2015

Robotics and the Lessons of Cyberlaw

Ryan Calo
University of Washington School of Law

Robotics and the Lessons of Cyberlaw

Ryan Calo*

Two decades of analysis have produced a rich set of insights as to how the law should apply to the Internet's peculiar characteristics. But, in the meantime, technology has not stood still. The same public and private institutions that developed the Internet, from the armed forces to search engines, have initiated a significant shift toward developing robotics and artificial intelligence.

This Article is the first to examine what the introduction of a new, equally transformative technology means for cyberlaw and policy. Robotics has a different set of essential qualities than the Internet and accordingly will raise distinct legal issues. Robotics combines, for the first time, the promiscuity of data with the capacity to do physical harm; robotic systems accomplish tasks in ways that cannot be anticipated in advance; and robots increasingly blur the line between person and instrument.

Robotics will prove "exceptional" in the sense of occasioning systematic changes to law, institutions, and the legal academy. But we will not be writing on a clean slate: many of the core insights and methods of cyberlaw will prove crucial in integrating robotics and perhaps whatever technology follows.

---

* Assistant Professor, University of Washington School of Law. Faculty Director, University of Washington Tech Policy Lab. Affiliate Scholar, Stanford Law School Center for Internet and Society. This paper benefited from presentations at Yale Law School and University of Washington seminars, workshops at Fordham Law School and the University of Miami School of Law, and computer science and engineering colloquia at the University of Washington and the University of California, Berkeley. Thank you to Jack Balkin, Kate Darling, Michael Froomkin, Woodrow Hartzog, Margot Kaminski, Ian Kerr, Mark Lemley, David Post, Joel Reidenberg, Zahr Said, and other participants in the above events for their helpful comments. Justin Hughes, Sean O'Connor, Lisa Larrimore Ouellette, and Daniel Siciliano helped generate several of the hypotheticals I explore in Part II. Thank you also to Grace Feldman and Elena Ponte for excellent research.

INTRODUCTION

The law found the Internet unsettling. That a buyer in one location could access the website of a seller in any other forced courts to revisit basic questions of jurisdiction and federalism.[1] The potential to share and edit software and other digital objects introduced novel questions of ownership and control.[2] In the mid-1990s, a movement arose among legal academics to address these and similar challenges. Known by the name *cyberlaw*, its central tensions flow from the essential qualities of the Internet, by which I mean the characteristics that distinguish the Internet from prior or constituent technology such as computers or phones.

Some early cyberlaw questions have seen a kind of resolution in the twenty years since the rise of cyberlaw. Legislatures and courts have weighed in,[3] and the vigorous debate has continued—around "net neutrality," for instance, and the impossible puzzle that is privacy.[4] But even here, participants have at least a sense of the basic positions and arguments.

---

1. *See infra* Part I.B.
2. *See infra* Part I.B.
3. *See, e.g.*, Digital Millennium Copyright Act, Pub. L. No. 105-304, 112 Stat. 2860 (1998) (codified as amended in scattered sections of 17 U.S.C.); Reno v. ACLU, 521 U.S. 844 (1997) (holding that free speech protection extends to the Internet and invalidating, in part, the Communications Decency Act of 1996).
4. *E.g.*, Verizon v. FCC, 740 F.3d 623 (D.C. Cir. 2014) (invalidating the antidiscrimination and antiblocking rules under FCC's *Open Internet Order*); Daniel J. Solove, *Introduction: Privacy*

Law, in other words, is catching up. But technology has not stood still. The same military that funded the early network that became the Internet now funds robotics competitions.[5] The same household-name Internet companies that brought us search engines and social networks have begun a large-scale pivot toward robotics and artificial intelligence.[6] State and federal lawmakers are authoring laws around the domestic use of drones and issuing license plates to cars without drivers.[7]

Robotics is shaping up to be the next transformative technology of our time. And robotics has a different set of essential qualities than the Internet. Robotics combines, arguably for the first time, the promiscuity of information with the capacity to do physical harm.[8] Robots display increasingly emergent behavior, permitting the technology to accomplish both useful and unfortunate tasks in unexpected ways.[9] And robots, more so than any technology in history, feel to us like social actors—a tendency so strong that soldiers sometimes jeopardize themselves to preserve the "lives" of military robots in the field.[10]

The essential qualities of robotics will drive a distinct conversation. We think of the Internet as a powerful tool for people to communicate. Robotics blurs the very line between people and instrument. If the United States does not maintain sufficient control over its autonomous submarines, perhaps the submarines are not "vessels" entitled to passage through Chinese waters under international law.[11] If a defendant injures a person while trying to vandalize an anthropomorphic robot rather than a wall, transferring intent arguably furthers the purposes of criminal and tort law. These are not scenarios about which cyberlaw has much to teach.

Self-Management and the Consent Dilemma, 126 HARV. L. REV. 1880 (2013) (canvassing contemporary issues in privacy).

5. *See infra* Part II.

6. *See infra* Part II.

7. *E.g.*, S.B. 1298, 2012 Leg., Reg. Sess. (Cal. 2012) (authorizing autonomous vehicles); A.B. 511, 2011 Leg., 76th Sess. (Nev. 2011) (same); S.B. 313, 2013 Leg., 77th Sess. (Nev. 2013) (regulating autonomous vehicles); S.B. 1134, 62nd Leg., 1st Reg. Sess. (Idaho 2013) (placing limits on domestic use of drones); S.B. 1587, 98th Gen. Assemb., Reg. Sess. (Ill. 2013) (same); *see also* John Bacon, *Google This: Nevada Issues License for Driverless Car*, USA TODAY (May 8, 2012, 1:35 PM), http://content.usatoday.com/communities/ondeadline/post/2012/05/google-this-nevada-issues-license-for-driverless-car/1#.VOVPHEKpI9x.

8. *See infra* Part II.B.1.

9. *See infra* Part II.B.2.

10. *See* P.W. SINGER, WIRED FOR WAR: THE ROBOTICS REVOLUTION AND CONFLICT IN THE TWENTY-FIRST CENTURY 337–43 (2009); M. Ryan Calo, *The Drone As Privacy Catalyst*, 64 STAN. L. REV. ONLINE 29 (2011), http://www.stanfordlawreview.org/online/drone-privacy-catalyst; *see also* Julie Carpenter, *Just Doesn't Look Right: Exploring the Impact of Humanoid Robot Integration into Explosive Ordnance Disposal Teams*, *in* II HANDBOOK OF RESEARCH ON TECHNOSELF: IDENTITY IN A TECHNOLOGICAL SOCIETY 609 (Rocci Luppicini ed., 2013).

11. *See* Craig H. Allen, *The Seabots are ~~Coming~~ Here: Should they be Treated as 'Vessels'?*, 65 J. NAVIGATION 749 (2012).

But the parallels are also strong. Drones, no less than the Internet, raise questions of speech, innovation, and privacy.[12] Courts that struggled for the proper metaphor to apply to the Internet will struggle anew with robotics. Scholars interested in the way we are hardwired to think of going online as entering a cyber "place"[13] will also be interested in the way we are hardwired to treat social technology as though it were a person.[14] Those who consider how software constrains human behavior may be interested in the reverse question of how people and institutions can manage behavior generated by software. One hopes, in particular, that scholars interested in robotics will continue in a tradition of interdisciplinary pragmatism that is perhaps cyberlaw's greatest legacy.

Part I of this Article describes the qualities that characterize and distinguish the Internet and traces how these qualities came to disrupt legal discourse. Two decades of law and scholarship have resolved, or at least clarified, some of cyberlaw's central tensions. Yet the same public and private institutions at the heart of the Internet now direct their attention toward a unique and equally transformative technology.

Part II shows how the mainstreaming of robotics will muddy anew the waters, so recently stilled, posing distinct challenges for law and legal institutions. This descriptive claim has normative consequences: the better we understand how a technology will affect society, the better position we are in to integrate the technology gracefully.

Part III explores whether robotics is legally "exceptional" in the sense of meriting new laws, legal institutions, and research methods. The insights, methods, and norms of cyberlaw—its deepest lessons[15]—will prove crucial in helping to integrate into society a new transformative technology. Ultimately, however, robotics law can and should depart from cyberlaw and form a distinct area of governance and study.

This project involves a degree of guesswork. Herbert Simon, the progenitor of behavioral economics,[16] wrote a lesser-known series of essays in the 1960s on the societal effects of automation. In a preface to a 1965 book

12. *See, e.g.*, Margot E. Kaminski, *Drone Federalism: Civilian Drones and the Things They Carry*, 4 CALIF. L. REV. CIRCUIT 57 (2013), http://scholarship.law.berkeley.edu/cgi/viewcontent.cgi?article=1007&context=clrcircuit.

13. *E.g.*, Julie E. Cohen, *Cyberspace As/And Space*, 107 COLUM. L. REV. 210 (2007); Mark A. Lemley, *Place and Cyberspace*, 91 CALIF. L. REV. 521 (2003); Dan Hunter, *Cyberspace as Place and the Tragedy of the Digital Anticommons*, 91 CALIF. L. REV. 439 (2003) (arguing that the "cyberspace as place" metaphor leads to undesirable digital anticommons).

14. *See infra* Part II.B.3.

15. *Cf.* Lawrence Lessig, *The Law of the Horse: What Cyberlaw Might Teach*, 113 HARV. L. REV. 501 (1999) (arguing that cyberspace law has lessons to impart beyond the particulars of cyberspace).

16. Herbert Simon coined the term "bounded rationality" to refer to the way people act rationally in their self-interest, but only to a point. HERBERT A. SIMON, MODELS OF MAN: SOCIAL AND RATIONAL 196 (1957).

collecting his thoughts, Simon made no apologies for speculating about how computers could overhaul the realm of labor:

> In our kind of world, those who are closest to important new technical innovations have a responsibility to provide reasoned interpretations of these innovations and their significance. Such interpretations should be, of course, the beginning and not the end of public discussion. But they cannot be made at all without extrapolation from present certainties into future probabilities.[17]

Simon went on to distinguish between the technological and economic dimension of the analysis. He said of himself that he was "radical" about the technology—he believed computers will one day be able to do just about everything people can.[18] But he was "conservative" about the ramifications.[19] For Simon, even a world pervaded by automation will not necessarily look so different from our own, much less necessitate novel economic theories.

My commitments are just the opposite. When it comes to the technology, I find I am conservative: robotics will continue to evolve, but mostly in ways that solve known technical challenges and reduce costs.[20] You will not find any references to HAL or C3PO in the pages that follow. And yet the widespread distribution of robotics in society will, like the Internet, create deep social, cultural, economic, and of course legal tensions long before the advent of science fiction.

I.
THE RISE OF THE INTERNET

Cyberlaw refers to the legal and policy discourse that attends the Internet.[21] The central themes and tensions of cyberlaw flow more or less directly out of a handful of essential qualities: a set of specific characteristics that distinguish the Internet from its predecessor and constituent technologies. Part I explores what those qualities are and how they interact with law and policy. Part II explores how the Internet's essential qualities and the experiences these qualities generate have come to inform specific doctrinal and theoretical debates within cyberlaw.

---

17. HERBERT A. SIMON, THE SHAPE OF AUTOMATION FOR MEN AND MANAGEMENT vii (1965).

18. *Id.* at xii–xiii.

19. *Id.*

20. *See infra* Part II.

21. Black's Law Dictionary defines "cyberlaw" as "[t]he field of law dealing with the Internet, encompassing cases, statutes, regulations, and disputes that affect people and businesses interacting through computers." BLACK'S LAW DICTIONARY 443 (9th ed. 2009). *But see* Jacqueline D. Lipton, *Law of the Intermediated Information Exchange*, 64 FLA. L. REV. 1337, 1339 (2012) ("Despite the resilience of cyberlaw as a staple in today's law school curricula, no one has yet accurately explained the nature of the field.").

Part I is a prelude to Part II, which performs the equivalent exercise prospectively for robotics. Part II asks: If the essential qualities of the Internet drive a particular conversation, how will that conversation change with the introduction of a distinct transformative technology? The collective thesis of these Parts involves a claim as obvious as it is under theorized: much of what characterizes an emerging technology as unique also makes it interesting to the law. As with the Internet, the breadth and depth of the experiences robotics makes possible will determine the contours of any legal discourse. This insight turns out to be rather important. An academic and policy-oriented community that understands at the outset what challenges a technology poses stands a better chance of fashioning a sensible, theoretic, empirical, and (if indicated) regulatory agenda.

A. Definitions

According to the U.S. Supreme Court, the Internet is "an international network of interconnected computers."[22] At a technical level, the Internet switches "packets" of data between nodes; it leverages a set of protocols to divide digital information into separate containers and to route those containers between end points for reassembly and delivery.[23] The networks and protocols that comprise the Internet constitute, according to the Court, "a unique medium—known to its users as 'cyberspace'—located in no particular geographical location but available to anyone, anywhere in the world."[24] The Internet originated as a military-funded research network; the government was interested in a more resilient set of networks that, unlike a legacy telecommunications system, would continue to function if one segment were incapacitated.[25] The then-ARPAnet originally connected a handful of military and university computers.[26] This research network eventually became the Internet, blossoming into a commercial and cultural juggernaut that touches billions of lives every day.

The Internet sits upon a number of constituent technologies: processors, software, switches, and wires.[27] It shares certain characteristics with legacy modes of communication such as telephone and television. And yet the Internet is distinct. The Internet supplants the broadcast model of many to one by connecting people and institutions directly to one another in something like real

22. Reno v. ACLU, 521 U.S. 844, 849 (1997).

23. *See* TIM WU, THE MASTER SWITCH: THE RISE AND FALL OF INFORMATION EMPIRES 172–74 (2010) [hereinafter WU, MASTER SWITCH] (discussing how packet switching differs from legal telecommunications).

24. *Reno*, 521 U.S. at 851.

25. *Id.* at 850.

26. *Id.*

27. *See* Orin S. Kerr, *The Problem of Perspective in Internet Law*, 91 GEO. L.J. 357, 360 (2003).

time.[28] Relatedly, the Internet supports shared digital spaces and objects that facilitate collaborative creation and governance.[29] Experiences in cyberspace are mediated, meaning they take place *through* technology.[30] The fact of common mediation is precisely what enables two people to coexist in a common cyberspace, to consume but also "remix" content.[31] But, as Joel Reidenberg, Lawrence Lessig, and others have catalogued, mediation also introduces the prospect of interference, persuasion, or control.[32]

Thus, the Internet has at least three hallmarks. First, it allows for promiscuous and interactive flows of information (connection). Suddenly, anyone on the network can reach anyone/everyone else, often at very low cost, and without sensitivity to distance.[33] That person can, in turn, respond immediately or at a delay. Second, by mediating user experience, the Internet is capable of generating shared objects and spaces (collaboration).[34] People can "meet" on a website and comment or alter the text, pictures, videos, software, or other content they find there. Finally, the Internet allows for additional or at least more exquisite forms of observation and manipulation than offline analogs (control).[35] The architecture of networks and interfaces is subject to alteration in a way that can greatly constrain human behavior, more and more of which is taking place through technology.

Each of these facets of the Internet ends up, alone or in combination, forming the basis for one or more central tensions in cyberlaw. The free flow of information enables new forms of peer production and governance, while simultaneously introducing or exacerbating threats to intellectual property and privacy. The Internet stitches communities together, but conflicts invariably burst out at the seams. The Internet invokes a distinct sense of a place with new possibilities and norms, but simultaneously introduces methods of exquisite control by organized private and state interests. The remainder of this Part runs through a nonexhaustive sampling of examples of Internet-specific legal issues, touching upon jurisdiction, intermediary liability, digital property, copyright, free speech, and privacy, among other challenges.

---

28. Jack M. Balkin, *Digital Speech and Democratic Culture: A Theory of Freedom of Expression for the Information Society*, 79 N.Y.U. L. REV. 1, 6–9 (2004).

29. *Id. See generally* JONATHAN ZITTRAIN, THE FUTURE OF THE INTERNET AND HOW TO STOP IT (2008).

30. *See* YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM 392 (2006) (discussing how the Internet mediates human communication).

31. *See generally* LAWRENCE LESSIG, REMIX: MAKING ART AND COMMERCE THRIVE IN THE HYBRID ECONOMY (2008) [hereinafter LESSIG, REMIX].

32. *See* LAWRENCE LESSIG, CODE: VERSION 2.0 (2006) [hereinafter LESSIG, CODE 2.0]; Joel R. Reidenberg, *Lex Informatica: The Formulation of Information Policy Rules Through Technology*, 76 TEX. L. REV. 553 (1998).

33. Eugene Volokh, *Cheap Speech and What It Will Do*, 104 YALE L.J. 1805 (1995).

34. *See supra* text accompanying notes 28–30.

35. *See supra* note 32.

B. Law Meets the Internet

Perhaps the simplest way the Internet disrupts the status quo is by connecting individuals and institutions cheaply and without sensitivity to distance. This difference is, I think, largely quantitative: people could invite and carry on conversations by mail or telephone, just not with speed or at scale. Nevertheless, the law found the massive and cheap interconnectivity of the Internet plenty challenging.

