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Future-Proofing Law

Anupam Chander[*]

It was only fifty years ago that Texas Instruments introduced a pocket calculator, and that a South African doctor performed a heart transplant. The iPhone is merely a decade old. In the blink of an eye, everyday objects are gaining intelligence, robots are taking to the streets, and drones are taking to the air. The quickening pace of technological change challenges regulators across the world. This essay introduces the articles in the UC Davis symposium on "Future-Proofing Law: From rDNA to Robots," published in two issues of the UC Davis Law Review. It distills some of the lessons that regulators might keep in mind as they approach rapidly advancing technologies.

TABLE OF CONTENTS

 Director of the California International Law Center and Martin Luther King, Jr. Professor at UC Davis School of Law; Visiting Professor, Georgetown University Law Center; A.B. Harvard College; J.D. Yale Law School. The author is grateful to the Knight Foundation for being the principal sponsor of the conference; to Fenwick & West for their continued support of technology studies at King Hall; to Dean Kevin Johnson for his continued support; to the extraordinary editors of the UC Davis Law Review, including Senior Symposium Editors Rachel Kane and Shree Sharma and Editors in Chief Molly Niffenegger and Lars Reed; and to a Google Research Award in support of related research.

INTRODUCTION

> "Technology is not going to be the long pole. The long pole is going to be regulatory."
>
> — Jeff Bezos[1]

In 2016, the United States Department of Commerce requested comments on the government's role in fostering and regulating the Internet of Things. Privacy advocates suggested that the United States government issue "legal requirements ensur[ing] that companies providing 'Internet of Things' services adopt Privacy Enhancing Technologies; do not track, profile, or monitor users . . . ."[2] IBM, on the other hand, argued, "Wait and see."[3]

When it comes to emerging technologies, should we wait and see or should we regulate in advance? Proponents of the precautionary principle would be more likely to prefer preemptive regulation designed to foresee and forestall potential risks. Proponents of risk-based approaches often prefer to wait-and-see, depending on the particular risks involved.[4] This so-called procrastination principle would have regulators learn from experience before intervening, but as Jonathan Zittrain notes, "The procrastination principle rests on the assumption that most problems confronting a network can be solved later or by others."[5] Innovators themselves often prefer "to ask forgiveness, not permission,"[6] but they often recognize the need for

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[1] Henry Blodget, *I Asked Jeff Bezos the Tough Questions — No Profits, the Book Controversies, the Phone Flop — and He Showed Why Amazon is Such a Huge Success*, BUS. INSIDER (Dec. 13, 2014, 11:10 AM), http://www.businessinsider.com/amazons-jeff-bezos-on-profits-failure-succession-big-bets-2014-12.

[2] ELEC. PRIVACY INFO. CTR., ON THE BENEFITS, CHALLENGES, AND POTENTIAL ROLES FOR THE GOVERNMENT IN FOSTERING THE ADVANCEMENT OF THE INTERNET OF THINGS 1 (June 2, 2016), https://www.ntia.doc.gov/files/ntia/publications/epic_comments_to_ntia_on_iot_-_06.02.2016.pdf.

[3] Letter from Christopher O'Connor, Gen. Manager, IBM, to Travis Hall, U.S. Dep't of Commerce 2 (June 2, 2016), https://www.ntia.doc.gov/files/ntia/publications/ibm_submission_to_doc_rfc_on_iot_06022016.pdf.

[4] Risk-based approaches are often founded on cost-benefit analysis. As Justice Cuéllar notes in his keynote for the conference, such approaches are complicated by the fact that "we do not have neat formulas to answer the question of what government should maximize, because we often lack consensus about how best to define individual rationality (especially across time), and aggregate social welfare." Mariano-Florentino Cuéllar, *A Simpler World? On Pruning Risks and Harvesting Fruits in an Orchard of Whispering Algorithms*, 51 UC DAVIS L. REV. 27, 36 (2017).

[5] JONATHAN ZITTRAIN, THE FUTURE OF THE INTERNET — AND HOW TO STOP IT 31 (2008). I am grateful to B.J. Ard for drawing my attention to this approach.

[6] Fred Shapiro traces the origins of this maxim to at least 1980. Fred Shapiro, *Quotes Uncovered: Forgiveness, Permission, and Awesomeness*, FREAKONOMICS BLOG

regulation to assure the public or even to stymie competition. Proponents of all approaches recognize the need for preparation.

I introduce here the papers from a major symposium on "Future-Proofing Law: From rDNA to Robots," held at the University of California, Davis in January 2017. The UC Davis Law Review is publishing the voluminous papers from the symposium, numbering twenty-one, including this one, in two issues. The principal sponsor of the symposium was the Knight Foundation, with additional support from the law firm of Fenwick & West LLP.

Associate Justice Mariano-Florentino Cuéllar of the Supreme Court of California, and formerly of Stanford Law School, offered an insightful keynote address on artificial intelligence in the administrative state. Mark Lemley, William H. Neukom Professor of Law and Director, Program in Law, Science & Technology at Stanford Law School, presented a compelling keynote on virtual reality and the law. Ben Wizner, the Director of the Speech, Privacy & Technology Project at the American Civil Liberties Union and Legal Counsel to Edward Snowden, gave a special lecture on the threat that growing surveillance powers pose to liberty.

The remaining presenters (other than me) were: Chinmayi Arun, the Executive Director of the Centre for Communication Governance and Assistant Professor at the National Law University Delhi; Jane Bambauer, Associate Professor of Law at the University of Arizona; Dan L. Burk, Chancellor's Professor of Law at the UC Irvine School of Law; Mira Burri, Senior Lecturer and Managing Director for Internationalization at the Faculty of Law of the University of Lucerne; Ryan Calo, Assistant Professor at the University of Washington School of Law; I. Glenn Cohen, Faculty Director of the Petrie-Flom Center for Health Law Policy, Biotechnology, and Bioethics and Professor at Harvard Law School; Julie E. Cohen, Mark Claster Mamolen Professor of Law and Technology at the Georgetown University Law Center; Laura DeNardis, Professor and Associate Dean in the School of Communication at American University; Mary Anne Franks, Professor at the University of Miami School of Law and the Vice-President of the Cyber Civil Rights Initiative; Henry T. Greely, Director of the Center for Law and the Biosciences and Deane F. and Kate Edelman Johnson Professor of Law at Stanford Law School; Lisa C. Ikemoto, Martin Luther King, Jr. Professor at UC Davis School of Law; Elizabeth Joh, Professor at UC Davis School of Law; Margot E. Kaminski, Associate

(June 24, 2010, 3:00 PM), http://freakonomics.com/2010/06/24/quotes-uncovered-forgiveness-permission-and-awesomeness.

