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Sharing the Costs of Artificial Intelligence: Universal No-Fault Social Insurance for Personal Injuries

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Sharing the Costs of Artificial Intelligence: Universal No-Fault Social Insurance for Personal Injuries

ABSTRACT

The twenty-first century is the artificial intelligence (AI) century. In the past few years, AI has become a familiar fixture of everyday life thanks to services like YouTube, Spotify, Netflix, and Alexa. Stock traders, doctors, insurance brokers, real estate agents, recruiters, artists, and even lawyers now rely on predictive tools powered by AI to perform their highly skilled—even creative—tasks. In the following decades, AI will continue to transform more fields and deliver astonishing advancements in convenience, comfort, safety, and security. At the same time, however, AI will bring about new challenges. AI will offend, disrupt, crash, breach, incite, injure, and even kill in unexpected ways. Unlike traditional injuries, tort law will have difficulty finding the injuries caused by highly sophisticated AI to be the fault of someone's negligence or some product's defect. Regulating AI ex ante will be increasingly difficult due to AI's growing complexity. As such, under current law, blameless victims of AI injuries are likely to bear all the burden of AI's negative externalities. Thus, to ensure the fair and sustainable development of AI, this Note proposes adopting a universal social insurance scheme modeled after New Zealand's accident compensation scheme that complements appropriate safety regulations. Specifically, this Note proposes a social insurance scheme that covers all personal injuries by accident, abolishes tort claims, and finances itself from general tax revenues. These features will ensure AI injuries are a collective responsibility, so AI can continue to grow and promote social progress with the public's full confidence.

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In Guido Calabresi's *Ideals, Beliefs, Attitudes, and the Law*, Calabresi presents a hypothetical scenario in which an imaginary community is offered a magical gift from an "evil deity" that will benefit the community at the expense of one thousand sacrificial lives.[1] Whether to accept the gift, however, is not the interesting issue, because real-world communities almost always accept the real-world gift.[2] The gift, of course, is a metaphor for technological innovations, like automobiles or the factory production process, which raise the standard of living while creating new sources of personal injuries.[3] The interesting issue is instead how to equitably allocate the cost of the gift.[4] Should the unlucky victims who incur technological injuries independently bear the burden? Or should other members of the community share the burden and, if so, how?

In the twentieth century, the US personal injury legal regime assigned the costs of technological injuries to those "at fault."[5] The basic principle of fault-based tort law was that a defendant who acted

1. GUIDO CALABRESI, IDEALS, BELIEFS, ATTITUDES, AND THE LAW: PRIVATE LAW PERSPECTIVES ON A PUBLIC LAW PROBLEM 1 (1985).

2. *See id.* at 2.

3. *See id.* at 1, 5.

4. *See id.* at 17.

5. *See* DAN B. DOBBS, PAUL T. HAYDEN & ELLEN M. BUBLICK, HORNBOOK ON TORTS § 9.1 (2d ed. 2016).

unreasonably, and thereby caused an injury, was liable for the damages.[6] Courts gradually extended rules[7] and admitted new doctrines[8] to more extensively shift costs from victims to injurers in situations where they found the traditional fault-based system did not compensate victims adequately. In select fields, legislatures also augmented or replaced tort law with regulatory regimes, such as the motor vehicle safety regime,[9] and with social insurance schemes, such as workers' compensation, to shift costs and prevent injuries.

While the allocation schemes of the twentieth century sufficed for the evil deity of technological innovations, can they respond adequately to twenty-first century challenges borne by the Artificial Intelligence (AI) "deity," the contemporary bearer of magical gifts? This Note argues that they cannot and proposes that—to properly allocate the cost of AI injuries—the United States should consider replacing the current tort regime with a universal no-fault social insurance scheme, in addition to appropriate AI regulations. Part I explains the benefits of AI, how it works, and what unique legal problems it presents. Part II analyzes the weaknesses of tort law and regulatory law, both generally and as applied to AI. Part III discusses no-fault social insurance for personal injuries, summarizing how New Zealand implemented a successful scheme and how a similar scheme may address AI injuries in the United States. Part IV concludes with a discussion on the implications of failing to develop AI in a fair manner in the United States.

I. THE IMPENDING AI REVOLUTION AND ITS SOCIAL COSTS

AI will transform the way people live in the twenty-first century. AI will raise the standard of living and has the potential to ameliorate the social inequities that result from human biases and errors.[10]

6. *See id.* §§ 9.5–.6.

7. *See, e.g.*, MacPherson v. Buick Motor Co., 111 N.E. 1050, 1053 (N.Y. 1916) (eliminating the privity requirement for claims of negligent product design).

8. *See, e.g.*, Greenman v. Yuba Power Prods., Inc., 377 P.2d 897, 900 (Cal. 1963) (establishing strict products liability).

9. *See, e.g.*, National Traffic and Motor Vehicle Safety Act of 1966, Pub. L. No. 89-563, 80 Stat. 718 (1966) (codified as amended in scattered sections of U.S.C.).

10. *See* Eric Rice & Milind Tambe, *Forget Killer Robots, AI as a Tool for Social Justice*, HUFFINGTON POST (Dec. 7, 2017, 10:11 AM), https://www.huffingtonpost.com/entry/forget-killer-robots-ai-as-a-tool-for-social-justice_us_5a2956a3e4b053b5525db7dd [https://perma.cc/MZB4-AVA3]; *see, e.g.*, Angela Chen, *How Artificial Intelligence Can Help Us Make Judges Less Biased*, VERGE (Jan. 17, 2019 12:07 PM), https://www.theverge.com/2019/1/17/18186674/daniel-chen-machine-learning-rule-of-law-economics-psychology-judicial-system-policy [https://perma.cc/ACE8-RMZF] (describing how machine learning algorithms can raise awareness of unconscious biases in judges). *But see, e.g.*, CATHY O'NEIL, WEAPONS OF MATH DESTRUCTION 13 (2016) (describing how algorithms have reinforced and amplified existing inequities in many areas of life,

However, the proliferation of AI will also lead to injuries that are not any human's fault.

A. The AI Revolution

AI will revolutionize society in the near future. For example, Elon Musk predicts that self-driving vehicles, one prominent application of AI, will replace conventional, human-operated vehicles by the year 2035.[11] Self-driving vehicles will facilitate car-sharing and driverless taxi services, optimize vehicle utilization, reduce the cost of transportation, and democratize mobility.[12] They will serve underserved populations, like the disabled, the elderly, and minors, who are unable to drive themselves.[13] When there is no demand for them, self-driving vehicles will park themselves away from city centers, returning valuable inner city parking space back to city planners for more productive uses like parks or developments.[14] Self-driving vehicles, being efficient drivers, will consume fuel more economically—thus contributing less carbon emissions.[15] They will potentially communicate with each other and with "smart grids" to coordinate routes, prevent traffic on a system-wide level, and reduce emergency vehicle response times.[16] They will free drivers from the dynamic

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including access to credit, school admissions, and job prospects); Karen Hao, *AI Is Sending People to Jail—and Getting It Wrong*, MIT TECH. REV. (Jan. 21, 2019), https://www.technologyreview.com/s/612775/algorithms-criminal-justice-ai/ [https://perma.cc/MMS6-MAL2].

11. *See* Cadie Thompson, *Elon Musk: In Less Than 20 Years, Owning a Car Will Be Like Owning a Horse*, BUS. INSIDER (Nov. 4, 2015, 7:16 AM), https://www.businessinsider.com/elon-musk-owning-a-car-in-20-years-like-owning-a-horse-2015-11 [https://perma.cc/TB4D-RX68]. Similar estimates have been made by a variety of authorities. For example, the United Arab Emirates aims to convert 25 percent of total transportation in Dubai to self-driving vehicles by 2030. *See Mohammed bin Rashid Approves Dubai Autonomous Transportation Strategy*, DUBAI FUTURE FOUND. (Apr. 25, 2016), https://www.dubaifuture.gov.ae/mohammed-bin-rashid-approves-dubai-autonomous-transportation-strategy/ [https://perma.cc/4QWJ-NTSQ]. *But see* Tim Higgins, *Driverless Cars Tap the Brakes After Years of Hype*, WALL ST. J. (Jan. 17, 2019, 10:00 AM), https://www.wsj.com/articles/driverless-cars-tap-the-brakes-after-years-of-hype-11547737205 [https://perma.cc/WZJ8-E3FK].

12. *See* Saeed Asadi Bagloee et al., *Autonomous Vehicles: Challenges, Opportunities, and Future Implications for Transportation Policies*, 24 J. MODERN TRANSP. 284, 289, 295 (2016); Michele Kyrouz, *Mobility for Everyone: The Social and Economic Benefits of Autonomous Vehicles*, MEDIUM (Nov. 28, 2017), https://medium.com/smart-cars-a-podcast-about-autonomous-vehicles/balancing-mobility-equity-and-traffic-concerns-bbb8d682c1c5 [https://perma.cc/UAR2-2RTA].

13. *See* JAMES M. ANDERSON ET AL., AUTONOMOUS VEHICLE TECHNOLOGY: A GUIDE FOR POLICYMAKERS 16 (2016).

14. *See id.* at 27.

15. *See id.* at 28; Jeffrey K. Gurney, *Sue My Car Not Me: Products Liability and Accidents Involving Autonomous Vehicles*, 2013 U. ILL. J.L. TECH. & POL'Y 247, 251 (2013).

16. *See* ANDERSON ET AL., *supra* note 13, at 23–24.

driving task and allow them to use their travel time more productively.[17] Most importantly, self-driving vehicles are never drunk, distracted, or willing to take irrational or emotional risks. Accordingly, they will prevent needless accidents and save lives.[18] All of these social benefits stem from a single AI product.[19] Experts predict similar extraordinary advances in living standards and equity within two to three decades in healthcare,[20] the food and agriculture industry,[21] education,[22] environmental conservation,[23] space exploration,[24] and more.[25]

Although two decades sounds like fantasy, it is not an unrealistic timeframe given the law of accelerating returns.[26] The law of accelerating returns is the observation and prediction that the development of technology has and will progress at an exponential rate.[27] Consider, for example, that early human technology, like fire

17. *See id.* at 25–26.

18. *See id.* at 15–16. A survey of accidents involving early stage self-driving vehicles testing in California revealed that out of sixty-two accidents that occurred while the vehicles were in autonomous mode, only one was due to AI error. *See* Kia Kokalitcheva, *People Cause Most California Autonomous Vehicle Accidents*, AXIOS (Aug. 29, 2018), https://www.axios.com/california-people-cause-most-autonomous-vehicle-accidents-dc962265-c9bb-4b00-ae97-50427f6bc936.html [https://perma.cc/K93A-AVXQ].

19. *See* ANDERSON ET AL., *supra* note 13, at 40.

20. *See* Nic Fleming, *How Artificial Intelligence Is Changing Drug Discovery*, NATURE (May 30, 2018), https://www.nature.com/articles/d41586-018-05267-x [https://perma.cc/38VX-2DQD]; Christianna Reedy, *Kurzweil: By 2030, Nanobots Will Flow Throughout Our Bodies*, FUTURISM (Apr. 24, 2017), https://futurism.com/kurzweil-by-2030-nanobots-will-flow-throughout-our-bodies [https://perma.cc/4G8R-X8GF].