Jurisdiction presented an early and salient example. The Internet is famously ambivalent about boundaries.[36] Thus, a citizen with a website in one state could delight or defraud a citizen in any other. But for a state to exercise jurisdiction over an out-of-state defendant, consistent with constitutional principles of due process, that defendant must have "purposefully avail[ed] itself of the privilege of conducting activities within the forum State."[37] The question whether Internet activity constitutes purposeful availment quickly landed before a federal court. In *Zippo Manufacturing Co. v. Zippo Dot Com, Inc*., the question was whether operating a website accessible in Pennsylvania was enough to permit a California corporation to be sued there for violation of state and federal trademark law.[38] The *Zippo Dot Com* court found that an "interactive" website like the defendant's was sufficient to anchor jurisdiction, whereas a "passive" website that merely presented information would not be.[39] Some courts to confront this issue followed *Zippo Dot Com*'s reasoning; others have struck different balances.[40]

A related set of questions attends choice of law and enforcement. In *Yahoo! Inc. v. La Ligue Contre Le Racisme et L'Antisemitisme*, for instance, the U.S. Court of Appeals for the Ninth Circuit faced the question of whether to enforce a French judgment against the Internet company Yahoo![41] The case involved Yahoo!'s decision to permit the sale of Nazi paraphernalia as well as hate speech on its website, accessible in France, in apparent contravention of French law.[42] In the United States, such a decision, however unwise or offensive, is protected under the First Amendment.[43] But whose law should apply to a company located in the United States yet facilitating sales in Europe? The *Yahoo!* court, sitting en banc, issued a complex, splintered opinion countenancing the prospect of invalidating a French order as repugnant

---

36. *See* DAVID G. POST, IN SEARCH OF JEFFERSON'S MOOSE: NOTES ON THE STATE OF CYBERSPACE 163–65 (2009) [hereinafter POST, NOTES].

37. Hanson v. Denckla, 357 U.S. 235, 253 (1958) (citing Int'l Shoe Co. v. Washington, 326 U.S. 310, 319 (1945)).

38. 952 F. Supp. 1119, 1121 (W.D. Pa. 1997).

39. *Id.* at 1124.

40. *See, e.g.*, M. Shamsuddin v. Vitamin Research Prods., 346 F. Supp. 2d 804, 813 (D. Md. 2004); *see also id.* at 810–11 (citing cases and law review articles critical of *Zippo Dot Com*).

41. 433 F.3d 1199, 1201 (9th Cir. 2006).

42. *Id.* at 1202.

43. *Id.* at 1220.

to public policy while determining the question was not ripe for review: "First Amendment issues arising out of international Internet use are new, important[,] and difficult," the court said. "We should not rush to decide such issues based on an inadequate, incomplete[,] or unclear record."[44]

There are issues even within the same jurisdiction. The Supreme Court decided relatively early in the Internet's history that free speech principles apply with equal vigor in cyberspace.[45] But free speech principles do not apply equally across all contexts, even offline. Thus, for instance, courts have repeatedly encountered the question of whether speech originating outside of the school could form the basis for punishment: a fake social network profile of a principal was not grounds for state action in *Layshock v. Hermitage School District*,[46] whereas the threatening electronic messages at issue in *Wynar v. Douglas County School District* were.[47] Adventurous scholars would take this melding of contexts further, for instance into the realm of employment.[48]

The Internet does more than connect disparate contexts; it creates its own sense of place. We are almost hardwired to think of websites or virtual worlds as places we visit, places that in turn contain the digital equivalent of objects.[49] The first, fortuitous consequence of this quality is that people can collect somewhere to engage, share, and create.[50] More than simply connected, we find ourselves commonly mediated.[51]

This communal property of the Internet generates new possibilities for governance, or so scholars have argued. Cyberlaw pioneers such as David Post and David Johnson hold that the Internet is best understood as a separate sovereign, beholden to no particular nation.[52] Others, notably Michael Froomkin, explore how the Internet supports democracy by "mak[ing] possible the construction of new communities of shared interest."[53] The hope—periodically reaffirmed—is that the Internet provides the tools to discuss and evaluate ideas and norms, and even to arrive at civic consensus.[54] At a minimum, the Internet enables groups to organize around particular political concerns.

---

44. *Id.* at 1223.

45. Reno v. ACLU, 521 U.S. 844, 870 (1997) ("[O]ur cases provide no basis for qualifying the level of First Amendment scrutiny that should be applied to this medium.").

46. 650 F.3d 205, 207 (3d Cir. 2011).

47. 728 F.3d 1062, 1075 (9th Cir. 2013).

48. *See* Mary Anne Franks, *Sexual Harassment 2.0*, 71 MD. L. REV. 655 (2012).

49. *See* Hunter, *supra* note 13, at 443 (canvassing the literature and finding that "cognitive science investigations provide ample evidence that, purely as a descriptive observation, we do think of cyberspace as a place").

50. *See generally* BENKLER, *supra* note 30.

51. *Id.* at 392.

52. *See* David R. Johnson & David Post, *Law and Borders—The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367 (1996).

53. A. Michael Froomkin, *Habermas@Discourse.net: Toward a Critical Theory of Cyberspace*, 116 HARV. L. REV. 749, 856 (2003).

54. *See, e.g.*, ZITTRAIN, *supra* note 29, at 223–28 (espousing "code-backed norms").

The Internet also democratizes the market. Whereas we once gathered by the radio and television to take in whatever happened to be broadcast, we now select from a wide variety of media capable of delivering information in myriad ways.[55] And there is far more agency over the information we receive. The Internet permits novel forms of social production—or, more colloquially, it supports a "remix" culture of individuals and institutions as avid and adept at transforming content as they are at consuming it.[56] People in the Internet age discover, but also shape news; they purchase, but also comment upon goods and services;[57] they watch, but also edit and create art and entertainment. Together we collectively curate a torrent of content that increasingly blurs the line between professional and amateur.[58]

I have so far only described one side of the proverbial coin. Common mediation opens exciting new paths for communities but also invites exquisite new forms of surveillance and control. Many of the central debates among policymakers, industry, activists, and academics involve understanding precisely who can exert control over these shared spaces and objects, over the network and other "layers" of technology that underlie them, or over the information each generates.[59] Control is a way to understand key topics in cyberlaw, including intellectual and virtual property, net neutrality, and privacy.

One of the central issues of cyberlaw deals with the limits of cyberproperty—how much control firms can maintain over the services they offer. An early and influential case, *CompuServe Inc. v. Cyber Promotions, Inc.*, involved whether one actor could trespass on the (nonland) property of another merely by sending uninvited electronic communications.[60] The *CompuServe* court blessed a theory that became known as electronic trespass to chattels.[61] In other instances, courts and prosecutors have interpreted the Computer Fraud Abuse Act of 1986 to impose civil or criminal liability on individuals or firms that violate a website's terms of service, which govern the

55. *See* Balkin, *supra* note 28, at 6–7.

56. *See* LESSIG, REMIX, *supra* note 31.

57. *See* Scott R. Peppet, *Freedom of Contract in an Augmented Reality: The Case of Consumer Contracts*, 59 UCLA L. REV. 676, 679 (2012).

58. One reason we see more remixing today is because there exist powerful and inexpensive tools for editing. I would argue, however, that no one would necessarily invest in developing those tools were it not for the demand the Internet creates. Developers would also have a harder time disseminating their software.

59. *See* ZITTRAIN, *supra* note 29, at 67–71; *see also* DANIEL J. SOLOVE, THE DIGITAL PERSON: TECHNOLOGY AND PRIVACY IN THE DIGITAL AGE (2004); BARBARA VAN SCHEWICK, INTERNET ARCHITECTURE AND INNOVATION (2010).

60. 962 F. Supp. 1015, 1021 (S.D. Ohio 1997).

61. *See* Hunter, *supra* note 13, at 483–88. Some courts followed and even expanded this theory. *See, e.g.*, eBay, Inc. v. Bidder's Edge, Inc., 100 F. Supp. 2d 1058, 1069 (N.D. Cal. 2000). Others imposed limits. *See, e.g.*, Intel Corp. v. Hamidi, 71 P.3d 296, 299 (Cal. 2003).

relationship between website and user, if in doing so they cause one of several types of harm.[62]

Other issues center around the control content owners should be able to exert over intellectual property. The Digital Millennium Copyright Act of 1998 strives to balance the speed and scale of the Internet ecosystem with a concern over promiscuous sharing of copyrighted material.[63] Copyright law protects platforms from primary liability and thereby attempts to remove their incentives to be overly censorial of user content.[64] Nevertheless, some find the tactics of content owners aggressive in policing their rights against consumers and peer-to-peer services. The Act contains controversial provisions that criminalize attempts to circumvent access controls, so-called digital rights management, even where the fair use or first sale doctrines would otherwise permit the desired use of the copyrighted work.[65]

These and similar concerns have lead various scholars—Dan Hunter, James Boyle, and Julie Cohen, for example—to worry aloud about the pernicious effect of an over-alienable Internet.[66] Though perhaps inevitable to a degree, thinking of cyberspace as a place imports a stifling, inefficient, or otherwise undesirable tendency to enclose information—to lock it away. We risk a "tragedy of the digital anticommons," to paraphrase Hunter.[67] Others have defended the notion of cyberproperty with equal vigor, noting that the "dire predictions about the effects of such an approach on the shape of the Internet have not come to pass."[68]

Another example of the control debate is "network neutrality" or "non-discrimination."[69] Initially, the Internet was set up to be a dumb, impartial conduit of information.[70] Increasingly, however, the Internet service providers that connect us claim the right to manage traffic on their network by slowing down or blocking certain services, or imposing extra fees for high traffic applications like video. Other intermediaries, notably Apple, block competitor

62. *See* Andrea M. Matwyshyn, *The Law of the Zebra*, 28 BERKELEY TECH. L.J. 155, 165–68 (2013).

63. Pub. L. No. 105-304, § 103, 112 Stat. 2860, 2863–76 (1998) (codified as amended at 17 U.S.C. §§ 1201–1205 (2012)).

64. Online Copyright Infringement Liability Limitation Act, 17 U.S.C. § 512(a)(1) (2012).

65. Timothy K. Armstrong, *Digital Rights Management and the Process of Fair Use*, 20 HARV. J.L. & TECH. 49 (2006).

66. *See* Hunter, *supra* note 13; James Boyle, *The Second Enclosure Movement and the Construction of the Public Domain*, 66 LAW & CONTEMP. PROBS. 33 (2003); Cohen, *supra* note 13; *see also* Lawrence Lessig, *The Architecture of Innovation*, 51 DUKE L.J. 1783 (2002).

67. Hunter, *supra* note 13.

68. Patricia L. Bellia, *Defending Cyberproperty*, 79 N.Y.U. L. REV. 2164, 2171 (2004).

69. *See* Tim Wu, *Network Neutrality, Broadband Discrimination*, 2 J. ON TELECOMM. & HIGH TECH. L. 141, 145–46 (2003); *see also* Susan P. Crawford, *The Internet and the Project of Communications Law*, 55 UCLA L. REV. 359, 395 (2007) (defining network discrimination as "allowing network-access providers to treat some traffic or some users differently").

70. *See* POST, NOTES, *supra* note 36, at 86–89; WU, MASTER SWITCH, *supra* note 23, at 202 (describing the early Internet as "a text-only network, good for transmitting verbal messages alone").

applications on their popular phone and tablet platforms.[71] Proponents of non-discrimination argue in favor of regulatory intervention that would prevent intermediaries from leveraging their control over the network or market dominance to squash innovation by competitors. Detractors—including, curiously, otherwise avid proponents of "permissionless innovation"[72]—believe market forces provide an adequate check against abuse.[73]

A final example is privacy. Information privacy has long been, at one level or another, about control. Early discussions focus on how little control consumers or citizens are able to maintain over their personal information in the digital age.[74] The Internet's connectivity, coupled with the pervasiveness of cheap sensors, means that a discrete transgression or moment of intimacy can "go viral," sometimes with devastating results.[75] The Internet tears down practical barriers to accessing technically public information.[76] The fact that firms mediate Internet activity, coupled with vanishingly low storage costs, also means that consumers and citizens leave a digital trail for hackers, firms, and governments to follow.[77] Much law and scholarship explores these harms and how best to mitigate them.[78]

But more recent scholarship focuses on a different form of control: the control that holding information about a consumer, citizen, or institution

71. *See* Jeffrey Jarosch, *Novel "Neutrality" Claims Against Internet Platforms: A Reasonable Framework for Initial Scrutiny*, 59 CLEV. ST. L. REV. 537, 582 (2011). Some argue for "search neutrality" as well, by which they mean that search engines like Google or Bing should not privilege results that benefit the firm and should generally be transparent about how their ranking algorithms operate. *E.g.*, Frank Pasquale, *Internet Nondiscrimination Principles: Commercial Ethics for Carriers and Search Engines*, 2008 U. CHI. LEGAL F. 263, 264 (favoring both net neutrality and some forms of search neutrality).

72. There is a strain in libertarian thought that implies discrimination against innovators is fine, as long at it emanates from private, not public, sources. *Compare* Adam Thierer, *Who Really Believes in "Permissionless Innovation"?*, TECH. LIBERATION FRONT BLOG (Mar. 4, 2013), http://techliberation.com/2013/03/04/who-really-believes-in-permissionless-innovation ("I believe a strong case can be made that permissionless innovation should be our default position in public policy deliberations about technological change."), *with* Adam D. Thierer, *"Net Neutrality": Digital Discrimination or Regulatory Gamesmanship in Cyberspace?*, POL'Y ANALYSIS, Jan. 12, 2004, at 1, 7 ("Even if broadband operators are discriminating it should be clear that this sort of discrimination is not cause for the same sort of concern or regulatory response as other forms of discrimination.").

73. *E.g.*, Christopher S. Yoo, *Technological Determinism and Its Discontents*, 127 HARV. L. REV. 914 (2014) (reviewing SUSAN CRAWFORD, CAPTIVE AUDIENCE: THE TELECOM INDUSTRY AND MONOPOLY POWER IN THE NEW GILDED AGE (2013)).

74. *See* Jane B. Baron, *Property as Control: The Case of Information*, 18 MICH. TELECOMM. & TECH. L. REV. 367, 368 (2012); Julie E Cohen, *Examined Lives: Informational Privacy and the Subject as Object*, 52 STAN. L. REV. 1373, 1379 (2000) ("Data privacy advocates seek . . . to guarantee individuals control over their personal data.").

75. *See generally* SOLOVE, *supra* note 59.

76. *See* Harry Surden, *Structural Rights in Privacy*, 60 SMU L. REV. 1605 (2007).

77. *See* Daniel J. Solove, *Privacy and Power: Computer Databases and Metaphors for Information Privacy*, 53 STAN. L. REV. 1393 (2001); *see also* M. Ryan Calo, *Against Notice Skepticism in Privacy (and Elsewhere)*, 87 NOTRE DAME L. REV. 1027, 1039 (2012).

78. *E.g.*, Jonathan Zittrain, *Cyberspace and Privacy: A New Legal Paradigm?*, 52 STAN. L. REV. 1201 (2000) (examining how technology has made exploiting personal information easier).

permits.[79] Intermediaries meticulously study the personal data they gather by virtue of providing a service, and they possess monetary incentives to use the information in problematic ways.[80] More worrisome still, or at least more broadly worrisome, is the ability of the government to reach every nook and cranny of digital space, and the growing tendency among public institutions to share information and use it in ways that disadvantage people or groups.[81] This new conversation deals in power and asymmetry, bringing to bear a diverse array of methodologies from behavioral economics to constitutional and postmodern theory.

A mere sampling, these examples show how the Internet's essential qualities of connection, community, and control end up driving a particular conversation across a wide swath of cyberlaw issues.

II.
THE RISE OF ROBOTICS

The essential qualities of the Internet, and the experiences these characteristics generated, led more or less directly to a specific legal discourse we know collectively as cyberlaw. Several of these discussions are ongoing. The various stakeholders have yet to resolve how much control Internet service providers should be able to maintain over their network.[82] The Computer Fraud and Abuse Act, thought of at the time as a "[m]easured response to a growing problem,"[83] continues to draw withering criticism as excessively protective of digital property rights.[84] The discussion of online privacy remains vivid.[85]

Other questions have been largely answered. Mark Lemley remarks, for instance, upon the agility of courts in applying the traditional due process framework to Internet jurisdiction.[86] He cites to the dormant Commerce Clause and free speech as areas in which "courts have demonstrated their ability to adapt to the virtual world."[87] We have also seen some ingenious socio-legal

79. *E.g.*, Neil M. Richards, *The Dangers of Surveillance*, 126 HARV. L. REV. 1934 (2013).

80. *See* Ryan Calo, *Digital Market Manipulation*, 82 GEO. WASH. L. REV. 995 (2014).

81. *See* JULIA ANGWIN, DRAGNET NATION: A QUEST FOR PRIVACY, SECURITY, AND FREEDOM IN A WORLD OF RELENTLESS SURVEILLANCE (2014); Lior Jacob Strahilevitz, *Toward a Positive Theory of Privacy Law*, 126 HARV. L. REV. 2010 (2013).

82. *See, e.g.*, Verizon v. FCC, 740 F.3d 623 (D.C. Cir. 2014) (invalidating the FCC's net neutrality rules as enacted).

83. Dodd S. Griffith, Note, *The Computer Fraud and Abuse Act of 1986: A Measured Response to a Growing Problem*, 43 VAND. L. REV. 453, 453 (1990).