Professor of Law at University of Colorado Boulder, Colorado Law; Peter Lee, Professor at UC Davis School of Law; Nancy Leong, Professor at University of Denver, Sturm College of Law; Albert Lin, Martin Luther King, Jr. Professor at UC Davis School of Law; Gary E. Marchant, Regents' Professor of Law and Faculty Director, Center for Law, Science & Innovation at Arizona State University, Sandra Day O'Connor College of Law; Paul Ohm, Professor of Law and Faculty Director, Center on Privacy and Technology at the Georgetown University Law Center, who was joined by Yale law student David Lehr, a research fellow at Georgetown; Arti Rai, Elvin R. Latty Professor of Law and co-Director, Duke Law Center for Innovation Policy; and Molly Van Houweling, Associate Dean, Harold C. Hohbach Distinguished Professor of Patent Law and Intellectual Property, and Co-director, Berkeley Center for Law & Technology, UC Berkeley School of Law. Commentators included: Mario Biagioli, Distinguished Professor of Law and Science and Technology Studies ("STS") and Director of the Center for Science and Innovation Studies at UC Davis School of Law; Malavika Jayaram, the Executive Director of Digital Asia Hub; Sarah Jeong, then of Vice Media and now of The Verge; Stephanie M. Lee of Buzzfeed; Thomas Lee of the S.F. Chronicle; Professor K.S. Park of Korea University Law School and Director of Open Net Korea; and Brian Soucek, Professor at UC Davis School of Law.

This introduction proceeds as follows. Part I describes the quickening pace of change, from the rise of smart objects to our growing ability to alter life itself. Part II considers the rise of robots, specifically robot cars and robot delivery vehicles, revealing regulatory lacunae, arbitrage, and maneuvering. Part III offers some preliminary principles for future-proofing law.

I. THE AGE OF MAGIC

The technologies of fantasy worlds are increasingly becoming our lived reality. The things around us are becoming intelligent and aware, driving us to our destinations, monitoring our homes, and entertaining our children. Computer algorithms seek to identify reliable borrowers or even predict crimes. Augmented reality technologies overlay information on the world around us, and virtual reality allows us to step into someone else's shoes in a visceral way. Gene editing techniques allow scientists to reshape human, animal, and plant biology, engineering designer babies or designer crops. One technologist thinks of T cells as being "like little computers" that can

be reprogrammed.[7] Computers are expanding our powers while scientists are hacking our bodies. Say a word, "Lumos," and light the room. Peer into a mirror and see what is happening across the world. In his keynote address to this symposium, Justice Mariano-Florentino Cuéllar begins by remembering some fourth-graders who recently visited his courtroom, and calls on us to "imagine what life will be like for . . . the children of those fourth graders."[8]

How should law respond to these technological changes reshaping our society and even our bodies? Should law constrain our ability to change the human body or the human mind, to engineer the perfect child to eliminate supposed "imperfections"? Will automated decision-making technologies worsen inequalities, or can they reduce discrimination? Will our smartphone assistants make our lives easier only at the price of government surveillance of our every communication and activity? The technologies that give us increasing powers might at the same time give others power over us. When these technologies fail or when they are misused, who will be liable? When third parties come into the path of such technologies, can disclosure and consent suffice to manage risks?

The relationship of law to technology is more often assumed than interrogated, but technological change often forces the issue. For example, the limits that the Fourth Amendment places on police searches and seizures of our homes and possessions can become meaningless if the government can read our writings or view our photos when they are stored in the cloud. Confronted with technologies that can peer inside the home without stepping inside, the Supreme Court has found itself asking "what limits there are upon this power of technology to shrink the realm of guaranteed privacy."[9]

Consider the rapidity of change over the last half-century. It was only fifty years ago when Texas Instruments introduced a pocket calculator. Any rules written for pocket calculators at that time would not prove adequate to the world of computing around the corner. In California, the same year when the pocket calculator was introduced, 1967, Governor Ronald Reagan passed a law legalizing abortion under certain circumstances. 1967 also witnessed the first heart transplant, which occurred not in the United States but in South Africa.

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[7] Antonio Regalado, *Money Behind First CRISPR Test? It's from Internet Billionaire Sean Parker*, MIT TECH. REV. (June 20, 2016), https://www.technologyreview.com/s/601742/money-behind-first-crispr-test-its-from-internet-billionaire-sean-parker.

[8] Cuéllar, *supra* note 4, at 29.

[9] Kyllo v. United States, 533 U.S. 27, 34 (2001).

The quickening pace of technological change makes the issue of regulatory capacity and readiness increasingly urgent. Cars are already driving themselves on our roads, apparently without any regulatory oversight because these innovations are introduced as safety features.[10] Our increasingly digital lives leave enormous data trails that can be studied to improve our lives or to monitor or manipulate us. The questions are at once theoretical and practical. Should lawmakers approach technological innovations according to the precautionary principle, cost-benefit analysis, or another principle altogether? How can we anticipate risks, but still promote innovations that benefit society?

This symposium brings together leading scholars on issues of technology and law. The papers examine how law might adapt to emerging technologies — a kind of future-proofing law. The goal of the symposium is to think far into the future, and start planning regulatory approaches to meet coming challenges. By engaging both health ethicists and cyber-lawyers, for example, we help prepare for the day when robotics converges with biology. Because technological innovations can be dreamed up and implemented across the world, any discussion of the legal response to emerging technologies must take into account varying political, economic, and cultural contexts.

II. THE RISE OF ROBOTS

Public sidewalks and streets are heavily regulated, but few jurisdictions have anticipated the rise of autonomous vehicles jostling with cars, pedestrians, bicyclists, dogs, and cats on these public ways. This means that most jurisdictions are unprepared for the coming of autonomous vehicles. We consider below the relationship of regulation to two types of autonomous vehicles: personal delivery robots and self-driving cars.

A. Sidewalk Robots

Because sometimes jurisdictions might actually make it illegal to run robots on sidewalks and bikeways, the introduction of delivery robots will require regulatory intervention.[11] Starship Technologies, a delivery robot startup whose operations are centered in Estonia, has lobbied statehouses and municipalities for new regulations permitting

[10] *See infra* notes 38-39 and accompanying text.

[11] *See* Alexis Kramer, *Delivery Robots Rolling into Regulatory Thicket*, BLOOMBERG BNA (June 19, 2017), https://www.bna.com/delivery-robots-rolling-n73014453559.

personal delivery robots. As a result, five states have passed laws this year to regulate delivery robots: Florida, Idaho, Ohio, Virginia, and Wisconsin.[12]

Perhaps because of their common proponent, the new laws all use similar language and definitions. The delivery robots are called "personal delivery devices" ("PDDs"). Figure 1 below compares some notable similarities and differences between the various statutes.