21. *See* Krista Garver, *6 Examples of Artificial Intelligence in the Food Industry*, FOOD INDUSTRY EXECUTIVE (Apr. 11, 2018), https://foodindustryexecutive.com/2018/04/6-examples-of-artificial-intelligence-in-the-food-industry/ [https://perma.cc/KM7B-WDUY]; Kumba Sennaar, *AI in Agriculture—Present Applications and Impact*, EMERJ (Jan. 31, 2019), https://www.techemergence.com/ai-agriculture-present-applications-impact/ [https://perma.cc/QSA9-ZKSS].

22. *See* Tom Vanderbilt, *How Artificial Intelligence Can Change Higher Education*, SMITHSONIAN.COM (Dec. 2012), https://www.smithsonianmag.com/innovation/how-artificial-intelligence-can-change-higher-education-136983766/ [https://perma.cc/H84M-47PH].

23. *See* Renee Cho, *Artificial Intelligence—A Game Changer for Climate Change and the Environment*, COLUM. U. EARTH INST. (June 5, 2018), https://blogs.ei.columbia.edu/2018/06/05/artificial-intelligence-climate-environment/ [https://perma.cc/X783-NUVP].

24. *See* Abby Norman, *NASA: AI Will Lead the Future of Space Exploration*, FUTURISM (June 27, 2017), https://futurism.com/nasa-ai-will-lead-the-future-of-space-exploration [https://perma.cc/CWU8-USHP].

25. JAMES MANYIKA, MCKINSEY GLOB. INST., WHAT'S NOW AND NEXT IN ANALYTICS, AI, AND AUTOMATION 1 (2017), https://www.mckinsey.com/~/media/mckinsey/featured%20insights/digital%20disruption/whats%20now%20and%20next%20in%20analytics%20automation/final%20pdf/mgi-briefing-note-automation-final.ashx [https://perma.cc/4K3Q-2ZY4].

26. *See* RAY KURZWEIL, THE SINGULARITY IS NEAR 35 (2005); MURRAY SHANAHAN, THE TECHNOLOGICAL SINGULARITY, at xviii (2015).

27. *See* KURZWEIL, *supra* note 26, at 35.

and stone tools, took tens of thousands of years to spread after their discovery; the printing press, invented five hundred years ago, took about a century; and, recently, worldwide adoption of revolutionary technologies, like cellular phones and the internet, only took a few years.[28] Exponential growth occurs because each new invention or discovery makes it easier to develop the next thing.[29] The use of early-stage AI in certain fields has itself already accelerated the speed at which humans innovate.[30] Soon, AI will replace humans in scientific discovery[31] and even the arts,[32] leading to even faster development of smarter AI and an explosion in social welfare. The law must prepare now to respond to the AI revolution, or it will become dangerously obsolete.[33]

B. What Is AI?

AI, like many things, is a spectrum.[34] On the simplest end is the smart vacuum, the Roomba. A Roomba is intelligent in that it makes

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28. *See id.* at 42. The cost performance of computational power is famously growing at an exponential rate as well. *See id.* at 71.

29. *See id.* at 40.

30. *See* Ben Hattenbach & Joshua Glucoft, *Patents in an Era of Infinite Monkeys and Artificial Intelligence*, 19 STAN. TECH. L. REV. 32, 35 (2015); Patrick Riley & Dale Webster, *Large-Scale Machine Learning for Drug Discovery*, GOOGLE AI BLOG (Mar. 2, 2015), https://ai.googleblog.com/2015/03/large-scale-machine-learning-for-drug.html [https://perma.cc/38XE-LK6K].

31. *See generally* Hiroaki Kitano, *Artificial Intelligence to Win the Nobel Prize and Beyond: Creating the Engine for Scientific Discovery*, 37 AI MAG. 39, 39 (2016) (challenging the AI community to develop an AI system that will win the Nobel prize and predicting that it will).

32. *See, e.g.*, Gabe Cohn, *Up for Bid, AI Art Signed 'Algorithm,'* N.Y. TIMES (Oct. 22, 2018), https://www.nytimes.com/2018/10/22/arts/design/christies-art-artificial-intelligence-obvious.html [https://perma.cc/CK2D-8DE9] (visual arts); Tirhakah Love, *Do Androids Dream of Electric Beats? How AI Is Changing Music for Good*, GUARDIAN (Oct. 22, 2018, 9:00 AM), https://www.theguardian.com/music/2018/oct/22/ai-artificial-intelligence-composing [https://perma.cc/8X36-QUHZ] (music); David Streitfeld, *Computer Stories: A.I. Is Beginning to Assist Novelists*, N.Y. TIMES (Oct. 18, 2018), https://www.nytimes.com/2018/10/18/technology/ai-is-beginning-to-assist-novelists.html [https://perma.cc/PU8Z-QSZB] (literary arts).

33. *See* Kelsey R. Marquart, *If We Don't Regulate Automation, It Could Decimate the U.S. Economy*, FUTURISM (Apr. 14, 2017), https://futurism.com/if-we-dont-regulate-automation-it-could-decimate-the-u-s-economy [https://perma.cc/44DZ-PSDW].

34. *See* Michael Guihot, Anne F. Matthew & Nicolas P. Suzor, *Nudging Robots: Innovative Solutions to Regulate Artificial Intelligence*, 20 VAND. J. ENT. & TECH. L. 385, 396 (2017). Defining AI is one of the most fundamental challenges of AI law. *See* Matthew U. Scherer, *Regulating Artificial Intelligence Systems: Risks, Challenges, Competencies, and Strategies*, 29 HARV. J.L. & TECH. 353, 359 (2016). Perhaps this difficulty is only natural since delineating the contours of "person" has been similarly intractable. *See* SAMIR CHOPRA & LAURENCE F. WHITE, A LEGAL THEORY FOR AUTONOMOUS ARTIFICIAL AGENTS 183 (2011) (discussing the jurisprudence of personhood for slaves and corporations); Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1284–85 (1992) (discussing the debates over legal personhood in fringe cases like higher mammals, individuals with Dissociative Identity Disorder, comatose persons, fetuses, and trees).

independent decisions—to turn, to stop, and to return to its base—without direct human control.[35] A Roomba is able to do this thanks to sensors, which detect when the Roomba has hit a wall or reached a cliff, and a basic *set of rules*, written by the Roomba's programmer, which dictate the Roomba's response to each kind of stimulus.[36] A Roomba, however, is not able to change the rules that govern its actions.

An image recognition software that identifies faces is an example of a slightly more sophisticated, learning AI.[37] An image recognition software is not pre-programmed with a set of rules to follow.[38] It instead has a machine learning algorithm, which takes a large set of training images labeled by human trainers and generates *its own rules* for predicting the correct label of a new image.[39] After training, the software can recognize faces in a never-before-seen image.[40] If a human labels the new image for the algorithm, the software can update its rules to reflect the additional information.[41] Learning AI thus have two important traits: (1) their rules are not hardcoded by a human and (2) their rules continue to change even after they have left the programmer's control.[42] Because they do not simply

35. *See* Julia Layton, *How Robotic Vacuums Work*, HOWSTUFFWORKS (Nov. 3, 2005), https://electronics.howstuffworks.com/gadgets/home/robotic-vacuum2.htm [https://perma.cc/SX5D-JAGA].

36. *See id.*

37. *See* Warren E. Agin, *A Simple Guide to Machine Learning*, 14 SCITECH LAW. 4, 7 (2017).

38. *See id.* For example, there is no rule programmed into the machine that tells the machine that a person with long hair may be a girl. *See id.*

39. *See id.*; Chris Meserole, *What Is Machine Learning?*, BROOKINGS INST. (Oct. 4, 2018), https://www.brookings.edu/research/what-is-machine-learning/ [https://perma.cc/99L4-EPBU]. The machine learning algorithm itself *is* hard-coded by a programmer. *See generally* CHRISTOPHER M. BISHOP, PATTERN RECOGNITION AND MACHINE LEARNING 2 (Michael Jordan et al. eds., 2006). There are many machine learning algorithms that the programmer may choose, ranging from statistical algorithms to artificial neural networks. *See id.* at 3; Joe Davison, *No, Machine Learning Is Not Just Glorified Statistics*, TOWARDS DATA SCI. (June 27, 2018), https://towardsdatascience.com/no-machine-learning-is-not-just-glorified-statistics-26d3952234e3 [https://perma.cc/5PVP-YLY3]. Each kind of algorithm *does* require a programmer to make design choices, which affect how a machine learns. *See generally* BISHOP, *supra*, at 33–34. For example, if the algorithm is learning a neural network, then the programmer typically chooses the number of "layers" and "neurons" on the basis of some engineering principles and experience. *See id.* at vii, 32, 229. However, the fundamental characteristic of learning AI, that they learn rules independently, is true in all of these algorithms. *See id.* at 1. Furthermore, new techniques are quickly being developed to take even the engineering task away from humans. *See* Janakiram MSV, *Why AutoML Is Set to Become the Future of Artificial Intelligence*, FORBES (Apr. 15, 2018), https://www.forbes.com/sites/janakirammsv/2018/04/15/why-automl-is-set-to-become-the-future-of-artificial-intelligence/#52622726780a [https://perma.cc/R235-VBEA].

40. *See* Agin, *supra* note 37, at 7.

41. *See id.*

42. *See id.*

do what they were programmed to do, this kind of AI will challenge existing legal doctrines.[43]

C. The Social Cost of AI

While AI will provide exciting benefits, it will do so at the cost of highly unpredictable injuries. AI causes unpredictable injuries because of its ability to exhibit surprising behavior, also known as emergent behavior, which is itself a product of AI's aforementioned ability to learn rules from training data autonomously.[44] Usually, making a startling discovery—or, as marketers call it, an insight—is one of the key features of using AI.[45] But emergent behavior can also have appalling consequences, like when Google Photos labeled two black people as gorillas[46] or when Microsoft's chatbot turned into a sex-crazed neo-Nazi.[47] Facebook's algorithms, which have the purported purpose of helping people share valuable content and bring the world closer together, have instead spread fake news, trapped people in echo chambers, and incited hate and violence.[48] Since these AI are not

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43. *See* Curtis E.A. Karnow, *The Application of Traditional Tort Theory to Embodied Machine Intelligence*, *in* ROBOT LAW 51, 52 (Ryan Calo et al. eds., 2016).

44. *See id.* at 57.

45. *See* Ryan Calo, *Is the Law Ready for Driverless Cars?*, 61 COMM. ACM 34, 36 (2018); *see, e.g.*, Jody Kochansky, *The Promise of Artificial Intelligence and What It Means to BlackRock*, BLACKROCK: BLOG, https://www.blackrockblog.com/2018/03/08/artificial-intelligence-blackrock/ [https://perma.cc/6YJ5-63LJ].

