not meet minimum design requirements and [to publish] erroneous information regarding [the] airport's runway length"); Lee v. Southeastern Pa. Transp. Auth., 418 F. Supp. 2d 675 (E.D. Pa. 2005) (holding that the regional transit authority in Pennsylvania could invoke sovereign immunity to shield itself from an injury that occurred when a woman boarded one of their buses).

[115] Even if self-driving cars were perfect drivers, car crashes would still be likely to occur because driver error is not the sole cause of automobile accidents. *See* ENO CTR. FOR TRANSP., PREPARING A NATION FOR AUTONOMOUS VEHICLES (Oct. 2013), https://www.enotrans.org/wp-content /uploads/wpsc/downloadables/AV-paper.pdf ("Driver error is believed to be the main reason behind over 90 percent of all crashes."); NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., U.S. DEP'T OF TRANSP., NATIONAL MOTOR VEHICLE

many victims the chance to compensation seems unsatisfactory.

Instead, manufacturers of nondiscretionary-communicative vehicles should be opened up to market-share liability, which could more reasonably accommodate this system-wide diffusion of agency and shared responsibility. In *Sindell v. Abbott Laboratories*, the Supreme Court of California introduced market-share liability, a method of recovery that allows a plaintiff to sue a group of manufacturers even when she does not know which specific manufacturer caused her harm.[116] In that case, each manufacturer of DES, a miscarriage-preventing compound that had the unfortunate side effect of causing cancer, produced the drug for inclusion in various pharmaceuticals.[117] The case turned on the fact that DES was "interchangeable with other brands of the same product" and was the only known cause of that specific variety of cancer.[118] If cars operating under V2V or intelligent highway guidance were sufficiently uniform (and, external control and the commingling of authority certainly make vehicles more "interchangeable"), AV manufacturers could be held liable according to their market share for accidents involving nondiscretionary-communicative vehicles. Whether thought of as a means of filling in the liability gap opened up by industry-wide interdependence, or simply as a tax of doing business in an inherently dangerous area, market-share liability is a practical means of assigning liability in markets with uniform products.

Market-share liability would probably be the simplest and cheapest form of liability and insurance administration yet examined. In effect, each manufacturer would contribute to a fund from which victims would be compensated without having to prove responsibility for any accidents. Furthermore, if nondiscretionary-communicative vehicles became mandatory (as the introduction of either the interactive or remote-controlled models might require), there would be no need for private insurance, since all liability for AVs would be transferred to manufacturers. Eliminating the entire automobile insurance industry (which has roughly $200 billion dollars in annual revenue)[119] would be a monumental boost to administrative efficiency.

CRASH CAUSATION SURVEY (2008), http://www-nrd.nhtsa.dot.gov/Pubs/811059.PDF.

[116] Sindell v. Abbott Laboratories, 26 Cal. 3d 588 (1980).

[117] *Id.* at 594.

[118] *Id.* at 595.

[119] IBISWORLD, AUTOMOBILE INSURANCE IN THE US: MARKET RESEARCH REPORT 4 (2014), http://www.marketresearch.com/Vendors/SampleViewer/unlock.ncp?vendorid=2487.

E. *Mixed Systems*

Though I have presented each paradigm of self-driving cars as a discrete possibility, significant middle ground exists between approaches. A user who had the discretionary ability to alter the route of her self-driving car, but who could not actually resume control of the wheel, might find herself held liable for a different array of accidents than a user of either a fully discretionary or fully nondiscretionary vehicle. Similarly, a manufacturer who was relayed information like total mileage and speed, but not location, might not meet the requirements of foreseeability or duty-to-warn even when the manufacturer of a fully communicative vehicle would.[120]

Mixed systems are also possible: it could be the case that, in cities, AVs become subject to the authority of intelligent highways, while in rural areas, self-driving technology returns to self-contained functionality. It might be that, no matter what freedom-privacy pairing is eventually deemed most appropriate, self-driving cars will first be introduced as discretionary-uncommunicative vehicles in order to ease their transition into the market. While acknowledging that the messy reality of self-driving car regulation will not conform exactly to any of the above freedom-privacy pairings, anyone trying to understand the freedom, privacy, and liability implications of a given self-driving car could gain insight by viewing it through the framework discussed above.