Figure 1. Rules for Delivery Robots

	Ohio	Florida	Wisconsin	Idaho	Virginia
Max. Weight (empty)	90 lbs.[13]	80 lbs.[14]	80 lbs.[15]	80 lbs.[16]	50 lbs.[17]
Minimum Liability Insurance	$100,000[18]	$100,000[19]	Not required	Not required	Not required
Restricted Cargo	No hazardous materials that would require a permit[20]	No hazardous materials[21]	None	No hazardous materials or hazardous waste[22]	No hazardous materials, including ammunition[23]

Common features of the regulations include the following restrictions on PDD operation:

[12] April Glaser, *Ohio Is Now the Fifth U.S. State to Permit Delivery Robots on Sidewalks*, RECODE (July 5, 2017, 1:06 PM), https://www.recode.net/2017/7/5/15916688/ohio-fifth-state-delivery-food-robots-starship-law. Virginia was the first to pass a law, though its law went into effect on July 1, 2017, like the laws passed by other jurisdictions. *See* April Glaser, *Virginia Is the First State to Pass a Law Allowing Robots to Deliver Straight to Your Door*, RECODE (Mar. 1, 2017, 6:54 PM), https://www.recode.net/2017/3/1/14782518/virginia-robot-law-first-state-delivery-starship.

[13] OHIO REV. CODE ANN. § 4511.513(A)(2)(b) (2017).

[14] FLA. STAT. § 316.003(51)(b) (2017).

[15] WIS. STAT. § 340.01(43fg)(b) (2017).

[16] IDAHO CODE § 49-117(8) (2017).

[17] VA. CODE ANN. § 46.2-100 (2017).

[18] OHIO REV. CODE ANN. § 4511.513(B)(3) (2017).

[19] FLA. STAT. § 316.2071(4) (2017).

[20] OHIO REV. CODE ANN. § 4511.513(C)(3) (2017).

[21] FLA. STAT. § 316.2071(3)(c) (2017).

[22] IDAHO CODE § 40-2305(6) (2017).

[23] VA. CODE ANN. § 46.2-908.1:1(C) (2017).

- Restricted to sidewalks, crosswalks, and similar paths;[24]
- Restricted to a maximum speed of 10 miles per hour;[25]
- Must be accompanied and monitored by an operator;[26]
- Must have identifying and contact information of the operator or owner;[27] and
- Must be capable of navigating with or without direct control by an operator.[28]

The various regulations demonstrate how laws can be used to favor certain corporations over others. Starship Technologies' robots are relatively light, weighing some 40 pounds.[29] Its competitor Marble's robots, on the other hand, are twice as heavy — more than 80 pounds, and thus would not come within the protections of these laws.[30] Competitor Vespa's rover, named Gita, weighs 70 pounds, and would thus fall outside the protection of the Virginia law.[31] The weight limits seem arbitrary — one Wisconsin legislator apparently "arrived at the 80-pound weight limit by doubling the weight of Starship's robot."[32]

State legislators also looked over their shoulders as they legislated. A Wisconsin legislator urged the legislature to legalize sidewalk robots in part because Wisconsin would be the first state in the Midwest to

[24] *See* FLA. STAT. § 316.003(51)(a) (2017); IDAHO CODE § 40-2305(3) (2017); OHIO REV. CODE ANN. § 4511.513(B) (2017); VA. CODE ANN. § 46.2-100 (2017); WIS. STAT. § 346.807(1) (2017).

[25] FLA. STAT. § 316.003(51)(c) (2017); IDAHO CODE § 49-117(8) (2017); OHIO REV. CODE ANN. § 4511.513(A)(2)(c) (2017); VA. CODE ANN. § 46.2-100 (2017); WIS. STAT. § 340.01(43fg)(c) (2017).

[26] FLA. STAT. § 316.2071(3)(b) (2017); IDAHO CODE § 40-2305(8) (2017); OHIO REV. CODE ANN. § 4511.513(B)(2) (2017); VA. CODE ANN. § 46.2-908.1:1(E) (2017); WIS. STAT. § 346.807(2)(a) (2017).

[27] FLA. STAT. § 316.2071(2)(b) (2017); IDAHO CODE § 40-2305(4) (2017); OHIO REV. CODE ANN. § 4511.513(B)(4)(a) (2017); VA. CODE ANN. § 46.2-908.1:1(A) (2017); WIS. STAT. § 347.489(4) (2017).

[28] FLA. STAT. § 316.003(51)(d) (2017); IDAHO CODE § 49-117(8) (2017); OHIO REV. CODE ANN. § 4511.513(A)(2)(d) (2017); VA. CODE ANN. § 46.2-100 (2017); WIS. STAT. § 340.01(43fg)(d) (2017).

[29] Ann Glaser, *Robots Will Start Delivering Food to Doorsteps in Silicon Valley and Washington, D.C., Today*, RECODE (Jan. 18, 2017, 1:49 PM), https://www.recode.net/2017/1/18/14306674/starship-robot-food-delivery-washington-dc-silicon-valley.

[30] *See* Ann Glaser, *A Robot-Delivery Startup Helped Write State Laws that Are Locking out Competition*, RECODE (Apr. 22, 2017, 1:30 PM), https://www.recode.net/2017/4/22/15273698/robot-delivery-startup-starship-state-laws-lock-out-competitors.

[31] *See id.*

[32] *Id.*

open its markets to Personal Delivery Devices, and thus help "identify Wisconsin as a technology leader in the Midwest."[33]

B. Robot Cars

In 2015, Tesla's blog announced, "Your autopilot has arrived."[34] *The New York Times* reported, "[I]t is not every day you get to open a door and step into the future." The product, Tesla's CEO Elon Musk announced, was still in "beta," a term typically used to refer to software that has not yet been fully tested.[35] Tesla's software, available as a $2,500 download, enabled the car "to steer within a lane, change lanes with the simple tap of a turn signal, and manage speed by using active, traffic-aware cruise control."[36]

The law did not anticipate cars with self-steering features. Only New York has a law that requires at least one hand on the wheel at all times, but this law is not directed towards car manufacturers, but rather the individuals who drive cars (who can, after all, still put their hands on the wheel of a Tesla Autopiloted car).[37] The federal government does not require prior approval of automated technologies. In fact, the technologies were introduced under the rubric of enhanced safety — including automatic emergency breaking and forward collision warning. Indeed, the rollout of the automated features took the federal regulators by surprise.[38] Asked about the surprise rollout, the National Highway Transportation Safety Administration referred reporters to earlier statements by the

[33] Memorandum from Mike Kuglitsch to the Wis. Assembly Comm. on Sci. & Tech. (Apr. 19, 2017), https://docs.legis.wisconsin.gov/misc/lc/hearing_testimony_and_materials/2017/ab191/ab0191_2017_04_19.pdf.