46. *See* Alistair Barr, *Google Mistakenly Tags Black People As 'Gorillas,' Showing Limits of Algorithms*, WALL ST. J.: DIGITS BLOG (July 1, 2015, 3:40 PM), https://blogs.wsj.com/digits/2015/07/01/google-mistakenly-tags-black-people-as-gorillas-showing-limits-of-algorithms/ [https://perma.cc/EZA9-99PH]; Tom Simonite, *When It Comes to Gorillas, Google Photos Remains Blind*, WIRED (Jan. 11, 2018, 7:00 AM), https://www.wired.com/story/when-it-comes-to-gorillas-google-photos-remains-blind/ [ttps://perma.cc/9FWD-RSYY].

47. Rachel Metz, *Why Microsoft Accidentally Unleashed a Neo-Nazi Sexbot*, MIT TECH. REV. (Mar. 24, 2016), https://www.technologyreview.com/s/601111/why-microsoft-accidentally-unleashed-a-neo-nazi-sexbot/ [https://perma.cc/2S3X-G8M2].

48. *See* JANNA ANDERSON & LEE RAINIE, PEW RESEARCH CTR., THE FUTURE OF TRUTH AND MISINFORMATION ONLINE 8, 17, 46 (2017), http://assets.pewresearch.org/wp-content/uploads/sites/14/2017/10/19095643/PI_2017.10.19_Future-of-Truth-and-Misinformation_FINAL.pdf [https://perma.cc/NNQ7-R78T]; Michal Lavi, *Evil Nudges*, 21 VAND. J. ENT. & TECH. L. 4, 6 n.14, 93, n.673 (2018); Carole Cadwalladr, *'I Made Steve Bannon's Psychological Warfare Tool': Meet the Data War Whistleblower*, GUARDIAN (Mar. 18, 2018, 5:44 AM), https://www.theguardian.com/news/2018/mar/17/data-war-whistleblower-christopher-wylie-faceook-nix-bannon-trump [https://perma.cc/TC8Y-5NJ9]; Carole Cadwalladr & Emma Graham-Harrison, *How Cambridge Analytica Turned Facebook 'Likes' into a Lucrative Political Tool*, GUARDIAN (Mar. 17, 2018, 9:02 AM), https://www.theguardian.com/technology/2018/mar/17/facebook-cambridge-analytica-kogan-data-algorithm [https://perma.cc/E4YG-WAJZ]; Amanda Taub & Max Fisher, *Where Countries Are Tinderboxes and Facebook Is a Match*, N.Y. TIMES (Apr. 21, 2018), https://www.nytimes.com/2018/04/21/world/asia/facebook-sri-lanka-riots.html [https://perma.cc/77T8-MWJR].

executing specific instructions given to them by any human, it is not obvious who, if anybody, is responsible for such injuries, at least the first time the injury occurs.[49]

Unexpected interactions between sophisticated AI systems can amplify the effects of emergent behavior. For example, high-frequency trading algorithms acting independently of each other caused shocking market crashes in 2010 and 2015.[50] In fact, mini flash crashes are now an everyday occurrence for many stocks.[51] So far, computer scientists have not been able to develop a method to predict harmful emergent behavior ex ante; they have only been able to apply patches to problems ex post.[52] With respect to high-frequency trading, the stock exchanges have installed breakers to shut down trading in the event of an emergency and speed bumps to slow down trading; however, no technical solutions exist to prevent crashes, no financial regulations impose liability on algorithmic traders, and society is unwilling to give up the technology.[53] With advancements in mechanical engineering and robotics technology, AI machines—such as self-driving vehicles, surgery robots, and personal care robots—will begin to cause physical injuries that will similarly challenge programmers and policy makers.[54]

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49. *See* Agin, *supra* note 37, at 7. With respect to social media platforms, their executives have been subjected to congressional inquiries and some members of congress have voiced support for some kind of regulation, but no bills have been proposed to address responsibility for AI injuries yet. *See* Katy Steinmetz, *Lawmakers Hint at Regulating Social Media During Hearing with Facebook and Twitter Execs*, TIME (Sept. 5, 2018), http://time.com/5387560/senate-intelligence-hearing-facebook-twitter/ [https://perma.cc/G9A4-EKP9].

50. Ted Kaufman, *Preventing the Next Flash Crash: Why We're Still at Risk*, FORTUNE (May 5, 2016), http://fortune.com/2016/05/05/flash-crash-high-frequency-trading-risk/ [https://perma.cc/T5T4-XJDQ].

51. Alexander Munk & Erhan Bayraktar, *Opinion: The Stock Market Has About 12 Mini Flash Crashes a Day—and We Can't Prevent Them*, MKT. WATCH (July 31, 2017, 12:47 PM), https://www.marketwatch.com/story/the-stock-market-has-about-12-mini-flash-crashes-a-day-and-we-cant-prevent-them-2017-07-31 [https://perma.cc/KY3E-BQML].

52. *See, e.g.*, Kaufman, *supra* note 50 (noting that stock exchanges now automatically shut down upon flash crashes); Metz, *supra* note 47 (noting that Microsoft's chatbot was shut down); Simonite, *supra* note 46 (noting that Google Photos, unable to fix the problem of labeling black people as gorillas, simply eliminated gorillas from the universe of potential matches). One brute-force attempt to address emergent behavior is to test run the machine in a fake environment, though anticipating AI behavior through simulations has mathematical limitations. *See* Calo, *supra* note 45, at 36.

53. *See* Kaufman, *supra* note 50; Felix Salmon & Jon Stokes, *Algorithms Take Control of Wall Street*, WIRED (Dec. 27, 2010, 12:00 PM), https://www.wired.com/2010/12/ff-ai-flashtrading/ [https://perma.cc/A5Y4-7EBA]; Megan Woodward, Bumping Up the Competition: The Influence of IEX's Speed Bump in US Financial Markets 13–14, 19 (May 6, 2018) (unpublished manuscript), https://ssrn.com/abstract=3202843 [https://perma.cc/F8MA-UVD5]. The SEC's proposed regulation, Regulation Automated Trading, came close to regulating high-frequency trading, by requiring high-frequency traders to register with the Commodity Futures Trading Commission. *See id.* at 13–14.

54. *See* Calo, *supra* note 45, at 35; Drew Simshaw et al., *Regulating Health Care Robots: Maximizing Opportunities While Minimizing Risks*, 22 RICH. J.L. & TECH. 1, 15–23 (2016). Calo

As AI grows even more sophisticated, it will even become difficult to fix or understand AI behavior ex post facto.[55] In fact, inexplicable AI behavior already occurs on a small scale: Facebook's AI research team observed its experimental trade and negotiation AI develop their own incomprehensible language in order to hammer out deals with each other more efficiently.[56] Similarly, Google Translate, in order to translate one language to another, first translates the input language into its self-developed artificial language and then translates that to the target language.[57] Future AI will utilize even more sophisticated knowledge representation and reasoning powers. For example, consider an advanced AI vehicle fleet, equipped with the collective experience of millions of driving hours, and informed by superhuman sensors and smart grid data.[58] It is also able to discern the age, health, wealth, and criminal status of people on the road around it and apply that data to its culturally specific ethics training.[59] In the event of a fatal collision, this AI will have relied on complex, multifactor, machine-learned rules that are, in effect, impossible for humans to review or appreciate.[60] It will be even harder to appreciate, both legally and technically, this AI's mysterious decisions to reroute, delay, or make harmful maneuvers in order to preemptively avoid a worse outcome.[61]

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describes a hypothetical scenario in which a self-driving vehicle accidentally kills its owner by running its engine in the garage and suffocating the owner, because it learned that it has better gas mileage if it charges its battery overnight. *See* Calo, *supra* note 45, at 35.

55. *See* David C. Vladeck, *Machines Without Principals: Liability Rules and Artificial Intelligence*, 89 WASH. L. REV. 117, 127 (2014); John Pavlus, *A New Approach to Understanding How Machines Think*, QUANTA MAG. (Jan. 10, 2019), https://www.quantamagazine.org/been-kim-is-building-a-translator-for-artificial-intelligence-20190110/ [https://perma.cc/4E5B-KZ2L].

56. *See* Andrew Griffin, *Facebook's Artificial Intelligence Robots Shut Down After They Start Talking to Each Other in Their Own Language*, INDEPENDENT (July 31, 2017, 5:10 PM), https://www.independent.co.uk/life-style/gadgets-and-tech/news/facebook-artificial-intelligence-ai-chatbot-new-language-research-openai-google-a7869706.html [https://perma.cc/Z59S-2ZYE].

57. *See id.*

58. *See* Kevin Funkhouser, *Paving the Road Ahead: Autonomous Vehicles, Products Liability, and the Need for a New Approach*, 2013 UTAH L. REV. 437, 443–44 (2013); Vladeck, *supra* note 55, at 125–26.

59. *See* WENDELL WALLACH & COLIN ALLEN, MORAL MACHINES: TEACHING ROBOTS RIGHT FROM WRONG 16 (2008); Ajung Moon et al., *The Open Roboethics Initiative and the Elevator-Riding Robot*, *in* ROBOT LAW, *supra* note 43, at 131, 131–32; Zak Doffman, *Killer Cars and Four Other Terrifying Predictions for the Future of AI*, FORBES (Oct. 31, 2018, 10:03 AM), https://www.forbes.com/sites/zakdoffman/2018/10/31/five-ghoulish-big-brother-predictions-for-ai-given-its-halloween/#5857d2de308b [https://perma.cc/4RBT-9VTS]; Caroline Lester, *A Study on Driverless-Car Ethics Offers a Troubling Look into Our Values*, NEW YORKER (Jan. 24, 2019), https://www.newyorker.com/science/elements/a-study-on-driverless-car-ethics-offers-a-troubling-look-into-our-values [https://perma.cc/CTG2-UKEQ].

60. *See* WALLACH & ALLEN, *supra* note 59, at 86–91; Bryant Walker Smith, *The Trolley and the Pinto: Cost-Benefit Analysis in Automated Driving and Other Cyber-Physical Systems*, 4 TEX. A&M L. REV. 197, 207 (2017).

61. *See* Calo, *supra* note 45, at 35.

II. ANALYSIS OF EXISTING AND PROPOSED US LAW

Broadly, there are two regimes for assigning injury costs: private tort law and public regulatory law.[62] This Part reviews the unique challenges that AI will pose to both.

A. Private Tort Law

The two tort doctrines most relevant to AI injuries are negligence and products liability. Both causes of action require fault—either the unreasonable conduct of a defendant or the unreasonable design of a product.[63] Given that even the most careful AI programmers are unable to predict or completely prevent highly sophisticated AI injuries without removing AI's autonomy altogether, tort law will not find any person or product at fault and will consequently allocate injury costs to victims.[64] Some commentators have instead proposed extending various strict liability doctrines so that AI product designers are categorically responsible for AI injuries.[65] While this is an attractive solution for victims, this proposal goes too far in shifting the burden to designers because a strict liability regime would discourage the production of AI and its tremendous positive externalities. In addition to these allocative problems, the tort regime also suffers from various nonallocative flaws.

1. Negligence

In general, a defendant is liable for the cost of a plaintiff's injury if the plaintiff proves the defendant owed her a duty, breached that duty, and, as a result, proximately caused her injury.[66] In general, an individual only has a duty to act as a reasonable person.[67] A defendant's negligence is the proximate cause of an injury only if the injury was a foreseeable consequence of that negligence.[68] There are two kinds of negligence that are relevant to sophisticated AI injuries: negligent design and negligent use.

