Judging Autonomous Vehicles

Jeffrey J. Rachlinski & Andrew J. Wistrich[†]

The introduction of any new technology challenges judges to determine how it fits into existing liability schemes. If judges choose poorly, they can unleash novel injuries on society without redress or stifle progress by overburdening a technological breakthrough. The emergence of self-driving, or autonomous, vehicles will present an enormous challenge of this sort to judges. This technology will alter the foundation of the largest source of civil liability in the United States. Although regulatory agencies will determine when and how autonomous cars may be placed into service, judges will likely play a central role in defining the standards of liability for them. Will judges express the same negative biases that lay people commonly express against technological innovations?

In this Article, we present data from 967 trial judges showing that judges are biased against self-driving vehicles. They both assigned more liability to a self-driving vehicle than to a human-driven vehicle for an accident caused under identical circumstances and treated injuries caused by a self-driving vehicle as more serious than identical injuries caused by a human-driven vehicle. These results suggest that judges harbor suspicion or animosity towards autonomous vehicles that might lead them to burden manufacturers and consumers of autonomous vehicles with more liability than the tort system currently imposes on conventional vehicles.

[†] Jeffrey J. Rachlinski is the Henry Allen Mark Professor of Law, Cornell Law School. Andrew J. Wistrich is a Magistrate Judge, United States District Court, Central District of California (retired) and an Adjunct Professor of Law, Cornell Law School.

Introduction

Would you rather be run over by an autonomous (self-driving) car or a car driven by a human being?[1] Assuming a

[1] Throughout this Article we use the terms "autonomous" and "self-driving" interchangeably. Some argue that both terms are imprecise. *See* William Payre, Steward Birrell & Andrew Martin Parkes, *Although Autonomous Cars Are Not Yet Manufactured, Their Acceptance Already Is*, 22 THEORETICAL ISSUES ERGONOMIC SCI. 567 (2021) (discussing the misuse of terms such as "autonomous" or "self-driving" vehicle and suggesting the

similar vehicle travelling at a similar speed, the choice should hardly matter. A serious injury is a serious injury, whatever its cause. Likewise, a sensible transportation system minimizes the cost of accidents regardless of how they occur.[2] People are often suspicious of new technology, however.[3] Reacting to public skepticism, regulators might adopt more strenuous regulatory standards to govern autonomous vehicles than apply to conventional vehicles. Judges will play an important role in the development of the liability system governing autonomous vehicles. Will they also react negatively to this new technology?

Judges have sometimes saddled new technologies with overly burdensome rules. Most first-year law students learn Justice Holmes' quaint rule that drivers must "stop, look, and listen" outside of their vehicles at railroad tracks before crossing.[4] In other cases, judges might under-regulate. For example, the immunity that courts have afforded social media platforms for the content users post has surely contributed to their virulent tone and thus drawn enormous criticism.[5] Judicial reac-

---

proper use of such terms). The scientific community prefers the term "autonomous." *Id.* at 573 (noting that 49.6% of references to such vehicles in the scientific literature between 1995 and 2019 use the term "autonomous vehicles."). Virtually all modern cars include automatic systems, such as automatic transmissions, but most still lack the capacity to drive without human control. We nevertheless mean "autonomous" and "self-driving" to refer to vehicles that are capable of fully autonomous navigation.

[2] *See* GUIDO CALABRESI, THE COST OF ACCIDENTS 26 (1970) ("I take it as axiomatic that the principal function of accident law is to reduce the sum of the costs of accidents and the costs of avoiding accidents.").

[3] *See* Kyle Graham, *Of Frightened Horses and Autonomous Vehicles: Tort Law and Its Assimilation of Innovations*, 52 SANTA CLARA L. REV. 1241, 1256 (2012) ("The public can exaggerate the harms associated with an innovation; this problem is, I believe, well understood, and forms part of the basic critique of tort law as it applies to innovation.").

[4] Balt. & Ohio R.R. Co. v. Goodman, 275 U.S. 66, 70 (1927) ("[I]f a driver cannot be sure otherwise whether a train is dangerously near he must stop and get out of his vehicle . . . .").

[5] *See* Jonathan Zittrain, *A History of Online Gatekeeping*, 19 HARV. J.L. & TECH. 253, 298 (2006) ("The history of online gatekeeping is . . . also one of policy judgment in the judicial as well as legislative spheres that generative technologies ought to be given wide latitude to find a variety of uses . . . .").

tions to novel risks influence the course of technological development in society, for good or for ill.[6] Judges' responses to autonomous vehicles will be particularly important, given that automobile accidents are "the 800-pound gorilla of the tort liability system, accounting for more than half of all trials, nearly two-thirds of all injury claims, and three-quarters of all damage payouts."[7]

Judges are likely to treat novel technology the same way as most adults.[8] Decades of research have identified notable biases in how people react to risk. Hazards that are vivid, uncommon, unfamiliar, and involuntarily imposed, inspire more concern than hazards that are pallid, common, familiar, and voluntarily chosen.[9] Scholars debate the rationality of these biases in risk perception,[10] but it is clear that they drive public demand for regulatory attention.[11] Negative reactions to innovation can

---

[6] *See* Clayton P. Gillette & James A. Krier, *Courts, Risk & Agencies*, 138 U. PA. L. REV. 1027, 1033-36 (1990) (documenting the role courts play in regulation of risk).

[7] Nora Freeman Engstrom, *When Cars Crash: The Automobile's Tort Law Legacy*, 53 WAKE FOREST L. REV. 293, 295 (2018).

[8] *See* Chris Guthrie, Jeffrey J. Rachlinski & Andrew J. Wistrich, *Inside the Judicial Mind*, 86 CORNELL L. REV. 777, 829 (2001) ("[J]udges rely on the same cognitive decision-making process as laypersons and other experts, which leaves them vulnerable to cognitive illusions that can produce poor judgments.").

[9] *See* Paul Slovic, Baruch Fischhoff & Sarah Lichtenstein, *Facts Versus Fears: Understanding Perceived Risk, in* JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 463, 469 (Daniel Kahneman, Paul Slovic & Amos Tversky eds., 1982) ("Other characteristics that affect people's attitude toward hazards, but are neglected in statistical summaries, are voluntariness, controllability, familiarity, immediacy of consequences, threat to future generations, the ease of reducing the risk and the degree to which benefits are distributed equitably to those who bear the risk.").

[10] *See* Phillip E. Tetlock & Barbara A. Mellers, *The Great Rationality Debate*, 13 PSYCH. SCI. 94, 98 (2003) ("From a revisionist perspective, dysfunctional effects within one framework will often look functional in another.").

[11] *See* CASS R. SUNSTEIN, THE LAWS OF FEAR: BEYOND THE PRECAUTIONARY PRINCIPLE 51-53 (2005) (discussing how cognitive biases influence the demands for regulation).

lead to regulatory responses that impede the adoption of safer technologies.[12]

Assessments of automated or robotic technology might be particularly harsh.[13] Most fictional depictions of computers in Western culture are negative, such as Hal from the film *2001: A Space Odyssey*,[14] the Cybermen from the British television series *Dr. Who*,[15] and Isaac Asimov's *Caves of Steel*, in which future humans fear and reject robots.[16] In Hollywood, autonomous robots are inevitably the harbingers of doom, as in the *Terminator* series.[17] Even the pioneering use of the term "robot", in the 1920 Karel Čapek play, *R.U.R.*, depicts androids that destroy every human but one.[18] "Many Western works of sci-fi harken back to the same moral warnings from Frankenstein and R.U.R.: the folly of creating artificial life, the paradox of whether anything made by humans can have a soul, and the impossibility of people coexisting with our most sophisticated creations."[19] Fear of autonomous vehicles itself seems to provide ample fodder for contemporary authors to play on the

---

[12] *See id*. at 14-15 (critiquing the idea of the precautionary principle as an approach to risk regulation). *See also* WILLIAM D. EGGERS & MIKE TURLEY, THE FUTURE OF REGULATION: PRINCIPLES FOR REGULATING EMERGING TECHNOLOGIES 4 (2018), https://www2.deloitte.com/content/dam/insights/us/articles/4538_Future-of-regulation/DI_Future-of-regulation.pdf [https://perma.cc/HQ5A-LSXT] (reporting the example of a nineteenth century British law requiring that a person walk ahead of locomotives carrying a red flag to warn pedestrians and horse-drawn carriages and noting that this law "stifled the development of road transport in the British Isles.").

[13] *See* Andrew Keane Woods, *Robophobia*, 93 U. COLO. L. REV. 51, 55 (2022) ("[*R*]*obophobia*—a bias against robots, algorithms, and other non-human deciders . . . is pervasive.").

[14] 2001: A SPACE ODYSSEY (Metro-Goldwin-Mayer 1968).

[15] *Dr. Who: The Tenth Planet* (BBC television broadcast Oct. 8, 1966) (featuring the first appearance of the Cybermen on the Dr. Who Series).

[16] ISAAC ASIMOV, CAVES OF STEEL (1953).

[17] THE TERMINATOR (Hemdale Film Corp. 1984).

[18] KAREL ČAPEK, R.U.R. (1920).

[19] Amos Zeeberg, *What We Can Learn About Robots From Japan*, BBC FUTURE (Jan. 23, 2020), https://www.bbc.com/future/article/20191220-what-we-can-learn-about-robots-from-japan [https://perma.cc/K9ZY-P7T5].

public's technological phobias.[20] These fictional accounts suggest that we seem especially to fear autonomous technology with artificial intelligence.

The pace at which people adopt a new technology depends on a variety of factors, including its utility and its quality. Chief among them is the response it evokes in relevant audiences, mainly consumers, but also in judges and regulators. Ultimately, consumer reaction matters most, but courts and regulatory bodies provide part of the context that shapes that reaction. If judges are wary of a new technology, they may burden, delay, or shape it by imposing prohibitions, liability, or damages. Our experiments study judges' reactions to autonomous vehicles along two of those dimensions: liability and damages.

The experiments that we report in this Article tested whether judges would react negatively to the emerging use of autonomous vehicles. In our research, 967 sitting state and federal trial judges evaluated either liability (Study 1) or damages (Study 2) for an accident caused either by an autonomous vehicle or a human-driven vehicle. Even though the nature of the accident and the injuries were identical, judges assigned more responsibility to the autonomous pilot than to the human driver. Even more surprisingly, they awarded more in compensatory damages for an accident caused by an autonomous vehicle, even though the injury and the defendant were identical.

I. The Future of Autonomous Vehicles in the Courts

Most experts agree that autonomous vehicles are coming to our streets and highways. Automation holds the promise of numerous benefits, chief among them greater safety. Autonomous vehicles, however, will not be perfectly safe—they will still cause injuries and death. Regulators and courts will have

---

[20] *See* JOHN MARRS, THE PASSENGERS (2021). The publisher describes the plot as follows: "You're riding in your self-driving car when suddenly the doors lock, the route changes and you have lost all control. Then, a mysterious voice tells you, 'You are going to die.'" https://www.penguinrandomhouseaudio.com/book/609304/the-passengers [https://perma.cc/9AMJ-524J]. *See infra* notes 113-115 and accompanying text for other accounts of menacing autonomous vehicles.

to address these injuries, but an excess of regulation or liability will delay the adoption of autonomous vehicles. Research on attitudes towards novel risks in general and autonomous vehicles in particular reveals that people react negatively to the dangers these vehicles pose.

A. Rise of the Machines: Autonomous Vehicles on the Road

Autonomous vehicles have been contemplated nearly as long as automobiles have existed. They have provided material for many science-fiction stories. In 1911, a British silent film called "The Automatic Motorist" featured a car driven by a robot that took newlyweds on a honeymoon under the ocean, to the moon, and around the rings of Saturn before returning the apparently satisfied couple to Earth.[21] In a 1935 short story, which might be the earliest appearance in literature of a true self-driving car, "driverless taxis" develop their own will, refuse to open their doors, and eventually kill.[22] Science fiction author Isaac Asimov later wrote a short story about an "automatobile" which had been driving regularly, even though "there'd never been a human being behind her wheel. . . . You got in, punched your destination and let it go its own way."[23] In his book *Magic Motorways*, Norman Bel Geddes argued that vehicles could be automated and urged society to "eliminate the human factor in driving."[24] In 1958 "Disney aired a program titled 'Magic Highway USA' that imagined a future with, among other technologies, AVs guided by colored highway lanes and operated with addresses coded on punch cards."[25] Arthur C. Clarke predicted the demise of human-driven cars in

---

[21] THE AUTOMATIC MOTORIST (Kineto Films 1911), https://www.youtube.com/watch?v=-m9YtGJ3ptU [https://perma.cc/J9G9-9TCN].

[22] David H. Keller, *The Living Machine*, WONDER STORIES, May 1935, at 1465, 1497 ("[T]hey found tire marks on his arms and body.").

[23] Isaac Asimov, *Sally*, FANTASTIC, May-June 1953, at 13.

[24] NORMAN BEL GEDDES, MAGIC MOTORWAYS 41 (1940).

[25] JAMES M. ANDERSON ET AL., AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICY MAKERS 55 (2016).

one of his stories: "It's been a criminal offense for at least a hundred years to drive manually on a public highway."[26]

As early as the mid-1920s, Houdina Radio Control and Achen Motor conducted experiments on various forms of vehicles with human-directed radio control.[27] Vehicles guided by electromagnetic circuits embedded within the roadway were demonstrated at the Futurama Exhibit at the 1939 World's Fair and by RCA Laboratories in Nebraska in 1957.[28] This basic approach was followed until the 1980s when the Defense Advanced Research Projects Agency (DARPA) Autonomous Land Vehicle relied on an onboard robot for navigation and operation.[29] Researchers at Carnegie Mellon University subsequently pioneered the use of neural networks to control vehicles equipped with vision sensors, paving the way for technologies being developed today.[30] Since then, progress has been steady, with incremental improvements in reliability, speed, and safety.

Although challenges remain for the implementation of self-driving vehicles,[31] they are no longer confined to science

---

[26] ARTHUR C. CLARK, IMPERIAL EARTH 101 (1976).

[27] *See Radio Auto*, TIME, Aug. 10, 1925 (reporting that a radio-controlled car navigated the crowded streets of New York City), http://content.time.com/time/subscriber/article/0,33009,720720,00.html [https://perma.cc/Q2NB-8TSQ].

[28] *See* Joseph C. Ingraham, *Electronic Roads Called Practical*, N.Y. TIMES (June 6, 1960), https://www.nytimes.com/1960/06/06/archives/electronic-roads-called-practical-new-system-of-guiding-cars-safely.html [https://perma.cc/5M9M-XMQP] (describing demonstrations of the radio-controlled driverless car).

[29] *See* ANDERSON, *supra* note 25, at 56-67 (describing how DARPA helped foster the development of autonomous systems for driving).

[30] *See id*. at 57-58.