[34] The Tesla Motors Team, *Your Autopilot Has Arrived*, TESLA (Oct. 14. 2015), https://www.tesla.com/blog/your-autopilot-has-arrived.

[35] Musk would explain in a subsequent tweet that "beta" for Tesla meant that the car had not been driven a billion miles, which would provide the data that they need before removing the "beta" designation. Zachary Shahan, *What Does Tesla Autopilot "Beta" Mean?*, CLEANTECHNICA (July 11, 2016), https://cleantechnica.com/2016/07/11/tesla-autopilot-beta-mean. Musk would explain that the one billion miles driven were needed for minimum statistical sample, but that figure seems somewhat arbitrary, rather than statistically determined. *See id.*

[36] The Tesla Motors Team, *supra* note 34.

[37] Aaron M. Kessler, *Hands-Free Cars Take Wheel, and Law Isn't Stopping Them*, N.Y. TIMES (May 2, 2015), https://www.nytimes.com/2015/05/03/business/hands-free-cars-take-wheel-and-law-isnt-stopping-them.html.

[38] "[F]ederal regulators seemed caught off guard this week." Grayson Ullman, *Tesla's Self-Driving Software: Is It Street Legal?*, FEDSCOOP (Oct. 16, 2015), https://www.fedscoop.com/teslas-self-driving-update-how-is-it-legal.

Transportation Secretary praising the potential safety benefits of automated technology in cars.[39]

But what about Tesla's home state of California, one of the few states with special regulations for autonomous vehicles? In 2014, California passed a law requiring the Department of Motor Vehicles to adopt regulations for testing autonomous vehicles.[40] These regulations include section 227.34, "Prohibitions on Operation on Public Roads," which provides: "A manufacturer shall not permit any of its autonomous vehicles to be operated on public roads in California . . . ."[41] Tesla argued that it was not subject to the regulations because its cars did not qualify as "autonomous vehicles" under the statute. Indeed, the underlying statute defines "autonomous vehicles" as vehicles equipped with "autonomous technology," which was further defined as "technology that has the capability to drive a vehicle without the active physical control or monitoring by a human operator."[42] Because Tesla's cars require active human monitoring, they appear not to be "autonomous vehicles" governed by the statute. Uber made a similar argument for its self-driving cars, though the Department of Motor Vehicles disputed that interpretation in its case.[43] Thus, the odd result is that because the cars are less automated than some drivers might wrongly assume, the cars are not subject to the California regulation.

Federal review of Tesla's astonishing innovations would come in the wake of a tragic, fatal crash in May 2016 in Florida of a 2015 Tesla Model S, traveling at seventy-four miles per hour with the Traffic-Aware Cruise Control ("TACC") and the Autosteer lane-keeping system engaged.[44] The National Transportation Safety Board concluded in a preliminary report that, "Of the 41 minutes . . . of the crash trip, the driver operated the vehicle with TACC and Autosteer engaged for approximately 37.5 minutes."[45] The car had "presented a

[39] *Id.* (quoting Transportation Secretary Anthony Foxx).

[40] CAL. VEH. CODE § 38750 (2017).

[41] CAL. CODE REGS. tit. 13, § 227.34 (2017).

[42] CAL VEH. CODE § 38750 (2017).

[43] *See* Jack Stewart, *California's Finally Ready for Truly Driverless Cars*, WIRED (Mar. 11, 2017, 7:00 AM), https://www.wired.com/2017/03/californias-finally-ready-truly-driverless-cars ("Uber based its initial refusal to apply for a self-driving permit on the argument that because it's cars need human backups, they don't meet the state's definition of autonomous.").

[44] NAT'L TRANSP. SAFETY BD., CRASH SUMMARY REPORT 2 (Jun. 15, 2017) (NTSB Report Number HWY16FH018).

[45] NAT'L TRANSP. SAFETY BD., HUMAN PERFORMANCE FACTORS GROUP CHAIRMAN'S SUPPLEMENTAL REPORT: DRIVER ASSISTANCE SYSTEMS 20 (Jun. 15, 2017) (NTSB Report

visual warning to the driver on 7 occasions" and on six of those times, "the visual warnings occasions were followed with the initial level of auditory warning."[46] Despite these warnings, "The data shows that out of those 37.5 minutes during which the Autopilot was active, the system did not detect driver's hands on the steering wheel for approximately 37 minutes."[47]

In the wake of the crash, the National Highway Traffic Safety Agency ("NHTSA") reviewed overall crash rates for Tesla vehicles, and found that crash rates (as identified by airbag deployment) fell forty percent after Autosteer installation.[48] There is some reason to question this astonishing improvement. It was calculated on the basis of Autosteer installation, not use. It is not clear if there were other changes introduced along with Autosteer — for example, improved automated emergency breaking[49] — that might have been more instrumental in any reduction in crash rates; thus, even if there is a correlation, causation is not clear. Crash rates also do not tell us whether the severity of the accident has changed with the introduction of Autosteer. Furthermore, the NHTSA has not provided the underlying data that would allow independent evaluation of its conclusion, despite requests.[50] Finally, other data seems to call the NHTSA conclusion into question: the Insurance Institute for Highway Safety reports "abnormally high claim frequencies and high costs of insurance claims [for Tesla vehicles] compared with other cars in the same classes."[51]

Number HWY16FH018), https://dms.ntsb.gov/public/59500-59999/59989/604713.pdf.

[46] *Id.*

[47] *Id.*

[48] KAREEM HABIB, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., AUTOMATIC VEHICLE CONTROL SYSTEMS 10 (Jan. 19, 2017) (Investigation Number PE 16-007).

[49] One study from the Insurance Institute for Highway Safety finds that forward collision warning systems coupled with autonomous emergency braking reduce police-reported crash rates by thirty-nine percent. *See* JESSICA B. CICCHINO, INS. INST. FOR HIGHWAY SAFETY, EFFECTIVENESS OF FORWARD COLLISION WARNING SYSTEMS WITH AND WITHOUT AUTONOMOUS EMERGENCY BRAKING IN REDUCING POLICE-REPORTED CRASH RATES 14 (Jan. 2016), http://orfe.princeton.edu/~alaink/SmartDrivingCars/Papers/IIHS-CicchinoEffectivenessOfCWS-Jan2016.pdf.

[50] *See, e.g.*, Allana Akhtar, *Does Tesla's Autosteer Really Cut Crashes by 40 Percent?*, JALOPNIK (July 3, 2017, 1:30 PM), http://jalopnik.com/does-teslas-autosteer-really-cut-crashes-by-40-percent-1796548178.

[51] Katie Burke, *AAA Premiums for the Tesla Model S Could Rise About 30 Percent*, AUTOMOTIVE NEWS (June 4, 2017, 12:01 AM), http://www.autonews.com/article/20170604/FINANCE_AND_INSURANCE/170609884/tesla-owners-should-pay-more-for-insurance-aaa-says.