84. *See, e.g.*, Matwyshyn, *supra* note 62.

85. *See, e.g.*, Symposium, *Privacy and Technology*, 126 HARV. L. REV. 1880 (2013) (canvassing contemporary issues in privacy); Symposium, *Privacy and Big Data: Making Ends Meet*, 66 STAN. L. REV. ONLINE 25 (2013) (same).

86. Lemley, *supra* note 13, at 529–30.

87. *Id.* at 531.

and technological fixes such as Creative Commons and Content ID that provide copyright holders and consumers with greater flexibility.[88]

Even unsettled questions begin to take on a more mature and formal structure. The definition of, and best framework for, innovation sits at the heart of many cyberlaw debates.[89] The conversation tends toward a cost-benefit analysis of open versus closed systems and the role of government and markets in policing against abuse.[90] There are outliers, but conversations in privacy tend to coalesce along particular lines: a conversation that began around an individual's control over her own information has evolved into a conversation about the control information has over individuals by whomever holds it. Any participant in these debates is familiar with the basic arguments and starting positions—the universe of proverbial "moves." One feels in the discussion a certain clarification and stabilization. Each new wine from the vineyard of cyberlaw has a familiar taste.

Let me be clear: I do not mean to suggest that cyberlaw has somehow run its course, or that the qualities that make the Internet unique are no longer relevant. David Post could well be right to speculate, "[T]he Internet gets more interesting, more valuable, and more transformative moving forward, making these questions of law and governance themselves more interesting, and more important, over time."[91] I am suggesting, rather, that the Internet is much more familiar and mature today than it once was, and that the twenty or so years legal and other academics have spent studying the Internet have paid the dividends of structure and clarity that one would hope.

Yet even as the hungry background of life absorbs the Internet, another technology ascends in its place. It is becoming increasingly obvious that advances in robotics will come to characterize the next several decades. The mainstreaming of robotics is not as sudden as it might seem. Artists and hobbyists—early harbingers of the computer revolution—have turned to robotics in droves.[92] The Department of Defense, having provided the kernel of interest and funding to spur the commercial Internet, soon turned to a new project. Ten years ago, in the Mojave Desert, some of the same universities that operated the first nodes of the ARPAnet found themselves competing to build

88. Creative Commons is an organization founded by Lawrence Lessig that permits copyright holders to pick and choose which of the otherwise bundled copyrights they wish to maintain. *See* CREATIVE COMMONS, http://creativecommons.org (last visited Mar. 6, 2015). Content ID is a system Google developed to identify and address infringing content on its video service YouTube. *See How Content ID Works*, YOUTUBE, https://support.google.com/youtube/answer/2797370?hl=en (last visited Mar. 6, 2015).

89. *See* Frank Pasquale, *Beyond Innovation and Competition: The Need for Qualified Transparency in Internet Intermediaries*, 104 NW. U. L. REV. 105, 124 (2010) ("Innovation has been the central focus of Internet law and policy.").

90. *Id.* at 124–50.

91. POST, NOTES, *supra* note 36, at 129.

92. *See* Ryan Calo, *The Need to Be Open: U.S. Laws Are Killing the Future of Robotics*, MASHABLE (Jan. 1, 2014), http://mashable.com/2014/01/01/us-law-robotics-future.

vehicles capable of navigating a course without human intervention.[93] This was the DARPA Grand Challenge, the first of many robotics competitions for prize money put forward by the U.S. military.[94] As Peter Singer chronicles, the Armed Forces itself has invested massively in ground, air, and sea robotics in a bid to remake warfare.[95]

The private sector has been busy as well. The same household-name companies that have come to dominate the Internet have pivoted toward robotics and its constituent technologies. As of this writing, the Internet search giant Google has purchased at least seven robotics or artificial intelligence companies for sums totaling in the billions.[96] This is after the company revealed a fleet of well-tested driverless cars. Amazon, the online marketplace, purchased a robotics company to help automate its many warehouses for $775 million and in late 2013 announced a plan to deliver some packages by drone.[97] The former editor in chief of *Wired Magazine*, arguably the publication of record for the digital revolution, left the magazine to found a robotics company.[98] Capital that once flowed exclusively to software is returning to hardware. Today there are several venture capital funds devoted to robotics start-ups.[99] Law firms, including the largest labor law firm in the world, have entire practice groups around robotics and artificial intelligence.[100]

This is not the first wave of excitement over robotics. For a time in the 1980s it seemed that America had caught robot fever. The difference between then and now is twofold. First, the cost of sophisticated robotics has dropped considerably. Perhaps the most vivid example is Microsoft's development of the Kinect, a platform that packages a suite of sensors with powerful motion-modeling software.[101] Widely adopted by amateur and professional roboticists alike, the Kinect dramatically reduces the cost of one of the more expensive

93. *See* SINGER, *supra* note 10, at 135–37.

94 *Id.* at 135.

95. *See generally id.*

96. John Markoff, *Google Puts Money On Robots, Using the Man Behind Android*, N.Y. TIMES, Dec. 4, 2013, http://www.nytimes.com/2013/12/04/technology/google-puts-money-on-robots-using-the-man-behind-android.html?pagewanted=all&_r=0.

97. Timothy B. Lee, *Amazon Envisions Eventually Delivering Packages in 30 Minutes via Drones*, WASH. POST, Dec. 1, 2013, http://www.washingtonpost.com/blogs/the-switch/wp/2013/12/01/amazon-wants-to-deliver-packages-in-30-minutes-with-drones; John Letzing, *Amazon Adds That Robotic Touch*, WALL ST. J. (Mar. 20, 2012, 3:00 PM), http://online.wsj.com/news/articles/SB10001424052702304724404577291903244796214.

98. *See* Wired Staff, Wired *Editor-in-Chief Chris Anderson Steps Down to Run Robotics Startup*, WIRED (Nov. 2, 2012, 6:11 PM), http://www.wired.com/about/2012/11/wired-editor-in-chief-chris-anderson-steps-down.

99. Examples include Grishin Robotics, Bosch Venture Capital, and Lemnos Labs.

100. Ryan Calo, *Even (Some) Law Firms Think Robots Are the Next Big Thing*, FORBES (Jan. 31, 2014, 1:14 AM), http://www.forbes.com/sites/ryancalo/2014/01/31/even-some-law-firms-think-robots-are-the-next-big-thing.

101. *See* Evan Ackerman, *Microsoft Releases Kinect SDK, Robotocists Cackle with Glee*, IEEE SPECTRUM (June 17, 2011, 10:06 AM), http://spectrum.ieee.org/automaton/robotics/diy/microsoft-releases-kinect-sdk-roboticists-cackle-with-glee.

components of robots. Second, and relatedly, roboticists have embraced an open ecosystem that permits individuals and firms to build on another's work.[102] The Kinect comes with a set of software development tools (a software development "kit" or SDK) that supports the ability of third parties to build and share applications for the device.[103] Companies have developed competing robot operation systems and amassed large databases of vision, mobility, manipulation, and other code in an effort to jumpstart the industry.[104]

So I join a chorus of voices, from Bill Gates[105] to the White House,[106] that assumes that robotics, the next transformative technology after computers and the Internet, represents an idea whose time has come. Robotics, meanwhile, has a different set of essential qualities. These qualities, and the experiences they generate, occasion a distinct catalogue of legal and policy issues that sometimes do, and sometimes do not, echo the central questions of contemporary cyberlaw. Against the backdrop of Part I, Part II unpacks these emerging challenges. Part II.A defines robotics and makes the case for what distinguishes robots and artificial intelligence from previous and constituent technologies. Part II.B explores the issues that result from these distinguishing features, noting again the breadth of possibilities and pausing on several case studies for deeper analysis.

One important caveat: various authors have imagined a world in which robots or software achieve, or at any rate claim, a human-like consciousness.[107] Little in the literature gives me confidence that artificial intelligence will approximate human intelligence in the foreseeable future. There are analytic and technical reasons to believe robots will never think like people.[108] If they

---

102. *See* M. Ryan Calo, *Open Robotics*, 70 MD. L. REV. 571, 582–83 (2011).

103. *See* Ackerman, *supra* note 101.

104. *See* Calo, *supra* note 102, at 586.

105. Bill Gates, *A Robot in Every Home*, SCI. AM., Jan. 2007, at 58, http://www.scientificamerican.com/article/a-robot-in-every-home.

106. Phil Larson, *We the Geeks: "Robots,"* WHITE HOUSE BLOG (Aug. 6, 2013, 1:41 PM), http://www.whitehouse.gov/blog/2013/08/06/we-geeks-robots ("[T]he Obama Administration's National Robotics Initiative is accelerating innovations that will expand the horizons of human capacity and potentially add over $100 billion to the American economy in the next decade.").

107. *E.g.*, Steven Goldberg, *The Changing Face of Death: Computers, Consciousness, and Nancy Cruzan*, 43 STAN. L. REV. 659 (1991); F. Patrick Hubbard, *"Do Androids Dream?": Personhood and Intelligent Artifacts*, 83 TEMP. L. REV. 405 (2011); Christopher D. Stone, Should Trees Have Standing? *Revisited: How Far Will Law and Morals Reach? A Pluralist Perspective*, 59 S. CAL. L. REV. 1, 15 (1985).

108. The work of Jerry Fodor, though contested, suggests that artificial intelligence may never overcome the so-called Frame Problem. *See* JERRY A. FODOR, THE MODULARITY OF MIND 114 (1983) ("How . . . does the machine's program determine which beliefs the robot ought to reevaluate given that it has embarked upon some or other course of action?"); *see also* ROGER PENROSE, THE EMPEROR'S NEW MIND: CONCERNING COMPUTERS, MINDS, AND THE LAWS OF PHYSICS (1989) (questioning the prospect of artificial meaning); JOHN SEARLE, MINDS, BRAINS AND SCIENCE 28–32 (1984) (same). *But see* Goldberg, *supra* note 107, at 673–80 (critiquing Searle and Penrose). To Fodor, Searle, and Penrose's credit, there were so few gains in artificial intelligence in the decade or so following their critique that the period is known as the "AI Winter." For a discussion of the AI Winter, see HP NEWQUIST, THE BRAIN MAKERS 356 (1994).

did, the sorts of problems conscious machines would present are vastly underappreciated. Scholars interested in human-level artificial intelligence have a tendency to carve out a specific question they can intelligibly address. [109] But that is cheating.

A thought experiment we might call the "Copy or Vote Paradox" serves as an example. Imagine, with James Boyle, that an artificial intelligence announces it has achieved self-awareness, a claim no one seems able to discredit.[110] Boyle examines the difficulty we might face in shutting this system down and explores some sensible arguments on either side.[111] But why stop there? Say the intelligence has also read *Skinner v. Oklahoma*, a Supreme Court case that characterizes the right to procreate as "one of the basic civil rights of man."[112] The machine claims the right to make copies of itself (the only way it knows to replicate). These copies believe they should count for purposes of representation in Congress and, eventually, they demand a pathway to suffrage. Of course, conferring such rights to beings capable of indefinitely self-copying would overwhelm our system of governance. Which right do we take away from this sentient entity—the fundamental right to copy, or the democratic right to participate?

In other words, the kinds of issues that would arise were robots to "wake up" are of entirely another order. This Part looks instead at the immediate commercial prospects of robotics. As it turns out, even the readily achievable (or achieved) properties this Part outlines present interesting and difficult challenges for existing legal thoughts and doctrines.

A. Definitions

Few complex technologies have a single, stable, uncontested definition. Robots are no exception. There is some measure of consensus, however, around the idea that robots are mechanical objects that take the world in, process what they sense, and in turn act upon the world.[113] The utility here of the so-called sense-think-act paradigm lies in distinguishing robots from other technologies. A laptop with a camera can, to a degree, sense and process the external world. But a laptop does not act upon the world. A remote control car with a camera senses and physically affects its environment but relies on the

109. *See* JAMES BOYLE, BROOKINGS INST., ENDOWED BY THEIR CREATOR?: THE FUTURE OF CONSTITUTIONAL PERSONHOOD (Mar. 9, 2011), http://www.brookings.edu/~/media/Research/Files/Papers/2011/3/09-personhood-boyle/0309_personhood_boyle.PDF.

110. *See id.*

111. *See id.*

112. 316 U.S. 535, 541 (1942).

113. The "sense-think-act cycle" represents a way to model human intelligence that has been particularly influential in the robotics and artificial intelligence communities. *See* ROLF PFEIFER & CHRISTIAN SCHEIER, UNDERSTANDING INTELLIGENCE 37 (1999); *see also* Rodney A. Brooks, *Intelligence Without Reason*, 1 PROC. 12TH INT'L JOINT CONF. ON ARTIFICIAL INTELLIGENCE 569, 570 (1991) (referring to "sense-model-plan-act" or SMPA).

human operator for processing. The idea of a robot or robotic system is that the technology combines all three.[114]

Each of these characteristics of sensing, processing, and acting exists on a spectrum. Some robots sense the world but little. The gaming platform Sphero—a programmable robot ball—can sense orientation and distance from the gamer as well as note when the ball itself is being shaken or moved.[115] Other robots can leverage data from any sensor. A sophisticated research platform such as the PR2 from Willow Garage comes equipped with dozens of sensors, including video, audio, range, pressure, and acceleration, and the protocols to integrate them into a complex model of its environment.[116]

While well-known robots like the Mars Rover, the Da Vinci surgical robot, and the infamous Predator B drone are substantially teleoperated in that a human being sees what the machine sees and controls its movements, these systems also "think" to a limited degree. The Mars Rover, for example, has self-directed modes and will not necessarily take certain actions suggested by NASA, like drive off a Martian cliff, if doing so will imperil the robot.[117] The Da Vinci integrates what it sees with doctor input in a continuous effort to improve precision and safety.[118] Pilots can fly some military drones simply by clicking on a point on a map and letting the drone get there itself; these systems can also fly patterns or land themselves.[119] At the other end of the spectrum, driverless cars navigate hundreds of thousands of miles of urban, suburban, and highway conditions without human intervention.

Robots can "act" to varying degrees as well—they can possess a greater or lesser ability to move around or manipulate the world. But acting invites a more fundamental question of definition: Can technology act non-mechanically? Recall that we are looking here for the ways robots differ from longstanding and constituent technologies. If a user interface is the same as an actuator, it is not clear how robots are different from smartphones. At the same time, visual and auditory interfaces introduce energy into and hence alter the human environment. Movies and other stimuli—including social "bots" made

114. SINGER, *supra* note 10, at 67 (adopting this view).

115. *See* David Pogue, *A Bundle of Potential in a Ball*, N.Y. TIMES, Dec. 21, 2011, www.nytimes.com/2011/12/22/technology/personaltech/remote-controlled-ball-holds-potential-delights-state-of-the-art.html.

116. *See PR2 Hardware Specs*, WILLOW GARAGE, https://www.willowgarage.com/pages/pr2/specs (last visited Mar. 5, 2015).

117. *See NASA's Mars Curiosity Debuts Autonomous Navigation*, NASA JET PROPULSION LAB. (Aug. 27, 2013), http://www.jpl.nasa.gov/news/news.php?release=2013-259.

118. *See The Da Vinci Surgical System*, INTUITIVE SURGICAL, http://www.intuitivesurgical.com/products/davinci_surgical_system (last visited Mar. 5, 2015).

119. *See* SINGER, *supra* note 10, at 69. This is true of some commercially available drones as well, such as the quadcopter "Iris" from 3D Robotics. *See Iris Info*, 3D ROBOTICS, http://3drobotics.com/iris/info (last visited Mar. 6, 2015).

of software—can induce a range of emotions and physiological responses.[120] Flashing lights have been known to induce epileptic fits;[121] heavy concentrations of light can cut metal. You and I sometimes act just by speaking, as when we agree to an oral contract.[122]

My working assumption is that a system acts upon its environment to the extent it changes that environment directly. A technology does not act, and hence is not a robot, merely by providing information in an intelligible format. It must *be* in some way. A robot in the strongest, fullest sense of the term exists in the world as a corporeal object with the capacity to exert itself physically.[123] But again, I am talking in terms of a continuum. It may well be appropriate to refer to certain virtual objects organized to exist in and influence the world as robots, especially if they meet the other definitional elements. Imagine a room in which there is projected an image of a person who appears to walk around the room. The animating program has access to various sensors and speakers that, in combination with considerable processing power, allow the program to interact with visitors. Imagine further that this room has access to a line of credit and can initiate the delivery of takeout food. It would take a somewhat arbitrary purism to deny that the system acts upon the world, the room, and the people in it.

A working definition of what it means for technology to act, as opposed to inform, is of particular interest to legal analysis. As we will see in the Sections that follow, officials and courts will face the line between informing and acting more and more, just as scholars have already started to grapple with the essential qualities of robotics without acknowledgment of the transition.

To sum up, robots are best thought of as artificial objects or systems that sense, process, and act upon the world to at least some degree. But this is just a technical definition, akin to describing the networks and protocols that comprise the Internet. What turns out to be important for legal and policy discourse is not the precise architecture, but the possibilities and experiences the architecture generates and circumscribes. In other words, the debates that attend the Internet are not about packet switching as such, but rather the massive, asynchronous, and distance-insensitive communication this technique permits. The following Section turns from a technical definition of a robot to

120. *See, e.g.*, Ian R. Kerr, *Bots, Babes and the Californication of Commerce*, 1 U. OTTAWA L. & TECH. J. 285 (2004) (describing the use of software bots to extract information from consumers); *see also* B.J. FOGG, PERSUASIVE TECHNOLOGY: USING COMPUTERS TO CHANGE WHAT WE THINK AND DO (2003).