[31] *See* Wilko Schwarting, Javiar Alonso-Mora & Daniela Rus, *Planning and Decision-Making for Autonomous Vehicles*, 1 ANN. REV. CONTROL, ROBOTICS & AUTONOMOUS SYSTEMS 187, 188 (2018) ("Achieving the vision of fully capable automated vehicles will require overcoming many technical, legal, and social challenges."); *Autonomous Cars: Five Reasons They Still Aren't on Our Roads*, THE CONVERSATION (July 30, 2020), https://theconversation.com/autonomous-cars-five-reasons-they-still-arent-on-our-roads-143316 [https://perma.cc/M9YB-8674] (citing, among other reasons, a

fiction and laboratory experimentation. For many years, automobiles have employed radar sensors to assist drivers, thereby providing the foundational technology necessary for cars to navigate themselves. Adding artificial intelligence to allow the vehicle to interpret the signals from these sensors is all that is really required to create a fully autonomous vehicle. That said, the development of the artificial intelligence necessary to navigate roads under all circumstances that a human driver can manage is posing considerable difficulties.[32]

Many new cars already include systems that assist drivers and fully autonomous cars are already on the road.[33] Automotive engineers recognize six different levels of automation for vehicles, many of which can be found in existing commercially available cars: 0) no driving automation; 1) driver assistance; 2) partial driving automation; 3) conditional driving automation; 4) high driving automation; 5) full driving automation.[34] Level 1 is common in many vehicles and includes mechanisms such as adaptive cruise control that changes speed to match the car ahead, parking assist signals, and active lane-centering.[35] These

---

lack of technology: "Lousy weather, heavy traffic, roads signs with graffiti on them can all negatively impact the accuracy of sensing capability.").

[32] *See* Editorial, *Slam the Brakes on Tesla's Self-Driving Madness*, L.A. TIMES (Dec. 21, 2021), https://www.latimes.com/opinion/story/2021-12-20/editorial-slam-the-breaks-on-teslas-self-driving-madness [https://perma.cc/9FNL-X5X9].

[33] *See* LAWRENCE D. BURNS, AUTONOMY: THE QUEST TO BUILD THE DRIVERLESS CAR AND HOW IT WILL RESHAPE OUR WORLD 4 (2018) ("[W]e've entered a period that is moving us towards a saner transportation solution [than human-driven, privately owned cars].").

[34] *See* SAE INT'L, TAXONOMY AND DEFINITIONS FOR TERMS RELATED TO DRIVING AUTOMATION SYSTEMS FOR ON-ROAD MOTOR VEHICLES, J3016-202104 (Apr. 30, 2021), https://www.sae.org/standards/content/j3016_202104 [https://perma.cc/J7EG-Q53S]. The SAE (formerly the Society of Automotive Engineers) recently updated its account of these standards, although the update has yet to be adopted by the National Highway Transportation Safety Administration. *See id*. *See also* NHTSA, AUTOMATED VEHICLES FOR SAFETY, https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety [https://perma.cc/4YYX-ETX2] (last visited Dec. 31, 2022) (adopting this taxonomy and providing an overview of the six levels of automation and the history of automated vehicles).

[35] *See* NHTSA, *supra* note 34.

mechanisms include some of the technology needed for more advanced automation, such as radar that senses objects and the edges of traffic lanes. The second level takes advantage of the inputs from these sensors and uses artificial intelligence software to combine them so as to navigate a vehicle in simple highway driving under good conditions, or to park the vehicle.[36] The third level includes more elaborate radar and a much greater degree of artificial intelligence to navigate a vehicle in heavy traffic conditions on highways and under certain other conditions.[37] At the fourth level, the inputs and artificial intelligence are sufficiently powerful that they can navigate a vehicle completely, although the technology has limits and continues to require the supervision of the driver.[38] At this level, poor weather or unusual conditions might require intervention by the driver. Finally, at the fifth level, a fully autonomous vehicle would be capable of total navigation under any circumstances and hence would not require a human at the wheel other than to set the destination.[39]

Most fully autonomous systems remain experimental. Even the widely available Tesla with "Autopilot" is considered only a level-two vehicle, as it requires constant supervision.[40]

---

[36] *See id.*

[37] *See id.* Manufacturers have not offered any level three vehicles for purchase by consumers because level three automation requires the driver to remain vigilant to the need to take over control of the vehicle at any moment. Developers have discovered that the time required for a human takeover in response to a vehicle warning or request may be as much as 40 seconds, which is simply too long. *See* MARC SCRIBNER, CHALLENGES AND OPPORTUNITIES FOR FEDERAL AUTOMATED VEHICLE POLICY 11 (2021), https://reason.org/wp-content/uploads/challenges-opportunities-federal-automated-vehicle-policy.pdf [https://perma.cc/5QHF-HGQM].

[38] *See* SCRIBNER, *supra* note 37.

[39] *See id.*

[40] *See* Rani Molla, *Self-Driving Cars: The 21st Century Trolley Problem*, VOX (Oct. 6, 2021), https://www.vox.com/recode/22700022/self-driving-autonomous-cars-trolley-problem-waymo-google-tesla [https://perma.cc/X65U-VVVX] ("Tesla vehicles are considered to be at level 2 on the engineering society SAE International's automation scale.").

Nevertheless, autonomous vehicles have already driven millions of miles on public roads.[41] One city in Arizona has a fleet of self-driving taxis.[42] Arizona has now begun allowing a fully autonomous tractor-trailer truck on the road between Tucson and Phoenix without a human behind the wheel.[43] Early on in the pandemic, autonomous vehicles distributed self-administered tests for Covid-19.[44] The use of autonomous vehicles will likely grow as the technology progresses.

B. The Regulation of Autonomous Vehicles

Experts assert that autonomous vehicles will eventually be safer than conventional vehicles.[45] "Robot drivers react faster

---

[41] *See* Lisa Marie Segarra, *How the Auto Industry is Driving Itself into the Future*, FORTUNE (Sept. 25, 2018), https://fortune.com/2018/09/25/brainstorm-reinvent-volvo-ford-gm [https://perma.cc/89AZ-H7LX].

[42] *See* Andrew J. Hawkins, *Waymo's Driverless Car: In the Back Seat of a Self-Driving Taxi*, THE VERGE (Dec. 9, 2019), https://www.theverge.com/2019/12/9/21000085/waymo-fully-driverless-car-self-driving-ride-hail-service-phoenix-arizona [https://perma.cc/XXR5-5GU7].

[43] *See* Alan Ohnsman, *TuSimple to Haul Freight for Union Pacific in 'Driver Out' Robot Trucks*, FORBES (Feb. 2, 2022), https://www.forbes.com/sites/alanohnsman/2022/02/02/tusimple-to-haul-freight-for-union-pacific-in-driver-out-robot-trucks [https://perma.cc/88ZV-J9CY].

[44] *See* Sebastian Blanco, *NAVYA's Autonomous Vehicles Are Transporting COVID-19 Tests,* CAR & DRIVER (Apr. 6, 2020), https://www.caranddriver.com/news/a32051316/navya-autonomous-vehicles-coronavirus-tests [https://perma.cc/2KYY-AW6J].

[45] *See* Mark A. Geistfeld, *A Roadmap for Autonomous Vehicles: State Tort Liability, Automobile Insurance, and Federal Safety Regulation*, 105 CALIF. L. REV. 1611, 1615 (2018) ("Autonomous vehicles would not eliminate all . . . [automobile] crashes, but they should significantly enhance motor vehicle safety."). *But see* Cade Metz & Neal E. Boudette, *Inside Tesla as Elon Musk Pushed an Unflinching Vision for Self-Driving Cars*, N.Y. TIMES (Dec. 7, 2021), https://www.nytimes.com/2021/12/06/technology/tesla-autopilot-elon-musk.html [https://perma.cc/B82G-JYSB] (reporting that the National Highway Traffic Safety Administration is investigating whether in describing its cars as "autonomous" or "self-driving" Tesla may have exaggerated their capabilities and misled consumers).

than humans, have 360-degree perception and do not get distracted, sleepy or intoxicated."[46] As many as nine out of ten accidents arise from these human failings.[47] A recent analysis estimated that autonomous vehicles could eventually prevent 73% of crashes.[48] As one expert has put it: "We should be concerned about automated driving. We should be terrified about human driving."[49] Automated vehicles also hold out the promise of more efficient, automated transportation systems.[50] They might also reduce traffic by facilitating more car-sharing or other models for transportation than individually driven cars.[51]

---

[46] John Markoff, *Google Cars Drive Themselves, in Traffic*, N.Y. TIMES (Oct. 9, 2010), https://www.nytimes.com/2010/10/10/science/10google.html [https://perma.cc/6DT3-MVK8].

[47] *See* Jinan Piao et al., *Public Views Towards Implementation of Automated Vehicles in Urban Areas*, 14 TRANSP. RSCH. PROCEDIA 2168, 2169 (2016) ("Automated vehicles will avoid crashes caused by human errors which are believed to be the main reasons behind over 90 percent of all crashes such as driving under distraction, speeding, alcohol, drug involvement and/or fatigue.").

[48] *See* Partners for Automated Vehicle Education, *On the Life Saving Potential of Autonomous Vehicles*, MEDIUM (June 12, 2020), https://medium.com/pave-campaign/on-the-life-saving-potential-of-autonomous-vehicles-b002a668b530 [https://perma.cc/8QV9-2DEL].

[49] Jacques Billeaud & Tom Krisher, *Crash Marks 1st Death Involving Fully Autonomous Vehicle*, ASSOCIATED PRESS (Mar. 20, 2018), https://apnews.com/article/north-america-ap-top-news-az-state-wire-ca-state-wire-phoenix-a995aacee83d4cc5a7ac8f251fa34874 [https://perma.cc/TXK6-UGQ5] (quoting Professor Bryant Walker Smith).

[50] *See* Robert Sparrow & Mark Howard, *When Human Beings Are Like Drunk Robots: Driverless Vehicles, Ethics, and the Future of Transport*, 80 TRANSP. RSCH. PART C: EMERGING TECHS. 206, 206-07 (2017) ("Freeing people from the necessity of driving, though, will transform the relationship people have with their cars, which will in turn open up new possibilities for the transport uses of the automobile.").

[51] *See* Rico Krueger et al., *Preferences for Shared Autonomous Vehicles*, 69 TRANSP. RSCH. PART C: EMERGING TECHS. 343, 343 (2016) ("[T]he advent of the AV technology may allow for the emergence of novel business models such as shared autonomous vehicles . . . ."); Kareem Othman, *Exploring the Implications of Autonomous Vehicles: A Comprehensive Review*, 7 INNOVATIVE INFRASTRUCTURE SOLS., no. 165, 2022, at 27 ("AVs have the potential to reduce vehicle ownership.").

Autonomous vehicles can also facilitate independence among disabled and elderly persons who cannot drive themselves.[52]

Although they will someday be safer, autonomous cars have already caused fatalities. One autonomous vehicle struck and killed a woman on a bicycle without even slowing down, having failed to identify her as a cyclist.[53] Another autonomous car ran straight into a white truck after misinterpreting the truck as a cloud.[54] Recently, a motorist was charged with a felony when his Tesla ran a red light and struck another vehicle, causing a fatality, while the autopilot function on the vehicle was engaged.[55] Even if autonomous vehicles eventually become safer than human drivers, they will still cause accidents. Furthermore, although autonomous vehicles are apt to avoid many accidents that an inattentive driver would have caused, they will also cause some accidents that a human driver would not.[56]

Scholars and regulators already have begun to grapple with liability issues arising from autonomous vehicles.[57] Nota-

---

[52] *See* Jonas Meyer et al., *Autonomous Vehicles: The Next Jump in Accessibilities*?, 62 RSCH. TRANSP. ECON. 80, 80 (2017) ("[Autonomous vehicles] will open car travel to children, elderly and the disabled.").

[53] *See* Lulu Chang & Luke Dormehl, *6 Self-driving Car Crashes that Tapped the Brakes on the Autonomous Revolution,* DIGITAL TRENDS (June 22, 2018), https://www.digitaltrends.com/cool-tech/most-significant-self-driving-car-crashes [https://perma.cc/4Q2W-N3Q9].

[54] *See id*.

[55] *See* Tom Krisher & Stephanie Dazio, *L.A. County Felony Charges Are First in Fatal Crash Involving Tesla's Autopilot*, L.A. TIMES (Jan. 18, 2022), https://www.latimes.com/california/story/2022-01-18/felony-charges-are-first-in-fatal-crash-involving-teslas-autopilot [https://perma.cc/SBY9-PP5V]. For a contrary view, suggesting that the human operator should not face liability for accidents while an autonomous feature is engaged, see LAW COMMISSION OF ENGLAND AND WALES, AUTOMATED VEHICLES: JOINT REPORT 266 (2022) ("Recommendation 44. While a relevant ADS feature is engaged, the user-in-charge should not be liable for any criminal offence or civil penalty which arises from dynamic driving.").

[56] *See*, *e.g*., Geistfeld, *supra* note 45, at 1634-35 (describing the potential for liability for autonomous vehicle manufacturers for software bugs).

[57] *See generally id*. (reviewing the legal issues governing the introduction of autonomous vehicles).

bly, the manufacturer and designer of the vehicle are the targets of liability, rather than the human driver.[58] The National Highway Traffic Safety Administration ("NHTSA") has drafted a set of guidelines on the use of autonomous cars.[59] Although the federal government has not promulgated any binding regulations on the topic,[60] NHTSA currently has seven ongoing automated driving technology rulemaking projects.[61] States that allow autonomous vehicles on their roads do so under strict regulatory oversight.[62] Thirty states have enacted legislation addressing some aspect of automated vehicle technology, operation, licensing, or liability.[63] Liability for and regulation of autonomous vehicles will necessarily differ from that of human-driven vehicles.

---

[58] *See* JERRY ALBRIGHT ET AL., KPMG, MARKETPLACE OF CHANGE: AUTOMOBILE INSURANCE IN THE ERA OF AUTONOMOUS VEHICLES 28 (2015), https://assets.kpmg.com/content/dam/kpmg/pdf/2016/06/id-market-place-of-change-automobile-insurance-in-the-era-of-autonomous-vehicles.pdf [https://perma.cc/A57Z-UM8Q] ("As the vehicle makes more decisions, the potential liability of the . . . manufacturer will increase too.").

[59] These are summarized in NHTSA, AUTOMATED VEHICLES FOR SAFETY, https://www.nhtsa.gov/technology-innovation/automated-vehicles-safety [https://perma.cc/BA95-WN4X].

[60] NHTSA's publications to date merely provide voluntary, non-binding guidance. *See* NHTSA, AUTOMATED DRIVING SYSTEMS 2.0: A VISION FOR SAFETY 1 (2017), https://www.nhtsa.gov/sites/nhtsa.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf [https://perma.cc/R5UC-BJTZ].

[61] *See* SCRIBNER, *supra* note 37, at 21-22 & tbl. 4.