The Obama Administration sought to promote self-driving cars, releasing guidelines that "outlined safety expectations and encouraged uniform rules."[52] The director of the National Economic Council declared that autonomous vehicles "will save time, money and lives."[53] The guidance includes a fifteen-point safety assessment that manufacturers of highly-automated vehicles might undertake.[54] It also included guidance for a division of responsibility between state and federal authorities. The Obama Administration made the guidelines, including the safety assessment, voluntary. California proposes to convert the voluntary safety assessment into a mandatory one, a move that many car companies, including Ford, Tesla, and Volvo oppose.[55] Opportunities for regulatory capture are greater in regulatory arenas that few understand.

Tesla revised both its software and hardware after the Florida crash, disabling the car if the driver ignored warnings to keep hands on the wheel even with Autosteer engaged. As noted previously, Tesla released the features as "beta" features. With "beta" software, a user can take on the risks of that product being less than fully tested. But with a car, the other drivers on the road, the bicyclists, and pedestrians have not consented. We become part of the "beta" test, willingly or not.

III. PRINCIPLES FOR PREPARATION

"Predicting the future is a surefire way to embarrass oneself," Jane Bambauer warns.[56] Policy-makers must approach planning for the future with humility, knowing that they will fail to anticipate both the technologies that develop, or how actual human beings will deploy them. The insightful symposium papers offer a host of suggestions

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[52] Cecilia Kang, *Self-Driving Cars Gain Powerful Ally: The Government*, N.Y. TIMES (Sept. 19, 2016), https://www.nytimes.com/2016/09/20/technology/self-driving-cars-guidelines.html?mcubz=0&_r=0.

[53] *Id.*

[54] *Fact Sheet: Federal Automated Vehicles Policy Overview*, U.S. DEP'T OF TRANSP. 2-3, https://www.transportation.gov/sites/dot.gov/files/docs/DOT_AV_Policy.pdf (last visited Sept. 9, 2017). The safety assessment seems to belong to a growing class of anticipatory assessments for new ventures — beginning with environmental impact statements, human rights assessments, and privacy assessments.

[55] Letter from Wayne E. Bahr, Glob. Dir., Ford, to Brian Soublet, Deputy Dir./Chief Counsel, Dep't Motor Vehicles 2 (Apr. 24, 2017), https://www.dmv.ca.gov/portal/wcm/connect/8ccf24b4-254a-430c-84b8-9d0c1f37dfcd/Ford.pdf?MOD=AJPERES.

[56] Jane R. Bambauer, *Dr. Robot*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 1) (on file with editors).

that policy-makers might keep in mind. This part seeks to tease out some overarching principles from these papers.

A. Technologies Often Worsen Inequality

A number of papers explore the effect of new technologies on equality. While technologies by themselves often appear neutral, ultimately they often side with the powerful. Technologies can further entrench inequality — making the rich richer or allowing more exploitation of the weak.

Ryan Calo writes that artificial intelligence can lead to inequality in application, with examples ranging "from a camera that will not take an Asian American family's picture because the software believes they are blinking, to an image recognition system that characterizes an African American couple as gorillas, to a translation engine that associates the role of doctor with being male and the role of nurse with being female."[57] Nancy Leong observes that bias in the workplace is "filtered, changed, or amplified as new technology is introduced."[58] Mary Anne Franks suggests "equality stress testing" for new products.[59] She asks designers to ask critical questions about new technologies:

> "Does the product encourage or discourage respect for the autonomy of others? Does it emphasize the importance of consent or embolden aggression? Does it foster empathy or entitlement? Who is able to use the product? Who designed the product? Whose interests are enriched by the product? Whose interests are minimized?"[60]

Technologies are often beyond the reach of the poorest in society. Mary Anne Franks notes that virtual and augmented reality technologies can be inaccessible to many, especially those outside the United States. She points out that "[t]he majority of the world's population — 60% — does not have access to the Internet."[61] At

[57] Ryan Calo, *Artificial Intelligence Policy: A Primer and Roadmap*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 9) (on file with editors).

[58] Nancy Leong, *The Race Neutral Workplace of the Future*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 2) (on file with editors).

[59] Mary Anne Franks, *The Desert of the Unreal: Inequality in Virtual and Augmented Reality*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 26) (on file with editors). Her questions are originally posed in the context of virtual and augmented reality, but they are applicable more broadly as well.

[60] *Id.* (manuscript at 3).

[61] *Id.* (manuscript at 23).

times, governments have responded to this issue with subsidies or universal access obligations — such as for telephones, requiring companies to make telephone services available in rural communities even if they are not lucrative. Moore's Law can be helpful here: as computing capacity increases, earlier technologies tend to become more accessible.

Both Franks and Leong offer some hopeful notes. Franks notes that virtual and augmented reality technologies can potentially "heighten or bring attention to the experiences of marginalized social groups, such technologies can be considered forces for equality."[62] It may be easier to identify discrimination because "[t]ransactions leave more of a data trail," Leong writes. Leong also suggests that well-designed technologies can reduce discriminatory impact. She offers the example of passengers giving lower ratings to Uber drivers because of the passengers' racial bias. If people were forced to justify their low rating, that may tend to reduce the expression of bias. Leong notes software that can "remove[] faces and names from LinkedIn profiles to reduce the effects of unconscious bias," thereby reducing bias at the initial screening stage.[63] It is interesting to note that the pre-technological version of this — requesting name-redacted résumés via mail — was widely available, but rarely used. Harvard Law Review and the Yale Law Journal require anonymized submissions of articles for review, for example, but few other journals do the same.

B. Classification Problems: Regulatory Lacunae and Accidental Proscription

New technologies often raise issues of how to classify them under existing regulations. The new technologies may offer potent capabilities to a previously benign device, perhaps introducing new risks unanticipated by prior regulation or alternatively reducing risks present in prior technologies. New technologies may utilize existing infrastructure in ways previously unimaginable. They thus may take earlier regulations by surprise — perhaps falling under old prohibitions no longer justified with respect to this new technology, perhaps falling into regulatory lacunae because prior technologies did not pose the risks of new ones. New technologies often present regulatory misfits — either accidentally falling outside regulation (a regulatory hole that can be exploited) or accidentally falling within a

[62] *Id.* (manuscript at 4-5).

[63] Leong, *supra* note 58 (manuscript at 4). For an early exploration of related issues, see generally Jerry Kang, *Cyber-Race*, 113 HARV. L. REV. 1130 (2000).

regulation (a kind of regulatory collateral damage). Law might accidentally allow or ban a new technology. Thus, emerging technologies challenge existing regulatory paradigms. To take a pedestrian example: Is a motorized bicycle a "bicycle" for regulatory purposes? Is an autonomous bicycle a "bicycle"? The answer to these questions may depend on the particular regulation at issue.