121. *See* Kevin Poulsen, *Hackers Assault Epilepsy Patients via Computer*, WIRED (Mar. 28, 2008), http://archive.wired.com/politics/security/news/2008/03/epilepsy.

122. For a foundational discussion of the speech-act distinction, see J.L. AUSTIN, HOW TO DO THINGS WITH WORDS (1962).

123. This is the sense in which "embodiment" is typically used in the literature. *E.g.*, H.R. EKBIA, ARTIFICIAL DREAMS: THE QUEST FOR NON-BIOLOGICAL INTELLIGENCE 258 (2008).

the essential qualities—embodiment, emergence, and social valence—that characterize robotics as a transformative technology.

B. Law Meets Robotics

The Internet's essential characteristics interact with the law in novel ways; so, too, will the essential characteristics of robotics. Specifically, as I discuss below, the qualities of embodiment, emergence, and social valence will challenge the law and legal institutions in years to come.

Data is not embodied; robots generally are. Sensing, navigating, and acting upon the world generally requires a physical presence, and that physical presence opens up a universe of new possibilities. Robots execute commands, of course, and can be useful merely by repeating a task with inhuman patience, or by reproducing an action in hazardous conditions. But the processing capabilities of robots translate into the tantalizing prospect of original action. The literature tends to refer to this exciting potential as "autonomy" or "true learning," but I prefer "emergence."[124] Emergence refers to unpredictably useful behavior and represents a kind of gold standard among many roboticists for reasons I will describe. Finally, robots, more so than other technology in our lives, have a social valence. They *feel* different to us, more like living agents. The effect is so systematic that a team of prominent psychologists and engineers has argued for a new ontological category for robots somewhere between object and agent.[125] These categories are distinct but mutually reinforcing. For instance: a physical embodiment coupled with apparently spontaneous action leads people to lend robots social valence.

Embodiment, emergence, and social valence—alone, and especially in combination—turn out to be relevant to an extraordinarily wide variety of legal contexts: criminal law and procedure, tort, intellectual property, speech, privacy, contract, tax, and maritime law, to name but a few. The remainder of this Section proceeds by expanding on the essential or distinguishing qualities of robots and their repercussions for law and policy. It hopes to convey with examples both the breadth and depth of this interaction.

1. Embodiment

We live in a digital age; the availability of information has reshaped, often for the better, virtually every human pursuit. Certain qualities of data, as discussed above, lend themselves to transformation. For instance, digital information is promiscuous—it "wants to be free," as the saying goes—and faces few natural barriers to dissemination.[126] The digital age is a collaborative

124. *See infra* Part II.B.2.

125. *See* Peter H. Kahn, Jr., et al., *The New Ontological Category Hypothesis in Human-Robot Interaction*, 2011 PROC. 6TH INT'L CONF. ON HUMAN-ROBOT INTERACTION 159.

126. *See* R. Polk Wagner, *Information Wants To Be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995, 999 n.14 (2003).

one. Jonathan Zittrain refers to personal computers and the Internet, the central vehicles of data to date, as "generative" technologies.[127] The idea is that contemporary software and hardware facilitates individual and collective innovation on an unparalleled scale. There are, as we explored, various private and public threats to this model; the very mediation that empowers Internet users renders them vulnerable to control. And there are downsides even where—indeed, because—freedom of information is preserved. Privacy is one example; hate speech is another.

Early in the days of the digital revolution, however, another question quickly arose, and was just as quickly answered: What do we do about the inevitable instability of these radically generative systems? Confronted with the problem of glitch-ridden, multipurpose computers running third-party software, courts moved quickly to curb liability.[128] Early decisions about software liability invoked the economic loss doctrine, limited loss as intangible for insurance purposes, and aggressively upheld warranties, all to avoid allocating responsibility among the many movers, shapers, and consumers of data.[129] Courts are still acting to domesticate liability in the digital context, but you probably would not even think to sue Microsoft or Dell because Word froze and ate your manuscript.[130] The Internet confronted a similar challenge around whether to hold platforms liable for what users do on those platforms. To varying degrees, Congress or courts acted to limit liability for most categories of user conduct by 1998—early days in the commercial history of the Internet.[131]

While robotics also relies on data, the mainstreaming of robots signals a shift back to the physical. Robots run on software and process sensory and other information. Many robotic systems are actually connected to the Internet to supplement functionality, or even to run core functions (sometimes called

127. ZITTRAIN, *supra* note 29, at 70. By "generative," Zittrain means "a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences." *Id.*; *see also* Jonathan L. Zittrain, *The Generative Internet*, 119 HARV. L. REV. 1974 (2006).

128. *E.g.*, Transp. Corp. of Am. v. IBM, 30 F.3d 953, 960 (8th Cir. 1994) (barring recovery under the economic loss doctrine for lost data). For more examples, see Calo, *supra* note 102, at 598–61.

129. *But see* Pompeii Estates, Inc. v. Consol. Edison Co. of N.Y., Inc., 397 N.Y.S.2d 577 (N.Y. Civ. Ct. 1977) (refusing to insulate Consolidated Edison for a service termination mistake involving a computer). I am grateful to James Grimmelmann for this example.

130. *See* David E. Jordan, *The Tortious Computer—When Does EDP Become Errant Data Processing?*, *in* 4 COMPUTER LAW SERVICE § 5-1, art. 2, at 4, 8 (Robert Bigelow ed., 1979) (acknowledging an "implicit acceptance of the fallibility of computers" and suggesting that computer users may be "consciously accepting the risks of defects and operational difficulties in new equipment, in preference to delaying purchase until the 'bugs' have been worked out").

131. *E.g.*, Communications Decency Act, Pub. L. No. 104-104, 110 Stat. 56, 133–43 (1996) (codified as amended in scattered sections of 47 U.S.C.); Zeran v. Am. Online, Inc., 129 F.3d 327, 328 (4th Cir. 1997).

"cloud robotics").[132] Robots, however, differ from computers and software precisely in that they are organized to act upon the world. The capacity to act physically upon the world translates, in turn, to the potential to physically harm people or property.

Obviously the capacity to affect the world physically is not novel in any meaningful legal sense. The earliest cases in tort dealt with the physical consequences of objects.[133] Nor does it necessarily matter that drones or other robots permit physical harm at a distance. A bullet shot from land one has permission to enter can trespass onto land one does not.[134] The question whether a drone flying over a backyard below navigable airspace constitutes a trespass may be an interesting example in terms of defining property rights more precisely,[135] but it is not ultimately novel.

There is, however, a significant difference between a bullet and a robot: the prospect of programming. Programming dictates behavior in complex ways. Code interacts with other code and various inputs, for instance, operator instructions or sensor data. It turns out to be very difficult to predict its influence entirely.[136] Code can also have complicated origins. Software can have one or many authors. It can originate anywhere, from a multimillion-dollar corporate lab to a teenager's bedroom. Given that robots run on code, anticipating and accounting for robot behavior represents at least as difficult a task as accounting for user behavior in the context of personal computers or smartphones. You cannot anticipate exactly how a robot will behave by looking at it. Indeed, two physically identical robots can behave in radically different ways because of small differences in their software.

Robots thus combine, arguably for the first time, the generative promiscuity of data with the capacity to do physical harm.[137] This has a number of legal repercussions. In her 2013 essay, Nora Engstrom explores how the

132. *See* Erico Guizzo, *Cloud Robotics: Connected to the Cloud, Robots Get Smarter*, IEEE SPECTRUM (Jan. 24, 2011, 4:39 PM), http://spectrum.ieee.org/automaton/robotics/robotics-software/cloud-robotics.

133. The writs of trespass and trespass on the case dealt with direct and indirect injury, respectively, of person or property.

134. *See* Herrin v. Sutherland, 241 P. 328 (Mont. 1925).

135. *Cf.* United States v. Causby, 328 U.S. 256, 266 (1946) (abrogating rule that property owners take all land rights above and below property).

136. *See* Richard Mateosian, *No More Wishful Thinking*, IEEE MICRO, Mar./Apr. 2009, at 68 ("Testing everything is impossible in a finite amount of time. Furthermore, although testing can identify problems, it can't correct them." (reviewing GERALD WEINBERG, PERFECT SOFTWARE AND OTHER ILLUSIONS ABOUT TESTING (2008))); *see also* Curtis E.A. Karnow, *Liability for Distributed Artificial Intelligences*, 11 BERKELEY TECH. L.J. 147, 162 (1996) (amassing evidence of "*inherent* problems with software liability" and noting that it is "practically impossible to test software thoroughly" (citation omitted)).

137. As Mark Lemley notes in the context of intellectual property, 3D printing (described below) and synthetic biology also combine data promiscuity with physical ramifications. *See* Mark A. Lemley, *IP in a World Without Scarcity* (Stanford Pub. Law Working Paper No. 2413974, 2014), http://ssrn.com/abstract=2413974.

mainstreaming of 3D printers—a close cousin of robotics—stands to interact with product liability law.[138] 3D printing refers to the creation of physical objects from code; the technology works by alternatively heating and cooling a material such as plastic or metal to create three-dimensional objects according to a pattern contained in a software file. Some units are quite affordable and can be used in the home.[139] 3D printing is often linked with robotics in that it uses some of the same underlying software and hardware.[140]

Under existing doctrine, plaintiffs injured by the products they buy can generally avail themselves of strict liability.[141] They do not need to show negligence. But strict product liability only applies to "[o]ne engaged in the business of selling or otherwise distributing products."[142] It is well established that noncommercial "sellers" (think handcrafts or lemonade) are only liable for defects in products if they were negligent.[143] Were individuals to print the objects they buy at home instead of picking them up at a store, it is not at all clear whether strict liability would apply in the event of an injury. This may be fine if we are talking about the equivalent of combining squeezed lemons, water, and sugar, where the risk is a sour taste. As access to complex 3D designs and materials increases, however, individuals will be in a position to create and sell complex, valuable, and dangerous products.

Arguably there are other ways to establish liability. Many 3D products will have been professionally designed. Programming a chair or Lego piece is presumably hard enough, much less more complicated products. So what about locating liability in the commercial designer of the "print-at-home" product? A commercial distributor of, say, microwave popcorn could probably be held strictly liable for an injury proximately caused when the bag catches fire in minute three. Why not hold liable the designer of the toothbrush that, when printed, ends up cutting the gums? In other words, while perhaps we cannot hold enterprises strictly liable for a manufacturing defect, perhaps we can hold a company with deep pockets liable for a design defect because the product is harmful even when properly assembled.

The issue is that products as understood by contemporary product liability law are by definition tangible—intangible products do not generally give rise to

138. Nora Freeman Engstrom, *3-D Printing and Product Liability: Identifying the Obstacles*, 162 U. PA. L. REV. ONLINE 35 (2013), http://www.pennlawreview.com/online/162-U-Pa-L-Rev-Online-35.pdf.

139. *Id.* at 35.

140. The difference is that 3D printers have limited sources of input: the program that supplies the pattern, for instance, and the position of the actuator. But they are made up of very similar components (e.g., Arduino hardware, Kinect sensors) and raise similar issues around embodiment. Indeed, the most popular 3D printer on the market is called Makerbot, whereas Chris Anderson's aforementioned robotics start-up is called 3D Robotics.

141. *See* Engstrom, *supra* note 138, at 40.

142. *Id.* at 36 (quoting RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 1 cmt. c (1998)).

143. *Id.* at 37.

product liability actions.[144] Thus, a guidebook claiming that a particular beach was nice for swimming would not be a product for purposes of an injury from a shark bite, nor would an encyclopedia of mushrooms that turned out to be wrong about which were poisonous.[145] The code conveyed to the consumer fails to be defective for purposes of a product liability claim not because it lacks defects, but for the antecedent reason that it is not even a product. The same may—or may not—prove true of robotics software generally.

Engstrom's essay shows how the interaction of product liability law and embodiment presents the prospect of systematically undercompensating victims. Embodying data also disrupts a more basic distinction between informing and acting. Products being sold and under development increasingly situate data in the physical world. Truly driverless cars are on their way, but driver assistance systems are already organized to act upon the world.[146] Lane correction features in luxury vehicles range from alerting the driver of a lane drift with an expectation the driver will react, to actually providing resistance in the steering wheel. Robotic surgery lets surgeons "feel" organs through resistance.[147] The Tangible Media Group at the MIT Media Lab has developed an interface that lets users "reach through" a screen to manipulate objects at a distance.[148]

Embodiment turns out to challenge a basic compact that underlies the digital revolution. Congress and the courts have been in a position to shield the

144. *Id.* at 38–39.

145. *Id.* at 39 (citing Winter v. G.P. Putnam's Sons, 938 F.2d 1033, 1036 (9th Cir. 1991)).

146. The state of Nevada, in its driverless car legislation, originally defined autonomous vehicles as a motor vehicle that "uses artificial intelligence, sensors and global positioning system coordinates to drive itself without the active intervention of a human operator." NEV. REV. STAT. § 482A.030 (2011), *amended by* 2013 Nev. Stat., ch. 377, § 7. The new definition makes clear that driver assistance is not necessarily autonomous. NEV. REV. STAT. § 482A.025 (2013) ("The term does not include an active safety system or a system for driver assistance, including, without limitation, a system to provide electronic blind spot detection, crash avoidance, emergency braking, parking assistance, adaptive cruise control, lane keeping assistance, lane departure warning, or traffic jam and queuing assistance, unless any such system, alone or in combination with any other system, enables the vehicle on which the system is installed to be driven without the active control or monitoring of a human operator.").

147. *See, e.g.*, Jake J. Abbott et al., *Haptic Virtual Fixtures for Robot-Assisted Manipulation*, *in* 28 SPRINGER TRACTS ADVANCED ROBOTICS 49 (2007); Fredrik Rydén & Howard Jay Chizeck, *Forbidden-Region Virtual Fixtures from Streaming Point Clouds: Remotely Touching and Protecting a Beating Heart*, 2012 PROC. INT'L CONF. ON INTELLIGENT ROBOTS & SYS. (IROS) 3308.

148. *See* Sean Follmer et al., *inFORM: Dynamic Physical Affordances and Constraints Through Shape and Object Actuation*, 2013 PROC. USER INTERFACE SOFTWARE & TECH. 13, 417. Recently a colleague in the computer science department dropped and broke his phone because he perceived there was a spider running across it. In actuality, a fitness application he had been using permitted an exterminator to take over the screen of the phone to advertise with a virtual spider. According to the Restatement of Torts (Second), a defendant commits assault by yelling "snake" on a hiking trail in order to scare someone, and is liable for any damage that may occur should the person jump out of the way of the fake threat. *See* RESTATEMENT (SECOND) OF TORTS § 25 cmt. a, illus. 1 (1965). The increasing opportunity to organize data to provoke reliance or reaction could force courts to revisit and perhaps fortify the line between display and force.

engines behind the digital economy from significant liability, thereby promoting innovation, precisely because *information* was at issue.[149] For example, courts have invoked the economic loss doctrine to limit liability for data lost pursuant to a computer freezing, even when such data is clearly of great value to the aggrieved party. But the economic loss doctrine does not apply by its terms to physical harm.[150] Indeed, where glitches in software have resulted in physical injury, the courts have allowed actions in tort to proceed.[151]

Congress has shielded the Internet even more directly: Section 230 of the Communications Decency Act of 1996 expressly immunizes Internet platforms for what users say there.[152] Thus, for instance, the social network Facebook will not be held accountable for a fraud committed by one of its many users through the service. The Act does so, however, by providing that the platform will not be treated as the "publisher" of the offending information.[153] Part of the rationale was that Facebook should not be thought of as the speaker in these and similar instances, nor placed in a position where the company must constantly police against its users' speech on pain of suffering tort or criminal liability. Congress will be hard pressed to immunize manufacturers of robotic platforms where (a) physical harm can result and (b) the free speech arguments that animated Section 230 are not really in play.[154] But the need to promote an open ecosystem in robotics is no less pronounced.[155]

The basic point is this: the law will face the question, maybe soon, and likely often, of what to do when a digital object made up of bits becomes a physical object made up of atoms. Courts may soften or strengthen existing doctrines, import doctrines across subject matter, or resurrect doctrines long forgotten—all prospects I countenance in Part III. But the set of compromises we have in place today—the balances lawmakers, courts, and regulators have struck—will plausibly unwind in the coming decades.

---

149. *See* Calo, *supra* note 102, at 598–601.

150. *See* Michael L. Rustad & Thomas H. Koenig, *The Tort of Negligent Enablement of Cybercrime*, 20 BERKELEY TECH. L.J. 1553, 1580 (2005).

151. *See id.* at 1578 ("Courts have had little difficulty extending product liability for bad software when the design defect causes physical injury or death."); Calo, *supra* note 102, at 599–600 (citing examples).

152. 47 U.S.C. § 230 (2012).

153. *Id.* § 230(c)(1) ("No provider or user of an interactive computer service shall be treated as the publisher or speaker of any information provided by another information content provider.").