62. Injury costs can also be allocated by contract law to a certain extent. For a brief discussion on contracts, see F. Patrick Hubbard, *"Sophisticated Robots": Balancing Liability, Regulation, and Innovation*, 66 FLA. L. REV. 1803, 1817 (2014).

63. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, §§ 2.3–.4.

64. *See* Karnow, *supra* note 43, at 52.

65. *See* Hubbard, *supra* note 62, at 1865.

66. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, §§ 9.5–.6.

67. *See id.*; *cf.* § 10.5 (ordinary standard of care); *id.* § 10.17 (common carrier); *id.* § 11.1 (negligence per se).

68. *See id.* § 9.6.

a. Negligent Design

With negligent design, a product designer is liable for the costs of an injury related to her product if the victim establishes that the injury was proximately caused by the designer's specific unreasonable acts or omissions in the process of designing the product.[69] Whether the designer acted unreasonably is substantially informed by industry standard practices.[70]

In the AI context, breach of duty and proximate cause will pose an insurmountable hurdle for victims of AI injuries in a suit alleging negligent design. In analyzing whether the designer satisfied her duty of care, the court will examine the designer's practices when designing the machine-learning algorithm, training the algorithm, and testing and debugging the algorithm—all relative to industry norms and the state of the art.[71] The court will consider whether the designer adequately predicted risks and implemented safeguards against those risks.[72] Unpredictable AI injuries occur, however, despite a designer's reasonable or even perfect performance of the product design process.[73] Because a court cannot expect a designer to predict the unpredictable, it will not be possible to prove insufficient care.[74]

Perhaps a creative plaintiff's attorney might one day argue that a designer's duty requires the designer to develop a better intuition of the kinds of injuries that might result from AI products or to utilize state-of-the-art tools, like virtual simulators, to predict previously unpredictable AI injuries.[75] While such an argument may persuade

69. *See id.* §§ 12.1, .6; CHOPRA & WHITE, *supra* note 34, at 139. This Note does not consider the trivial cases where, thanks to a pattern of recurring accidents, *res ipsa loquitur*—the principle that the fact finder may reasonably infer negligence from the circumstances—will apply. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 13.3; Vladeck, *supra* note 55, at 142–44. This Note focuses on the "rare, untraceable to any defect, and inexplicable" injuries where no inference of negligence can be made. Vladeck, *supra* note 55, at 143–44.

70. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 12.6.

71. *See* CHOPRA & WHITE, *supra* note 34, at 140; Bryan H. Choi, *Crashworthy Code* 47–48 (Ohio State Pub. Law, Working Paper No. 465, 2018), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3230829 [https://perma.cc/P9YR-MN8Q]. It is a mathematically-proven fact that testing the code after it has been written, which is the standard practice of the industry, will not assure correctness in the code. *See* Choi, *supra*, at 27. Furthermore, judges' and juries' competence in evaluating scientific evidence, like the expert testimonies of computer engineers, is highly suspect. *See* KENNETH S. BROUN ET AL., MCCORMICK ON EVIDENCE § 203 (7th ed. 2014).

72. *See* Smith, *supra* note 60, at 207.

73. *See* CHOPRA & WHITE, *supra* note 34, at 140; Karnow, *supra* note 43, at 74 ("All the knowledge in the universe about all the agents and subsystems is not enough to fix the future behavior of these systems.").

74. *See* Karnow, *supra* note 43, at 74.

75. *See id.* at 76.

some courts, as a technical matter, predicting and preventing AI behavior may never become feasible.[76]

For the same reason, victims of AI injuries will not be able to establish proximate cause. Proximate cause is satisfied if the factfinder determines that the particular injury was within the scope of the risk created by the designer's negligence.[77] In the case of AI design, the designer's liability extends only to reasonably foreseeable consequences of negligently designing AI products.[78] It is unlikely that an injury resulting from a complex interaction of unpredictable AI algorithms and unforeseeable environmental factors is within the scope of the designer's liability.[79] In the language of tort law, the environment and the machine learning process itself are superseding causes that break the chain of causation between the designer's conduct and the injury.[80]

b. Negligent Use

A product's user is liable for a product-related injury if the user's failure to exercise reasonable care in the use of the product proximately caused the injury.[81] Negligent use or misuse is typically alleged by the designer as a shield to avoid liability,[82] but a victim could also use it as a sword against a third party.[83]

In the context of AI injuries, misuse may include feeding the AI poor or insufficient training data, providing careless instructions to the machine, or inadequately supervising the machine.[84] For example, in an early automation case, a court refused to find the manufacturer of a plane's autopilot feature responsible for a crash, reasoning that the

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76. *See id.* at 74; *supra* note 55 and accompanying text.

77. *See* DOBBS, HAYDEN & BUBLICK, supra note 5, § 15.10. For example, a negligent vacuum designer is only liable for injuries that are a foreseeable consequence of negligent vacuum design; she is not liable for an injury sustained as a consequence of the victim's car accident, even if it occurred because she was on the way to repairing a negligently designed vacuum. *See id.* § 15.1.

78. *See id.*

79. *See* Karnow, *supra* note 43, at 73 ("With autonomous robots which are complex machines, ever more complex as they interact seamless[ly], porously, with the larger environment, linear causation gives way to complex, nonlinear interactions."). A designer would certainly be liable for the injuries caused by a trivial autonomous robot with only a few inputs and only a few degrees of freedom, but that is not the focus of this Note. *See id.* at 74.

80. *See* CHOPRA & WHITE, *supra* note 34, at 122.

81. *See id.* at 138; DOBBS, HAYDEN & BUBLICK, *supra* note 5, §§ 33.17–.18.

82. *See* DOBBS, HAYDEN & BUBLICK, supra note 5, §§ 33.17–.18.

83. *See* CHOPRA & WHITE, *supra* note 34, at 132. Claiming that another misused a product is a typical negligence claim. *Id.*

84. Hubbard, *supra* note 62, at 1861.

pilot had caused the accident by failing to maintain a proper lookout.[85] Similarly, it is likely that courts will continue to hold passengers of self-driving vehicles liable for injuries resulting from carelessly engaging self-driving mode, so long as self-driving vehicles expect passengers to disengage the self-driving feature in dangerous conditions or conditions against which the manual warns.[86]

A user accused of misusing a product can counter that the "misuse" was foreseeable, and therefore, the designer should have provided reasonable safeguards against the misuse.[87] For example, a user could argue that his failure to maintain a lookout over a self-driving vehicle was a foreseeable kind of misuse and therefore the vehicle's designer should have designed a safety feature to prevent it.[88] However, designers are not required to implement safeguards for every foreseeable misuse of their products, in particular, those misuses that present obvious risks to the user.[89] As AI technology proliferates, AI users will increasingly be on notice of the dangerous consequences of improperly training or supervising AI.[90]

Over time, however, it is likely that negligent use, like negligent design, will also become a futile claim, since AI performance will quickly exceed human performance and humans will reasonably, if not necessarily, come to rely on increasingly flawless and paternalistic AI.[91] In fact, experts anticipate that some AI products will ultimately lack human controls entirely. For example, advanced self-driving vehicles will not come with steering wheels or pedals.[92] As such, neither negligent design nor negligent use will be to blame for AI injuries.

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85. *See* Gary E. Marchant & Rachel A. Lindor, *The Coming Collision Between Autonomous Vehicles and the Liability System*, 52 SANTA CLARA L. REV. 1321, 1325 (2012) (discussing Brouse v. United States, 83 F. Supp. 373 (N.D. Ohio 1949)).

86. *See id.* at 1326–27.

87. *See* DOBBS, HAYDEN & BUBLICK, supra note 5, § 33.18.

88. *See* Gurney, *supra* note 15, at 268.

89. *See id.* at 269–70; DOBBS, HAYDEN & BUBLICK, *supra* note 5, §§ 33.10, .17 (explaining that assuming the risk of using a product in an obviously dangerous way is essentially the same legal claim as negligence).

90. *See* Hubbard, *supra* note 62, at 1861–62.

91. *See* CHOPRA & WHITE, *supra* note 34, at 125; Jason Millar & Ian Kerr, *Delegation, Relinquishment, and Responsibility: The Prospect of Expert Robots*, ROBOT L. 102, 117 (2016); Bill Joy, *Why the Future Doesn't Need Us*, WIRED (Apr. 1, 2000, 12:00 PM), https://www.wired.com/2000/04/joy-2/ [https://perma.cc/7T6R-TRZP].

92. *See* Alex Davies, *GM Will Launch Robocars Without Steering Wheels Next Year*, WIRED (Jan. 12, 2018, 12:01 AM), https://www.wired.com/story/gm-cruise-self-driving-car-launch-2019/ [https://perma.cc/4UMM-N94Z].

2. Strict Liability for Design Defects

A product designer may also bear the cost of a product-related injury if the product's design was unreasonably dangerous (i.e., defective), and the design defect proximately caused the injury.[93] A design is defective, according to the risk-utility test, only if the potential harms of the design (i.e., the risks) outweigh its potential benefits (i.e., the utility).[94] A design's utility is comprised of the benefits to the user, including reduced price, and to society in general.[95] In lieu of a full risk-utility analysis, some courts merely ask whether there existed a reasonable alternative design (i.e., another design that could have reduced the danger, which would not have unduly burdened the product's utility).[96] In theory, once the victim establishes that a product's design was at fault for her injury (i.e., that the design was defective and the defect caused the injury), the product's designer is strictly liable even if she exercised perfect care.[97]

In the context of AI injuries,[98] early victims may prevail against AI designers.[99] However, fewer accidents will be attributable to faulty design as the technology matures. This is because producing a reasonable alternative design is particularly difficult for AI and machine learning algorithms.[100] As a practical matter, intelligent machines keep little documentation of their reasons for making certain decisions, namely, the rules that they have learned and how the rules

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93. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 33.4 (elements of products liability); *id.* § 33.9 (risk utility test); *id.* § 33.11 (reasonable alternative design).

94. *See id.* § 33.9; John W. Wade, *On the Nature of Strict Tort Liability for Products*, 44 MISS. L.J. 825, 836–37 (1973). A minority of jurisdictions apply solely the consumer expectations test, but the consumer expectations test is criticized as both over- and under-inclusive, and the Products Restatement rejects the test in favor of balancing risk-utility. *See* RESTATEMENT (THIRD) OF TORTS: PRODUCTS LIABILITY § 2 cmt. a (AM. LAW INST. 2018); DOBBS, HAYDEN & BUBLICK, *supra* note 5, §§ 33.6, .8.

95. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 33.9; Wade, *supra* note 94, at 837–38 (listing seven factors to consider in a full risk-utility analysis).

96. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 33.11.

97. *See id.* §§ 33.2, .9.; Bryant Walker Smith, *Automated Driving and Product Liability*, 2017 MICH. ST. L. REV. 1, 38 (2017) [hereinafter Smith, *Automated Driving*]; Bryant Walker Smith, *Proximity-Driven Liability*, 102 GEO. L. REV. 1777, 1800 (2014) [hereinafter Smith, *Proximity-Driven Liability*].