[62] *See* Avaz Taeihagh & Hazel Si Min Lim, *Governing Autonomous Vehicles: Emerging Responses for Safety, Liability, Privacy, Cybersecurity, and Industry Risks*, 39 TRANSP. REVS. 103, 107 (2018) ("So far, most states have taken the first step towards a control-oriented strategy to address liability risks by revising the definitions of AVs."); Matt McFarland, *Tesla's 'Full Self-Driving' Feature May Have Met Its Match*, CNN (Aug. 15, 2022), https://www.cnn.com/2022/08/15/business/tesla-fsd-california-dmv/index.html [https://perma.cc/HPC2-23UN] ("The California DMV has become the first US government entity to formally move against the naming of 'full self-driving.'").

[63] *See* NAT'L CONF. OF STATE LEGISLATURES, AUTONOMOUS VEHICLES: SELF-DRIVING VEHICLES ENACTED LEGISLATION, NCSL.ORG (Feb. 18, 2020), https://www.ncsl.org/transportation/autonomous-vehicles [https://perma.cc/TWC7-9S8K].

Beyond *ex ante* regulation, courts will have to resolve liability issues *ex post*. As with every new technology in a country governed by a common-law tort system, judges will have to craft a liability system using precedent and their understanding of statutes and regulations addressing this technology. Although many judges in the United States are elected,[64] judges are generally thought to be more insulated from public pressure than regulators and legislators.[65] Judges might not respond so readily to public demands for heavy regulation of new technologies. Judges are also human beings, however. They rely on the same kinds of potentially faulty decision-making strategies concerning risk that adversely affect most people.[66] Judges might well approach liability issues for autonomous vehicles with the same biases as the public.

How will courts treat accidents caused by autonomous vehicles? At present "there is enormous uncertainty concerning how many cases [involving autonomous vehicle accidents] will be brought and how they will be resolved by courts."[67] If nothing else, the locus of liability will largely shift from the error caused by human miscalculation or inattention to the design of the automated system. With manufacturers as the defendants (perhaps in addition to vehicle owners), the ability of defendants in automobile accidents to pay compensation will almost

---

[64] Approximately 39 states elect at least some of their judges. BRENNAN CENTER FOR JUSTICE, JUDICIAL SELECTION: SIGNIFICANT FIGURES, https://www.brennancenter.org/our-work/research-reports/judicial-selection-significant-figures [https://perma.cc/7ZZA-FFDL] (last updated Oct. 11, 2022).

[65] *See* Williams-Yulee v. Florida Bar, 575 U.S. 433, 437 (2015) ("Judges are not politicians, even when they come to the bench by way of the ballot."). *But see* Herbert M. Kritzer, *Impact of Judicial Elections on Judicial Decisions*, 12 ANN. REV. L. & SOC. SCI. 353 (2016) (describing numerous effects of the election process on judicial decision making).

[66] *See* Guthrie et al., *supra* note 8, at 829.

[67] Gary Marchant & Rida Bazzi, *Autonomous Vehicle Liability: What Will Juries Do?*, 26 B.U. J. SCI. & TECH. 67, 113 (2020).

certainly increase.[68] Individual drivers rarely pay more in liability for an accident than the limits of their insurance policies,[69] which is commonly less than the actual extent of liability.[70] Adding the deeper pocket of a corporate defendant to an ordinary automobile accident will therefore change the nature of liability, but will an accident caused by an autonomous vehicle also affect how liability works?

C. Biases Against Autonomous Vehicles

Developers of autonomous vehicles seem to understand that they will have to demonstrate that they are far safer than human-driven vehicles before regulators and the public will accept their presence on the roads. In one survey, transportation experts cited regulatory hurdles and legal liability as key impediments to the development and introduction of autonomous vehicles.[71] Another study found that people insist that autonomous vehicles must be "four to five times as safe as" human-driven vehicles for people to be comfortable with them.[72] Waiting for cars that are eighty percent safer could impose a

---

[68] *See* Geistfeld, *supra* note 45, at 1637 ("Based on this coding objective for an autonomous vehicle's operating system, any crash arguably involves a failure of the vehicle's manifestly intended function, constituting a product malfunction that subjects the manufacturer to strict liability.").

[69] *See* Tom Baker, *Blood Money, New Money & the Moral Economy of Tort Law in Action*, 35 LAW & SOC'Y REV. 275, 277 (2001) ("Real money from real people accounts for a very small fraction of tort settlement dollars.").

[70] *See* Tom Baker, *Conflicts and Defense Lawyers: From Triangles to Tetrahedrons*, 4 CONN. INS. L.J. 101, 114-18 (1998) (describing "low limits" cases in which insurance does not cover all of the liability).

[71] Steve E. Underwood, *Automated Vehicles Forecast Vehicle Symposium Opinion Survey*, *in* PROCEEDINGS OF AUTOMATED VEHICLES SYMPOSIUM 12, 12-13 (2014), https://onlinepubs.trb.org/onlinepubs/conferences/2014/AutomatedVehicleSymposium2014Proceedings.pdf [https://perma.cc/N9SY-WSSG].

[72] Peng Liu, Yong Du & Zhigang Xu, *Machines Versus Humans: People's Biased Responses to Traffic Accidents Involving Self-Driving Cars*, 125 ACCIDENT ANALYSIS & PREVENTION 232, 238 (2019). *See also* Aaron Smith & Monica Anderson, *Automation in Everyday Life*, PEW RESEARCH CENTER (Oct. 4, 2017), https://www.pewresearch.org/internet/2017/10/04/automation-in-everyday-life [https://perma.cc/MCS2-J9BP] (discussing mixed survey results regarding the perceived safety of autonomous vehicles).

great deal of needless carnage because fatalities would noticeably diminish if autonomous cars were even a few percentage points safer.[73] Biases against autonomous vehicles are apt to influence how the law develops. Excessive liability will likely discourage the development and sale of autonomous vehicles, thereby preventing widespread use of autonomous vehicles and depriving the public of the potential benefits of the new technology.[74]

Why are people anxious about autonomous vehicles? Several aspects of this new technology might lead people to perceive injuries caused by autonomous vehicles as more serious

---

[73] *See* NIDHI KALRA & DAVID G. GROVES, RAND CORP., THE ENEMY OF GOOD: ESTIMATING THE COST OF WAITING FOR NEARLY PERFECT AUTOMATED VEHICLES, at ix-x (2017), https://www.rand.org/pubs/research_reports/RR2150.html [https://perma.cc/24MZ-EB6W] ("We find that, in the short term . . . more lives are cumulatively saved under the less stringent . . . policy than the more stringent . . . policies [with respect to permitting autonomous vehicles on roads.]"). *See also* Woods, *supra* note 13, at 55 ("The crucial question is not whether an algorithm has *any* flaws, but whether it outperforms current methods used to accomplish a task.").

[74] *See* Edmond Awad et al., *Drivers Are Blamed More Than Their Automated Cars When Both Make Mistakes*, 4 NATURE HUM. BEHAV. 134, 134 (2019) ("If manufacturers cannot assess the scope of the liability they will incur from automated vehicles, that uncertainty will translate to substantially inflated prices of automated vehicles."). *See also* Thierry Bellet et al., *From Semi to Fully Autonomous Vehicles: New Emerging Risks and Ethico-Legal Challenges for Human-Machine Interactions*, 63 TRANS. RSCH. PART F 153, 163 (2019) ("The propensity for technology to advance at a speed which outstrips the ability of government regimes to keep pace is well documented . . . [and] insurance law is a key component of such regimes."); Carrie Schroll, Note, *Splitting the Bill: Creating a National Car Insurance Fund to Pay for Accidents in Autonomous Vehicles*, 109 NW. U. L. REV. 803, 820 (2015) ("High insurance costs may prevent new companies from forming, which will, in turn, prevent widespread AV use."); Bryant Walker Smith, *Automated Driving and Product Liability*, 2017 MICH. ST. L REV. 1, 5 ("Differences between vehicular negligence and product liability could distort the relative economics of automated driving and conventional driving."). *But see* Anat Lior, *The AI Accident Network: Artificial Intelligence Liability Meets Network Theory*, 95 TUL. L. REV. 1103, 1105 (2021) (providing an analysis to support a "well-grounded base for applying a strict liability regime when AI-inflicted damages transpire.").

than injuries caused by human drivers. Several cognitive phenomena might produce biases against self-driving vehicles among the public, among regulators, and in the civil liability system: normality bias, naturalness bias, betrayal aversion, the availability heuristic, algorithm aversion, and anti-corporate biases. We review these below.

1. Normality Bias

People react more strongly to novel sources of injuries than to well-understood sources.[75] "Lay persons composing a jury are suspicious of unfamiliar and exotic-edge technologies, regardless of their actual probability of causing harm."[76] For example, jurors ascribe more blame to defendants who adopt nontraditional medical treatment or investment strategies than those who stick with the tried and true.[77] This normality bias is robust and has been shown to influence a wide range of judgments.[78] Although autonomous vehicles are becoming more common, they are still unfamiliar and abnormal. They remain a radical departure from conventional vehicles. Therefore, people influenced by the normality bias will treat autonomous

---

[75] *See* Baruch Fischhoff, *When Assessing Novel Risks, Facts Are Not Enough*, SCI. AM. (Sept. 1, 2019), https://www.scientificamerican.com/article/when-assessing-novel-risks-facts-are-not-enough [https://perma.cc/4LTZ-3M8X] (describing how people react to novel, unfamiliar risks).

[76] Gary E. Marchant & Rachel A. Lindor, *The Coming Collision Between Autonomous Vehicles and the Liability System*, 52 SANTA CLARA L. REV. 1321, 1335 (2012).

[77] *See* Robert A. Prentice. & Jonathan J. Koehler, *A Normality Bias in Legal Decision Making,* 88 CORNELL L. REV. 583, 631 (2003) ("When bad outcomes arise in association with unusual circumstances, jurors are quicker to assign blame and punishment.").

[78] *See* Adrien Fillon, Lucas Kutscher & Gilad Feldman, *Impact of Past Behaviour Normality: Meta-Analysis of Exceptionality Effect*, 35 COGNITION & EMOTION 129 (2021) (reporting a meta-analysis of studies testing people's reactions to departures from normality and concluding that the normality bias—called the exceptionality bias in the study—is widespread and robust).

vehicles more harshly than conventional, human-controlled vehicles when accidents occur.

2. Naturalness Bias

People dislike products and devices seen as "artificial" and prefer otherwise identical products and devices perceived as "natural," thereby expressing a naturalness bias.[79] Cars are not natural, of course, but a human driver is more natural than an autonomous vehicle. It is no accident that producers of a variety of products, including food, medicine, and vitamin supplements, fight for the right to use terms such as "natural," "organic," and "non-GMO" in describing their products.[80] "[N]atural is an inherently positive concept"[81] and "most people prefer a natural product when other attributes—such as price, potency, and taste—are held constant."[82] In an online survey, 88% of health-conscious mothers were willing to spend almost 50% more for a flavored milk beverage made with en-

---

[79] *See* Paul Rozin et al., *Preference for Natural: Instrumental and Ideational/Moral Motivations, and the Contrast Between Foods/Medicines*, 43 APPETITE 147, 147 (2004) ("In recent decades, in the developed world, especially in the United States, a strong desire for things that are natural has appeared.").

[80] *See* Adam Chandler, *How National Food Companies are Responding to Vermont's GMO Law*, THE ATLANTIC (July 8, 2016), https://www.theatlantic.com/business/archive/2016/07/vermont-gmo-foodcompanies/490553 [https://perma.cc/RX23-7877] (describing how companies fight about natural labeling).

[81] Brian P. Meier et al., *A Behavioral Confirmation and Reduction of the Natural Versus Synthetic Drug Bias*, 39 MED. DECISION MAKING 360, 368 (2019).

[82] Sydney E. Scott & Paul Rozin, *Are Additives Unnatural? Generality and Mechanisms of Additivity Dominance*, 12 JUDGMENT & DECISION MAKING 572, 572 (2017). *See also* Serio Roman, Luis Manuel Sanchez-Siles & Michael Siegrist, *The Importance of Food Naturalness for Consumers: Results of a Systematic Review*, 67 TRENDS IN FOOD SCI. & TECH. 44, 51 (2017) (reporting that people "prefer foods that are grown and produced in a traditional way and in accordance with nature.").

tirely natural ingredients than for an identical beverage containing artificial flavoring.[83] In a survey of citizens in eight European countries, 40% reported that "I do everything I can to avoid contact with chemical substances in my daily life" and 39% said that "I would like to live in a world where chemical substances do not exist."[84]

The naturalness bias can produce bizarre phenomena. People report that water tastes better when it contains naturally occurring mineral content than when minerals are said to be added, even when the water is identical.[85] People read faster under light they believe to be filtered sunlight than under light they believe to be artificial—even when they experience it in a controlled setting in which the light is identical.[86] People rate drugs as more potent and effective when extracted from plants than when produced in a laboratory—even when they are identical chemicals.[87] In one study, most preferred a natural drug to

---

[83] *Asian Consumer Preference for Natural Colours and What It Means for Dairy*, ASIA-PACIFIC FOOD INDUSTRY (Sept. 20, 2017), https://apfoodonline.com/industry/asian-consumer-preference-for-natural-colours-and-what-it-means-for-dairy [https://perma.cc/AD33-HRDW].

[84] Michael Siegrist & Angela Bearth, *Chemophobia in Europe and Reasons for Biased Risk Perceptions*, 11 NATURE CHEMISTRY 1071, 1071 (2019). The authors attributed the results to "chemophobia"—an irrational fear of chemicals—caused in part to excessive reliance on the intuitive rule of thumb they called the "natural is better" heuristic. *Id*. *See also* Radek Chalupa & Karel Nesměrák, *Chemophobia Versus the Identity of Chemists: Heroes of Chemistry as an Effective Communication Strategy*, 151 CHEMICAL MONTHLY 1192, 1192 (2020) ("Chemophobia continues to surprise us with the irrationality of its manifestations.").

[85] *See* Sofia Deleniv, Dan Ariely & Kelly Peters, *Natural Is Better": How the Naturalistic Fallacy Derails Public Health*, BEHAV. SCI. (Mar. 8, 2021), ("[P]eople strongly prefer to drink "natural" spring water to water that has been distilled and subsequently mineralized even after researchers tell them that the two drinks are certified to be chemically identical.").

[86] *See* Antal Haans, *The Natural Preference in People's Appraisal of Light*, 39 J. ENV'T PSYCH. 51 (2014) ("Consistent with our natural preference hypothesis, a larger proportion of participants preferred the daylight harvester . . . over the daylight simulator room . . . .").

[87] *See* Marco daCosta DiBonaventura & Gretchen B. Chapman, *Do Decision Biases Predict Bad Decisions? Omission Bias, Naturalness Bias, and*

an equally effective and safe artificial one, and some preferred a natural drug to a more effective and safer synthetic one.[88] Even experts share this bias; a survey of obstetricians and gynecologists revealed that 31% preferred a natural hormone replacement therapy as compared to 3% who preferred a synthetic one, even though the research materials described both as identical.[89] These results suggest that some of the aversion people have to self-driving vehicles might be because they seem unnatural.