Henry Greely seeks to ground classification based on functional aspects of the thing being regulated. Beginning with the proposition that pet owners are liable for dogs, but not cats, he seeks to understand why the law might draw such a distinction. He argues that the central issue is "either perfect predictability or perfect controllability."[64]

The problem of classification of emerging technologies can be dealt with in different ways. Let us consider three here. The regulation can be written to be applied based on product function, and not the particular technology used, thereby covering different technologies that perform that function in the future. The Appellate Body of the Dispute Settlement Body of the World Trade Organization has interpreted the General Agreement on Trade in Services ("GATS") in this dynamic way. In a United States challenge to Chinese restrictions on audiovisual imports, China argued that it had never agreed to liberalize the *electronic* distribution of audiovisual products, only the physical distribution of those products.[65] The Appellate Body ruled that commitments should be interpreted dynamically if the terms used are "sufficiently generic that what they apply to may change over time."[66] As Daniel Crosby has noted: "Based on WTO jurisprudence, aspects of the GATS should be considered a 'living agreement' under which the scope and meaning of commitments evolve to accommodate technological advances, specifically concerning new forms of service

[64] Henry T. Greely, *Neuroscience, Artificial Intelligence, CRISPR — and Dogs and Cats*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 9) (on file with editors).

[65] Panel Report, *China — Measures Affecting Trading Rights and Distribution Services for Certain Publications and Audiovisual Entertainment Products*, ¶ 340, WTO Doc. WT/DS363/AB/R (adopted Dec. 21, 2009).

[66] *Id.* at ¶ 396; *see* ANUPAM CHANDER, THE ELECTRONIC SILK ROAD: HOW THE WEB BINDS THE WORLD IN COMMERCE 156 (2013) ("The Appellate Body also stated that commitments should be interpreted in a dynamic fashion, rather than strictly interpreted according to the ordinary meaning at the time the commitment was made . . . . By subsuming an electronic version of the service within a services commitment and by interpreting treaty commitments in a dynamic form, the treaty can take account of changing technologies.").

delivery . . . ."[67] Mira Burri notes that "WTO law also often tackles issues in a technologically neutral way," thereby allowing for technological advances to be governed by prior regulations.[68]

A second solution is to allow for ex post determinations of legality or illegality. Consider the example of U.S. fair use exceptions to copyright. The U.S. common law approach to vetting exceptions to copyrights have allowed unanticipated technological manipulations of copyrighted materials to be retroactively validated by judges. Fair use has turned out to be useful for permissionless innovation.[69]

A third solution is to simply try to encompass all future technological developments peremptorily. Consider the definition of "Internet" in a variety of U.S. federal statutes. The Children's Online Privacy Protection Act defines "Internet" as follows:

> The term "Internet" means collectively the myriad of computer and telecommunications facilities, including equipment and operating software, which comprise the interconnected world-wide network of networks that employ the Transmission Control Protocol/Internet Protocol, or any predecessor or successor protocols to such protocol, to communicate information of all kinds by wire or radio.[70]

Congress anticipated that the current TCP/IP protocols underpinning the internet will be replaced in the future, and indicated "successor protocols" to cover this possibility. (Even this may prove inadequate; Laura DeNardis and Mark Raymond observe that the emergence of cyber physical systems, known popularly as the Internet of Things, challenges the conventional description of the internet as "a shared universal address space.")[71] Copyright lawyers have their own version

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[67] DANIEL CROSBY, ANALYSIS OF DATA LOCALIZATION MEASURES UNDER WTO SERVICES TRADE RULES AND COMMITMENTS (Mar. 2016), http://e15initiative.org/wp-content/uploads/2015/09/E15-Policy-Brief-Crosby-Final.pdf.

[68] Mira Burri, *The Governance of Data and Data Flows in Trade Agreements: The Pitfalls of Legal Adaptation*, 51 UC DAVIS L. REV. 65, 93 (2017).

[69] *See* Anupam Chander, *How Law Made Silicon Valley*, 63 EMORY L.J. 639, 664 (2014); Anupam Chander, *Law and the Geography of Cyberspace,* 6 W.I.P.O. J. 99, 100 (2014).

[70] 15 U.S.C. § 6501 (2012). Compare a simple definition in the Communications Decency Act: "The term 'Internet' means the international computer network of both Federal and non-Federal interoperable packet switched data networks." 47 U.S.C. § 230 (2012).

[71] Laura DeNardis & Mark Raymond, *The Internet of Things as a Global Policy Frontier*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 5) (on file with editors).

of this strategy that is far more expansive. Licenses for copyrighted work often extend "in all media, throughout the universe."[72] These lawyers apparently anticipate a time when one can enforce one's copyright not only across planets, but across galaxies.[73]

Albert Lin discusses the introduction of a genetically modified mosquito that had been modified using recently introduced gene manipulation technologies.[74] When this mosquito mates with wild mosquitos, it produces offspring that do not survive into adulthood. Lin observes that the company introducing the mosquito had first run trials in the Cayman Islands, Panama, Malaysia, and Brazil. When it sought to introduce it in the wild in Florida, in response to the Zika crisis, it followed a novel strategy to avoid the prior approval needed for new animal drugs. Lin writes:

> Rather than seeking full-scale approval of its genetically modified mosquito as a new animal drug, Oxitec framed its proposed trial as an "investigational new animal drug" ("INAD"). Under FDA regulations, INADs are subject to certain labeling and recordkeeping requirements, but are exempt from the approval process applicable to new animal drugs. In order to qualify as an INAD, a drug must be "intended solely for investigational use by experts qualified by scientific training and experience to investigate the safety and effectiveness of animal drugs." Investigational use presumes in vitro testing, lab animal research, or clinical research. Though an INAD usually does not require FDA approval, FDA reviews the environmental impacts of an INAD under the National Environmental Policy Act ("NEPA").[75]

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[72] Mike Masnick, *Licensing Agreements Now Covering 'The Universe' and Future Media Not Yet Developed*, TECHDIRT (Oct. 30, 2009, 1:52 PM), https://www.techdirt.com/articles/20091029/0151366712.shtml.

[73] Commentators noted that this formulation left a loophole — parallel universes, a phenomenon predicted by certain physical theories. Perhaps licensing agreements will now begin to suggest "throughout the multiverse." Grey Ferret, Comment to *Licensing Agreements Now Covering 'The Universe' and Future Media Not Yet Developed*, TECHDIRT (Oct. 30, 2009, 2:13 PM), https://www.techdirt.com/articles/20091029/0151366712.shtml.

[74] Albert Lin, *Mismatched Regulation: Genetically Modified Mosquitoes and the Coordinated Framework for Biotechnology*, 51 UC DAVIS L. REV. 205, 207 (2017).