98. Although this Note treats injuries due to intelligent machines and software in the same way, software may not be considered a "product" subject to products liability law in the first place because it is not a tangible manufactured product; in which case, the victim can only rely on negligence law. *See* CHOPRA & WHITE, *supra* note 34, at 136.

99. *See* Marchant & Lindor, *supra* note 85, at 1333–34. Marchant and Lindor argue that, initially, AI designers are likely to lose because juries are unable to put aside their hindsight bias and because juries will not sympathize with the argument that the intangible social utility of an algorithm outweighs the risk of a concrete injury. *See id.* at 1334.

100. *See* ANDERSON ET AL., *supra* note 13, at 125–26; CHOPRA & WHITE, *supra* note 34, at 136; Gurney, *supra* note 15, at 263–64; Smith, *Automated Driving*, *supra* note 97, at 38.

were applied to the instant facts.[101] Even if they kept more documentation, AI's rules are too complex for a human, even an AI expert, to analyze or to adjudge their reasonableness.[102] Victims will struggle to persuade a court that an alternative learning algorithm or training process would have led to AI that could have avoided the risk at a reasonable cost to consumers.[103] A victim may instead argue that the designer could have hardcoded the machine to avoid the injury for essentially no extra cost;[104] but (1) the injury likely occurred because no one could foresee it in the first place, so it would not have been possible for the designer to hardcode a safeguard and (2) the main benefit of using a machine learning algorithm is that designers are freed from manually coding the AI's rules.[105] In fact, many AI could not exist if designers were required to code rules for each scenario.[106] Courts will hesitate to repudiate machine learning algorithms and all their social benefits under the design defect theory.[107]

3. Other Bases for Strict Liability

Dissatisfied with existing doctrines, some commentators have proposed subjecting AI designers to strict liability for the injuries their AI cause regardless of defect by analogizing the injuries to other types of injuries that give rise to liability without fault.[108] For example, AI injuries have been compared to injuries caused by employees, children, abnormally dangerous animals, and abnormally dangerous activities,

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101. *See* JAMES M. ANDERSON ET AL., RETHINKING INSURANCE AND LIABILITY IN THE TRANSFORMATIVE AGE OF AUTONOMOUS VEHICLES 13 (2018).

102. *See* Smith, *Automated Driving*, *supra* note 97, at 51–52; Smith, *supra* note 60, at 207.

103. *See, e.g.*, Steven Walczak & Narciso Cerpa, *Heuristic Principles for the Design of Artificial Neural Networks*, 41 INFO. & SOFTWARE TECH. 107, 107 (1999) (discussing improvements to the design process of artificial neural networks, one type of AI algorithm). AI designers have many choices when designing an intelligent machine that affect the choices the machine ultimately makes and the speed at which the machine reaches its decisions. However, there exist only basic heuristics to help make those choices, and designers currently rely on experts' past experience and intuition. *See id.* at 107, 115.

104. *See* Smith, *Automated Driving*, *supra* note 97, at 47. To hardcode a rule simply means to encode the rule in the AI's algorithm directly, as opposed to having the AI learn it through training. *See id.*; *see also* James Vincent, *Inside Amazon's $3.5 Million Competition to Make Alexa Chat Like a Human*, VERGE (June 13, 2018, 9:17 AM), https://www.theverge.com/2018/6/13/17453994/amazon-alexa-prize-2018-competition-conversational-ai-chatbots [https://perma.cc/M5U6-J4VQ] (discussing hardcoding).

105. *See* CHOPRA & WHITE, *supra* note 34, at 138–39; *supra* Section I.B.

106. *See* CHOPRA & WHITE, *supra* note 34, at 138–39.

107. *See* Funkhouser, *supra* note 58, at 457–58.

108. Hubbard, *supra* note 62, at 1866–67; *see also, e.g.*, CHOPRA & WHITE, *supra* note 34, at 120, 131.

all of which give rise to vicarious or strict liability.[109] The random occurrence of AI injuries is also comparable to the random occurrence of manufacturing defects despite a product manufacturer's best efforts at quality assurance.[110] Although these legal doctrines do not fit AI injuries perfectly, proponents argue that the underlying principles of strict liability regimes are the same, namely, that designers are best suited to and therefore ought to internalize the cost of AI injuries to third parties.[111] Designers can pass the cost onto consumers by hiking prices, or bear those costs themselves and have insurers spread the risk.[112] Furthermore, designers might embrace greater responsibility because (1) the positive impact on product demand due to AI's safety will outweigh the negative impact due to higher prices, so designers can still anticipate a healthy profit anyway[113] and (2) designers prefer the certain liability of strict liability regimes over the uncertain risk of other liability regimes.[114]

However, strict liability regimes allocate an undue proportion of costs to AI designers and users and are therefore socially undesirable. Under a strict liability regime, AI designers or their users are forced to bear the cost of AI's *negative* externalities without compensation for the value of their substantial *positive* externalities.[115] Put differently, strict liability shifts the *costs* of AI injuries from victims to AI designers and users, but does not shift the value of social *benefits* that third parties receive back to the designers and users. As such, the market will overly disincentivize AI production and the market's demand for AI will be unsatisfied.[116] The underproduction of AI is not merely an economist's academic concern; each day that AI products are delayed is an extra day that conventional products continue to expel carbon dioxide into the atmosphere, injure or kill people in accidents, and perpetuate social inequities. Therefore, some commentators have argued for a subsidy rather than a tax on AI to accelerate its development.[117]

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109. *See, e.g.*, Hubbard, *supra* note 62, at 1863–65; *see also* CHOPRA & WHITE, *supra* note 34, at 128, 130.

110. *See* DOBBS, HAYDEN & BUBLICK, supra note 5, § 33.5.

111. *See* Hubbard, *supra* note 62, at 1862–65; Vladeck, *supra* note 55, at 146.

112. *See* Gurney, *supra* note 15, at 272–73.

113. *See* Smith, *Automated Driving*, *supra* note 97, at 44–45, 53–54.

114. *See* Smith, *Proximity-Driven Liability*, *supra* note 97, at 1813.

115. *See* Hubbard, *supra* note 62, at 1862–63.

116. *See* OPENSTAX COLLEGE, PRINCIPLES OF ECONOMICS 280 (2014); *supra* Section I.A. In the absence of a public subsidy, a product or service that produces a positive externality is underproduced because consumers tend rationally to become "free riders," people who hope that others will pay for the product so they get to enjoy the benefits for free. *See* OPENSTAX COLLEGE, *supra*, at 280.

117. *See* Hubbard, *supra* note 62, at 1870; JAMES ANDERSON ET AL., U.S. EXPERIENCE WITH NO-FAULT AUTOMOBILE INSURANCE, at xiii–xiv n.1 (2010).

4. General Problems with the Tort Regime

In addition to its difficulty allocating AI injury costs, the tort regime suffers from other weaknesses that apply generally to all injuries. This Section briefly discusses a few of the most prominent weaknesses: high costs, inadequate compensation due to lump-sum damage awards, and minimal deterrent effect.

High private and public costs. Parties to an injury undergo a multi-year litigation process and expend sizable legal fees.[118] While the suit drags on, the victim also foregoes valuable opportunities as a result of her injury.[119] These costs are incurred not only by the parties, but also by the public in the form of judicial administration costs and lost social productivity.[120]

Lump-sum damages. Courts award damages as a lump sum, as opposed to ongoing benefits, which results in (1) inaccurate speculation of the future cost of injuries and (2) systematic undervaluation of injury costs because of a tendency to underestimate the impact of inflation.[121]

Minimal deterrence. While it is often argued that tort law prevents injuries by penalizing fault, product designers are often undeterred by the penalty. In theory, this is because the amount of liability is a function of the victim's injury, not a function of the tortfeasor's fault (with the exception of punitive damages for outrageous conduct).[122] As such, damage awards can be small, both objectively and relative to the product designer's total costs.[123] Liability insurance also spreads the cost of damages, cushioning the financial pain and consequently the deterrent effect.[124] Consistent with the theory, the empirical evidence of tort law's actual deterrent effect is inconclusive at

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118. *See* GEOFFREY PALMER, COMPENSATION FOR INCAPACITY: A STUDY OF LAW AND SOCIAL CHANGE IN NEW ZEALAND AND AUSTRALIA 21 (1979).

119. *See id.* at 24.

120. *See id.* In theory, much of the time and expense to litigants are avoided by settlement if the facts and law are clear. *See* Russell Korobkin & Chris Guthrie, *Psychology, Economics, and Settlement: A New Look at the Role of the Lawyer*, 76 TEX. L. REV. 77–79 (1997). Now, most car accidents are settled outside of the courtroom. However, settlements still fail because the law is not clear, the case is highly fact-specific, information asymmetry exists between the parties, and not all victims behave rationally. *See id.* at 79–81.

121. *See* PALMER, *supra* note 118, at 24.

122. *See id.*

123. *See* Stephen D. Sugarman, *Doing Away with Tort Law*, 73 CAL. L. REV. 555, 570–71 (1985).

124. *See id.*; Craig Brown, *Deterrence in Tort and No-Fault: The New Zealand Experience*, 73 CALIF. L. REV. 976, 977–78 (1985).

best.[125] Tort law is indeed an inefficient cost allocation regime, nothing more.[126]

B. Public Regulatory Law

Regulatory law also plays an important role in allocating injury costs, as well as in preventing injuries. Regulatory regimes are created by federal or state legislatures, which first set broad policy goals, and then delegate authority to administrative agencies to implement detailed plans that achieve those goals.[127] Agencies conduct research, promulgate standards, and investigate and adjudicate violations.[128] Their strength lies in their ability to gather experts and to analyze problems with a different perspective, motivation, and timescale from the private sector,[129] provided they are not captured by the industry they regulate.[130] Their weakness, however, is the high decision cost of administrative actions such as the notice-and-comment process for making new regulations.[131]

Various kinds of regulatory regimes have been proposed to address AI injuries. Most involve implementing or amending specialized regimes, such as the automobile safety regime.[132] Some have proposed creating a general regime tasked with overseeing all AI-related matters.[133] Both methods have their respective strengths, and some form of regulatory regime will likely be necessary, but it will be increasingly difficult for the regulatory process to adequately respond to AI's complexity and electric pace of progress.[134]

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125. *See* Sugarman, *supra* note 123, at 587–90 (discussing the empirical research conducted by proponents of the tort-as-deterrent theory and concluding that all either suffer from methodological problems or fail to consider alternative explanations for their data).

126. *See id.*

127. *See* Scherer, *supra* note 34, at 381.

128. *See id.* at 382.

129. *See id.* at 383.

130. *See* JACOB TURNER, ROBOT RULES: REGULATING ARTIFICIAL INTELLIGENCE 212 (1st ed. 2019).

131. *See* ALFRED C. AMAN, JR. & WILLIAM T. MAYTON, ADMINISTRATIVE LAW § 2.2 (2d ed. 2014).