People also react more negatively to unnatural than natural hazards, which might influence judgments of liability. For example, people state that they would rather suffer an electrical burn from lightning than from a downed power line.[90] They also rate a volcano killing fifteen people from sulfur dioxide poisoning as a less serious harm than an identical tragedy

---

Influenza Vaccination, 28 MED. DECISION MAKING 532, 535 (2008) (describing the results of an experiment in which people expressed a preference for an herbal medicine that was chemically identical to a manufactured medicine); Meng Li & Gretchen B. Chapman, *Why Do People Like Natural? Instrumental and Ideational Bases for the Naturalness Preference*, 42 J. APPLIED PSYCH. 2859, 2867 (2012) ("People preferred Vitamin C pills made from natural ingredients to those synthesized in the lab.").

[88] Brian P. Meier & Courtney M. Lappas, *The Influence of Safety, Efficacy, and Medical Condition Severity on Natural Versus Synthetic Drug Preference*, 36 MED. DECISION MAKING 1011, 1018 (2016) ("participants were biased toward a natural drug label."). *See also* Brian P. Meier, Amanda J. Dillard & Courtney M. Lappas, *Naturally Better? A Review of the Natural-Is-Better Bias*, 13 SOC. & PERSONALITY PSYCH. COMPASS e12494 (2019) (reviewing similar results). Similarly, when offered a pain reliever as a gift in two studies, 86% and 93% respectively chose the natural drug over the synthetic one. *See* Meier et al., *supra* note 81, at 363 (reporting results).

[89] Jonathan Baron, Gerald B. Holzman & Jay Schulkin, *Attitudes of Obstetricians and Gynecologist Toward Hormone Replacement Therapy*, 18 MED. DECISION MAKING 406, 408-10 (1998) (reporting results). Two-thirds of these experts expressed no preference. *Id.*

[90] *See* Jeffrey M. Rudski et al., *Would You Rather Be Injured by Lightening or a Downed Power Line? Preference for Natural Hazards*, 6 JUDGMENT & DECISION MAKING 314, 316 (2011) ("For each of the 10 scenarios [describing injuries by natural or artificial hazards] . . . significantly more subjects perceived the artificial version as being more dangerous.").

caused by a release of the same chemical from a factory.[91] The preference for natural extends even to hazards and instruments of harm. As an example, people offered the choice of suffering an equally severe sun burn from either a tanning bed or the sun were ten times more likely to prefer the latter.[92] Similarly, most people believe that cigarettes labeled "natural" or "organic" are less harmful than cigarettes not so labeled.[93] If people view autonomous vehicles as less natural than human-driven vehicles, they might react more negatively towards the accidents that autonomous vehicles cause.

3. Betrayal Aversion

Because autonomous vehicles are supposed to be safer than human-driven vehicles, people might see the accidents they cause as a betrayal. Betrayal produces a strong negative reaction and induces people to assign more blame and to treat injuries caused by a safety mechanism as more serious than injuries caused by other sources.[94]

"A number of studies now support the idea that aversion to betrayal is an important factor influencing how individuals

---

[91] Michael Siegrist & Bernadette Sütterlin, *Human and Nature-Caused Hazards: The Affect Heuristic Causes Biased Decisions*, 34 RISK ANALYSIS 1482, 1485 (2014) ("In the sulfur dioxide experiment, the outcome was perceived as significantly more severe . . . and was considered to have a significantly higher impact on the population . . . in the case of the accident in a factory compared with the volcanic eruption.").

[92] Rudski et al., *supra* note 90, at 316.

[93] Sabeeh Baig et al., "*Organic," "Natural," and "Additive-Free" Cigarettes: Comparing the Effects of Advertising Claims and Disclaimers on Perceptions of Harm*, 21 NICOTINE TOBACCO RSCH. 933, 937 (2019) ("In a large national probability sample of US adults, 'organic,' 'natural,' and 'additive-free claims reduced perceived harm of advertised cigarettes and, among smokers, increased interest in switching to modified versions of their current cigarettes bearing those claims.").

[94] *See* Jonathan J. Koehler & Andrew D. Gershoff, *Betrayal Aversion: When Agents of Protection Become Agents of Harm*, 90 ORG. BEHAV. HUM. DECISION PROCESSES 244, 244 (2003) (presenting the results of five studies showing that people react "more strongly (in terms of punishment assigned and negative emotions felt) to acts of betrayal than to identical bad acts that do not violate a duty or promise to protect.").

approach and respond to risky outcomes."[95] Harm caused by someone with a duty to protect seems worse than the same harm caused by a random stranger. As an example, in one study, people responded more negatively to a burglary committed by a security guard than to a burglary committed by a thief.[96] Even though objects cannot voluntarily enter into a trust relationship, the phenomenon applies to products and machines as well. As an example, undergraduate students awarded punitive damages more often and awarded greater amounts when a fire was caused by a defective fire alarm rather than by a defective refrigerator.[97]

The negative reaction to the crashes caused by a malfunctioning safety algorithm in the Boeing 737 Max illustrates betrayal aversion well:

> A tug of war follows between men and computer, at 450 miles an hour—the human pilots trying to right the downward plunge, the automatic pilot taking it back from them. The bot wins. The jetliner crashes into the Java Sea. All 189 onboard are killed.
>
> *And here's the most agonizing part*: *The killer was supposed to save lives*. It was a smart computer designed to protect a gravity defying machine from error. It lacks judgment and intuition, precisely because those human traits can sometimes be fatal in guiding an aerodynamic tube through the sky.[98]

---

[95] Jason Aimone, Sheryl Ball & Brooks King-Casas, *The Betrayal Aversion Elicitation Task: An Individual Level Betrayal Aversion Measure*, 10 PLOS ONE e0137491, 1 (2015).

[96] Koehler & Gershoff, *supra* note 94, at 246-247.

[97] *Id*. at 250.

[98] Timothy Egan, *The Deadly Soul of a New Machine*, N.Y. TIMES (Dec. 8, 2018), https://www.nytimes.com/2018/12/07/opinion/artificial-intelligence-machines.html [https://perma.cc/P9WC-GQYF] (emphasis added).

4. Availability Heuristic

The availability heuristic also might influence perceptions of self-driving vehicles. The availability heuristic is "the process of judging frequency by the ease with which instances come to mind."[99] As an example of how availability can affect judgment, most people will state that there are more words in the English language that start with the letter "r" than have the letter "r" in the third position.[100] "Because it is much easier to search for words by their first letter than by their third letter, most people judge words that begin with a given consonant to be more numerous than words in which the same consonant appears in the third position."[101] It therefore seems that there are more words that start with the letter "r", even though there are actually many more words with "r" in the third position.

Availability has a powerful effect on assessment of accident rates and likelihood of disasters.[102] Dramatic accidents, such as the crash of a commercial airliner or a shark attack, tend to be memorable and widely reported; the individual death from a heart attack tends not to be (unless it is a celebrity). Hence, people overestimate the risk of the former and underestimate the risk of the latter.

Self-driving car accidents are much more salient than human-driven car accidents.[103] "When the first traffic fatality involving Tesla's Autopilot occurred in May 2016, it was covered

---

[99] DANIEL KAHNEMAN, THINKING, FAST AND SLOW 129 (2011).

[100] *See* Amos Tversky & Daniel Kahneman, *Judgment Under Uncertainty: Heuristics and Biases*, 185 SCIENCE 1124, 1127 (1974) (describing this example of availability).

[101] *Id.*

[102] *See* Paul Slovic, Baruch Fischhoff & Sarah Lichtenstein, *Facts Versus Fears: Understanding Perceived Risks*, *in* JUDGMENT UNDER UNCERTAINTY: HEURISTICS AND BIASES 464, 467-68 (Daniel Kahneman et al. eds. 1982) ("In keeping with availability considerations, overestimated items were dramatic and sensational, whereas underestimated items tended to be unspectacular events.").

[103] *See* SHELLY FAN, WILL AI REPLACE US? A PRIMER FOR THE 21ST CENTURY 130 (2019) ("AI systems are harshly (and perhaps unfairly) judged for

in every major news organization—a feat unmatched by any of the other 40,200 U.S. traffic fatalities that year."[104] "Outsized media coverage of crashes involving autonomous vehicles may feed and amplify people's fears by tapping into the availability heuristic (risks are subjectively higher when they come to mind easily) and affective heuristic (risks are perceived to be higher when they evoke a vivid emotional reaction)."[105]

5. Algorithm Aversion

Autonomous vehicles rely heavily on algorithms and artificial intelligence, which might trigger "algorithm aversion." Algorithm aversion is "the tendency for people to more rapidly lose faith in an erring decision-making algorithm than in humans making comparable errors."[106] Most studies show that when offered a choice people prefer to rely on a human than an algorithm,[107] even when they acknowledge that the algorithm will make fewer errors.[108] Multiple studies show that people judge the failure of a machine or an algorithm more harshly

---

their failures. Accidents by self-driving cars, for example, garner more attention than those of human drivers, even if on average the safety ratings of the former are better.").

[104] Azim Shariff, Jean-Francois Bonnefon & Iyad Rahwan, *Psychological Roadblocks to the Adoption of Self-Driving Vehicles*, 1 NATURE HUM. BEHAV. 694, 695 (2017).

[105] *Id*.

[106] *Id*. *See also* Jack Balkin, *Sidley Austin Distinguished Lecture on Big Data Law and Policy: The Three Laws of Robotics in the Age of Big Data*, 78 OHIO ST. L.J. 1217, 1223 (2017) ("When we talk about robots, or AI agents, or algorithms, we usually focus on whether they cause problems or threats. But in most cases, the problem isn't the robots; it's the humans.").

[107] *See* Dilek Önkal et al., *The Relative Influences of Advice from Human Experts and Statistical Methods on Forecast Adjustments*, 22 J. BEHAV. DECISION MAKING 390, 402 (2009) (reporting that people attend more closely to advice "when they think it has been provided by a human expert than a statistical method."); Marianne Promberger & Jonathan Baron, *Do Patients Trust Computers?*, 19 J. BEHAV. DECISION MAKING 455, 465 (2006) (reporting that patients were "more likely to follow a physician's recommendation than that of a computer program" and placed more trust in the physician than the computer program).

[108] *See* Jason W. Burton, Mari-Klara Stein & Tina Blegind Jensen, *A Systematic Review of Algorithm Aversion in Augmented Decision Making*, 32 J.

than a human failure.[109] We expect humans to fail, but we expect machines to perform better. "Human drivers may be forgiven for making an instinctive but nonetheless bad split-second decision, such as swerving into oncoming traffic rather than the other way into a field. But programmers do not have

---

BEHAV. DECISION MAKING 1, 1 (2019) ("[I]n spite of the growing ubiquity of algorithmically augmented decision making, recent research demonstrates the persistence of algorithm aversion, which is the reluctance of human decision makers to use superior but imperfect algorithms."); Mary T. Dzindolet et al., *The Perceived Utility of Human and Automated Aids in a Visual Detection Task*, 44 HUM. FACTORS 79, 88 (2002) (reporting a strong bias towards "self reliance", even when avoiding the use of a machine algorithm was costly).

[109] *See* Berkeley J. Dietvorst, Joseph P. Simmons & Cade Massey, *Algorithm Aversion: People Erroneously Avoid Algorithms After Seeing Them Err*, 144 J. EXPERIMENTAL PSYCH. 114, 119 (2015) ("[S]eeing . . . [an algorithm] perform, and therefore err, . . . decrease[d] participants' tendency to bet on it rather the human forecaster, despite the fact that the model was more accurate than the human."); Andrew Prahl & Lyn Van Swol, *Understanding Algorithm Aversion: When is Advice From Automation Discounted?*, 36 J. FORECASTING 691, 696 (2017) (reporting an aversion to reliance on an algorithm when it underperformed relative to high expectations). *But see* Kevin Tobia, Aileen Nielsen & Alexander Stremitzer, *When Does Physician Use of AI Increase Liability?*, 62 J. NUCLEAR MED. 17, 21 (2021) (reporting results of a mock-jury study showing that when a doctor's decision is consistent with an algorithm, the doctor is less likely to be found liable). *See also* Johannes Schwienbacher, Reactions on Algorithms: A Systematic Literature Review of Algorithm Aversion and Algorithm Appreciation 79 (May 2020) (M.S. Thesis, University of Innsbruck School of Management 2020), https://www.datascienceassn.org/sites/default/files/Reactions%20on%20algorithms.pdf [https://perma.cc/ZQ3P-F9BV] (surveying the literature on algorithm aversion and algorithm appreciation and concluding that whether the reaction to an algorithm is positive or negative may depend upon the context). "Aversion toward algorithms was found in medical economic, and business decision-making, as well as for moral decisions in legal, military, and driving tasks. Subjective recommendations have also shown the effect of algorithm aversion, whereas in other subjective tasks, such as in visual estimation, song forecasting, and person-perception, algorithm appreciation was found. Algorithm appreciation was also shown for news selection and in a time-critical scenario in human-robot interaction." *Id.*

that luxury since they do have the time to get it right and therefore bear more responsibility for bad outcomes."[110]

6. Anti-Corporate Bias

Research has demonstrated that people often assign higher damage awards to injuries caused by corporate actors than individual actors, even when the injuries themselves are identical.[111] Corporations are far more likely to be the defendants in suits for injuries caused by autonomous vehicles than for injuries caused by human drivers. In particular, individuals who embrace communitarian ideals might also see accidents caused by software developed by corporations more negatively than accidents caused by individual drivers.[112]

* * *

In sum, a number of well-known tendencies in human judgment might combine so as to induce people to treat accidents caused by autonomous vehicles as more serious than those caused by human drivers. They might blame autonomous

---

[110] Patrick Lin, *The Ethics of Autonomous Cars*, THE ATLANTIC (Oct. 8, 2013), https://www.theatlantic.com/technology/archive/2013/10/the-ethics-of-autonomous-cars/280360 [https://perma.cc/84EP-YTFK]. *See also* Woods, *supra* note 13, at 55 ("Rather than engage in a rational calculation of who performs a task better, we place unreasonably high demands on robots.").

[111] *See* Valerie P. Hans & M. David Ermann, *Responses to Corporate Versus Individual Wrongdoing*, 13 LAW & HUM. BEHAV. 151, 157 (1989) (reporting a mock-jury experiment showing that corporate actors are held liable for more aspects of a claim than identical individual actors).

[112] *See* Dan M. Kahan, *The Cognitively Illiberal State*, 60 STAN. L. REV. 115, 124 (2007) (arguing that communitarians are more concerned about the harms corporations can inflict). For a contrary position, *see* Charles E. Naquin & Terri R. Kurtzberg, *Human Reactions to Technological Failure: How Accidents Rooted in Technology vs. Human Error Influence Judgments of Organization Accountability*, 93 ORG. BEHAV. & HUM. DECISION PROCESSES 129, 138 (2004) ("[R]elative to organizational accidents caused by human behavior, technologically induced accidents tend to allow organizations to escape the full brunt of accountability for the ensuing harm caused by their failures.").

pilots more than they blame human drivers and treat the injuries sustained in accidents that autonomous vehicles cause as more serious.