154. *Id.* § 230(a)(5) (finding that "[i]ncreasingly Americans are relying on interactive media for a variety of political, educational, cultural, and entertainment services"). Prior to the enactment of Section 230, a court had already immunized a website for user speech it was not made aware of on First Amendment grounds. *See* Cubby, Inc. v. CompuServe Inc., 776 F. Supp. 135 (S.D.N.Y. 1991). And while the solution to bad speech may be more speech, Whitney v. California, 274 U.S. 357, 377 (1927) (Brandeis, J., concurring), the solution to arson is not more fire.

155. *See* Calo, *supra* note 102, at 612–13 (explaining why robotics needs an open ecosystem no less than the Internet in order to realize its transformative potential).

2. Emergence

Today's robots do a variety of tasks that people could do, but don't for reasons of cost or preference.[156] Moving more tasks into the category of automation could in and of itself cause legal issues at scale. Imagine, for instance, if just one major fast food chain were to automate one or more tasks now done by people. Such a shift would move enough company expenditures from payroll to capital that most states in America would have to reexamine their tax laws.[157] I would characterize this change as superficial, however, despite the fact that the law would need to undergo deep or systemic changes. Adjusting the tax code to accommodate greater automation seems akin to having to change antitailgating or texting laws to accommodate driverless cars. To this day there are jurisdictions that technically require elevators to have seats for the operator;[158] we just ignore them.

Researchers dream of systems that do more than merely repeat instructions but adapt to circumstance. Emergent behavior is a clearly stated goal of robotics and artificial intelligence, going directly to the "think" component of our earlier definition of the technology. Kenneth Anderson and Matthew Waxman describe why this capacity would be useful in a military setting.[159] Robotic systems might be faster than people at reacting to battlefield developments, especially ones initiated by other machines.[160] As Ronald Arkin's work explores, a machine that is versatile enough to "learn" from mistakes could stop itself (and people) from committing those mistakes in the future.[161]

Emergent behavior turns out to be useful well beyond military applications. For example, emergence cuts down on training time: rather than designate every behavior with its own block of code, users can set goals and

156. *See* Leila Takayama et al., *Beyond Dirty, Dangerous and Dull: What Everyday People Think Robots Should Do*, 2008 PROC. 6TH INT'L CONF. ON HUMAN-ROBOT INTERACTION 25, 25 ("Robots are frequently envisioned as fulfilling jobs that have the three Ds: dirty, dangerous and dull. In this model, the archetypical robot job is repetitive physical labor on a steaming hot factory floor involving heavy machinery that threatens life and limb.").

157. The U.S. Department of Treasury once received a proposal asking manufacturers to pay income tax when replacing workers with robots, to which the department responded: "[I]nanimate objects are not required to file income tax returns." 25 TAX NOTES 20 (1984). This example comes from Stone, *supra* note 107, at 15 n.52.

158. *E.g.*, N.Y. LAB. LAW § 203-a (McKinney 2014) ("Every passenger elevator operated and maintained for use by the public shall be equipped or furnished with a seat, collapsible or otherwise, for the use of the operator when the elevator is not being operated . . . .").

159. *See* Kenneth Anderson & Matthew Waxman, *Law and Ethics for Robot Soldiers* (Columbia Pub. Law Research Paper No. 12-313, Am. Univ. WCL Research Paper No. 2012-32, 2012), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2046375 (noting the inevitability of greater automation).

160. *Id.*; *see also* SINGER, *supra* note 10, at 64.

161. *See generally* RONALD ARKIN, GOVERNING LETHAL BEHAVIOR IN AUTONOMOUS ROBOTS (2009).

train the system to accomplish them.[162] Further, because an emergent system learns from previous behavior, it will improve at a task over time even when unaided.[163] You see this aspiration in a recent demo by Carnegie Mellon and Intel of their robotic butler, which appears to try various methods to separate an Oreo cookie.[164] Importantly, emergent behavior can lead to solutions no human would have come to on her own. Something approaching creativity can emerge from feeding data into a complex system and allowing it to iterate toward a semiarbitrary goal. Thus, the company Gillette reportedly entered various parameters into an algorithm with emergent properties, called a "Creativity Machine," which in turn spit out a patentable innovation in toothbrushes.[165]

I use the term "emergence" instead of "autonomy" by design. Autonomy suggests that robots are somehow making a decision to act in a particular way. Little is gained, and much is arguably lost, by pretending contemporary robots exhibit anything like intent.[166] Instead, I would draw on Stephen Johnson's work in emergence spanning across a number of disciplines. Johnson sees the essence of emergence as the coupling of complexity and usefulness, the movement of low-level rules to tasks of apparently high sophistication.[167] A common example is the way ants follow simple rules to accomplish complex, seemingly intelligent tasks. Artificial intelligence pioneer Alan Turing understood the utility of emergence and, according to Johnson, contemporary

---

162. *See* Yueh-Hsuan Weng et al., *Toward the Human-Robot Co-Existence Society: On Safety Intelligence for Next Generation Robots*, 1 INT. J. SOC. ROBOTICS 267 (2009).

163. *See, e.g.*, Guizzo, *supra* note 132 ("[James Kuffner, of Carnegie Mellon University] envisions a future when robots will feed data into a 'knowledge database,' where they'll share their interactions with the world and learn about new objects, places, and behaviors."); Aaron Saenz, *Robot Learns How to Flip Pancakes . . . But Not on the First Try*, SINGULARITY HUB (July 27, 2010), http://singularityhub.com/2010/07/27/robot-learns-how-to-flip-pancakes-but-not-on-the-first-try-video (discussing how a robot learned to flip pancakes via evaluating its own performance).

164. *See* Tim Hornyak, *Knife-Wielding Robot HERB Separates Oreo Cookies*, CNET (Mar. 12, 2013, 12:43 PM), http://news.cnet.com/8301-17938_105-57573865-1/knife-wielding-robot-herb-separates-oreo-cookies. Another example is so-called swarm robotics where smaller machines following simple rules mimic higher order behavior typical of ant or bee colonies. *E.g.*, Robert Wood, Radhika Nagpal, & Gu-Yeon Wei, *Flight of the Robobees*, SCI. AM. (Mar. 2013).

165. *See* ROBERT PLOTKIN, THE GENIE IN THE MACHINE: HOW COMPUTER-AUTOMATED INVENTING IS REVOLUTIONIZING LAW AND BUSINESS 51–52 (2009). The prospect of machine-designed products challenges, for instance, Sheila Birnbaum's influential elision between "products" and "conduct." *See* Sheila L. Birnbaum, *Unmasking the Test for Design Defect*: *From Negligence [to Warranty] to Strict Liability to Negligence*, 33 VAND. L. REV. 593, 610 (1980).

166. A recent book purports to advance a "legal theory for autonomous agents" that boils down to treating software as though it holds intent, regardless of whether it does—what the authors call the "intentional stance." *See* SAMIR CHOPRA & LAURENCE F. WHITE, A LEGAL THEORY FOR AUTONOMOUS ARTIFICIAL AGENTS 11–13 (2011). The trouble with this approach is that sometimes treating software as though it possesses intent advances law's goals, whereas other times it hinders those goals. The authors do not offer any theory for how to tell the difference. For an older, wiser approach to this topic, see Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 N.C. L. REV. 1231, 1232–38 (1992) (expressing skepticism that artificial systems possess intentionality, but advancing a modest hypothesis that they might serve a legal person for some purposes).

167. *See* STEVEN JOHNSON, EMERGENCE: THE CONNECTED LIVES OF ANTS, BRAINS, CITIES, AND SOFTWARE 18–19 (2001).

designers of intelligent systems rely on the principles of emergence with greater and greater frequency.[168]

The prospect of useful but unexpected problem solving by machines presents a number of challenges for the law. These challenges are particularly acute when combined with embodiment because of the premium the law places on physical effects. Yet the earliest puzzles for law have, in a sense, already arrived in the form of emergent speech. Indeed, scholars and courts are grappling creatively with these issues, without necessarily drawing the broader connection to emergence.

For example, Annemarie Bridy explores the implications of creative software for intellectual property: "The law as it is currently configured cannot vest ownership of the copyright in a procedurally generated work in the work's author-in-fact, because the work's author-in-fact—a generative software program—has no legal personhood."[169] Tim Wu examines speech generated by a machine, arguing that we should apply a functional lens to artificial speech on the theory that First Amendment protections do not generally attach to those who merely carry information and that "courts do not normally protect tools."[170] Stuart Benjamin, in contrast, believes a "fundamental reorientation" of First Amendment law may wind up being necessary to accommodate the increasing relevance of algorithm-based decisions.[171]

Bridy, Wu, Benjamin, and others are looking at what types of speech copyright or the Constitution protects. I believe the larger question will turn out to be who is liable for the infringement that an emergent system occasions. A claim of fault is often where the rubber meets the road. We see the beginnings of the infringement issue presented in cases, such as *Cartoon Network, LP, LLLP v. CSC Holdings, Inc.*, that turn on whether the user or the automated system "copied" a protected work.[172] But we can readily imagine more fundamental changes. Take, for instance, the difference between expression, which is copyrightable, and style, which is not.[173] Imagine a musical assistant

168. *Id*. at 18, 21, 126.

169. Annemarie Bridy, *Coding Creativity: Copyright and the Artificially Intelligent Author*, 2012 STAN. TECH. L. REV. 5, 21. Bridy's focus is copyright, but one might ask similar questions around patents. *A* holds the patent on a creation machine that *B* uses to generate a new, patentable invention. What result? The machine itself is not a person and hence, arguably, cannot qualify for a patent. *See* Ralph D. Clifford, *Intellectual Property in the Era of the Creative Computer Program: Will the True Creator Please Stand Up?*, 71 TUL. L. REV. 1675, 1696–97 (1997) (arguing that patent law implicitly assumed a human inventor); *see also* Pamela Samuelson, *Allocating Ownership Rights in Computer-Generated Works*, 47 U. PITT. L. REV. 1185 (1986).

170. Tim Wu, *Machine Speech*, 161 U. PA. L. REV. 1495, 1497 (2013) [hereinafter Wu, *Machine Speech*]. Wu also observes: "The question of 'rights for robots,' if once limited to science fiction, has now entered the public debate." *Id.* at 1496.

171. Stuart Minor Benjamin, *Algorithms and Speech*, 161 U. PA. L. REV. 1445, 1446 (2013).

172. 536 F.3d 121 (2d Cir. 2008).

173. Or at least, not necessarily. *See* 4 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 13.03 (2014) (noting that courts treat "format, theme, style, or setting" as ideas and hence do not protect them under copyright (internal citations omitted)); *see also* Midler v. Ford Motor

that helps a musician emulate the style of his favorite guitarist. Now imagine that the musician ends up reproducing some part of a real song by that guitarist while emulating his style. Assuming the musician had no access to the work itself, has there been independent creation? Or does the musical assistant's access to the work for training purposes convey to its user?

The same questions can be asked of liability for false speech. The popular television host Stephen Colbert recently created an account on the social network Twitter that automatically swaps in the names of personalities from the Fox News Network for movies reviewed on the website Rotten Tomatoes.[174] "The TV show's most compelling element of all is [Sarah] Palin," one tweet reads, "wandering the nighttime streets trying to find her lover."[175] Another tweet implied that Fox News anchor Bill Hemmer took communion while intoxicated.[176] To the initiated, the account is clearly satirical. Yet even a simple system of this kind could generate a claim, which would be defamatory if a person uttered it. The law would then face a choice between holding someone accountable for a result she did not specifically intend, or permitting without recourse what most any observer would take for defamatory or libelous speech.

Emergence in monetary transactions goes even further in affecting the world than music or tweets. Tom Win examines the role of high frequency trading algorithms in contemporary investment, noting that "cyborg finance" challenges certain assumptions around risk management and culpability.[177] The Securities and Exchange Commission struggles not only with how to prevent and address catastrophic market events such as the "Flash Crash" of 2010, as Win explores,[178] but also with how to deal with learning algorithms that arrive at information that would constitute insider trading were it revealed to the investor directly.[179] Contract law, too, grapples with the minimum

Co., 849 F.2d 460 (9th Cir. 1988) (finding appropriation of likeness, but no copyright violation, when car dealership used a Bette Midler "sound-alike" in commercial).

174. Beejoli Shah, *The Colbert Report's New Twitter Feed Praising Fox News Is Brilliant*, GAWKER (Nov. 5, 2013, 11:54 AM), http://defamer.gawker.com/the-colbert-reports-new-twitter-feed-praising-fox-news-1458817943.

175. *Id.*

176. Specifically, the tweet appears to accuse Hemmer of "vomiting up a communion wafer" and to cite the incident as evidence "age hasn't mellowed the master one whit." *See* Real Human Praise, Twitter (Dec. 12, 2013, 6:55 AM), https://twitter.com/RealHumanPraise/status/411147205664583680.

177. Tom C.W. Lin, *The New Investor*, 60 UCLA L. Rev. 678, 687 (2013) ("Modern finance is cyborg finance, an industry in which the key players are part human and part machine.").

178. *Id.* at 703–10.

179. An expert system could function, in other words, like an "expert network," which connects industry experts with investors, thereby implicating the "mosaic theory" of insider trading. For more on expert networks and the mosaic theory, see Daniel H. Jeng, *Expert Networks and Insider Trading: An Introduction and Recommendation*, 32 DEV. BANKING & FIN. L. 245 (2013).

intentionality a person must display before she will be held to the terms of a transaction negotiated by a software program that she initiated.[180]

The prospect of systems that are both emergent and fully, physically embodied provides the most acute challenges. The law is generally quicker to locate responsibility in the event of physical harm[181] and more reticent to allow innocent plaintiffs to bear the risk of injuries in the face of a colorable defendant. At the same time, the mechanisms by which the law sorts fault involve deeply human concepts such as mens rea (criminal law), mutual assent (contract), or foreseeability (tort)—all of which are absent where a system is built to be unpredictable by design. Several far-flung areas of the law also rely on the prospect of control, which in the case of emergent systems is sometimes disavowed for good reason.

Let us start with the "simple" cases—at least simple to spot. Imagine, with a string of scholars dating back decades, that an individual purchases a robot with emergent properties. The individual assigns the robot a task such as cleaning or delivering a package. The robot accomplishes this task in a way that, in addition to being unexpected, happens severely to injure a person or damages her property. Or consider a real "bot," designed by artist Darius Kazemi, which randomly purchases items on Amazon. Say the bot purchases Nazi paraphernalia in France, per the *Yahoo!* case described in Part I.[182] In determining culpability, criminal law would look to the state of mind of the defendant: did he intend, know, or at least have reason to know his robot would hurt the victim or break the law? Tort law would look to foreseeability: should the defendant have appreciated the risk of harm and its magnitude, or "fairly foreseen" the activity as part of the robot's assignment?[183]

These hypotheticals present, at base, the prospect of a victim who suffers a non-natural harm but no perpetrator to whom the law can attribute this harm. What scholarship exists on robotics and the law seems to address this particular problem. For instance, writing in 1981, Sam Lehman-Wilzig explores various models of accountability for artificial beings.[184] These include: product

180. The commission behind the Uniform Commercial Code (UCC) amended the UCC in 2003 to include a discussion on "electronic agents," meaning "a computer program or an electronic or other automated means used independently to initiate an action or respond to electronic records or performances in whole or in part, without review or action by an individual," only to withdraw the amendment in 2011 due to opposition from states and industry. U.C.C. § 2-103(g) (2003 Revision) (withdrawn 2011); *see also* Tom Allen & Robin Widdison, *Can Computers Make Contracts?*, 9 HARV. J.L. & TECH. 25 (1996).

181. *See* Nancy Levit, *Ethereal Torts*, 61 GEO. WASH. L. REV. 136 (1992).

182. For a variation on this hypothetical, see Greg Miller, *The Moral Hazards and Legal Conundrums of Our Robot-Filled Future*, WIRED (July 17, 2014, 6:30 AM), http://www.wired.com/2014/07/moral-legal-hazards-robot-future.

183. *See, e.g.*, O'Shea v. Welch, 350 F.3d 1101 (10th Cir. 2003) (discussing scope of employment).

184. Sam N. Lehman-Wilzig, *Frankenstein Unbound: Towards a Legal Definition of Artificial Intelligence*, 13 FUTURES 442 (1981); *see also* Peter M. Asaro, *A Body to Kick, But Still No Soul to*

liability, dangerous animals, slavery, diminished capacity, children, agency, and personhood.[185] These categories crop up in several accounts of robot responsibility; I imagine one or more occurred to you in reading the previous paragraph. Could we not hold a defendant robot owner responsible the *second* time his robot hurt someone, just as we hold him responsible the second time his dog bites? Can we categorize robots, like animals, into "roaming" or not for purposes of strict liability for intrusion?[186]

This set of questions is fascinating and important; the law will need to sort out analogies for robots or else create a new category.[187] Distinct from what a defendant intends or knows, however, there are questions around the very prospect and intelligibility of human control over emergent systems. Take the concept of res ipsa loquitur in tort law—roughly, the doctrine dispensing with the need to show negligence where the "thing speaks for itself."[188] The paradigmatic case remains the plaintiff who is struck by a barrel that rolls out of a warehouse window.[189] The plaintiff need not demonstrate the warehouse owner was negligent, because reasonable businesses do not let barrels fly out of their property onto the street.