132. *See, e.g.*, *Summary: SELF Drive Act, H.R. 3388—115th Congress (2017–2018)*, CONGRESS.GOV, https://www.congress.gov/bill/115th-congress/house-bill/3388 [https://perma.cc/6PKV-ADV7] (last visited Feb. 17, 2019) ("The Department of Transportation (DOT) must require safety assessment certifications for the development of a highly automated vehicle or an automated driving system.").

133. *See* TURNER, *supra* note 130, at 213; Scherer, *supra* note 34, at 393.

134. *See supra* notes 129–31 and accompanying text.

1. Specialized Regimes

Policy makers at the state and federal levels may regulate AI on an industry-by-industry basis. While specialized agencies may achieve some success at the outset, the necessarily slow and participatory nature of the rulemaking process will make it difficult for these agencies to address complex and rapidly evolving AI applications.[135]

Consider, for example, the motor vehicle industry. The motor vehicle regulatory regime consists of state law, which regulates vehicle operation (e.g., driver licensing and traffic rules) and ownership (e.g., titling and registration), and federal law, which regulates vehicle design and manufacture.[136] As of early 2019, over forty states have considered legislation concerning self-driving vehicles, and twenty-nine states and the District of Columbia have already enacted it.[137] Efforts are underway to draft a model statute.[138] At the federal level, the Department of Transportation published its third self-driving vehicle regulatory policy in October 2018,[139] and both houses of Congress have introduced bills to amend the federal motor vehicle safety laws to address AI.[140] Collectively, the motor vehicle regulatory regime must, at the very least, address the following issues[141]:

(1) How should self-driving vehicles be defined under these regulations? Self-driving vehicles are likely to differ greatly in their form and capabilities. The Society of Automotive Engineers currently defines degrees of vehicle automation on a five-level scale.[142] Agencies

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135. *See supra* Sections I.A, I.C.

136. *See* ANDERSON ET AL., *supra* note 13, at 138. The National Highway and Transportation Safety Administration, a subsidiary of the Department of Transportation, promulgates Federal Motor Vehicle Safety Standards; tests, certifies, and publishes reports on equipment; and orders recalls for unsafe equipment. *Id.* at xxii.

137. *See Autonomous Vehicles | Self-Driving Vehicles Enacted Legislation*, NAT'L CONF. ST. LEGISLATURES (Oct. 18, 2018), http://www.ncsl.org/research/transportation/autonomous-vehicles-self-driving-vehicles-enacted-legislation.aspx [https://perma.cc/W797-QLN8] [hereinafter *Self-Driving Vehicles Enacted Legislation*].

138. *See generally* HIGHLY AUTOMATED VEHICLES ACT (UNIF. LAW COMM'N, Proposed Official Draft Oct. 2018), https://www.uniformlaws.org/HigherLogic/System/DownloadDocumentFile.ashx?DocumentFileKey=48de7407-2cd5-2ae1-cc12-d9131132fd67&forceDialog=0 [https://perma.cc/NH5N-CAUG].

139. *See* U.S. DEP'T OF TRANSP., PREPARING FOR THE FUTURE OF TRANSPORTATION: AUTOMATED VEHICLES 3.0 (2018), https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf [https://perma.cc/XZ87-X3VQ].

140. *See* American Vision for Safer Transportation Through Advancement of Revolutionary Technologies Act (AV START Act), S. 1885, 115th Cong. (2017); SELF Drive Act, H.R. 3388, 115th Cong. (2017).

141. Cybersecurity and data privacy are also important issues raised by self-driving vehicle sensors and algorithms. *See* ANDERSON ET AL., *supra* note 13, at 70.

142. *See id.* at 2–3.

could adopt this scale or create their own, and promulgate separate rules for each level of autonomy.[143] Autonomous capabilities will, however, evolve over time, so regulators will have to update definitions continuously.[144]

(2) Should passengers be required to have driver's licenses? As discussed above, vehicles could drive with disabled or underage passengers, or no passengers at all.[145] Agencies must decide what skills passengers should be required to have.[146] On one hand, agencies could consider a tiered licensing system with fewer requirements for more autonomous vehicles.[147] On the other hand, agencies could require passengers to acquire new skills to properly supervise vehicles, in the way airplane pilots must be proficient in the capabilities and limitations of autopilot features.

(3) Should self-driving vehicles be required to follow conventional traffic rules? Some states have already adopted different rules for certain kinds of self-driving vehicles.[148] For example, in these states, autonomous truck platoons may drive with shorter trailing distances than human drivers.[149] Regulators must also consider whether to loosen requirements like speed limits, traffic signals, or signaling requirements.[150] At the same time, risks that arise from new capabilities will likely require new rules.

(4) How should agencies define and test vehicle safety standards? Current federal standards require traditional vehicle designs to satisfy technologically neutral standards (e.g., fuel economy tests, emissions tests, and crash safety tests) and to implement specified safety technologies, such as airbags and seat belts.[151]

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143. *See id.* at 72.

144. *See, e.g.*, Marcy Klevorn, *Taking Back the Streets: Using Systems Thinking to Return Our City Streets to the Community*, MEDIUM (Jan. 8, 2018), https://medium.com/cityoftomorrow/taking-back-the-streets-using-systems-thinking-to-return-our-city-streets-to-the-community-dc404cbee50f [https://perma.cc/WZ4L-Y3KP] (discussing Ford Motor Company's proposal to incorporate in vehicles and in city infrastructure a protocol to allow vehicles to communicate with each other and optimize the transportation ecosystem as a whole); *Hyperdrive: China's Built a Road So Smart It Will Be Able to Charge Your Car*, BLOOMBERG (Apr. 11, 2018, 4:00 PM), https://www.bloomberg.com/news/features/2018-04-11/the-solar-highway-that-can-recharge-electric-cars-on-the-move [https://perma.cc/P23W-2MSR] (discussing China's construction of a highway that wirelessly charges electric cars, for when cars that have the capability to be wirelessly charged hit the roads).

145. *See supra* Section I.A.

146. *See* ANDERSON ET AL., *supra* note 13, at 72.

147. *See id.* at 72–73.

148. *See Self-Driving Vehicles Enacted Legislation*, *supra* note 137.

149. *See id.*

150. *See* LAUREN ISAAC, DRIVING TOWARDS DRIVERLESS: A GUIDE FOR GOVERNMENT AGENCIES 27 (2016) (recommending raising speed limits and reducing lane widths, among other reforms).

151. *See* ANDERSON ET AL., *supra* note 13, at 101.

Likewise, agencies could subject self-driving vehicle designs to technologically neutral performance tests and specific coding requirements.[152] With respect to performance tests, self-driving vehicles will have to be tested in more conditions—wet, bumpy, unpaved, dark, foggy—than conventional vehicles, because the vehicle and the manufacturer will not be able to rely on a human to make adjustments to the various driving conditions.[153] Selecting specific coding requirements will be a highly technical task, requiring agencies to develop a whole new kind of expertise. And what would coding requirements look like? For example, would they require vehicles to know specific driving rules, to pass an intelligence test, or to have a specific neural network architecture?

This brief discussion of issues concerning the regulation of self-driving vehicles begins to reveal the Sisyphean nature of drafting regulations for AI.[154] Not only must agencies answer highly technical issues at the outset, but new, increasingly complex issues will arise with increasing frequency as the technology naturally evolves. Contrast that to the tremendous procedural and substantive burdens that administrative law justifiably imposes on agencies to ensure rational, fair, and democratic regulatory actions. Even with thoughtful rulemaking, agencies can easily cause catastrophic consequences on the complex systems they regulate with seemingly simple rules.[155] In certain industries, there are already signs that regulating AI may be an insurmountable challenge. For example, the Securities and Exchange Commission, a highly sophisticated agency with a narrowly tailored agenda, has essentially given up on regulating flash crashes.[156]

2. General AI Regime

Some commentators, such as Matthew U. Scherer and Jacob Turner, propose regulating AI across all industries under a single, general regime instead.[157] For example, Scherer proposes creating an administrative agency with the purpose "to ensure that AI is safe,

152. *See* U.S. DEP'T OF TRANSP., *supra* note 139, at iv. Under the Trump administration, the Department of Transportation has strongly supported a market-driven, technology neutral approach. *See id.*

153. *See* ANDERSON ET AL., *supra* note 13, at 107–08.

154. *See id.* at 103–04 (referencing a government transportation official's view that issuing "relevant" motor vehicle standards is extremely difficult).

155. *See* J.B. Ruhl, *Complexity Theory as a Paradigm for the Dynamical Law-and-Society System: A Wake-Up Call for Legal Reductionism and the Modern Administrative State*, 45 DUKE L.J. 849, 881, 883–84 (1996).

156. *See* Woodward, *supra* note 53, at 25.

157. *See* TURNER, *supra* note 130, at 213–14; Scherer, *supra* note 34, at 393.

secure, susceptible to human control, and aligned with human interests."[158] To that end, the proposed agency would define the AI that fall under its jurisdiction and update that definition regularly through notice and comment.[159] AI under the agency's jurisdiction will be reviewed, tested, and certified by expert staff with a mix of academic or industry experience attuned to prevailing trends in the study of AI.[160]

Regulating AI under a single regime is attractive for several reasons. First, it would allow experts in different fields of AI to share overlapping resources and insights. Second, a single agency can avoid redundant regulation, a risk of having separate, specialized regimes.[161] Third, a single agency can spot and address harms that arise from AI activity at the boundary between industries or from a combination of activities by AI from multiple industries.[162]

That said, a single regime has many weaknesses. First, a broadly defined AI agency would overlap with existing agencies.[163] For example, how would this regime interact with motor vehicle regulators? Second, an AI agency's scope may have no principled limit as AI eventually touches all aspects of human life. Third, the same weakness of specialized agencies—the slow, participatory nature of rulemaking—will afflict this regime, potentially with greater potency, since it must coordinate more people and respond to bigger, more complex problems. As such, while some combination of a general AI agency and industry-specific agencies is probably necessary to research and deter manageable harms,[164] traditional regulatory regimes will increasingly struggle to prevent complex, rapidly evolving AI harms.

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158. *See* Scherer, *supra* note 34, at 394.

159. *See id.* at 360–61.

160. *See id.* at 394–96.

161. *See id.*

162. *See id.* at 394–97.

163. *See id.* at 394–95.

164. *See* TURNER, *supra* note 130, at 220. Some potentially important bills have already been introduced in Congress to begin to address AI as a distinct problem separate from existing agencies. *See* Huu Ngyuen, *Artificial Intelligence Law Is Here, Part Three*, ABOVE LAW (Oct. 4, 2018, 11:00 AM), https://abovethelaw.com/legal-innovation-center/2018/10/04/artificial-intelligence-law-is-here-part-three/ [https://perma.cc/28RJ-RPGS]. The following are some bills Congress is considering: The National Security Commission Artificial Intelligence Act of 2018 (H.R. 5336); the Artificial Intelligence Job Opportunity and Background Summary Act of 2018 (H.R. 4829); the Fundamentally Understanding the Usability and Realistic Evolution of Artificial Intelligence Act of 2017 (H.R. 4625); Bot Disclosure and Accountability Act of 2018 (S.3127). *See id.* For a discussion on regulatory trends overseas, see TURNER, *supra* note 130, at 225–36.