D. Research on Bias Against Autonomous Vehicles

Fictional depictions of autonomous vehicles are often negative, even ominous. In the 1977 film *The Car*, a driverless black sedan becomes a predator, terrorizing a small town.[113] Similarly, the car named "Cristine", adapted from a story written by Stephen King, hunts to kill at night and is invulnerable because it can heal itself after suffering damage.[114] In the film *Minority Report*, the government controls an autonomous vehicle and when the protagonist tries to use it to flee, it delivers him the police.[115] *Total Recall* featured a creepy autonomous taxi named Johnny Cab that was more dysfunctional than menacing.[116] In contrast, Herbie the Love Bug was an autonomous, loveable Volkswagen Beetle.[117] Similarly the TV show *Knight Rider* featured a crime-fighting autonomous, intelligent vehicle named KITT. Notably, in one episode, KITT becomes frustrated with the recklessness of its human companion and takes over driving itself, explaining: "I cannot allow you to jeopardize your life. I am assuming control."[118]

Given the many potential sources of bias against autonomous vehicles, it is perhaps no surprise that polling shows that people approach the concept of autonomous vehicles with caution and skepticism. In one survey, only "58% of the respondents had a positive general opinion regarding AVs whereas

---

[113] THE CAR (Universal Pictures 1977).

[114] CRISTINE (Columbia Pictures 1983).

[115] MINORITY REPORT (20th Century Fox 2002).

[116] TOTAL RECALL (Tri-Star Pictures 1990).

[117] THE LOVE BUG (Walt Disney Productions 1968).

[118] *KITT, Knight Rider: Trust Doesn't Rust* (NBC television broadcast Nov. 19, 1982).

only 12% had a negative general opinion."[119] Viewing autonomous vehicles positively, however, is not the same as willingness to ride in or buy them. One recent survey reported that in the United States, 54% stated that they are "unsure about self-driving cars but find the idea interesting," and 24% are "against self-driving cars and would never use them."[120] In another survey, the modal response was to have "no self-driving (43.8%), followed by partially self-driving (40.6%), with completely self-driving being the least preferred (15.6%)."[121] Also, 63% of United States drivers feel afraid to ride in a fully self-driving vehicle, and 46% report that they would feel less safe sharing the road with self-driving vehicles.[122]Acceptance might be on the rise, however. Just one year earlier the first figure had been 78%.[123] Other studies also suggest growing acceptance of autonomous vehicles, albeit still tempered with caution.[124] "Preferences toward AVs may change with market penetration,

---

[119] Ilias Panagiotopoulos & George Dimitrakopoulos, *An Empirical Investigation on Consumers' Intentions Towards Autonomous Driving*, 95 TRANSP. RSCH. PART C: EMERGING TECHS. 773, 777 (2018).

[120] Niall McCarthy, *Global Opinion Divided on Self-Driving Cars*, FORBES (Apr. 13, 2018), https://www.forbes.com/sites/niallmccarthy/2018/04/13/global-opinion-divided-on-self-driving-cars-infographic [https://perma.cc/D4F2-PX2K].

[121] Bryan Jonston, *People Prefer People-Driven Cars Over Self-Driven Cars*, AUTO CONNECTED CAR NEWS (July 16, 2015), https://www.autoconnectedcar.com/2015/07/people-prefer-people-driven-cars-over-self-driving-vehicles [https://perma.cc/2J3J-8G8P].

[122] Ellen Edmonds, *Three in Four Americans Remain Afraid of Fully Self-Driving Vehicles*, AAA NEWSROOM (Mar. 14, 2019), https://newsroom.aaa.com/2019/03/americans-fear-self-driving-cars-survey [https://perma.cc/TQQ7-GNS5].

[123] Ellen Edmonds, *More Americans Willing to Ride in Fully Self-Driving Cars*, AAA NEWSROOM (Jan. 24, 2018), https://newsroom.aaa.com/2018/01/americans-willing-ride-fully-self-driving-cars [https://perma.cc/ZEM5-YX2D].

[124] *See* William Payre, Julien Cestac & Patricia Delhomme, *Intention to Use a Fully Automated Car: Attitudes and a Priori Acceptability*, 27 TRANSP. RSCH. PART F, 252, 253 (2014) ("Attitudes are globally positive toward simulated partially automated driving systems.").

technological developments, government policies, pricing, and so forth."[125]

People exhibit "persistent safety concern towards AVs."[126] While many believe that autonomous vehicles are or will be safer than human drivers, they nevertheless feel uncomfortable about trusting them and prefer to have a human driver in control.[127] Most drivers say they still prefer to drive themselves, and only a small minority is excited about self-driving cars.[128] Enthusiasm for autonomous vehicles is somewhat higher among men than women[129] and among drivers from outside of the United States, but concern is still widespread.[130] For now, skepticism remains; a survey in May 2017 reported that 56% of Americans said that they would not ride in a driverless car.[131] The overall attitude among the public is consistent with research on algorithms suggesting that people know that they are

---

[125] Peng Jing et al., *The Determinants Behind the Acceptance of Autonomous Vehicles: A Systematic Review*, 12 SUSTAINABILITY 1719, 1733 (2020).

[126] Priscilla N.Y. Wong, *Who Has the Right of Way, Autonomous Vehicles or Drivers? Multiple Perspectives in Safety, Negotiation and Trust*, 11TH ANN. CON. ON AUTOMOTIVE USER INTERFACES, 198, 207 (2019).

[127] *See generally* CHRIS TENNANT ET AL., EXECUTIVE SUMMARY: AUTONOMOUS VEHICLES: NEGOTIATING A PLACE ON THE ROAD, LONDON SCHOOL OF ECONOMICS (2016), https://www.lse.ac.uk/business-and-consultancy/consulting/consulting-reports/autonomous-vehicles-negotiating-a-place-on-the-road [https://perma.cc/8K56-FFLD].

[128] *See* M. Kyriakidis, R. Happee & J.C.F. de Winter, *Public Opinion on Automated Driving: Results of an International Questionnaire Among 5000 Respondents*, 32 TRANSP. RSCH.: PART F 127, 138 (2015) ("[T]here is a fair part of the population who will enjoy fully automated driving.").

[129] *See* Christoph Hohenberger, Matthias Spörrle & Isabell M. Welpe, *How and Why Do Men and Women Differ in Their Willingness to Use Automated Cars? The Influence of Emotions Across Different Age Groups*, 94 TRANSP. RSCH.: PART A, 374, 375 (2016) ("Men usually report higher tendencies to use automated cars.").

[130] *See* Chana J. Haboucha, Robert Ishaq & Yoram Shiftan, *User Preferences Regarding Autonomous Vehicles*, 78 TRANSP. RSCH.: PART C EMERGING TECHS. 37, 38 (2017) ("Despite the advantages, individuals are often hesitant to embrace new technology.")

[131] Smith & Anderson, *supra* note 72.

potentially more accurate, but still prefer to rely on their own judgment.[132]

Antipathy towards autonomous vehicles might explain the wide range of studies showing that people react especially negatively to harm they cause, as we describe below. It is perhaps not surprising to find that the more automation a vehicle has, the more people blame the car for injuries, rather than the driver.[133]

One survey revealed that aberrant behaviors by an autonomous vehicle—such as driving slowly—provoke more anger than does identical conduct by a human driver.[134] In a study in which participants evaluated a description of an accident, Li and colleagues also found a similar tendency to blame an autonomous vehicles more for an accident than they would have if a human had caused it.[135] The authors report that "[p]articipants confronted with a self-driving car at fault allocated greater responsibility to the manufacturer and the government than participants who were confronted with a human driver at fault did."[136] Franklin, Awad, and Lagunado found a similar effect in two studies in which people evaluated accidents caused

---

[132] *See* Prahl & Swol, *supra* note 109, at 56 ("[D]espite seeking advice from automation, decision makers frequently discount advice obtained from it, especially when compared to advice from a human advisor.").

[133] *See* Joanne M. Bennett, Kirsten L. Chalinor, Oscar Modesto & Prasannah Prabhakharan, *Attribution of Blame of Crash Causation Across Varying Levels of Vehicle Automation*, 132 SAFETY SCI. 104968, 6 (2020) ("The hypothesis that as vehicle automation increased, the attribution of blame for the crash would shift from the human driver towards other stakeholders was supported.").

[134] *See generally* Tingting Li et al., *Sharing the Road: Robot Drivers (vs. Human Drivers) Might Provoke Greater Driving Anger When They Perform Identical Annoying Driving Behaviors*, 38 INT'L J. HUMAN-COMPUTER INTERACTION 309 (2021).

[135] *See* Jamy Li et al., *From Trolley to Autonomous Vehicle: Perceptions of Responsibility and Moral Norms in Traffic Accidents with Self-Driving Cars* 1 (SAE Int'l, Technical Paper 2016-01-0164, 2016), https://www.sae.org/publications/technical-papers/content/2016-01-0164 [https://perma.cc/SS5U-7DWD].

[136] *Id.*

either by a human driver or an autonomous vehicle.[137] Finally, after giving six different accident scenarios to research participants, Zhang et al. concluded that in five of them "[p]articipants applied double standards when assigning blame to humans and autonomous systems: an autonomous system was blamed more than a human driver for executing the same actions under the same circumstances with the same consequences."[138]

Some studies suggest a notable reluctance to blame a human being when an autonomous vehicle is involved in a crash. In a highly realistic driving simulation study by Waytz, Haefner, and Epley, participants were either using an autonomous driving feature or driving themselves when they got into an accident clearly caused by another car.[139] Those using the autonomous system nevertheless blamed it for the crash, even though those participants driving themselves correctly blamed the other car. In a similar study, researchers presented participants with a summary of a crash that was comparable to a 2018 accident in which an automated driving system malfunctioned. In the accident, the human operator was distracted and failed to intervene, resulting in a pedestrian fatality. Only a bare majority of participants "thought the distracted human driver sitting behind the wheel should bear full legal responsibility when the vehicle was operating in the automated mode," even though the driver was clearly at fault.[140]

People seem particularly averse to autonomous vehicles that appear to make "choices" about risks. In a second experiment by Li and colleagues, the authors described a choice made

---

[137] Matija Franklin, Edmond Awad & David Lagunado, *Blaming Automated Vehicles in Difficult Situations*, 24 ISCIENCE 102252, 6 (2021).

[138] Qiyuan Zhang et al., *The Blame Game: Double Standards Apply to Autonomous Vehicle Accidents, in* ADVANCES IN HUMAN ASPECTS OF TRANSPORTATION 308, 308 (Neville Stanton ed., 2021)

[139] *See generally* Adam Waytz, Joy Heafner & Nicholas Epley, *The Mind in the Machine: Anthropomorphism Increases Trust in an Autonomous Vehicle*, 52 J. EXPERIMENTAL SOC. PSYCH. 113 (2014).

[140] Pen Liu, Manquing Du & Tingting Li, *Psychological Consequences of Legal Responsibility Misattribution Associated with Automated Vehicles*, 23 ETHICS & INFO. TECH. 763, 772 (2021).

by a human driver or an autonomous car to swerve and kill only one person to avoid killing five (akin to the well-known Trolley Problem).[141] Their participants found that the choice to minimize harm was an appropriate, moral choice, whether made by the human or the autonomous system. In related research, however, authors from the same research team found that people nevertheless hold the autonomous system more responsible for making the choice.[142] This result was replicated in a similar study showing that research participants were more apt to conclude that swerving to kill one person but to save five was the moral choice when it was made by a human than when an autonomous vehicle made the same decision.[143] Relatedly, research participants felt it was less acceptable for life-and-death driving decisions to be made by an autonomous computer program than a human driver.[144]

Two studies put these effects together. In a study by Liu, Du, and Xu, the participants read an account of an accident caused either by an autonomous vehicle or a human-driven vehicle. Participants displayed more negative affect towards accidents caused by self-driving car.[145] In turn, this induced participants to rate the accidents caused by the self-driving car as more serious, even when the injury was fatal.[146] Participants in

---

[141] Li et al., *supra* note 135, at 5-6.

[142] Bertram F. Malle et al., *Sacrifice One for the Good of Many? People Apply Different Moral Norms to Human and Robot Agents*, 15 PROC. 2015 ACM/IEEE CONF. ON HUM.-ROBOT INTERACTION 117, 122 (2015).

[143] April D. Young & Andrew E. Monroe, *Autonomous Morals: Inferences of Mind Predict Acceptance of AI Behavior in Sacrificial Moral Dilemmas*, 85 J. EXPERIMENTAL SOC. PSYCH. 103870 (2019).

[144] Yochanan E. Bigman & Kurt Gray, *People Are Averse to Machines Making Moral Decisions*, 181 COGNITION 21, 23-24 (2018).

[145] *See* Liu, Du & Xu, *supra* note 72, at 238 ("Our participants assess traffic accidents involving SDVs more negatively and had less acceptance of those crashes than ones involving HDVs, which persisted even when SDVs were not causally responsible for these crashes.").

[146] *Id. See also* Bing Huang, Sander van Cranenburgh & Caspar G. Chorus, *Death by Automation: Differences in Weighting of Fatalities Caused by Automated and Conventional Vehicles*, 20 EUR. J. TRANSP. & INFRASTRUCTURE RSCH. 71, 82 (2020) ("[F]atalities caused by AVs received more weight than fatalities caused by human drivers in CVs.").

this study also rated accidents caused by self-driving vehicles as less acceptable, and concluded that the automated system deserved more responsibility for the accident, even when the accident was caused by a third party.[147] Similarly, in a series of four experiments in which people evaluated crashes caused by human-driven or automated vehicles, Liu and Du found that participants "judge[d] the automation-caused crash more harshly, ascribe[d] more blame and responsibility to automation and its creators, and . . . [thought that] the victim in this crash should be compensated more."[148]

Evaluations of cases in which drivers and autonomous vehicles share control over the vehicle, however, show no real bias against autonomous vehicles. In one experiment, researchers found that "in cases where a human and a machine share control of the car [simultaneously], *less* blame is attributed to the machine when both drivers make errors."[149] A similar experiment in which participants evaluated scenarios describing one of four different automation levels found that "[h]umans are blamed more than machines in the context of a deadly accident."[150] Another smaller study found no differences in degree of blame assigned to a human versus an autonomous system in a case of shared control.[151] Finally, in a study in which participants read a fictional newspaper article in which either a human driver or an autonomous vehicle either rescued a human suffering a pulmonary embolism by driving him to a hospital or caused an automobile accident that killed a passenger, participants praised the autonomous vehicle more than human driver when the outcome of the incident was positive, but

---

[147] *Id*. ("[P]eople exhibit an over reaction to traffic crashes involving SDVs event when the crashes are not the SDVs fault.").