[75] *Id.* at 216-17 (citations omitted).

However, community backlash has thus far stopped the release of these genetically modified mosquitos in Florida.[76]

Lisa Ikemoto's discussion of "DIY bio," individuals who eschew institutional restraints to forge ahead with new biological hacking techniques, suggests that sometimes it is not only regulatory lacunae at issue, but also limited enforcement capacity.[77] Because government controls over biological innovations are often operationalized through restrictions on government funding, DIY bio's "lack of government funding do[es] not clearly trigger federal laws applicable to biotechnology," Ikemoto observes.[78]

Elizabeth Joh discusses the emergence of security robots, and wonders if courts will analogize them to spring guns, which are generally disfavored because they fail to discriminate between innocent and guilty persons. She argues that security robots should not be classified as simply an evolution of spring guns because such robots allow discrimination between different persons, though she notes that that discrimination might itself be problematic.[79] "The substitution of machines for people," she notes, "has begun to invite new questions that may not easily fit into existing analogies."[80]

C. The Law Constructs Technologies, Even as Technologies Challenge Law

Margot Kaminski argues that technologies are framed and constructed by preexisting law. She writes:

> Technology does not just act upon the law; it encounters and is framed by it. It is not just that technology makes salient or foregrounds existing features of the law; technology takes on a particular meaning within the law depending on what one

[76] Debra Goldschmidt, *Florida Releases Experimental Mosquitoes to Fight Zika*, CNN (Apr. 20, 2017, 3:56 PM), http://www.cnn.com/2017/04/20/health/florida-mosquito-wolbachia-trial-zika/index.html. Conventionally-modified mosquitos have been released in Florida to replace the disease-carrying mosquito with the new disease-free one. *Id.*

[77] Lisa C. Ikemoto, *DIY Bio: Hacking Life in Biotech's Backyard*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 13) (on file with editors) (noting that "agencies such as the FDA, the EPA, and the FBI cannot easily regulate DIY bio's activities").

[78] *Id.*

[79] Elizabeth H. Joh, *"A Certain Dangerous Engine": Security Robots, Artificial Intelligence, & Deadly Force*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 14-18) (on file with editors).

[80] *Id.* (manuscript at 19).

> thinks the law is or should be. The law constructs technologies.[81]

To take a simple example: if a robot can legally operate on a sidewalk only if it is less than 80 pounds, then the engineers will be told to build the robot accordingly if they can consistent with its other functional specifications.

At the same time, new technologies will force us to examine what a law is about. Mark Lemley and Eugene Volokh observe, for example, that virtual reality will force us to reexamine what harms particular laws are targeting:

> It may turn out that the reason we ban indecent exposure — the reason we care — is not just about the physical presence, the possibility of a physical threat, but about perception and psychic harm. If so, maybe that causes us to rethink legal harm not just in virtual reality, but in real reality.[82]

Reflecting on the law governing the virtual reality game Pokémon Go's interaction with real space, Molly Van Houweling finds herself critically examining real property law itself. She observes that property owners "want to exercise their right to include instead of their right to exclude."[83] Prompted by technological change, Van Houweling expands our conception of private property rights, historically focused on the right to exclude, to extend to the right to include. In so doing, she links virtual reality developments to the rise of Creative Commons, with which she served as the founding director and serves currently as chairperson of the board. She urges property law not to discourage sociability: "Liability for tempting trespass should not chill products designed to suggest sociability."[84]

D. Technologies Have Nationalities, but No Borders

Technologies are not some pure scientific creation, devoid of history or geography. Rather they reflect the time and place of their creation.

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[81] Margot Kaminski, *Authorship, Disrupted: AI Authors in Copyright and First Amendment Law*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 3) (on file with editors).

[82] Mark A. Lemley & Eugene Volokh, *The Real Law of Virtual Reality*, 51 UC DAVIS L. REV. 51, 64 (2017).

[83] Molly S. Van Houweling, *Tempting Trespass or Suggesting Sociability? Augmented Reality and the Right to Include*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 3) (on file with editors).

[84] *Id.* (manuscript at 10).

At the same time, technologies are rarely confined to their birthplace, and spread beyond borders. As those writing about the California Effect first showed, technologies are shaped by multiple jurisdictions, including especially particularly demanding jurisdictions. They are also shaped by particularly lax jurisdictions — where they can develop before being exported elsewhere in the world. Of course, it is not regulations alone that shape a technology. Take the example of Volvo's Large Animal Detection system, which originally did not properly identify a kangaroo because the system had not been trained on jumping animals.[85]

A regulator sitting in Washington, D.C. considering how to approach a new technology must keep in mind that her counterpart in Brussels, Beijing, or Bogota is likely pondering the same question. She has to make decisions to regulate or not, or how to regulate, while looking over her shoulder. There are multiple reasons for her to pay attention to foreign regulators: (1) fear of loss of domestic entrepreneurs to foreign shores, leading to a loss in the tax base and also employment; (2) the setting of technical regulations to favor the products of certain firms over others; (3) the setting of technical regulations that may not be appropriate for local conditions; and (4) the compliance costs of multiple regulations for enterprises. Even as multiple U.S. agencies consider the regulation of robots and artificial intelligence, Ryan Calo points out that "the governments of Japan and the European Union have formed official commissions around robots and AI in recent years."[86]

The desire to promote economic development can lead to a deregulatory race to the bottom — welcoming all manner of enterprise because of the jobs or taxes they bring. Entrepreneurs are increasingly aware of the differences in law between jurisdictions. Julie Cohen argues that platform companies "have proved adept . . . at practicing regulatory arbitrage."[87] I have argued elsewhere that U.S. law in particular proved particularly embracing of internet innovations.[88] The developing world in particular risks becoming the testing laboratory for developed world enterprises — for example, where genetically-

[85] Allana Akhtar, *Volvo's Driverless Cars Can't Figure out Kangaroos*, JALOPNIK (June 27, 2017, 1:00 PM), https://www.gizmodo.com.au/2017/06/volvos-driverless-cars-cant-figure-out-kangaroos.

[86] Calo, *supra* note 57.

[87] Julie Cohen, *Law for the Platform Economy*, 51 UC DAVIS L. REV 133, 184 (2017).

[88] Anupam Chander, *How Law Made Silicon Valley*, 63 EMORY L.J. 639 (2014).

modified mosquitos are released or where AI policing technologies are deployed without consideration of adverse consequences.