III. SOLUTION: UNIVERSAL NO-FAULT SOCIAL INSURANCE

No-fault insurance schemes are not a new concept,[165] but the proliferation of AI is resurrecting their appeal in the twenty-first century.[166] For example, one commentator has proposed a no-fault scheme inspired by the National Vaccination Injury Compensation Program (NVICP), noting the similarities between the risks and benefits posed by vaccinations and AI.[167] Under this commentator's scheme, certain AI, like self-driving vehicles, could be taxed to maintain a communal fund to compensate victims of injuries related to those AI.[168] This Note, however, focuses on the even more progressive scheme that New Zealand has adopted, which eliminates the tort regime, covers all personal injuries by accident, and is partly financed by general tax revenues.[169] A scheme based on the New Zealand model will distribute the costs of both AI and non-AI injuries fairly, ensure public confidence in the development of AI, and encourage AI's continuing growth in the United States.

A. The New Zealand Scheme

In 1972, New Zealand, which follows the same English common law tradition as the United States, enacted the Accident Compensation Act, creating a social insurance scheme administered by the Accident Compensation Corporation (ACC).[170] There are three essential components to the scheme: (1) it covers all personal injuries resulting from accidents without regard to fault;[171] (2) it abolishes the right to bring tort claims for covered injuries;[172] and (3) it is financed by appropriations from general tax revenues and by taxes on select

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165. *See, e.g.*, JAMES M. ANDERSON, PAUL HEATON & STEPHEN J. CARROLL, THE U.S. EXPERIENCE WITH NO-FAULT AUTOMOBILE INSURANCE 2 (2010) (historical and existing no-fault automobile insurance schemes in the United States); DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 36.2 (the workers' compensation system); *id.* § 36.6 (the Social Security disability system); *id.* § 36.9 (government compensation funds like the national childhood vaccine injury program).

166. *See, e.g.*, ANDERSON, HEATON & CARROLL, *supra* note 165, at 142–43; Funkhouser, *supra* note 58, at 461.

167. *See* Funkhouser, *supra* note 58, at 461.

168. *See* National Childhood Vaccine Injury Act of 1986, 42 U.S.C. § 300aa-1 to aa-34 (2018) (showing the model legislative structure of the proposed AI scheme).

169. *See generally* GEOFFREY PALMER, COMPENSATION FOR INCAPACITY: A STUDY OF LAW AND SOCIAL CHANGE IN NEW ZEALAND AND AUSTRALIA (1979) (explaining the legislative history and analyzing the policy issues of the New Zealand scheme).

170. *See* Accident Compensation Act (No. 43/1972) (N.Z.).

171. *See* PALMER, *supra* note 169, at 263.

172. *See id.* at 271.

activities.[173] This scheme has now been in place for nearly five decades and continues to enjoy great public support.[174]

1. Coverage and Benefits

New Zealand's insurance scheme covers all personal injuries by accident.[175] Personal injury by accident is, in general, an unexpected physical injury due to a specific event, regardless of who—if anybody—is at fault.[176] An injury due to a car crash is a prime example.[177] A physical injury due to an intentional tort or criminal act—even an assault—is also covered, because the injury is unexpected from the victim's perspective and is due to a specific event.[178]

Upon receiving a covered claim, the ACC compensates victims for covered injuries through four kinds of benefits: (1) ongoing compensation for medical treatment and social and occupational rehabilitation; (2) ongoing payment of 80 percent of the claimant's lost earnings subject to a statutory cap; (3) lump-sum payment for injuries that create a permanent disability; and (4) compensation to dependents of a person killed by accident, which includes one-time payments like funeral grants and periodic payments for loss of dependency.[179] The ACC has a legal obligation to make decisions in a timely manner, and claimants have a right to appeal administrative decisions to a court.[180]

Under the scheme, personal injuries as a result of AI—however attenuated—are already covered.[181] Such injuries include a substantial range of injuries *directly* caused by AI, such as those caused by self-driving vehicles, smart medical devices, surgical robots, factory robots,

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173. *See id.* at 365–66.

174. *See* Stephen Todd, *Forty Years of Accident Compensation in New Zealand*, 28 T.M. COOLEY L. REV. 189, 218 (2011) [hereinafter Todd, *Forty Years*]; Stephen Todd, *Negligence Liability for Personal Injury: A Perspective from New Zealand*, 25 U.N.S.W. L.J. 895, 895–96 (2002) [hereinafter Todd, *Negligence Liability*].

175. Todd, *Forty Years*, *supra* note 174, at 198.

176. *See id.* at 198–200.

177. *See id.* at 200.

178. *See* Margaret A. McGregor Vennell, *Accident Compensation*, *in* THE LAW OF TORTS IN NEW ZEALAND 26, 44 (1st ed. 1991). An intentionally self-inflicted injury—such as suicide—is not covered because it is not unexpected to the injured. *See* Todd, *Forty Years*, *supra* note 174, at 200, 211–12. Select somewhat attenuated injuries are covered, like post-traumatic stress disorder resulting from a specific, unexpected event and injuries or complications that arise from a medical treatment or workplace condition, regardless of whether the treatment or condition was negligent. *See What We Cover*, ACCIDENT COMPENSATION CORP. (ACC) (Dec. 12, 2018), https://www.acc.co.nz/im-injured/injuries-we-cover/what-we-cover/ [https://perma.cc/Q3W5-N5N7]. Ordinary, gradual illnesses, like appendicitis, are not covered, since they are not linked to a cognizable event or cause. *See id.*

179. *See* Todd, *Forty Years*, *supra* note 174, at 210–11.

180. *See id.* at 212–13.

181. *See* TURNER, *supra* note 130, at 103.

and police and emergency response robots.[182] They even include physical injuries that are *indirectly* caused by AI, like assaults incited by viral hate speech on social media platforms.[183] As AI takes over an increasing proportion of tasks in the physical world, AI injuries will make up an increasing proportion of total personal injuries.

2. Abolition of Tort Claims

In general, the New Zealand scheme bars access to courts for claims covered by the scheme, so that claimants cannot recover damages twice.[184] Claims seeking compensatory damages for personal injuries are therefore barred, including those caused by AI.[185] Claims seeking compensation for property damage, which are not covered by the scheme, survive.[186]

Claims seeking punitive damages for outrageous conduct also survive.[187] This is because, formally, a prayer for punitive damages arises out of the defendant's punishable conduct, not the victim's injury.[188] Also, punitive damages serve a different function than compensatory damages—namely, to punish and deter socially undesirable behavior. As such, the scheme continues to allow private claims for punitive damages.[189] This is similar to the workers' compensation scheme in the United States. Also like US courts, New Zealand courts typically award punitive damages only for reckless or intentional wrongdoing; negligence, however gross, will not suffice.[190] As such, the New Zealand scheme allows courts to impose punitive damages against, for example, AI designers who intentionally fail to rectify a dangerous condition of their products, but defective product and negligence claims against AI designers are barred.

Besides private punitive damages claims, the ACC also undertakes various mandatory and voluntary initiatives in order to

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182. *See supra* Section I.C.

183. *See supra* Section I.C. AI now make decisions that affect so many aspects of people's lives (e.g., credit applications, criminal sentencing, job recruitment) that it would not be surprising to find that AI somehow influences many violent acts. *See generally* O'NEIL, *supra* note 10.

184. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 36.5; Todd, *Forty Years*, *supra* note 174, at 207.

185. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 36.5; Todd, *Forty Years*, *supra* note 174, at 207.

186. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 36.5; Todd, *Forty Years*, *supra* note 174, at 207.

187. *See* Todd, *Forty Years*, *supra* note 174, at 209.

188. *See id.*

189. *See id.*

190. *See id.* at 209–10.

prevent injuries.[191] For example, the ACC has a duty to report insights on medical treatment risks it discovers from claims data to hospitals and to the Ministry of Health.[192] The ACC also maintains a broad portfolio of injury prevention programs.[193] In fiscal year 2017–18, these investments amounted to 69.4 million New Zealand dollars, and the ACC estimates that 1.72 dollars' worth of injuries were prevented for every dollar spent.[194] And New Zealand also enforces safety standards for hazardous activities—including product design—under regulatory legislation such as the Fair Trading Act, Consumer Guarantees Act, Medicines Act, Food Act, and Land Transport Act.[195] Early-stage discussions regarding how to regulate AI are underway in New Zealand.[196] For now, however, New Zealanders are ironically concerned with the government's and the ACC's use of AI to profile clients and predict their behavior.[197]

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191. *See id.* at 217–18.

192. *See id.* at 218.

193. *See* ACC New Zealand, *Injury Prevention at ACC*, YOUTUBE (Sept. 9, 2018), https://youtu.be/0RM4MPO3xb0. Programs promote safety in early childhood, teach adolescents about safe sex and respectful relationships, encourage healthy and safe workplace practices, promote safe driving, prevent sports-related injuries, and prevent falls and fractures in seniors. *See id.*

194. *See* ACCIDENT COMPENSATION CORPORATION, ANNUAL REPORT 2018: PARTNERING WITH NEW ZEALAND 28 (2018).

195. *See* SARAH ARMSTRONG ET AL., PRODUCT LIABILITY AND SAFETY IN NEW ZEALAND: OVERVIEW (2018).

196. *See* Jamie Morton, *Call for Govt Data-Mining Watchdog*, OTAGO DAILY TIMES (Apr. 22, 2018), https://www.odt.co.nz/news/national/call-govt-data-mining-watchdog [https://perma.cc/DNA4-FZJF].

197. *See id.*

3. Financing

Funding the New Zealand scheme is, in theory, the New Zealand public's collective responsibility.[198] In practice, the ACC maintains five distinct accounts with separate cash sources and uses—the non-earners' account, work account, earners' account, motor vehicle account, and treatment injury account[199]:

- The non-earners' account is funded by government appropriations (i.e., general tax revenues), and it covers people who are not working, such as children and retirees.[200]
- The work account is funded by taxes on employers and independent contractors; it covers injuries at work.[201]
- The earners' account is funded by income tax; it covers nonoccupational injuries suffered by employed individuals.[202]
- The motor vehicle account is funded by a vehicle and motorcycle ownership tax and a gasoline tax; it covers vehicle-related injuries.[203]
- The treatment injury account is funded by allocations from the earners' and non-earners' accounts; it covers injuries caused by medical treatment.[204]

The accounts are also supplemented by returns from the ACC's investment portfolio.[205] In fiscal year 2017–18, the ACC reported total claim costs of 6.969 billion New Zealand dollars, total tax revenue of 4.120 billion New Zealand dollars, total investment revenue of 3.515 billion New Zealand dollars, and a surplus of roughly 28 million New Zealand dollars.[206]

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198. *See* DOBBS, HAYDEN & BUBLICK, *supra* note 5, § 36.6 (discussing Social Security's source of funds); *Our History*, ACC (Dec. 12, 2018), https://www.acc.co.nz/about-us/who-we-are/our-history/ [https://perma.cc/QE39-LHFS].

199. *See* ACCIDENT COMPENSATION CORPORATION, *supra* note 194, at 3.