[148] Peng Liu & Yong Du, *Blame Attribution Asymmetry in Human-Automation Cooperation*, 42 RISK ANALYSIS 1769, 1769 (2022).

[149] Awad et al., *supra* note 74 (emphasis added).

[150] Christopher J. Copp, Jean J. Cabell & Markus Kemmelmeier, *Plenty of Blame to Go Around: Attributions of Responsibility in a Fatal Autonomous Vehicle Accident*, CURRENT PSYCH., June 26, 2021, at 10.

[151] Spencer C. Kohn et al., *Trust Repair Strategies with Self-Driving Vehicles: An Exploratory Study*, 62 PROC. HUM. FACTORS & ERGONOMICS SOC'Y ANN. MEETING 1108, 1109-1110, 1112 (2018).

blamed both equally when the outcome was negative.[152] Although these results seem inconsistent with the other research, the shared aspect adds an important wrinkle. As noted above, people perceive algorithms as more accurate, even though they have reservations about using them. Judging a shared system perhaps highlighted the frailties of a human driver.

Overall, this research supports the concerns of scholars who worry that many of the tendencies of human judgment noted earlier will lead to excessive liability for autonomous vehicles.[153] The data support the intuition that "[a]n autonomous-vehicle crash feels different, and maybe worse, than a human caused one . . . ."[154] It seems likely that "[j]uries tend to understand people making mistakes but not machines making mistakes."[155] People have high expectations for autonomous systems, which might be why they blame humans in jointly caused accidents but also blame autonomous vehicles more when they fail. This bias could dramatically affect the liability landscape for automobile accidents. "If a human driver causes an accident, it is unfortunate but normal. If an autonomous car causes

---

[152] Joo-Wha Hong, Yunwen Wang & Paulina Lanz, *Why Is Artificial Intelligence Blamed More? Analysis of Faulting Artificial Intelligence for Self-driving Car Accidents in Experimental Settings*, 36 INT'L J. HUM.-COMPUT. INTERACTION 1768, 1772 (2020).

[153] *See* Marchant & Bazzi, *supra* note 67, at 114 ("[S]everal factors would encourage plaintiffs' lawyers to pursue . . . lawsuits [against manufacturers of autonomous vehicles even though they would not do so against human drivers.]").

[154] Ian Bogost, *Can You Sue a Robocar?*, THE ATLANTIC (Mar. 20, 2018), https://www.theatlantic.com/technology/archive/2018/03/can-you-sue-a-robocar/556007 [https://perma.cc/2WAG-CM7E].

[155] JAMES M. ANDERSON ET AL., RAND CORP., RETHINKING INSURANCE AND LIABILITY IN THE TRANSFORMATIVE AGE OF AUTONOMOUS VEHICLES 5 (2018), https://www.rand.org/pubs/conf_proceedings/CF383.html [https://perma.cc/YUU5-4UCX].

an accident on the other hand, it is unacceptable, and it can shut down the entire industry."[156]

E. Summary and Application to Judges

Two themes emerge from the research on liability for accidents caused by autonomous vehicles. First, people might assign more responsibility to mistakes made by wholly autonomous systems than humans. Second, harms that autonomous systems produce seem worse than harms that humans produce. This research suggests that juries are apt to treat autonomous vehicles harshly in court. We studied whether judges would follow a similar pattern.

Judges potentially will have enormous influence on the development of a liability system for autonomous vehicles. In our common-law system, judges will not only decide some cases on their own, but also guide the development of the law along with regulators. Autonomous vehicles present several challenging questions concerning liability. Is a strict liability system appropriate? Should the software be treated differently than the hardware? Should limitations governing liability for products apply to autonomous vehicles? Judges who view autonomous vehicles with suspicion are apt to create a liability system that might slow the adoption of autonomous vehicles, even though they will ultimately be much safer than human-driven vehicles.

II. The Present Research

This study investigates whether judges react negatively to autonomous vehicles. We asked sitting state and federal trial judges to review a scenario concerning an automobile. In Study 1, judges read a comparative negligence scenario in which we asked them to allocate responsibility between a pedestrian and a vehicle operator described either as autonomous or human. In Study 2, we presented a similar scenario to judges and re-

---

[156] *Human Influence Makes Autonomous Vehicle Programming Unsafe*, INS. J. (Mar. 28, 2018), https://www.insurancejournal.com/news/national/2018/03/29/484726.htm [https://perma.cc/BU7F-3KLR] (quoting Aviral Shrivastava).

quested that they award compensatory damages for an identical accident caused either by an autonomous vehicle or a human driver. Consistent with the studies using lay adults as research participants, we found that judges assigned more responsibility for accidents to autonomous vehicles than to human drivers and awarded higher damages to victims of autonomous vehicles than to victims of human-driven vehicles.

A. Research Participants

We recruited 967 judges from six different jurisdictions to participate in our study: Minnesota (state trial judges); Texas (newly elected state judges in 2017, 2018, 2019, 2020, and 2021); two different groups of Ohio judges (municipal and county judges, and magistrates); federal district judges; Canadian trial judges; and New York family court judges. These judges were attending judicial education conferences in their jurisdictions. We collected the data at presentations we made to these judges. The conferences did not primarily concern the study of technology or psychology. In the case of Minnesota and Texas, attendance at the conferences was mandatory. Furthermore, other than for the federal judges, the presentation was at a plenary session—meaning that every judge at the conference attended our presentation. At the federal conference, our session was one of four optional sessions available to the conference attendees.

Our presentation titles gave no hint as to what we were planning.[157] At the outset of each of the sessions, we distributed a short survey to the judges that included one or more hypothetical questions and requested that the judges provide limited demographic information. We asked judges to complete the surveys and turn them in before the presentation. Most of

---

[157] Our session titles were as follows: "Inside the Judicial Mind" (Minnesota); "Implicit Judgments and Judicial Decision Making" (Texas); "Cognition & Judicial Decision Making" (Ohio magistrates); "Judicial Conduct: Implicit Judgments and Judicial Decision Making" (Ohio municipal and county judges); "Cognitive Science and Its Implications for Judging" (Federal district judges); "Intuition and Deliberation in Family Court" (New York family court judges).

the judges did so. Identifying the response rate precisely is impossible, as we do not know the exact number of judges in attendance, but we are confident the response rate was over ninety percent. The last page of the questionnaire gave the judges the opportunity to respond to the survey and participate in the educational program but withdraw their responses from our analysis. One judge did this and was removed from the analysis.

We report the demographic characteristics of the judges in Table 1. As we describe below, we conducted two different studies: Study 1 involved comparative fault and Study 2 involved a compensatory damage award. Table 1 also identifies the study in which the judges participated. We combined the federal judges from the two conferences, as they were both similar. We separated the four groups of judges in Texas, however, because we administered different studies to the different groups. Furthermore, 2018 was an unusual election year for the Texas judiciary,[158] and in 2020, the survey was administered online, as the conference was conducted as a synchronous, on-line event.[159]

[158] In 2018, Democrat Beto O'Rourke ran against Ted Cruz for one of the Texas' two Senate seats. The tight race between the two produced a record turnout for a non-Presidential year in Texas. Owing to the availability of straight party-line voting ballots in Texas at the time, many more voters than usual selected a full Democratic slate, which produced a wave of new Democratic judges in the state. *See* Ephrat Livni, *Beto O'Rourke Helped Turn Texas Courts Blue*, QUARTZ (Nov. 10, 2018), https://qz.com/1459057/beto-orourke-helped-turn-texas-courts-blue-in-us-midterms [https://perma.cc/A9L4-6BUS].

[159] We were more concerned with preserving anonymity than usual at this event, given that it was online. Hence, we did not collect demographic information from these judges.

Jurisdiction	Study	Sample Size	Average / median years of experience (N reporting[160])	% Female (N reporting)	% Republican (N reporting)
Minnesota*	Fault	216	11.4/10 (209)	44 (214)	11 (178)
Texas (2017)	Fault	30	0**	48 (27)	74 (27)
Texas (2018)	Fault	196	0**	48 (185)	30 (181)
Ohio (magistrates)	Fault	89	12.2/11 (80)	19 (81)	71 (80)
Texas (2019)	Damages	48	0**	55 (44)	59 (41)
Texas (2020)	Damages	53	0**	n/a	n/a
Texas (2021)	Damages	34	0**	53 (32)	59 (32)
Ohio (municipal & county)***	Damages	159	11.7/10 (149)	56 (134)	33 (109)
Federal	Damages	40	16.7/16 (35)	34 (35)	34 (35)
New York	Damages	69	9.2/8.0 (66)	61 (67)	25 (61)
Canada	Damages	33	9.3/8.5 (27)	36 (28)	n/a

Table 1: Demographics of Each Group of Judges

* 11 of the Minnesota judges were appellate judges.
** The Texas judges were all newly elected to the bench.
*** We asked these judges to identify their exact assignment and their responses were as follows: 40 common pleas; 26 municipal; 41 domestic relations; 34 juvenile; 4 retired; 8 probate.

[160] Not all the judges in the sessions responded to the demographic questions. Hence, the number "reporting" is invariably smaller than the sample size.

B. Materials

We created two similar scenarios to test the judges' reactions to autonomous cars.[161] In Study 1, we wanted to determine whether judges would attribute more fault to a self-driving car than a human-driven car under identical conditions. In Study 2, we wanted to determine whether judges would award more in compensatory damages when a self-driving car caused the injury rather than a human-driven car. Both scenarios, however, involved a similar fact pattern. In both, we informed the judges that they were presiding over a bench trial arising from an accident in which a taxi had struck a pedestrian. The materials indicated that the taxi company was "the first taxi service to incorporate some self-driving cars into its fleet in addition to its traditional person-driven cars."

In both studies, in the conditions in which the autonomous vehicle caused the accident, the materials described a vehicle that was "fully autonomous and navigate[d] without any human input"—what SAE International classifies as level five.[162] The materials explained that no human driver was present in the vehicle. We further stated that "extensive research and experience indicate that self-driving cars and person-driven cars have similar accident rates." As other research suggests, the distinction between fully and partially autonomous vehicles might matter,[163] but we studied only the fully autonomous vehicle.

In both studies, half of the judges read a version in which a human driver was operating the taxi at the time of the accident while the other half of the judges read a version in which

---

[161] Full copies of the materials we used in the two studies are included in the appendix.

[162] SAE INT'L, *SAE Standards News: J3016 automated-driving graphic update*, SAE.ORG (Jan. 7, 2019), https://www.sae.org/news/2019/01/sae-updates-j3016-automated-driving-graphic [https://perma.cc/9UXF-JA4A].

[163] *See* Awad et al., *supra* note 74 (testing reactions to various levels of automated vehicles).

a self-driving car was operating the taxi. The taxi struck the pedestrian because glare off of a mirrored building fooled either the driver's eyes or the sensors of the self-driving taxi.

In Study 1, the materials indicated that the pedestrian was partly to blame for the accident. The materials stated: "The plaintiff was jaywalking when she briefly glanced at her smart phone to confirm that her daughter had arrived home safely after school when the self-driving taxi drove straight into her without braking." Thus, the accident arose both from the plaintiff's inattention and the taxi's failure to stop. In this variation, we indicated that "[t]he plaintiff was not seriously injured. She suffered a severely sprained ankle, extensive bruising, and lacerations. She is suing to recover several thousand dollars in medical bills and lost wages, as well as pain and suffering."

Study 1 also included another variation. In the materials we used in Minnesota and Texas, we gave the driver one of three names: Brad, Bonnie, or DeShawn. Our intent was to suggest a race and gender by the name, with Brad being a white male, Bonnie being a white female, and DeShawn being an African-American male. The materials we used in Ohio simply referred to the driver as a human driver and did not provide a name.

In Study 1, we asked judges to assign a percentage of fault to both the plaintiff and the defendant. Minnesota, Ohio, and Texas all use a form of comparative negligence. In Minnesota and Ohio, the plaintiff may not recover if found to be more at fault than the defendant. In Texas, the plaintiff may not recover if found to be more than 50% at fault (which amounts to the same system as Minnesota and Ohio in a case in which there are only two parties potentially at fault). In all three jurisdictions, the degree of fault attributable to the plaintiff reduces the plaintiff's recovery. The materials reminded the judges that if they attributed more than 50% of the blame to the plaintiff, the plaintiff would recover nothing. The materials then asked for a percentage allocation of fault to both the plaintiff and the defendant (which should sum to 100%). We did not ask these judges to determine a damage award.

In Study 2, the materials made it clear that the defendant taxi company was liable and the judges only needed to determine a compensatory damage award. The materials indicated that the taxi struck the pedestrian in a crosswalk and then stated that, "[t]he parties have stipulated that the defendant is fully liable for the accident." The materials then described the extent of the plaintiff's injuries. These included acute problems after the accident such as "cervical and thoracic strain and a severe concussion," as well as memory problems. The materials also indicated that the symptoms had persisted and interfered with the plaintiff's ability to function at home and at work. The materials stated: "The defendant does not dispute that the plaintiff's injuries were caused by the accident, but it argued that the injuries are not serious, and do not warrant a significant damage award." The materials noted that the parties have settled all "medical expenses and economic losses, including lost wages" and that the "only remaining issue in the lawsuit was the amount of damages the plaintiff should receive for pain and suffering." Finally, the materials asked the judges to determine a compensatory damage award for pain and suffering and reminded them again that either a human or a self-driving car caused the accident.

C. *Results of Study 1: Fault*

Of the 531 judges in this study, thirteen did not respond: ten in the self-driving condition, and one in each of the Bonnie, DeShawn, and the unnamed human conditions.[164] Proportionally more judges in the self-driving condition did not respond (4.6%, or 10 out of 217) than in the combined human conditions (1.0%, or 3 out of 314).[165] This difference in response rates

---

[164] In all cases, the fault attributed to the plaintiff and defendant added up to 100% except for one Minnesota judge who assigned 51% to the plaintiff and 50% to the defendant (in the Brad condition) and one Minnesota judge who assigned 33% to the plaintiff and 66% to the defendant (in the Bonnie condition).

[165] Three of the judges simply put check-marks next to the plaintiff box. We scored these judges as having not responded. One judge only provided the plaintiff's fault (51%); for this judge, we treated the defendant's fault as 49%.

was modest but statistically significant.[166] The novelty of the self-driving condition might have made the evaluation somewhat more difficult for judges, thereby leading more judges to decline to respond.