In addition to fairness, res ipsa has an information-forcing function: the warehouse owner knows more about what happened than the plaintiff, and so tort law shifts the burden to the defendant to explain what happened.[190] The doctrine is perhaps less relevant with the advent of modern rules of discovery but continues to have life in, for instance, medical malpractice actions where the plaintiff was unconscious.[191] Importantly, for a plaintiff successfully to invoke res ipsa, she must show that the defendant had "exclusive control" over the instrumentality of her injury.[192] This is an antecedent question: the burden does not shift to the defendant in the absence of a showing of exclusive control.

But a plaintiff's ability to show that the defendant had "exclusive control" is further complicated when robots are involved. Imagine if, rather than a barrel, a robot jumped out of the window and injured the plaintiff. If this sounds too much like the lead up to a joke (about the "thing" that literally

---

Damn: Legal Perspectives on Robotics, *in* ROBOT ETHICS: THE ETHICAL AND SOCIAL IMPLICATIONS OF ROBOTICS 169 (Patrick Lin et al. eds., 2012) (invoking the same categories).

185. Lehman-Wilzig, *supra* note 184, at 447–53.

186. This turns out to be tricky! While the rule applies to horses and sheep, there are animals, such as dogs and cats, which we permit to roam without liability because of prevailing custom. *See* GLANVILLE L. WILLIAMS, LIABILITY FOR ANIMALS 145–46 (1939). We are at a stage today in robotics and law where deep dives into any one analogy, such as robots and animals, would be highly useful.

187. *See infra* Part III.

188. *Res ipsa loquitur*, BLACK'S LAW DICTIONARY 1424 (9th ed. 2009).

189. Byrne v. Boadle, 159 Eng. Rep. 299 (Exch. 1863).

190. *See* JOHN C.P. GOLDBERG ET AL., TORT LAW: RESPONSIBILITIES AND REDRESS 211 (2d ed. 2008).

191. *E.g.*, Ybarra v. Spangard, 154 P.2d 687 (Cal. 1944) (holding res ipsa applied where plaintiff sustained injuries while unconscious during surgery).

192. *E.g.*, Larson v. St. Francis Hotel, 188 P.2d 513, 514 (Cal. Ct. App. 1948).

"speaks for itself"), imagine instead that multiple robotics systems played a role in diagnosing and treating a patient at a hospital—hospitals being demonstrably early adopters of robotics and artificial intelligence, and places where res ipsa lives on.[193] The various potential configurations of robots in a hospital setting deeply complicate the plaintiff's ability to show exclusive control. Perhaps some control resides with the manufacturer or with one or more software programmers; perhaps no one effectively has exclusive control of a given system. The law would then have to decide whether to take exclusive control seriously as a threshold in this context.

The prospect of emergent behavior also presents interesting questions of damages. Recall that an early challenge of cyberlaw involved the prospect of electronic trespass to chattels, a doctrine unavailable in the absence of harm.[194] (The harm of electronic trespass to chattels, according to sympathetic courts, was the hassle to consumers of wading through unwanted electronic messages.[195]) Robotics presents the prospect that a defendant will, whether fully or partially, destroy a valuable emergent trait. *A* destroys *B*'s robot that cut the hedges a certain, wonderful way. Unlike in the case of animal training, *B* put in no additional labor in enhancing the value of the robot.[196] Courts will have to determine whether the loss is still market value.

The questions go beyond civil and criminal liability.[197] Craig Allen, a maritime law scholar, recently considered whether unmanned submarines with autonomous capabilities qualify for the full panoply of rights generally afforded vessels in international waters.[198] International law premises these rights on the ability of a flag state to retain control over the behavior of the vessel and crew.[199] This has been taken to mean that there are one or more people in charge of the vessel who are beholden to the flag nation in the right ways. The question whether autonomous systems are beholden to the United

193. *See* Timothy Hay, *The Robots Are Coming to Hospitals*, WALL ST. J. (Mar. 15, 2012, 3:02 PM), http://www.wsj.com/articles/SB10001424052702304459804577281350525870934 ("Robots have already staked out a place in the health-care world—from surgical droids that can suture a wound better than the human hand to 'nanobots' that can swim in the bloodstream. But the stage is now set for a different kind of robot, one with a sophisticated brain and an unlimited tolerance for menial tasks.").

194. *See* RESTATEMENT (SECOND) OF TORTS § 218(b) (1965) (to recover in trespass to chattel, property must be "impaired as to its condition, quality, or value ").

195. *See supra* note 61 and accompanying text.

196. *Cf.* Paguio v. Evening Journal Ass'n, 21 A.2d 667, 668 (N.J. 1941) (calculating the value of a stage dog on the basis of lost profit while retraining).

197. And there are many more examples within the civil and criminal context. For instance, in Section 1983 litigation, a private party must exert sufficient control over a government action for liability to attach. *See* King v. Massarweh, 782 F.2d 825, 829 (9th Cir. 1986). An increased reliance on algorithms that mix public and private sources of data raises the prospect that a private party will attempt to influence the outcomes of automated decisions about welfare. *Cf.* Danielle Keats Citron, *Technological Due Process*, 85 WASH. U. L. REV. 1249, 1260–61 (2008) (noting the role of private vendors in state automated decision-making systems).

198. Allen, *supra* note 11.

199. *See id.*

States is not (merely) academic: a nation such as China has a strategic incentive to disqualify underwater American military equipment that patrols its sea shelf, such that international bodies may have to confront the question sooner rather than later.

My purpose here is neither to belittle the important questions others have posed around attribution of fault, nor to catalog all of the ways emergence stands to challenge the law. Rather, my purpose is to anticipate the broader impact of unpredictability by design and to encourage those inclined to study robotics and the law to think systematically about emergence.

3. Social Valence

Early observers of the Internet remarked upon the predisposition of people to think of themselves as "visiting" cyberspace. Dan Hunter argues that this tendency is somehow hardwired, an inevitable byproduct of human cognition.[200] Julie Cohen and others see a danger, at any rate, in over-physicalizing the virtual.[201] Orin Kerr shows more precisely how perspective shapes legal outcomes: a court that, against Hunter's intuition, thinks of the Internet as wires and servers might be less likely to allow police officers to peruse an online bank account pursuant to a search warrant for the home.[202]

Robots also evoke responses in people. There is a robust literature suggesting that people are hardwired to react to anthropomorphic technology such as robots as though they were interacting with a person.[203] The threshold for what stimulates this reaction is low: early psychological studies show how people attribute social roles to shapes that move around on a page.[204] Any robot that exists physically in the world (acts) and appears to navigate the world with a measure of deliberation (senses and thinks) can invoke a social response. But robots are often intentionally designed to be anthropomorphic because it makes

200. *See* Hunter, *supra* note 13, at 443.

201. *See generally* Cohen, *supra* note 13.

202. *See* Kerr, *supra* note 27, at 367–68.

203. *See* BYRON REEVES & CLIFFORD NASS, THE MEDIA EQUATION: HOW PEOPLE TREAT COMPUTERS, TELEVISION, AND NEW MEDIA LIKE REAL PEOPLE AND PLACES (1996); *see also* CLIFFORD NASS & SCOTT BRAVE, WIRED FOR SPEECH: HOW VOICE ACTIVATES AND ADVANCES THE HUMAN-COMPUTER RELATIONSHIP 3 (2005) ("[O]ver the course of 200,000 years of evolution, humans have become *voice-activated* with brains that are wired to equate voice with people and to act quickly on that identification."). The notion of "computers as social actors," while well evidenced, is not without criticism. Ben Schneiderman at the University of Maryland, for instance, believes the effect is overrated and, to the extent presented, problematic. *See generally* BENJAMIN SCHNEIDERMAN, DESIGNING THE USER INTERFACE: STRATEGIES FOR EFFECTIVE HUMAN COMPUTER INTERACTION (1998) (arguing inter alia that anthropomorphized interfaces do not generally succeed and often lead to confusion).

204. The seminal example is Fritz Heider & Marianne Simmel, *An Experimental Study of Apparent Behavior*, 57 AM. J. PSYCHOL. 243 (1944). The animation itself is quite fascinating and available online. Kenjirou, *Heider and Simmel (1944) animation*, YOUTUBE (July 26, 2010), http://www.youtube.com/watch?v=VTNmLt7QX8E (showing the animation used in the Heider & Simmel study).

them more engaging.[205] The effects, moreover, persist over time, and do not depend on one's familiarity with the technology.[206]

Thus, to a greater degree than perhaps any technology in history, robots have a social valence to people. Psychologist Peter Kahn and colleagues have conducted a series of experiments attempting to get a sense of how we think about robots. The results have led the team to formulate a startling hypothesis: robots may belong in an entirely new "ontological category."[207] Subjects do not tend to think about personified robots as alive, but nor do they consider them to be objects. Rather, subjects in such studies tend to attribute mental states to robots and found it difficult to engage in behavior (e.g., cause discomfort) that would be easy if they were dealing with an object.[208] The work, funded in large part by the National Science Foundation, has lead increasingly to the view that no existing ontological category (i.e., distinct category of being) adequately captures robotics. As Kahn and colleagues put it:

> For the most part, people are not confused about how to categorize most entities in the world. We do not, for example, talk to a brick wall and expect it to talk back, nor do we attribute to it mental capabilities or think of it as a possible friend. But robots appear different.[209]

If contemporary psychology is struggling with how to categorize robotics given its liminal status between agent and object, it should not surprise us that criminal, tort, and other law may as well. Speaking very broadly, the law tends to assume a dichotomy between individuals and tools. A barrel rolls out of the window of a warehouse and we apply the doctrine of res ipsa loquitur. We blame the warehouse owner for her apparently poor safety practices that would permit gravity and wood to combine in this way. A man jumps out of the window of a warehouse, however, and we ask whether he was acting within the scope of his employment.[210] A man intends to run down one person with his car for excitement and instead runs over another person, we transfer the

205. *See* M. Ryan Calo, *People Can Be So Fake: A New Dimension to Privacy and Technology Scholarship*, 114 PENN ST. L. REV. 809, 828–29 (2010). For example, Carnegie Mellon reportedly had to redesign its nursing robot "Pearl" to be more anthropomorphic so that patients would take its recommendations to exercise and take pills. *See* PAMELA MCCORDUCK, MACHINES WHO THINK: A PERSONAL INQUIRY INTO THE HISTORY AND PROSPECTS OF ARTIFICIAL INTELLIGENCE 467 (2004).

206. In one study of how placing a picture of eyes over a collection basket affects likelihood to pay for coffee on the honor system, the (statistically relevant) effect was the same at week nine as at week two. *See* Melissa Bateson et al., *Cues of Being Watched Enhance Cooperation in a Real-World Setting*, 2 BIOLOGY LETTERS 412, 412–13 (2006). Reeves and Nass have found similar effects in people of all ages and backgrounds, including those who report familiarity with the technology. *See* REEVES & NASS, *supra* note 203, at 252.

207. *See* Kahn et al., *supra* note 125.

208. *Id.*

209. *Id.*

210. *See* RESTATEMENT (SECOND) OF AGENCY § 228 (1958).

specificity of this intent.[211] Had he intended to run over a fire hydrant, we hold him responsible commensurate with a tragic mistake.

The difficulty of placing robots in one category or another, and our tendency in general to behave around social technology as though it were a person, threatens to upset this dichotomy and the doctrines it underpins. The context of privacy furnishes interesting examples. Generally speaking, cyberlaw treats technology as implicating privacy to the extent the technology collects, processes, or disseminates information.[212] But a robot introduced into the home could implicate privacy merely by creating the sense of being observed.[213] At the same time, robotic surveillance reintroduces certain cues of observation that were missing in cyberspace.[214] The domestic use of drones for surveillance has triggered a uniquely visceral privacy backlash, likely due to cultural associations around robots.[215]

Courts, juries, prosecutors, and various other legal actors will have to decide, in innumerate contexts, whether to sort anthropomorphic technology as having social valence or not. One of the main drivers of medical malpractice claims is, reportedly, the frequency and character of the patient's interactions with the doctor.[216] Hospitals accordingly design and implement protocols that ensure doctor-patient contact in advance of surgery. They do not think about whether the patient should "meet" the scalpel. As robotic surgery becomes more popular, hospitals may develop protocols around discussing the hardware. Administrators will face incentives to investigate, for instance, whether introducing the patient to the robot beforehand leads to a greater or lesser likelihood of suit. Savvy manufactures may even try to negotiate terms with the hospital to dictate how the technology is characterized to patients (e.g., no names, no gender) in a bid to influence the patient not to pursue the manufacturer as the primary defendant.

Research out of Stanford University suggests that people feel differently about tasks they perform through robots depending on the design.[217] The more anthropomorphic the robot, the more subjects tended to share blame with the

211. *See* GLANVILLE L. WILLIAMS, CRIMINAL LAW 108 (1953) (describing transferred intent in criminal law). Of course, criminal law can sometimes go further and permit the intent to commit any felony to furnish the mens rea sufficient to uphold a conviction for murder under the felony-murder rule.

212. *See* Calo, *supra* note 205, at 817–25.

213. *See* M. Ryan Calo, *Robots and Privacy*, *in* ROBOT ETHICS: THE ETHICAL AND SOCIAL IMPLICATIONS OF ROBOTICS 187, 195 (Patrick Lin et al. eds., 2012). Moreover, robots are capable of exploiting social reactions in order to extract consumer or citizen information. *Id.* at 197.

214. *See* Calo, *supra* note 77.

215. *See* Calo, *supra* note 10.

216. *See* Philip J. Moore et al., *Medical Malpractice: The Effect of Doctor-Patient Relations on Medical Patient Perceptions and Malpractice Intentions*, 173 W.J. MED. 244 (2000).

217. *See* Victoria Groom et al., *I Am My Robot: The Impact of Robot-Building and Robot Form on Operators*, 2009 PROC. 4TH INT'L CONF. ON HUMAN-ROBOT INTERACTION 31.

robot for failure and praise for success.[218] Consider how this affects decision making by officials in the context of policing—another arena in which robots are becoming prevalent.[219] When a police officer hits a citizen with her car or shoots a citizen with her gun, other police are out the very next day driving cars and carrying weapons. If a police robot—particularly a humanoid one—were involved in a fatal accident, we might not expect to see the robot or a similar model on patrol for some time.[220]

Then there are the risks humans will foreseeably take on behalf of machines. Anecdotal accounts and a 2013 study out of the University of Washington suggest that soldiers' attachments to robots in the battlefield could affect battle outcomes due to risks the soldier is or is not willing to take regarding the machine.[221] We should expect to see this dynamic on the domestic front. It is, of course, conceivable that an individual will risk herself for an object she cherishes—but such behavior tends to be discounted as idiosyncratic.[222] And it is a matter of black letter tort law that, while danger invites rescue, plaintiffs will not be compensated for injuries sustained rescuing their possessions (including pets).[223] But can we ask the same of plaintiffs who form deep and predictable attachments to machines? Moreover, to return again to damages, how do we compensate losses for objects with not only objective sentimental value, but with an emotional attachment the marketplace cannot replicate?[224]

Robotics may also trigger a broader role for the concept of moral harm in the law. Moral harm refers to the harm that accrues to the actor, rather than another victim or society, by committing an immoral act.[225] The theory is that

---

218. *Id.*

219. *See* Noel Sharkey et al., *The Coming Robot Crime Wave*, COMPUTER, Aug. 2010, at 116 (describing increased government use of robots for police functions).

220. Novelty may help explain this intuition, but I submit it flows equally from our tendency to think of robots as existing in some twilight between instrument and moral agent. *See* Peter H. Kahn, Jr., et al., *Do People Hold a Humanoid Robot Morally Accountable for the Harm It Causes?*, 2012 PROC. 6TH INT'L CONF. ON HUMAN-ROBOT INTERACTION 33.

221. As Singer describes: "When one robot was knocked out of action in Iraq, an EOD soldier ran fifty meters, all the while being shot at by an enemy machine gun, to 'rescue it.'" SINGER, *supra* note 10, at 339; *see also id.* at 337–43 (describing soldier attachments to robots); Carpenter, *supra* note 10; Julie Carpenter, The Quiet Professional: An Investigation of U.S. Military Explosive Ordnance Disposal Personnel Interactions with Everyday Field Robots (2013) (unpublished Ph.D. dissertation, University of Washington) (on file with author).

222. *See* Blackburn v. Dorta, 348 So. 2d 287, 291 (Fla. 1977) (describing how the law would treat a plaintiff's attempt to reenter a burning building "to retrieve his favorite fedora").

223. *Compare* Wagner v. Int'l Ry. Co., 133 N.E. 437 (N.Y. 1921) (plaintiff who rescued fallen rider on train can recover under rescue doctrines), *with* Wignes v. Bottger, 518 N.Y.S.2d 936 (N.Y. Sup. Ct. 1987) (plaintiff who rescued cat from roof of house cannot recover under rescue doctrine).

224. Two recent films—*Her* and *Robot & Frank*—explore this very prospect. In *Her*, the lead character forms a romantic connection to a mobile operating system, whereas in *Robot & Frank*, the lead character forms a bond of friendship with a household robot. *See* HER (Annapurna Pictures 2013); ROBOT & FRANK (Dog Run Pictures 2012). I note these films insofar as art sometimes imitates life.