200. *Id.* at 3, 107.

201. *Id.* at 109.

202. *Id.* at 108.

203. *Id.* at 106.

204. *Id.* at 111.

205. *Id.* at 101.

206. *Id.* In addition to claim costs, 638 million New Zealand dollars were spent on injury prevention costs, investment expenditures, and operating costs. *Id.*

B. Application to AI Injuries

This Note proposes implementing a similar no-fault social insurance scheme in the United States to address the looming problem of AI injuries. This Section first discusses issues surrounding implementation. It then analyzes the plan's strengths, weaknesses, opportunities, and threats. In short, while there undeniably is a risk that claim costs will be great and the scheme financially unmanageable, this plan has an equal, if not greater, potential to solve the difficulty of allocating AI injury costs fairly and thereby support the legitimate growth of the AI industry.

1. Implementation

This Section discusses the proposed scheme's coverage and benefits, its relationship with the tort regime, and its financing. It assumes the scheme is enacted by Congress under its Tax and Spend authority,[207] as opposed to by states so as to prevent free riders and a race to the bottom.

Coverage. This Note proposes that, at first, the US scheme provide the same coverage as the New Zealand scheme: *all* personal injuries by accident. As previously discussed, the class of personal injuries by accident already includes many AI injuries and, going forward, AI will be responsible for an increasing proportion of all personal injuries.[208] This Note eschews a more modest approach that limits coverage to AI injuries for two reasons: (1) distinguishing AI injuries from traditional injuries is impracticable and (2) traditional injuries also suffer from the deficiencies of tort law and it makes little sense to distinguish the two kinds of injuries. Eventually, policy makers may consider extending coverage beyond personal injuries to intangible injuries like purely economic losses, emotional and psychological injuries, and breaches of privacy.

Tort Claims. The US scheme should abolish tort claims for covered injuries in order to prevent double recovery, as does the New Zealand scheme.[209] A plethora of statutes already exists to prohibit negligent and non-negligent dangerous activities and faulty products and protect the public from harm, such as the Consumer Product Safety Act and the Food, Drug, and Cosmetic Act.[210] Regulations and injury prevention initiatives specifically addressing AI should augment these

207. U.S. CONST. art. I, § 8; *see also* Helvering v. Davis, 301 U.S. 619, 640 (1937).

208. *See supra* Section III.A.1.

209. *See* Todd, *Forty Years*, *supra* note 174, at 207.

210. 15 U.S.C. §§ 2051–2089 (2018); 21 U.S.C. §§ 301–399i (2018).

programs, but this Note will not stake a position on whether they should be administered by existing agencies or a new, all-encompassing AI agency.[211] Since administrative actions may not be able to adequately prevent AI injuries, lawyers should seriously consider fundamental legal reforms such as robot personhood and robot liability as a new means of injury deterrence, sooner rather than later.[212]

Financing. This Note recommends that the US scheme be financed from general tax revenues rather than from categorized revenue streams as seen in the New Zealand scheme or the narrowly focused NVICP scheme. Separating revenue streams—by, for example, financing medical AI injuries with a tax on medical AI and financing self-driving vehicle injuries with a tax on self-driving vehicles—is not ideal because it would not spread the cost of AI across the entire community, which will likely enjoy the benefits of each AI collectively.[213] Consider again the example of self-driving vehicles. Shifting the injury costs of motor vehicles with what is functionally a strict liability regime to owners or to designers, who would in turn shift the costs to their customers, might make sense today, since the owners currently enjoy the entire benefits of conventional vehicles by themselves. However, it makes less sense in the future, when owners of self-driving vehicles provide substantial benefits to society with their personal enjoyment—namely, improvements to public safety, environmental quality, social productivity, and access to transportation. The system should arguably support, not burden, self-driving vehicle ownership, as discussed earlier.[214]

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211. *See supra* Section II.B.

212. *See* CHOPRA & WHITE, *supra* note 34, at 145. While shocking at first blush, robot personhood is not problematic or unusual as a legal matter; robots can be accorded personhood just as easily as a corporation is accorded personhood. *See id.* at 153; Vladeck, *supra* note 55, at 150. Granting robots personhood, and thereby granting them property rights, would allow regulators and courts to punish and deter the behavior of intelligent machines directly, assuming that machines are programmed to "fear" loss of property. *See* CHOPRA & WHITE, *supra* note 34, at 149, 166, 168; TURNER, *supra* note 130, at 188–89; Solum, *supra* note 34, at 1271. *But see* Janosch Delcker, *Europe Divided Over Robot 'Personhood'*, POLITICO (Apr. 13, 2018, 8:29 AM), https://www.politico.eu/article/europe-divided-over-robot-ai-artificial-intelligence-personhood/ [https://perma.cc/B8NT-893P].

213. *See* Sugarman, *supra* note 123, at 638–39. *But see, e.g.*, Kyle Colonna, *Autonomous Cars and Tort Liability*, 4 CASE W. RES. J.L. TECH. & INTERNET 81, 125 (2012) (proposing an insurance scheme for self-driving vehicle injuries financed by the car industry and modeled after the nuclear regime); Funkhouser, *supra* note 58, at 461.

214. *See supra* Section II.A.3.

2. Analysis

This Section analyzes the proposed scheme's strengths and weaknesses (internal factors), and opportunities and threats (external factors).

Strengths. No-fault insurance schemes remove many of the barriers that currently prevent victims, of both AI and non-AI injuries, from seeking a remedy for their injuries: the burden of collecting evidence, the burden of understanding and analyzing product designs, the burden of proof, and cost.[215] Simultaneously, the collective financing scheme empowers AI designers: it alleviates the chilling effect that unpredictable fault-based liability instills.

Weaknesses. As previously discussed, fault-based liability has minimal success at deterring undesirable behavior.[216] However, the civil tort regime arguably serves as a legitimate outlet for victims to satisfy their need for retributive and social justice.[217] Victims are potentially better able to express themselves, gain publicity, effectuate social change, and find comfort in private litigation rather than in administrative proceedings.[218] As such, eliminating the tort regime for personal injuries sacrifices an arguably important public interest.

Opportunities. Increased adoption of AI has the potential to vastly reduce personal injury rates: according to optimists like Ray Kurzweil, by the end of the twenty-first century, AI will not only reduce injuries, it will reverse global warming and even cure death.[219] Even if such utopian predictions are put aside, it is still reasonably likely that injury rates and costs per injury will substantially decline thanks to a few key injury-reducing AI technologies like self-driving vehicles and health care AI, making the scheme significantly easier to finance.[220]

Threats. Some futurists, on the other hand, have predicted AI will not only increase injuries, but pose an existential threat to humanity, similarly to nuclear and genetic technologies.[221] Again, even with a tempered outlook, the proliferation of AI realistically could

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215. *See supra* Section II.A.

216. *See supra* Section II.A.4.

217. *See* Shigeaki Tanaka, *Justice, Accidents and Compensation*, 15 U. HAW. L. REV. 736, 739 (1993).

218. *See id. But see* Sugarman, *supra* note 123, at 611.

219. *See* KURZWEIL, *supra* note 26, at 244, 323, 325.

220. *See* ANDERSON ET AL., *supra* note 13, at 13; Tanya M. Anandan, *Robots and AI in the OR*, ROBOTIC INDUS. ASS'N (Nov. 26, 2018), https://www.robotics.org/content-detail.cfm/Industrial-Robotics-Industry-Insights/Robots-and-AI-in-the-OR/content_id/7585 [https://perma.cc/5CWY-HWFE].

221. *See* Samuel Gibbs, *Elon Musk: Regulate AI to Combat 'Existential Threat' Before It's Too Late*, GUARDIAN (July 17, 2017), https://www.theguardian.com/technology/2017/jul/17/elon-musk-regulation-ai-combat-existential-threat-tesla-spacex-ceo [https://perma.cc/83DA-PRQ5].

increase injury rates and make an insurance scheme unsustainable. Moreover, even before including the impact of AI on injury rates, there is a risk that the insurance scheme would not translate from New Zealand to the United States as an actuarial matter. Slight differences in claim rates between Americans and New Zealanders due to cultural, political, or even climatic differences would change the economics of the scheme. Piloting the scheme on a small scale, such as at a state or municipal level, might allow administrators to collect data, experiment with the financial and administrative structure, and reduce these risks.

IV. CONCLUSION

In the coming decades, AI will provide vast improvements in comfort, convenience, safety, security, and even social justice. But at the same time, AI will inevitably cause a variety of injuries, the costs of which will land disproportionately on blameless victims. Preventing these injuries or shifting the liability with regulation will be challenging. As a result, it would not be surprising if public opinion quickly swings to suspicion, even fear, of AI. In response, this Note proposes a social insurance scheme that covers all personal injuries regardless of fault and whether AI was involved. The proposed solution properly balances the public's interest in receiving AI's benefits as soon as possible with victims' interest in just compensation. Going forward, lawmakers will also need to consider appropriate responses to intangible injuries, such as economic injuries, emotional and psychological injuries, improper discrimination, and breaches of privacy. A complete and effective social welfare system will maintain public confidence in the development of AI and support the continuing growth of AI industries.

Finally, growing domestic AI industries is increasingly crucial to the United States' national interest.[222] In addition to the positive applications discussed above, AI has suspect applications in the military, election tampering, public surveillance, and social engineering.[223] If an illiberal state, such as China or Russia, gains a

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222. *See* Elsa Kania, *The Policy Dimension of Leading in AI*, LAWFARE (Oct. 19, 2017, 10:30 AM), https://www.lawfareblog.com/policy-dimension-leading-ai [https://perma.cc/YK3B-XDYM]; Jayshree Pandya, *The Geopolitics of Artificial Intelligence*, FORBES (Jan. 28, 2019, 2:06 AM), http://www.forbes.com/sites/cognitiveworld/2019/01/28/the-geopolitics-of-artificial-intelligence [https://perma.cc/33JM-KSWF].

223. *See* Elaine Kamarck, *Malevolent Soft Power, AI, and the Threat to Democracy*, BROOKINGS INST. (Nov. 29, 2018), https://www.brookings.edu/research/malevolent-soft-power-ai-and-the-threat-to-democracy/ [https://perma.cc/MWE3-7XAC]; Nicholas Thompson & Ian Bremmer, *The AI Cold War That Threatens Us All*, WIRED (Oct. 23, 2018, 6:00 AM), https://www.wired.com/story/ai-cold-war-china-could-doom-us-all/ [https://perma.cc/JQK8-A7H5].

lead in or dominates AI technology, the United States' national security, and arguably the entire international order, could be threatened.[224] If, however, AI grows here, the United States can continue to lead the international community towards a cleaner, wealthier, and freer world.[225]

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224. *See* Kamarck, *supra* note 223; David Meyer, *Vladimir Putin Says Whoever Leads in Artificial Intelligence Will Rule the World*, FORTUNE (Sept. 4, 2017), http://fortune.com/2017/09/04/ai-artificial-intelligence-putin-rule-world/ [https://perma.cc/76MC-R46T]; Thompson & Bremmer, *supra* note 223.

225. *See* Kamarck, *supra* note 223; Kania, *supra* note 222.

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