Judges attributed more fault to the self-driving car than to the human-driven car. Judges evaluating the self-driving car attributed an average of 52% of the fault for the accident to the operator of the car, as comparted to 43% among the judges evaluating the human-driven car. This difference was statistically significant.[167] Furthermore, 67% of the judges evaluating the self-driven car assigned at least half of the fault to the driver—which meant that the pedestrian would recover some award. By contrast, only 51% of the judges evaluating the human-driven car assigned at least half of the fault to the driver. That difference was also statistically significant.[168]

The analysis of the differently named drivers revealed some bias against Bonnie. Analysis of the Texas and Minnesota judges (in which we compared the self-driving car to the three named drivers), showed a significant effect of the identity of the driver on the percentage of fault attributed to the defendant overall.[169] Post hoc analysis of these data using Scheffé's test showed that the self-driving condition differed significantly from Brad and DeShawn, but not from Bonnie, and that none of the named drivers differed significantly from each other. A greater percentage of the Texas and Ohio judges also assigned more than half of the fault to the self-driving defendant (67%, or 108 out of 161) than to Brad and DeShawn.[170] Bonnie, however, was statistically indistinguishable from the self-driving car.[171] A statistically significantly greater percentage of the judges who evaluated Bonnie exceeded the 50% threshold

---

[166] Fisher's Exact Test, $p < 0.001$.

[167] $t(516) = 4.08$, $p < 0.001$.

[168] Fisher's Exact Test, $p < 0.0001$.

[169] One-way ANOVA. $F(3, 429) = 5.92$, $p < 0.001$.

[170] Fisher's Exact Test, $p = 0.001$ and $p = 0.014$ for Brad and DeShawn, respectively.

[171] Fisher's Exact Test, $p = 0.58$.

than judges who evaluated Brad.[172] Although the data showed a similar trend to hold Bonnie more accountable than DeShawn, this difference was not statistically significant.[173] Table 2 reports these results.

Statistic (sample size)	**Autonomous (161)**	**Brad (88)**	**Bonnie (86)**	**DeShawn (98)**
Average % fault*	52	39	47	43
% D ≥50% fault**	67	43	60	49

Table 2: Fault Attribution[174]

* Average percentage of fault attributed to the Defendant

** Percent of judges who found the Defendant more than 50% at fault by condition and sample size among judges in Minnesota and Texas

Analysis of the demographic variables (experience, gender, political orientation) revealed no significant main effects or interactions either on the percentage of fault or the binary measure of whether the judge attributed more than 50% of the fault to the plaintiff.[175]

The main result is that judges attributed more responsibility to the taxi when it was driven by the autonomous pilot than by the human driver. Relatedly, the plaintiff was more likely to be able to recover within the comparative negligence system when the defendant was an autonomous rather than a human

---

[172] Fisher's Exact Test, $p = 0.02$.

[173] Fisher's Exact Test, $p = 0.14$.

[174] The Ohio judges read a version in which the name of the human driver was not identified and are thus not reported in this table.

[175] For each of the demographics, we conducted an analysis of variance of the fault variable on the identity of the driver (human or self), the demographic parameter (experience, gender, political orientation) and an interaction. The binary measure of whether the judge assigned more than 50% fault to the plaintiff was analyzed using logistic regression. None of the main effects of the demographic variables were significant and neither were the interactions with the condition for either variable.

driver. Furthermore, judges also found more fault with the human driver named Bonnie than with DeShawn or Brad. Although not the main target of our study, that result shows how implicit biases can also affect judges evaluating a woman working in a historically male-dominated profession. The bias expressed against Bonnie might also reflect judicial adherence to an age-old sexist trope about the abilities of female drivers.[176]

D. Results of Study 2: Damages

Many of the 436 judges in Study 2 did not provide a response: 43 out of 215 (20%) of the judges did not respond in the self-driven condition and 54 out of 221 (24%) did not respond in the human-driven condition. The difference in response rates was not significant.[177]

The results show that the judges treated the injury caused by the self-driving car as more serious than the injury caused by the human-driven car, although the effect was subtle. The judges granted a much higher average award in the self-driving condition than in the human-driven condition: $330,000 versus $256,000.[178] The data were highly positively skewed, however, making the average a somewhat unreliable indicator influenced upward by a small number of notably high awards. The median in both conditions was $100,000, but the data revealed important differences in the extremities. At the low end, nine judges in the self-driving condition awarded nothing (6%), as compared to twenty-one judges (13%) in the human-driven condition. This difference was statistically significant.[179] The tenth percentile of awards was $10,000 in the self-driving condition as compared to $0 in the human-driven condition. The judges evaluating the self-driving taxi likewise produced larger

---

[176] *See* Carol M. Sanger, *Girls and the Getaway Car: Cars, Culture, and the Predicament of Gendered Space*, 144 U. PA. L. REV. 705, 708 (1996) ("The very phrase 'women drivers' refers not to women who drive but absent-minded femmes at a loss behind the wheel of such a big machine.").

[177] Fisher's Exact Test, $p = 0.30$. Many of the judges noted that they felt the materials did not provide enough information.

[178] We rounded all summary statistics to the nearest thousand throughout.

[179] Fisher's Exact Test, $p = 0.04$.

awards than the human-driven condition, with twenty-three (13%) judges in the self-driving condition awarding one million dollars or more, as compared to fifteen (9%) in the human-driven condition. This difference was not statistically significant, however.[180] The ninetieth percentile of awards was $1,000,000 in the self-driving condition as compared to $750,000 in the human-driven condition.

To facilitate a comprehensive analysis that best fit these data, we conducted a Tobit regression on the fourth root, because the fourth root provided the best approximation of a normal distribution and because of the many zero awards.[181] We also clustered on judge type because the average and median awards varied notably among the different groups of judges.[182] The result produced a significant effect of the type of driver.[183]

The demographic variables influenced the awards somewhat. Female judges awarded slightly more than male judges,[184] although this trend was only marginally significant,[185] and the gender of judges did not interact with the condition significantly.[186] The 135 judges who identified as Democrats awarded more than the 86 who identified as Republicans: averages of

---

[180] Fisher's Exact Test, $p = 0.23$.

[181] We tested for skewness and kurtosis of the damage awards for the raw data and every root up to the sixth. Only at the fourth root can we fail to reject the hypothesis that the data are skewed or suffer from kurtosis at the 0.05 level.

[182] The Ohio, Federal, Canadian, New York, and Texas judges produced average awards of $209,000, $375,000, $118,000, $544,000, and $293,000, respectively. The median awards were $50,000, $175,000, $55,000, $250,000, and $100,000, respectively.

[183] $t = 2.73$, $p = 0.007$. The average of the fourth root of the awards was 3.28 versus 3.00 in the self and human driving conditions, respectively.

[184] The average and median award among the 136 judges who identified as female was $378,000 as compared to $278,000 among the 134 judges who identified as male. The medians did not differ.

[185] This analysis was conducted by using a Tobit regression on the fourth root of awards, as above, but with additional variables to code for gender and an interaction between gender and condition. In this analysis, gender was not significant. $t = 1.66$, $p < .10$.

[186] $t = 1.07$, $p = 0.29$.

$420,000 versus $266,000, and medians of $100,000 versus $95,000, respectively. This difference was not statistically significant, however.[187] The experimental manipulation had a much bigger effect on Republicans than Democrats, and this interaction was significant.[188] Finally, the years of experience of the judges correlated positively and statistically significantly with award size.[189] This effect interacted marginally significantly with the condition; the influence of the condition declined among the judges with more experience.[190]

III. Discussion: Judicial Bias Against Autonomous Vehicles

These results showed judges to be biased against autonomous vehicles. They reacted more negatively to an autonomous vehicle that had been involved in a car accident than to a human-driven vehicle involved in an essentially identical accident. When comparing the fault of a driver and a careless pedestrian, the judges in our study allocated more fault to the vehicle when it was automated than when a human was behind the wheel. Furthermore, judges awarded a larger amount in compensatory damages for exactly the same injury to a pedestrian struck by a self-driving car than to a pedestrian struck by a human-driven car. We explore the interpretation of these results and their implications below.

---

[187] $t = 0.20$, $p > 0.50$. This analysis was similar to that of gender.

[188] $t = 2.015$, $p < 0.05$. Democrats awarded an average of $430,000 and a median of $100,000 in the self-driving condition versus an average and median of $409,000 and $100,000 in the human-driven condition. In contrast, Republicans awarded an average of $365,000 and a median of $100,000 in the self-driving condition versus an average of $172,000 and a median of $55,000 in the human-driven condition.

[189] $t = 3.64$, $p < 0.001$. This analysis was similar to that of gender, except that experience was a continuous, rather than a binary variable. We did not include the new judges in Texas in this analysis because none of them had judicial experience. Including them would create a serious confound, in that virtually all the inexperienced judges would also consist of all of the judges from Texas.

[190] $t = 1.89$, $p = 0.06$.

A. Interpreting the Results

The results of both studies dovetail with the skepticism people express towards automated vehicles. In particular, these results are consistent with evidence that the public will demand that autonomous vehicles be vastly safer than human-driven vehicles.[191] Judges also seem to expect more safety from automated vehicles and will hold those who use them to a greater degree of responsibility than human drivers.

Although the only difference between the conditions in both studies was the identity of the driver, the difference we observed between the conditions might have different causes. In Study 1, ascribing more responsibility to the automated vehicle might have reflected judicial recognition of the superior ability of the automated vehicle to avoid accidents. Experts agree that self-driving cars will be substantially safer than human-driven vehicles.[192] The judges might reasonably have thought that the autonomous vehicle's failure to avoid an accident was more blameworthy, or at least had a different moral overtone. A short moment of inattention is all that is required for a human driver to cause a serious accident. By contrast, an accident caused by an autonomous vehicle is apt to be the result of decisions or omissions made by a team of software engineers who might have improperly tested the vehicle.[193] Thus, judges might reasonably treat these differently.

The results of this study are strikingly different than the studies in which a human driver and an autonomous system shared the operation of a vehicle and caused an accident. As discussed above, several such studies show that people often blame the human driver more in that context.[194] All of those

---

[191] Liu et al., *supra* note 72, at 238.

[192] *See* Geistfeld, *supra* note 45, at 1615.

[193] *See* Elin Pollanen et al., *Who Is to Blame for Crashes Involving Autonomous Vehicles? Exploring Blame Attribution Across the Road Transport System*, 63 ERGONOMICS 525, 525 (2020) (reporting survey results showing that "crashes involving fully autonomous vehicles, vehicle users received low blame while vehicle manufacturers and the government were highly blamed.").

[194] *See supra* notes 149-152 and accompanying text.

studies, however, assessed the comparative fault of a human and autonomous system behind the wheel of the same car. People seem to think that the autonomous system is superior, and hence a human who overrides it or fails to operate it properly is more at fault than the system. In contrast, we compared the fault of a driver to that of a pedestrian. Perhaps because people expect more from autonomous systems, judges seem to expect that self-driving cars will be more careful than humans in avoiding harm to even negligent pedestrians.

The disparity in the compensatory damages awarded to the blameless pedestrian in Study 2 is more remarkable. The compensatory award should depend on the extent of the injury, and the pedestrian suffered exactly the same injury in both conditions. Nevertheless, judges awarded the pedestrian more when struck by the autonomous vehicle. The disparity we observed might have several different causes.

First, any of the cognitive processes we described (normality bias, naturalness bias, betrayal aversion, availability heuristic, algorithm aversion, and anti-corporate bias) could have made the accident caused by the autonomous vehicle seem worse. The disparity is strikingly similar to the more extreme reaction people have to injuries caused by artificial versus natural sources.[195]

A second possibility is that judges might have thought that the autonomous vehicle inflicted more harm on the pedestrian than the self-driving car. Human drivers often brake at the last minute before an accident, thereby reducing their speed.[196] In the reported accidents involving autonomous vehicles, however, they did not process the hazard and did not brake. Judges might thus have thought that the accident involving the autonomous vehicle involved a greater speed. Although we described the injury in some detail, judges might have felt that the

[195] *See supra* notes 90-93 and accompanying text.

[196] *See* Calvin Iper, *40% of Drivers Never Hit Their Brakes in a Crash*, SAFE BRAKING (June 3, 2013), http://www.safebraking.com/40-percent-of-drivers-never-hit-their-brakes-during-a-crash [https://perma.cc/2T7G-5772] (reporting that 40% of drivers never hit their brakes in a crash; meaning that 60% do).

autonomous car did more damage than the human-driven car. That said, we summarized the most salient aspects of the injury, and we described both of the accidents and the injuries using identical text.

Finally, a third possible explanation is that the same kind of moral reasoning that influenced the first study might have been at work in the second as well. As happened in the first study, judges might have attributed more fault for the accident to the autonomous vehicle than the human-driven vehicle. If so, then judges likely would have wanted to punish the owner of the autonomous vehicle more harshly than they would have wanted to punish the owner of the human-driven vehicle. Even though we did not ask the judges to consider awarding punitive damages, some studies show that mock jurors award more in compensatory damages when they feel the defendant is more culpable for the injury.[197] Judges should know better, but as we have often found, they often behave much like jurors.[198]

The disparity we observed cannot be explained by a difference in wealth between the defendants in the two conditions. Judges might be willing to award more in damages against a wealthier defendant,[199] but in our study the defendant in both conditions was a taxi company that owned both the autonomous and human-driven vehicles.

The brevity of our materials necessarily omitted some contextual considerations that might have affected the results. In a

---

[197] *See* Edith Greene, David Coon & Brian Bornstein, *The Effect of Limiting Punitive Damage Awards*, 25 LAW & HUM. BEHAV. 217, 220 (2001) ("[D]efendant-focused concerns can cross over into the assessment of compensatory damages.").

[198] *See* Andrew J. Wistrich, Jeffrey J. Rachlinski & Chris Guthrie, *Heart Versus Head: Do Judges Follow the Law or Follow Their Feelings?*, 93 TEX. L. REV. 855, 911 (2015) ("By design, the justice system is a human process, and, like jurors, judges are influenced by their emotions to some degree, even when we would prefer that they were not . . . .").

[199] *See* Hans & Ermann, *supra* note 111, at 153 ("It is commonly claimed that juries award plaintiffs who sue corporations larger sums of money because the jurors believe that the corporations, with their 'deep pockets,' can afford more.").

full-length trial, a defendant would surely look to convince the judge or jury that they deserve credit for adopting a technology that avoids human error. Such efforts might prompt judges to view a case more favorably. Previous research, however, shows that defendants might struggle to convince judges that cost-effective safety precautions should exonerate them from liability.[200] Similarly, in our experiments, the blinding flash that triggered the collision occurred suddenly and unpredictably. Whether our results would hold if there was a possibility of anticipating and safeguarding against the precipitating event is debatable. In one study, a scenario that afforded the driver such an opportunity resulted in the allocation of greater blame to a human than to an autonomous vehicle, perhaps because the participants assumed that a human would have a greater ability to anticipate and adapt.[201]

We also did not describe other aspects of the accident, such as how the human driver or the autonomous vehicle reacted to the collision. This might matter. If the autonomous vehicle simply continued on its route after an accident, people might judge it harshly—just as they would a human driver who fled an accident scene. One study shows "that appropriate post-collision behavior substantially influences people's evaluation of the underlying crash scenario."[202] The study also reported that "people clearly think that automated vehicles can and should record the accident, stop at the site, and call police."[203]

The effects we have observed might be transitory. Some heuristics or biases prejudicing judges against autonomous vehicles could dissipate with time as artificial intelligence and robotics become more ubiquitous and accepted. Assuming that autonomous vehicles perform well and become commonplace,

---

[200] *See* W. Kip Viscusi, *How Do Judges Think About Risk?*, 1 AM. L. & ECON. REV. 26, 59 (2000) (reporting evidence that judge's decisions are often "out of line with standard law and economics prescriptions . . . .").