225. *See* 1 JOEL FEINBERG, THE MORAL LIMITS OF THE CRIMINAL LAW: HARM TO OTHERS 65–70 (1988).

certain objectionable but otherwise victimless behavior still morally compromises the actor behind it.[226] Kate Darling explores whether the way humans seem hardwired to react to anthropomorphic machines suggests the need to extend a limited set of legal rights to social robots, or at least prohibitions against abusing them, even where no one thinks of them as alive or sentient at a rational level.[227] We may not want to be the kind of society that tolerates cruelty to an entity we think of as quasi-human. Darling points out that we may want to protect citizens from the pain that even watching such abuse may occasion.[228] At a more practical level, there is a demonstrable link between willingness to abuse animals and to abuse people—so much so that some jurisdictions require officers responding to animal abuse allegations to call in child welfare services if there are kids in the house.[229] One could readily imagine pressure to study the correlation with social robotics.

In short, we may be on the cusp of creating a new category of legal subject, halfway between person and object. And I believe the law will have to make room for this category.[230]

III.
THE PATH OF CYBERLAW: FROM INTERNET TO ROBOTICS

To summarize the argument so far, transformative technologies tend to have essential qualities that drive the legal and policy conversations that attend them. The Internet, with its emphasis on connection, community, and control, generated a box of puzzles concerning the nature of commercial, creative, and civic communication, and the powerful role of intermediaries. These questions, while in a sense as important as ever, have faded into the discursive background by virtue of their familiarity and the efforts of academics and policymakers. Meanwhile, new technologies ascend, requiring a markedly different emphasis. The essential, distinguishing facets of robotics portend a new set of challenges centered around embodying data, harnessing unpredictability, and disentangling person from instrument.

---

226. *But see id.* (calling into question the coherence of moral harm on the basis that consummating the immoral act is evidence that the agent was already morally corrupted).

227. *See* Kate Darling, *Extending Legal Rights to Social Robots*, *in* ROBOT LAW (Ryan Calo et al. eds.) (forthcoming 2015), *available at* http://ssrn.com/abstract=2044797.

228. *Id.*

229. And vice versa. *See, e.g.*, OR. REV. STAT. § 609.650 (2013) ("The Legislative Assembly finds that . . . [t]here is a clear link between animal cruelty and crimes of domestic violence, including child abuse.").

230. Benjamin Wittes and Jane Chong offer a second sense in which person and thing are being blended. They note that people increasingly embed technology into their daily lives, becoming in a sense "cyborgs," with repercussions for at least privacy law. *See* BENJAMIN WITTES & JANE CHONG, BROOKINGS INST., OUR CYBORG FUTURE: LAW AND POLICY IMPLICATIONS (2014), http://www.brookings.edu/~/media/Research/Files/Reports/2014/09/cyborg-future-law-policy-implications/cyborg_future_law_policy_implications_FINAL2.pdf?la=en.

The question naturally arises as to how these new experiences will affect law and legal institutions. Will new institutions be necessary to deal with the issues robotics and artificial intelligence raise? How should legal academics and others engage with robotics? Even accepting for argument's sake that the advent of this technology will raise issues across many different legal disciplines, do we gain anything by drawing lines around robotics and artificial intelligence and treating them separately in the first place? If so, should a discipline such as cyberlaw expand to host this conversation or does robotics presage the formation of a separate community of academics, government, industry, and other stakeholders?

I turn to these questions in this final Section. I discuss what it means for a technology like robotics to be "exceptional" in the legal sense, such that it is sensible to examine the technology separately in the first place. I canvass various possible definitions of exceptionalism and settle on a moderate conception that holds technologies to be exceptional if the best reconciliation of societal values leads to systemic changes to law or institutions. I then show how robotics may occasion such changes. I explore how robotics could cause a variety of legal areas to move toward the risk management model now seen in financial and environmental regulation, for example.[231] And I show why robotics may join railroads, radios, vaccines, and other technologies in occasioning a standalone regulatory institution.

I close by examining the advantages and disadvantages of thinking of robotics as a separate field of study from cyberlaw. Robotics shares with the Internet a number of constituent technologies (e.g., computers and networks) and important issues (e.g., intermediary liability and privacy). It is hard to miss how many of the handful of important works at the intersection of law and robotics have come from scholars who also research the Internet. And in the past twenty years, cyberlaw has developed some edifying approaches to technology—the attention to metaphor, for instance, and a kind of interdisciplinary pragmatism—that could not but inform a law of robotics.[232] But there are key differences between robotics and the Internet that impede a straightforward application of those principles and methods. On balance, I see the utility of pursuing law and robotics as its own discipline with the lessons of cyberlaw firmly in mind.

A. Exceptionalism, Generally

The basic idea of exceptionalism is that a person, place, object, or concept is qualitatively different from others in the same basic category. Thus,

231. *See generally* Daniel A. Farber, *Uncertainty*, 99 GEO. L.J. 901 (2011) (noting role of uncertainty and risk management in economic and environmental regulation).

232. *Cf.* Neil M. Richards & William D. Smart, *How Should the Law Think About Robots?*, *in* ROBOT LAW (Ryan Calo et al. eds.) (forthcoming 2015), http://ssrn.com/abstract=2263363 (noting the likely importance of metaphor to robotics law); *see also infra* Part III.C.

American exceptionalism represents the (contested) idea that the United States is unlike any other nation in existence or history.[233] I raise the concept of exceptionalism because, if it turns out that America, or the Internet, or robots, differs in meaningful respects from other places, technologies, or legal domains, then perhaps we should engage in a standalone analysis. If, on the other hand, America is just modern day Athens, then treating it separately likely impoverishes our understanding.[234] Of course, not all differences are equally meaningful. Obviously, the United States is different from, and similar to, England in a variety of ways. We need to determine what differences matter. For our purposes, what differences between robots and previous technologies matter to law and legal analysis?

Robots would already meet a very weak form of exceptionalism that turns on the perceived necessity of new laws: dozens of states have robot-specific laws on the books.[235] The early Internet exceptionalists, however, adopted what might be described as a "strong" position. They hold that the Internet constitutes a separate sovereign that no contemporary legal system may govern.[236] On this view, the Internet joins, for instance, maritime law as one of the few sources of novel and distinct rules and institutions.[237] Presumably few would contest that maritime law should be treated differently—that, rather, every course in tort, property, or contract should instead have a unit related to how it works on the open sea. Some think cyberlaw should be its own body of law.

At the opposite extreme are those who see next to no meaningful difference between the Internet and any other technology. In what has become cyberlaw lore, judge and professor Frank Easterbrook once took the inauspicious occasion of an inaugural cyberlaw conference keynote to throw cold water on the entire enterprise. He famously likened studying Internet law to studying the law of the horse.[238] Sure, many cases involve horses as a factual matter. Disputes arise when horses are bought and sold, cared for by veterinarians, or tend to kick people. But "[a]ny effort to collect these strands into a course on 'The Law of the Horse' is doomed to be shallow and to miss

233. *See* SEYMOUR MARTIN LIPSET, AMERICAN EXCEPTIONALISM: A DOUBLE EDGED SWORD 18 (1996) (citing ALEXIS DE TOCQUEVILLE, I DEMOCRACY IN AMERICA 51 (Phillips Bradley ed., Henry Reeve & Francis Bowen trans., Alfred A. Knopf 1948) (1835)) (referring to America as "qualitatively" different from other nations).

234. *See* James Boyd White, *Law, Economics, and Torture*, *in* LAW AND DEMOCRACY IN THE EMPIRE OF FORCE 265 (H. Jefferson Powell & James Boyd White eds., 2009) (discussing the deleterious effect of Athenian, and now American, beliefs of exceptionalism).

235. *See supra* note 7 (listing laws related to drones and driverless cars); VA. CODE § 38.2-3418.16 (requiring insurers to cover telemedicine).

236. *See, e.g.*, Johnson & Post, *supra* note 52.

237. *See, e.g.*, Harris v. Pa. R.R. Co., 50 F.2d 866 (4th Cir. 1931) (announcing rule that ship masters have a duty to make reasonable efforts to rescue a seaman who fell overboard).

238. Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207.

unifying principles."[239] For this set, whom David Post calls the "unexceptionalists,"[240] talking in terms of an Internet law obscures much more than it reveals. You see this position implicit in the recent work of Tim Wu, an early critic of strong Internet exceptionalism.[241] For Wu, various communications technologies follow a similar arch from free and open to closed and proprietary that reflect certain diachronic political and market commitments.[242] This insight only emerges by studying the technologies together.[243]

There are one or more intermediate positions. Clearly a transformative technology like the Internet changes the available facts, and hence the doctrine, to a degree. Lawrence Lessig came to see the Internet as, in a sense, unexceptional, but believes the technology still reveals certain ambiguities that were "latent" in the law all along.[244] Studying cyberlaw becomes useful because, in doing so, we confront and hopefully resolve tensions in the law we had not realized existed. Some of the conclusions Lessig draws on this basis feel radical, like the suggestion that the private firms that control the architecture of the Internet might be subject to the First Amendment.[245] But at base his project is one of translation, where he applies existing principles to new technologies.[246]

In the spirit of these intermediate positions,[247] I too propose a moderate conception of legal exceptionalism for purposes of assessing robotics. A technology is not exceptional merely because it creates one or more small changes in the law, or because it reveals, at the margins, that an existing interpretation of a particular doctrine is incomplete. By the same token, a technology need not occasion a literal breakdown in the rule of law or prove the source of entirely novel doctrines to qualify. Rather, a technology is exceptional when its introduction into the mainstream requires a systematic change to the law or legal institutions in order to reproduce, or if necessary displace, an existing balance of values.

---

239. *Id.* at 207.

240. *See* POST, NOTES, *supra* note 36, at 166.

241. *See* Timothy S. Wu, Note, *Cyberspace Sovereignty?—The Internet and the International System*, 10 HARV. J.L. & TECH. 647 (1997); *see also* Jack L. Goldsmith, *Against Cyberanarchy*, 65 U. CHI. L. REV. 1199 (1998).

242. *See generally* WU, MASTER SWITCH, *supra* note 23.

243. For an early suggestion that Tim Wu will treat robotics, if at all, as unexceptional, see Wu, *Machine Speech*, *supra* note 170, at 1496–97 (noting that "[t]he question of 'rights for robots,' if once limited to science fiction, has now entered the public debate," but arguing that a functional theory of free speech captures the problem of machine speech).

244. *See* LESSIG, CODE 2.0, *supra* note 32, at 25.

245. *Id.* at 255–56.

246. Justin Hughes, *The Internet and the Persistence of Law*, 44 B.C. L. REV. 359 (2003).

247. *Cf.* DAVID HUME, ENQUIRIES CONCERNING HUMAN UNDERSTANDING AND CONCERNING THE PRINCIPLES OF MORALS 116–31 (L.A. Selby-Bigge ed., Clarendon Press 1975) (1777). Hume famously acknowledged that nothing could be shown with absolute certainty. Yet, at the same time, knowledge could hardly advance were we to spend all of our time doubting and denying.

Such a conception invites a number of candidates for legally exceptional technology. Negligence in tort was not invented to deal with the railroad. But the introduction of this technology arguably catalyzed the rapid and systemic uptake of negligence as a legal measure of liability.[248] There existed a federal department dedicated to health and human services prior to the development of the small pox vaccine, but the need to mobilize this technology helped launch a central pillar of the modern administrative state.[249] In 1926, the radio was sufficiently novel and pervasive that President Calvin Coolidge signed into law an act creating a standalone entity—the Federal Radio Commission—that eventually evolved into the Federal Communications Commission.[250] These major recalibrations of laws or institutions were perceived as necessary to preserve human values in the face of new technology[251]—to keep the law doing what the law does "when it does work."[252]

B. Robot Exceptionalism

Under the conception I have articulated, a technology is exceptional if it invites a systemic change to laws or legal institutions in order to preserve or rebalance established values. There are several candidates for systematic changes robotics could herald. I have alluded to the prospect of a third legal category between person and instrument—a "quasi *res*" intended to capture technology with social valence. Where people have difficulty categorizing something as being more object- or person-like, the law may similarly struggle. One option is ad hoc: treating a robot as more like a person in the context of damages or transferred intent but not agency law or the law of the sea. But even so, the temptation will be for courts and scholars to draw connections between the areas of law that countenance social objects.

This Section canvasses a few other candidates for how the law may change systemically in light of the qualities of robotics I have described in Part II. The candidates—lower mens rea in crime, risk over foreseeability in tort,

248. *See* P.H. WINFIELD, A TEXTBOOK OF THE LAW OF TORT 404 (5th ed. 1950) (noting the role of the Industrial Revolution in general, and the railways in particular, in catalyzing negligence as a doctrine).

249. *See* MICHAEL WILLRICH, POX: AN AMERICAN HISTORY 77, 81, 179, 307 (2011) (discussing the formation of the National Institutes of Health).

250. *See* WU, MASTER SWITCH, *supra* note 23, at 82–84 (describing the formation of the Federal Radio Commission). Of course, a new regulatory agency is not necessarily or unambiguously a welcome development. *See id.* at 128 (calling the Federal Communications Commission, which grew from the FRC, "among the most useful tools of domination that industry has ever invented").

251. *Cf.* WILLRICH, *supra* note 249, at 328 ("Since 1897, the vaccination cases had nudged state courts toward a more cautious balancing of state power and individual rights appropriate to an era of rapid technological and institutional change.").

252. *See* POST, NOTES, *supra* note 36, at 184 (drawing a distinction between law that is "theoretically unhinged," and law that simply "won't do the things that law does when it does work, namely help people enter into complicated transactions involving lots of other people and with important things at stake, secure (to a degree) in their expectations of how others will behave and secure (to a degree) that they will be treated fairly in the event of a problem").

and the prospect of a new administrative body—are not meant to be exhaustive; others may have equally viable ideas for how the law might change. The candidates do, however, aim to get beyond usual discussions of robotics and law, which tend to dwell exclusively on the prospect of robot agency.

1. Mens Rea

One change that the qualities of embodiment and emergence could herald is an increased role for strict liability in criminal law. Today, criminal law is skeptical of strict liability[253]—American society reserves strict liability for particularly sensitive contexts (e.g., sex with a minor) or lesser infractions with low stakes (e.g., traffic infractions). But as individuals and institutions increasingly leverage robotics with emergent properties, society could witness a barrage of activity that would be illegal were it carried out or even sanctioned by people.

The prospect of punishing corporations has already confronted courts and lawmakers with the problem that robots have "no soul to damn [and] no body to kick" when they violate the law.[254] But here we lack even the sense that a wrong, or even a mistake, was committed in the first instance.[255] No one expected, much less intended, the technology to do what it did.[256] And yet we have a victim who suffered real harm. The law could plausibly respond by creating a parasitic misdemeanor, akin to harboring or obstruction,[257] that punishes a defendant for putting into play a technology physically capable of causing a specific harm where that harm is actually realized. Rationales for such a category could include vindicating an injury in the eyes of society and providing a moral and pragmatic check on overuse of a potentially dangerous technology without justification. A category of emergent theft or homicide would itself represent change in the state of jurisprudence.

2. Foreseeability

In the realm of tort law, the prospect of truly emergent behavior may herald a lesser or altered role for foreseeability. Every law student knows that the actions of tortfeasors must not only be negligent, but must proximately

253. *Cf.* Leocal v. Ashcroft, 543 U.S. 1 (2004) (overturning deportation for a driving under the influence violation because of the lack of a mens rea requirement).

254. John C. Coffee, Jr., *"No Soul to Damn: No Body to Kick": An Unscandalized Inquiry into the Problem of Corporate Punishment*, 79 MICH. L. REV. 386 (1981).

255. *Cf.* Asaro, *supra* note 184 (noting that robots have "a body to kick" but "no soul to damn").

256. *See supra* Part II.B.

257. *E.g.*, MODEL PENAL CODE § 242.1 (2001) ("A person commits a misdemeanor if he purposely obstructs, impairs or perverts the administration of law or other governmental function by force, violence, physical interference or obstacle, breach of official duty, or any other unlawful act, except that this Section does not apply to flight by a person charged with crime, refusal to submit to arrest, failure to perform a legal duty other than an official duty, or any other means of avoiding compliance with law without affirmative interference with governmental functions.").

cause the injury. Showing proximate (sometimes "legal") causation is largely a function of whether the injury was foreseeable to the tortfeasor. Foreseeability remains a necessary ingredient even where liability is otherwise "strict" (i.e., where no showing of negligence by the plaintiff is necessary to recovery).[258] There will be situations, particularly as emergent systems interact with one another, wherein otherwise useful technology will legitimately surprise all involved. Should these systems prove deeply useful to society, as many envision, some other formulation than foreseeability may be necessary to assess liability.

As a consequence, we may see a broader role for risk mitigation within the law. The combination of data promiscuity mixed with the capacity to do physical harm can make unpacking liability impractical.[259] The difficulty in predicting emergent behavior in robotic systems compounds this problem, particularly where many systems are operating in the world together. Some of the early warnings of problems with artificial "agents"—a book listed for millions of dollars,[260] for instance, or the 2010 market flash crash[261]—resulted from the interaction of two or more software programs responding unpredictably to one another. Of course, risk or "uncertainty" management is hardly new to law—we see it in environmental and financial regulation, for instance.[262] The focus of this body of law and literature is on setting defaults and liability rules that keep risk at tolerable levels.[263] Robotics could result in the far greater deployment of these approaches such that they become a part of the everyday life of the law. [264] These or other doctrines may expand or shift with the ascendance of robotics.