III. RECONCILIATION

This Article has posited and elaborated upon a connection between the forfeiture of privacy and freedom, on one hand, and more efficient liability and insurance administration on the other. The question remains: Can regulators balance these competing concerns when regulating self-driving cars?

As a closing appeal, this Article argues that regulators should only allow AV technology to infringe on user freedom and/or privacy when (1) forfeiting these values will lead to a corresponding shift in liability toward the manufacturers of self-driving cars, and (2) gains in administrative efficiency or some other social good outweigh the social costs incurred by forfeiting these values.[121]

The first condition—that ceding these values must lead to a reduction in user liability—aims to individually compensate AV users for invasions of their freedom and/or privacy. The analysis provided in Part II demonstrated ways in which

---

[120] For a more detailed study of these dynamics, see Smith, *supra* note 18.

[121] I make no attempt to calculate these costs myself; individual communities and legislatures might arrive at very different conclusions, and theirs are the answers that truly matter.

existing tort concepts can be employed to help enact this shift in liability if regulators indeed choose to encourage nondiscretionary and/or communicative models of self-driving cars. Common-law doctrine tends to fulfill this condition; regulators should be wary of liability rules that fight against this tendency.

The second condition—that a greater social gain must offset the social costs of sacrificing freedom and privacy—aims to guarantee that value-sensitive regulation of self-driving cars benefits society as a whole. By focusing on how communicative and/or nondiscretionary vehicles might lead to sizable efficiencies in the administration of liability and insurance, this Article has suggested ways in which ceding freedom and privacy might be able to satisfy this condition. Though social goods ranging from reducing roadway congestion [122] to advancing environmental protection[123] should also weigh in on this calculus, examining them in-depth is beyond the scope of this Article.

Moreover, this Article urges proactive consideration of freedom and privacy regulation, which would likely be more effective than the free market at finding an optimal balance of these values in self-driving cars. Individual consumers are not always able to protect their own privacy interests and may not even understand when they are threatened by emerging technology. Consequently, consumers could end up driving vehicles that they never would have purchased had they known the extent to which the vehicles would compromise their privacy. Likewise, situations could arise in which the free market would fail to sufficiently restrict consumer freedom. For example, a single user who chose not to participate in an intelligent highway system could thwart the system's entire implementation.

Self-driving cars have the potential to radically alter our nation's roadways. This Article provides a framework for conceptualizing the interactions between freedom, privacy, and liability that AV regulation will encounter and must reconcile. While this Article has raised the possibility that self-driving cars will induce the upheaval of the current liability and insurance systems, it is important to remember that a robust regulatory regime has sprung up around automobile accidents in the last century and that attempts to deviate from this

---

[122] *Study: Self-Driving Cars Would Eliminate Majority of Traffic Deaths, Congestion*, CBS, Oct. 23, 2013, http://washington.cbslocal.com/2013/10/23/study-self-driving-cars-would-eliminate-majority-of-traffic-deaths-congestion.

[123] Jen Alic, *The Future of Fuel-Efficient, Self-Driving Cars*, CHRISTIAN SCI. MONITOR, Apr. 3, 2013, http://www.csmonitor.com/Environment/Energy-Voices/2013/0403/The-future-of-fuel-efficient-self-driving-cars.

precedent will face considerable resistance. Regardless, AV technology will be disruptive enough that real changes will probably come whether we like them or not—and regulators should begin thinking critically about how to address them now. When self-driving cars arrive, my hope is that this Article's integrative framework will help us welcome them, regulate them, and maximize the benefits they have to offer.