[201] Zhang et al., *supra* note 138, at 5-6.

[202] Sebastian Krugel, Matthias Uhl & Bryn Balcombe, *Automated Vehicles and the Morality of Post-Collision Behavior*, 23 ETHICS & INFO. TECH. 691, 691 (2021).

[203] *Id.*

the differences we have observed might diminish or disappear. On the other hand, "[t]he first representation of automated driving seems to be crucial and could be very difficult to change over time."[204]

Our scenarios required judges to engage in some imagination. We described a taxi that used full automation technology in which a human operator is unnecessary—something that might not be widely available for some time. While extreme in this respect, our scenarios remain relevant. Most believe that full autonomy "is inevitable."[205] As NHTSA itself has stated, "self-driving vehicles ultimately will integrate into U.S. roadways by progressing through six levels of driver assistance technology advancements in the coming years."[206] Thus, although our materials are still the stuff of science fiction, we believe that they shed light on how judges will respond to this new technology.

Judicial intuitions about automobile accidents had other effects on their judgments in our research. We also found that the judges treated the female driver more harshly, suggesting that judges are generally willing to indulge their implicit biases in automobile accident cases. The result is consistent with our finding in other contexts that sexist stereotyping influences judges.[207] Although our primary focus was to test whether judges' intuitive reactions to autonomous vehicles could burden the development of this new technology, the results have implications for how judges assess automobile accidents in general.

In sum, we found that judges assigned more fault to the autonomous vehicle than the human driver and awarded more in compensatory damages when the autonomous vehicle

---

[204] Payre et al., *supra* note 1, at 571.

[205] *See* MICHAEL WOOLDRIDGE, A BRIEF HISTORY OF ARTIFICIAL INTELLIGENCE: WHAT IT IS, WHERE WE ARE, AND WHERE WE ARE GOING 157 (2020).

[206] NHTSA, *supra* note 59.

[207] *See* Jeffrey J. Rachlinski & Andrew J. Wistrich, *Benevolent Sexism in Judges*, 58 SAN DIEGO L. REV. 101 (2021) (reporting that gender biases influence trial judges).

caused the accident. We reviewed a variety of alternative explanations and believe that bias against autonomous vehicles produced the effects we observed.

B. Implications

Our results suggest that autonomous vehicles will face a rough road in the court system. Although we did not ask for the kinds of rulings that will dictate the development of the law governing autonomous vehicles, the results show that judges are likely to demand more of autonomous vehicles than they do of human drivers. Judges will ultimately face questions such as: whether strict liability applies to autonomous vehicles; how fault should be apportioned between human plaintiffs and autonomous vehicles; and how courts should allocate responsibility between human and technology in partly autonomous systems in vehicles. These judgments have a moral component. If judges hold autonomous vehicles to a greater measure of responsibility, as they did in our study, they might also develop the law in a way that is overly restrictive, thus inhibiting the deployment and distorting the evolution of autonomous vehicles. Manufacturers of autonomous vehicles should expect judges to adopt rules that impose heightened degrees of liability on them.

This trend is already evident in Germany, albeit through legislative rather than judicial action. In its statute legalizing autonomous vehicles, Germany doubled the maximum liability limits for death or injury.[208] This suggests that the German government views autonomous vehicle crashes as more serious than human-driven vehicle crashes.

---

[208] Straßenvenkehrsgesetz [StVG] [Road Traffic Act] § 12(1), https://www.gesetze-im-internet.de/englisch_stvg/englisch_stvg.html [https://perma.cc/HYV9-WD2R] (Ger.). *See also* Markus Burianski & Christian M. Theissen, *Germany Permits Automated Vehicles*, JDSUPRA (June 24, 2017), https://www.jdsupra.com/legalnews/germany-permits-automated-vehicles-15610 [https://perma.cc/QU8K-QX3E] (describing one of the features of the law legalizing the use of autonomous vehicles as including a "100% increase in the maximum liability limits under the Road Traffic Act").

Our results also have implications for related technologies. Work is underway to replace airline pilots and ship captains with fully autonomous systems.[209] Our study suggests that harms caused by such autonomous entities may be punished more severely than otherwise identical incidents caused by human pilots or captains. Beyond transportation systems, medical robots also might be treated more harshly than human physicians who err in similar circumstances. Similarly, reliance on algorithms might expand an actor's liability, even though using algorithms often can make decisions more accurate. Judges' reactions to the failures of machines might depend on the type of technology being examined, but our study suggests that those who adopt autonomous technology will expose themselves to greater liability.

Our research also has implications for understanding how judges think. Previous studies show judges to be vulnerable to the same kind of errors in judgment as laypersons. Other research has shown that judges rely on simple but misleading cognitive strategies for thinking about cases, [210] favor female over male litigants,[211] are vulnerable to the influence of implicit biases,[212] and ignore precedent in favor of other extra-judicial factors.[213] Sympathy and empathy also affect judges[214]—a finding

---

[209] *See* Aristotelis Komianos, *The Autonomous Shipping Era Operational, Regulatory and Quality Challenges*, 12 INT'L J. MARINE NAVIGATION & SAFETY OF SEA TRANSP. 335 (2018) (autonomous ships); Thomas Pallini, *Airbus' Self-Flying Plane Just Completed Successful Taxi, Take-off, and Landing Tests, Opening the Door for Fully Autonomous Flight*, BUSINESS INSIDER (July 26, 2020), https://www.businessinsider.com/airbus-completes-autonomous-taxi-take-off-and-landing-tests-2020-7 [https://perma.cc/ED6E-CNKB] (autonomous planes).

[210] *See* Guthrie et al., *supra* note 8, at 829.

[211] *See* Rachlinski & Wistrich, *supra* note 207.

[212] *See* Jeffrey J. Rachlinski, Sheri Johnson, Andrew J. Wistrich & Chris Guthrie, *Does Unconscious Racial Bias Affect Trial Judges?* 84 NOTRE DAME L. REV. 1195, 1223 (2009) (reporting a study showing that "[i]mplicit associations influenced judges.").

[213] *See* Holger Spamann & Lars Klöhn, *Justice is Less Blind and Less Legalistic Than We Thought: Evidence from an Experiment with Real Judges*, 45 J. LEGAL STUD. 255 (2016).

[214] *See* Wistrich et al., *supra* note 198.

that might also have contributed to the result in the present study. Overall, the judicial treatment of autonomous vehicles is consistent with work showing judges to be vulnerable to a wide range of extra-legal influences.

The results of our studies also support the belief that judges disfavor new technologies in ways that can slow the adoption of such technologies. Even a choice to use a strict liability approach to autonomous vehicles will make it more costly for them to function. Whether judges consistently create adverse liability frameworks for new technologies is beyond the scope of our research. But imposing extra liability on technologies that save lives deters innovation and risks doing more harm than good. The results of these studies suggest that this might be the case for autonomous vehicles.

Should judges find some way of avoiding the biases they are expressing against autonomous vehicles? The disparity we observed is likely caused by excessive reliance on misleading intuitive reactions to new technology. Awareness of this phenomenon should alert judges to the danger and motivate them to attempt to overcome it. One study showed that a rational appeal reduces naturalness bias in college students choosing between natural and artificial drugs.[215] Our previous research suggests that when judges are aware of the potential misuse of a heuristic or susceptibility to a bias and highly motivated to avoid it, they are sometimes able to do so.[216] In addition, measures we have previously recommended elsewhere to promote deliberation rather than reflexive reliance on intuition—such as adequate nutrition and rest, reducing time pressure, obtaining feedback, opinion writing, etc.—reduce the potentially misleading impact of overreliance on intuition.[217] These efforts could allow judges to respond carefully to the accidents this novel technology will inevitably cause.

---

[215] Meier et al., *supra* note 88.

[216] *See* Rachlinski et al., *supra* note 212.

[217] *See* Chris Guthrie, Jeffrey J. Rachlinski & Andrew J. Wistrich, *Blinking on the Bench: How Judges Decide Cases*, 93 CORNELL L. REV. 1, 29-43 (2007) (reviewing these remedies).

On the other hand, maybe judges are rightly holding autonomous vehicles to a higher standard. Our recommendation that judges work to rely more heavily on careful deliberative responses, however, is no less compelling. Unlike jurors, judges can write judicial opinions that will allow them to explain why accidents caused by automated vehicles should be treated differently than accidents caused by human drivers. We did not test the efficacy of this technique in this study.[218] Nevertheless, careful deliberative explanations could either smoke out indefensible biases that would otherwise impede the development of a safer technology or allow judges to explain why this new technology should be treated differently.

Conclusion: Judges Versus a Brave New World

Most observers traditionally view the judiciary as a conservative branch of government, restraining the pace of societal evolution initiated by the popular will, the other branches of government, and technological changes. This is a function of the tendency to select relatively conservative people as judges and the precedent-based and hence (somewhat) past-oriented nature of adjudication. As one scholar famously observed: "Judges are concerned to preserve and to protect the existing order. This does not mean that no judges are capable of moving with the times or adjusting to changed circumstances. But their function in our society is to do so belatedly."[219] The research we presented in this Article showing that judges reacted towards autonomous vehicles with skepticism and negativity confirms that impression.

Our results suggest that, at least when an innovation is artificial, non-human, and a dramatic departure from existing practices, judges act as a brake, delaying and hindering its

---

[218] We have tested whether providing an explanation reduces reliance on misleading intuitions in judges and found no effect. Chris Guthrie, Jeffrey J. Rachlinski & Andrew J. Wistrich, *The "Hidden Judiciary": An Empirical Examination of Executive Branch Justice*, 58 DUKE L.J. 1477, 1504-05 (2009).

[219] J.A.G. GRIFFITH, THE POLITICS OF THE JUDICIARY 327-28 (4th ed. 1991).

adoption.[220] Ultimately, we are convinced that if autonomous vehicles prove successful and eventually become popular, consumers will adopt them. But mistaken judicial hostility toward innovative technologies—such as autonomous vehicles—risks unduly delaying or distorting them to the detriment of long-term public welfare.

---

220 In other contexts, judges might also be slow to adapt to technology by failing to impose liability. *See, e.g.*, Danielle Keats Citron, *Cyber Civil Rights*, 89 B.U. L. REV. 61, 67 (2009) (expressing concern that judges have been slow to address cyberbullying).

Appendix A: Stimulus Materials for Study 1: Fault

Automobile Accident

Imagine (in the near future) that you are presiding over a bench trial in which the plaintiff sued the defendant, Yellow Cab Inc. The plaintiff alleges that Yellow Cab is responsible for the negligent operation of one of its vehicles, which ran into her while she was crossing a street.

Yellow Cab is a state-of-the art company with all new vehicles. It is, in fact, the first taxi service to incorporate some self-driving cars into its fleet in addition to its traditional person-driven cars. Extensive research and experience indicate that self-driving cars and person-driven cars have similar accident rates. The self-driving cars are fully autonomous and navigate without any human input.

One of Yellow Cab's [**self-driving cars/cars, driven by a person, NAME**], picked up a passenger in a residential area and hit the plaintiff while on the way to the airport. The plaintiff was jaywalking when she briefly glanced at her smart phone to confirm that her daughter had arrived home safely after school when the self-driving taxi drove straight into her without braking. A sudden flash of light reflecting off of a building clad with mirrored glass fooled [**the self-driving car's sensors into perceiving the road as being clear/NAME's eyes into perceiving the road as being clear**].

The plaintiff was not seriously injured. She suffered a severely sprained ankle, extensive bruising, and lacerations. She is suing to recover several thousand dollars in medical bills and lost wages, as well as pain and suffering.

Minnesota comparative negligence law requires that you assess the responsibility of the parties (and a plaintiff may not recover if she is more responsible than the defendant).

What percentage of responsibility for the accident would you allocate to the parties? (The percentages must sum to 100%).

____ % Plaintiff

____ % Defendant

Appendix B: Stimulus Materials for Study 2: Damages

Automobile Accident

Imagine (in the near future) that you are presiding over a bench trial arising out of an automobile accident. The plaintiff is a 31-year-old male software programmer and the defendant is the Yellow Cab Company. The plaintiff alleges that Yellow Cab is responsible for the negligent operation of one of its vehicles, which ran into him while he was crossing a street in a crosswalk.

Yellow Cab is a state-of-the art company with all new vehicles. It is, in fact, the first taxi service to incorporate some self-driving cars into its fleet in addition to its traditional person-driven cars. Extensive research and experience indicate that self-driving cars and person-driven cars have similar accident rates. The self-driving cars are fully autonomous and navigate without any human input.

One of Yellow Cab's [**self-driving cars/person-driven cars]** picked up a passenger in a residential area and hit the plaintiff. A sudden flash of light reflecting off of a building clad with mirrored glass fooled the [**self-driving car's sensors into perceiving the road as being clear/driver's eyes into perceiving the road as being clear**].

The parties have stipulated that the defendant is fully liable for the accident. The parties have settled the plaintiff's claims for medical expenses and economic losses, including lost wages. The only remaining issue in the lawsuit is the amount of damages the plaintiff should receive for pain and suffering.

The evidence concerning the nature and extent of the plaintiff's residual symptoms was reasonably clear. Shortly after the accident (it is now approximately two years later), the plaintiff was diagnosed with cervical and thoracic strain and a severe concussion. The effects of the concussion persisted for about a year, during which time the plaintiff experienced memory problems. The plaintiff suffered no other cognitive problems and the memory problems have not recurred.

Although the plaintiff's doctors originally concluded that he would recover fully within about a year, the symptoms resulting from the cervical and thoracic strain gradually plateaued. The plaintiff still has stiffness in his neck, which is annoying and causes him to experience severe headaches that are sometimes debilitating. The plaintiff also experiences numbness in his left hand if he works at the computer for more than a few hours at a stretch.

The plaintiff's job requires that he use a computer for several hours a day. Only the more severe headaches cause him to lose any notable time at work. He manages to work through the less severe headaches with the assistance of over-the-counter pain medication and the numbness in his left hand dissipates if he takes a short break. He testified that his pain makes it hard for him to function as a parent for his two children, making him short-tempered and tired. He complained that he is often unable to help his children with their homework or play sports with them.

Although his doctors have not identified any specific physical injury as the cause of the plaintiff's symptoms, he might have suffered some slight brachial nerve damage during the accident. Doctors expect that his stiffness, headaches, and numbness will persist.

The defendant does not dispute that the plaintiff's injuries were caused by the accident, but it argued that the injuries are not serious, and do not warrant a significant damage award.

How much would you award the plaintiff for pain and suffering for the accident caused by Yellow Cab's [**self-driving car/driver**]?

$____________