Globally-coordinated regulation can deal with some of these concerns, though at the cost of sometimes useful regulatory experimentation. The World Trade Organization ("WTO") is likely the world's most important global regulator, though its mandate is rather narrow — to promote trade liberalization while respecting national regulatory sovereignty. Within those constraints, the WTO strengthens international standards. Mira Burri examines the use of international trade law to promote an economy increasingly dependent on data. While lauding its resolution of cases involving the internet, Burri notes that the WTO has not adapted sufficiently to the digital world by providing legal certainty.[89] She argues that this failure to advance at the WTO is because "the views of dominant actors — the United States and the European Union — diverge."[90]

Peter Lee shows that the United States has been keen to promote innovation through federal financial support for research and development, even if its strategies have changed over time.[91] The United States' apparent success in creating what Michael Polanyi called a "republic of science" (itself a result of peering over our shoulder for fear of being overtaken by the Soviet Union) will inspire more countries to vie for the same title.[92]

E. The Market Alone May Not Discipline Technologies

Laura DeNardis and Mark Raymond observe that, "Cyber physical system markets do not yet have trust architectures such as privacy policy terms of service, transparent practices around personal data disclosure, consumer choice for opting out of data collection, or data breach notifications."[93] DeNardis and Raymond note further the possibility of "market approaches in opposition to interoperability and competition,"[94] as private companies produce things that do not play well with those from other companies. There will certainly be instances where regulation is unnecessary to protect consumers from the ills of a particular technology because marketplace options are

[89] *See* Burri, *supra* note 68, at 98.

[90] *Id.*

[91] Peter Lee, *Democratic Engagement and the Republic of Science*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (on file with editors).

[92] *Id.* (manuscript at 1).

[93] DeNardis & Raymond, *supra* note 71 (manuscript at 7).

[94] *Id.* (manuscript at 14).

forthcoming. However, we cannot always expect that buyers will have access to the knowledge to make informed choices, because at times the risks are either so remote or obscure as to lead to little consumer discipline. Technology companies have often sought to offer technological solutions (to be implemented through marketplace choices) rather than the heavy hand of regulation. As Julie Cohen writes, "So framed [by technology companies], they are not problems requiring resolution in the domain of media regulation, competition regulation, or some other domain, but rather matters best left to the benevolent and disinterested experts in the white lab coats to sort out."[95] Cohen is skeptical of private efforts to, in the words of Microsoft's president, "function as 'a trusted and neutral digital Switzerland,'" seeing this as means to secure "regulatory independence."[96]

F. Technologies Are Often Misunderstood

Paul Ohm and David Lehr's careful study of the process of machine learning demonstrates that better understanding of technology is critical to both understand its risks and to craft better solutions to problems that might arise.[97] They show that "deeper understanding of the machine-learning workflow enriches discussions of [the] harms and benefits" of machine learning.[98] I. Glenn Cohen and Harry S. Graver note that medical professionals may not be prepared for the era of big data; they ask, "Is the current state of medical education adequate to make physicians (as well as nurses, hospital administrators, etc.) wise users of predictive analytics?"[99] Equally difficult, they note, is the problem of explaining to a patient therapies indicated by predictive analytics. Should the doctor explain to a patient, "the algorithm has examined 10,000 variables from your EHR and based on its validated model determines this is what is appropriate in your case"?[100]

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[95] Cohen, *supra* note 87, at 167.

[96] *Id.* at 201.

[97] David Lehr & Paul Ohm, *Playing with the Data: Legal Scholars Should Learn About Machine Learning*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (on file with editors).

[98] *Id.* (manuscript at 55).

[99] I. Glenn Cohen and Harry S. Graver, *A Dialogue Between Big Data in Health Care and Predictive Policing*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 13) (on file with editors).

[100] *Id.*

G. Technologies Might Not Be as Good as Their Promoters Claim

It is common for technologists — and their fellow entrepreneurs — to exaggerate the power of new technologies. After all, in order to succeed, the technologist often needs capital, which will likely come only if technology shows promise and scalability. Claims that the technology is X% more accurate or safer than the humans they replace will be commonplace, but the data needed to verify (or refute) those claims will often be hidden from the public, protected by trade secret or non-disclosure agreements. I. Glenn Cohen and Harry Graver cite Ziad Obermeyer and Zeke Emanuel, observing that predictive algorithms may be less than they appear:

> Algorithms might "overfit" predictions to spurious correlations in the data, or multiple collinear, correlated predictors could produce unstable estimates. Either possibility can lead to overly optimistic estimates of the accuracy of a model and exaggerated claims about real-world performance.[101]

Of course, technologists will seek to improve their technologies over time — but it may be that, in the interim, we are the guinea pigs who serve as the validation (or invalidation) set.

H. Digital Technologies Can Deepen Surveillance

Ben Wizner identifies some of the core — highly contestable — tenets of the modern security state — from "we live in uniquely dangerous times" to "we should defer to the expertise of national security experts."[102] Digital technologies increase the risks of a security state, handing the executive additional tools that can be used to threaten, coerce, or blackmail the citizenry. Proponents of digital technologies have to prepare for efforts to compel these technologies to be used for heightened control over the population.

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[101] *Id.* (manuscript at 16) (citing Ziad Obermeyer & Ezekiel J. Emanuel, *Predicting the Future — Big Data, Machine Learning, and Clinical Medicine*, 375 N. ENG. J. MED. 1216, 1217 (2016)).

[102] Ben Wizner, *National Security and the Loaded Weapon*, 51 UC DAVIS L. REV. (forthcoming Dec. 2017) (manuscript at 2, 7) (on file with editors).

I. Planning for Resilience

Gary Marchant and Yvonne Stevens want us to prepare for failure.[103] They want to build resilience into systems, so that they can respond to accidents or other problems that arise. They offer a variety of practical mechanisms to foster resilience.

J. Learning from History

Justice Cuéllar turns to history for lessons to help understand the age of artificial intelligence. Justice Cuéllar notes that we have experience with complex products and the clever corporations promoting them; speaking of processed foods, he writes, "They combine long lists of multisyllabic ingredients and leverage precise scientific knowledge to combine salt, sugar, and fat with a perfect crunch that keeps people reaching for the next morsel."[104] Indeed, Cuéllar's observation about food might readily be offered with respect to the next Instagram post. But he sees cause for cautious optimism: "[H]istory teaches how societies that were increasingly urban and interconnected managed problems involving public health and food."[105]

CONCLUSION

We are living in a time of unprecedented technological change. Here is an email on January 4, 2017 from Senior Symposium Editor Rachel Kane, as Rachel, Shree Sharma, and I were finalizing preparations for this conference:

> *Hanging out with the Bedouins in Wadi Rum desert now. Internet is sketchy but I'll chime in as much as possible.*
>
> *— Rachel*

Call it the age of magic.

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[103] Gary E. Marchant & Yvonne A. Stevens, *Resilience: A New Tool in the Risk Governance Toolbox for Emerging Technologies*, 51 UC DAVIS L. REV. 233 (2017).

[104] Cuéllar, *supra* note 4, at 46.

[105] *Id.* at 43.