3. Administrative Law

Finally, robotics may change public institutions. To date, federal agencies have divvied up robotics on the basis of existing categories—spatial distinctions such as airspace or highway, or activity contexts such as health and work. Congress charged the Federal Aviation Administration with the task of

258. Foreseeability crops up elsewhere in tort law as well, including in the assessment of whether there has been negligence in the first instance under a so-called negligence calculus, in determining whether the action of an agent fell within the scope of employment for purposes of vicarious liability, and in defenses such as implied assumption of risk that focus on what the plaintiff was in a position to anticipate.

259. *See supra* Part II.A.

260. *See* David Murphy, *Amazon Algorithm Price War Leads to $23.6-Million-Dollar* [sic] *Book Listing*, PC MAG. (Apr. 23, 2011, 6:03 PM), http://www.pcmag.com/article2/0,2817,2384102,00.asp.

261. *See* Lin, *supra* note 177.

262. *See generally* Farber, *supra* note 231.

263. *Id.* at 901.

264. Indeed, Tom Lin offers risk management principles as part of the solution to the problems he raises around "cyborg finance." *See* Tom C.W. Lin, *The New Financial Industry*, 65 ALA. L. REV. 567 (2014).

integrating drones into domestic airspace.[265] The National Highway Traffic Safety Administration has developed guidance around driverless cars.[266] The Food and Drug Administration approves robots for use in medicine.[267] The Occupational Health and Safety Administration issued directives regarding the safe use of industrial robotics dating back to 1987.[268]

As I argue elsewhere, however, we should not reflexively discount the prospect of a more unified agency for robotics, something like a Federal Robotics Commission (FRC) to deal with the novel human experiences robotics occasions.[269] New agencies do form from time to time. Although many of the household-name federal agencies have remained the same over the previous decades, there has also been considerable change. Agencies restructure, as we saw with the formation of the Department of Homeland Security.[270] New agencies, such as the Consumer Financial Protection Bureau, arise to address new or newly acute challenges posed by big events or changes in behavior. [271]

Technology has repeatedly played a meaningful part in the formation of new agencies. For instance, the advent of radio made it possible to reach thousands of people at once with entertainment, news, and emergency information. The need to manage the impact of radio on society in turn led to the formation in 1926 of the Federal Radio Commission. The Radio Commission itself morphed into the Federal Communications Commission as forms of mass media proliferated and is today charged with a variety of tasks related to communications devices and networks. The advent of the train required massive changes to national infrastructure, as it physically connected disparate communities and consistently sparked, sometimes literally, harm to people and property. We formed the Federal Railroad Administration in response. This agency now lives within the U.S. Department of Transportation,

265. FED. AVIATION ADMIN., INTEGRATION OF CIVIL UNMANNED AIRCRAFT SYSTEMS (UAS) IN THE NATIONAL AIRSPACE SYSTEM (NAS) ROADMAP (2013), http://www.faa.gov/uas/media/UAS_Roadmap_2013.pdf.

266. NAT'L HIGHWAY TRAFFIC SAFETY ADMIN., PRELIMINARY STATEMENT OF POLICY CONCERNING AUTOMATED VEHICLES (2013), http://www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Automated+Vehicle+Development.

267. Sarah Glynn, *FDA Approves First Medical Robot for Hospital Use*, MED. NEWS TODAY (Jan. 26, 2013, 12:00 AM), http://www.medicalnewstoday.com/articles/255457.php.

268. OCC. SAFETY & HEALTH ADMIN., DIRECTIVE NO. STD 01-12-002, GUIDELINES FOR ROBOTICS SAFETY (1987), https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1703.

269. *See* RYAN CALO, THE CASE FOR A FEDERAL ROBOTICS COMMISSION (2014), http://www.brookings.edu/~/media/Research/Files/Reports/2014/09/case-for-federal-robotics-commission/RoboticsCommissionR2_Calo.pdf?la=en.

270. For the agency's history in its own words, see *History*, DEP'T OF HOMELAND SEC., http://www.dhs.gov/history (last visited Mar. 6, 2015).

271. Congress formed the Consumer Financial Protection Bureau in 2010 as part of the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010. Pub. L. No. 111-203, §§ 1001–1100, 124 Stat. 1376, 1955–2113 (2010).

though the Department itself grew out of the ascendance of rail and later the highway. The introduction of the vaccine and the attendant need to organize massive outreach to Americans helped turn a modest U.S. Marine Hospital Service into the United States Centers for Disease Control and Prevention and sowed the seeds for the Department of Health and Human Services.[272] And, of course, there would be no Federal Aviation Administration without the experiences and challenges of human flight.

Unlike the previous examples, the Internet has no standalone federal agency that regulates it. Rather, multiple bodies with unique configurations set Internet policy at a technical and civil level: the Internet Engineering Task Force and the Internet Corporation for Assigned Names and Numbers, in particular, represent quasi-public institutions with responsibility for maintaining the architecture and protocols of the Internet even today. As Michael Froomkin and David Post each explore, this unique governance mechanism is perhaps the Internet's most interesting public legacy,[273] making it among the more exceptional technologies in recent memory.[274]

Ostensibly, the reason legislatures create, and courts defer to, agencies in the first place is that agencies foster justice and efficiency through the development of expertise.[275] But each of the three essential qualities of robotics requires a deeper examination by policymakers than current configurations allow. I alluded to the challenges the Securities and Exchange Commission faces around algorithmic trading.[276] A few years ago, the car manufacturer Toyota faced a class action lawsuit alleging that a software malfunction led its cars to accelerate unexpectedly—an analog to the problem of embodied data. The question proved so complex that the Department of Transportation had to enlist National Aeronautics and Space Administration engineers with expertise in computer-controlled electronic systems, electromagnetic interference, and software integrity to write the report.[277]

At some point, it is inefficient for an agency to develop expertise in the complexities of embodiment and emergence, and thus, the proposed FRC could routinely assist officials, states, and other agencies—from the Department of Justice to the U.S. Copyright Office—to grapple with the essential qualities of robotics. The agency could build its own expertise around the effects of social technology on human behavior and help develop standards for the industry and guidance for prosecutors and courts. Moreover, were we to decide that

272. *See* WILLRICH, *supra* note 249.

273. *See* POST, NOTES, *supra* note 36, at 128–29; Froomkin, *supra* note 53, at 856.

274. I owe this point to David Post.

275. *See* Chevron, U.S.A., Inc. v. Natural Res. Def. Council, Inc., 467 U.S. 837, 866 (1984).

276. *See supra* Part II.B.

277. In 2011, NASA wrote a report absolving Toyota and attributing the problem to human error. *See U.S. Department of Transportation Releases Results from NHTSA-NASA Study of Unintended Acceleration in Toyota Vehicles*, NAT'L HIGHWAY TRAFFIC SAFETY ADMIN. (Feb. 8, 2011), http://www.nhtsa.gov/PR/DOT-16-11.

insurance is the best way to manage the risks that attend robotics,[278] or that the technology should be registered in some way,[279] the FRC could coordinate such efforts.

In short, the essential qualities of robotics support the above and likely other candidates for a moderate legal exceptionalism. They are *different enough* to occasion broad, systemic changes to the law—to at least as great a degree as the Internet.

C. What Cyberlaw Might Teach

Even accepting that robotics will prove exceptional in the right sense, there remains the question of how academics should configure robotics and the law as a field. Should interested scholars working in a variety of disciplines such as tort, criminal law, contracts, and taxation come together around a new discipline of robotics and the law? Or should cyberlaw scholars engaged with today's transformative technologies simply pivot with the times? The answer is a bit of both.

A transformative technology such as the Internet or robotics matters insofar as it changes the range of human experiences in ways that undermine the balance the law hopes to strike. The possibilities the Internet or robotics engender force the law to confront assumptions, some of which are still held to be true, others of which end up requiring reexamination. The question of whether it is fair to hold a person in one state accountable for effects in another when she has never set foot there, owns nothing, and did not even specifically target the population, had not really come up before the Internet. Hence, the law made an assumption about "minimum contacts" and the importance and meaning of "availing" oneself of a jurisdiction that looks different today because of the Internet.

Where the same disrupted assumptions obtain across multiple areas of law—criminal and tort, for instance, or copyright—then it arguably makes sense to treat together the technology (or set of technologies) responsible for the disruption. How criminal law integrates the prospect of victims without perpetrators will inform inquiries into the propriety of an "actual malice" standard in the face of robot speech or the coherence of foreseeability in tort. Moreover, it will end up that the same sorts of essential qualities of robotics—on this account, embodiment, emergence, and social valence—trigger related concerns in distinct areas of law.

Parts I and II hoped to establish that robotics has a different set of essential qualities than the Internet and hence raises a distinct set of legal and

278. *See* Calo, *supra* note 102, at 609–11 (exploring consumer insurance markets for robots).

279. *Cf.* Joseph Lorenzo Hall, *'License Plates' for Drones?*, CTR. FOR DEMOCRACY & TECH. (Mar. 8, 2013), https://cdt.org/blog/license-plates-for-drones ("This radio-frequency drone identifier (RFDID) would allow members of the public to itemize the drones in a given airspace with relatively simple radio receivers. Ideally, the FAA would maintain a drone registry . . . .").

policy concerns. This would suggest treating robotics separately. At the same time, however, there are considerable parallels. Robotics shares with the Internet a number of constituent technologies (e.g., computers and networks) and important issues (e.g., intermediary liability and privacy). And in the past twenty years, cyberlaw has developed some edifying approaches to technology that could not help but inform a law of robotics.

The first insight is that robotics, no less than computers, will be subject to regulation by code. I mentioned above the claim that cyberlaw is really a "law of the horse" (i.e., a contrived and unhelpful umbrella term for a disparate set of issues that happen to touch upon the Internet). In 1999, one of the most influential figures in cyberlaw, Lawrence Lessig, replied directly to Judge Easterbrook's comments.[280] For Lessig, cyberlaw illuminates *the entire law* by revealing certain assumptions about what counts as public space and what it means to "regulate." What cyberlaw might teach is that the architecture of a system like the Internet, no less than law (and sometimes more so), can regulate human behavior. Lessig joins Joel Reidenberg and others in observing that software itself (the "code" of the Internet) amounts to a regulatory tool.[281] By controlling how and when people can communicate with one another online, governments and companies constrain human behavior just as effectively as laws.[282] Thus, for instance, the state can make copying and sharing digital music unlawful, or the content owner could make copying and sharing the files close to physically impossible.[283] Part I groups this lesson under the heading of "control."

The second insight has to do with the importance of analogy in legal reasoning, including in technology. Lessig's assertion that "code is law" changed the way many talk about Internet regulation.[284] But an equally influential concept in cyberlaw, particularly where it comes to the direction of actual Internet case law, is the role analogy plays.[285] Common law courts look to whether a given digital activity is "like" an activity for which there are already rules. Legal, policy, and academic debates become battles over the proper analogy or metaphor. A court might ask whether email is more like a postcard or a sealed letter for purposes of determining its level of protection under the Fourth Amendment.[286] A lawmaker might ponder whether

280. *See* Lessig, *supra* note 15.

281. *See supra* note 32.

282. *See id*.

283. *See* Dan L. Burk & Julie E. Cohen, *Fair Use Infrastructure for Rights Management Systems*, 15 HARV. J.L. & TECH. 41, 50–51 (2001).

284. A March 4, 2015 search on Westlaw of the phrase "code is law" within the Law Reviews & Journals database revealed 200 documents.

285. *See* A. Michael Froomkin, *The Metaphor is the Key: Cryptography, the Clipper Chip, and the Constitution*, 143 U. PA. L. REV. 709, 843 (1995).

286. *See* Kerr, *supra* note 27.

cryptography is best understood as "speech" before deciding whether and how to regulate it.[287]

Although I conclude that robotics should be treated separately, it would be wise to draw deeply from Lessig and other cyberlaw scholars. Both the prospect of control by code and the importance of analogy remain highly relevant to the context of robotics.[288] The degree to which the government or industry can control the architecture of robots will strongly influence academic and policy analysis. But in addition, a familiarity with the interplay between code and law could prove helpful in fashioning responses to the prospect of uncertain and destructive behavior by software. A puzzle over how software constrains human behavior can expand to encompass how law and code can constrain robot behavior.

The Food and Drug Administration already embraces analogy where, for instance, it approves surgical robots on an expedited basis because of the resemblance to laparoscopic surgery.[289] Existing and surely future work asks whether a robot is "like" an animal or a child or a slave.[290] And, as alluded to above, cyberlaw scholars puzzled extensively over how people think about cyberspace, and in particular, the perception that we travel to websites. We are at least as hardwired to treat anthropomorphic machines as though they were social. A familiarity with the influence of mental models on consumer, citizen, and official behavior could help cyberlaw unravel the distinction between person and instrument this tendency occasions.

Cyberlaw has, in short, developed a methodological toolkit that will be of obvious use to robotics law. But perhaps of greater relevance is the cyberlaw tradition of melding legal and technical expertise. The "interdisciplinary pragmatism" that grew up around cyberlaw cannot help but inform a robust dialogue as to the proper legal and policy infrastructure for robotics.

While Judge Easterbrook's "law of the horse" is legendary, less remarked was his admonition that lawyers should not interpret technology because they do not understand it. "I regret to report," said Judge Easterbrook, "that no one at this Symposium is going to win a Nobel Prize any time soon for advances in computer science. . . . Put together two fields about which you know little and get the worst of both worlds."[291]

Here, Judge Easterbrook was clearly wrong. Cyberlaw today is a deeply interdisciplinary enterprise, full of meaningful collaboration across a wide

287. *See* Froomkin, *supra* note 285.

288. *See* Richards & Smart, *supra* note 232.

289. *See* Sulbha Sankhla, Robotic Surgery and Law in USA—A Critique (June 1, 2013) (unpublished manuscript), http://ssrn.com/abstract=2425046 (discussing how problems related to robotic surgery appear to come from differences between it and laparoscopic surgery).

290. *See supra* note 184 and accompanying text.

291. Easterbrook, *supra* note 238, at 207.

variety of training.[292] Many of its brightest scholars and advocates take great pains to follow technology and social science. Not only have lawyers risen to the occasion of learning about technology and its effects, but the community around cyberlaw has also spurred technologists to develop a deeper understanding of law and policy.[293] The solution space, meanwhile, inevitably contains not just legal but also technological prescriptions—so much so that critics of cyberlaw bemoan its "technological solutionism."[294] We are not talking here of an intellectual fascination with comparative theory, but a practical agenda of looking across disciplines to solve real problems.

There can be no deep understanding of the interaction between robotics and the law without the hard fought interdisciplinary pragmatism that grew up around cyberlaw. The essential qualities of robotics implicate computer and social science to a degree even greater than the Internet. Whether at conferences or hearings, in papers or in draft legislation, the legally and technically savvy will need to be in constant conversation. We are, as it happens, already seeing this: interdisciplinary collaborations are cropping up around driverless car and drone regulation.[295] Events such as the annual robotics law and policy conference We Robot attract nearly as many roboticists as lawyers. As a person with the occasional front row seat to these efforts, I can tell you that the rapidity and seamlessness of these efforts owes a deep debt to cyberlaw.

---

292. Several prominent cyberlaw scholars have training in computer science and/or hold courtesy appointments in computer science or engineering. Contemporary cyberlaw conferences invite technologists, and papers often have technical co-authors. Several law schools, including University of Pennsylvania, have joint programs with engineering departments, in part to accommodate the demand for scientific training in patent law. Jonathan Zittrain is cross appointed in computer science at Harvard. *See* http://hls.harvard.edu/faculty/directory/10992/Zittrain. Barbara Van Schewick has a computer science PhD and is also cross appointed in electrical engineering at Stanford. *See* https://www.law.stanford.edu/profile/barbara-van-schewick. See http://www.law.berkeley.edu/15851.htm for a list of participants at a recent conference. Here are some examples of participants with computer science backgrounds: Annie Antón, Georgia Institute of Technology; Steven Bellovin, Columbia University; Matt Blaze, University of Pennsylvania; and Lorrie Cranor, Carnegie Mellon University. See https://www.law.upenn.edu/academics/crossdisciplinary/jd-engineering/ for Penn's joint program.

293. Non-profits, think tanks, and academic centers in cyberlaw increasingly hire fellows and staff with technical training. Government agencies—notably, the Federal Trade Commission and the White House—have chief technology officers. The White House appointed Megan Smith as Chief Technology Officer at the Office of Science and Technology Policy. *See* https://www.whitehouse.gov/administration/eop/ostp/about/leadershipstaff/smith. The think tank Center for Democracy and Technology has a Chief Technologist named Lorenzo Hall. *See* https://cdt.org/staff/joseph-lorenzo-hall/. The FTC appointed Ashkan Soltani to replace computer scientist Latanya Sweeny as chief technology officer. *See* https://www.ftc.gov/news-events/press-releases/2014/10/federal-trade-commission-appoints-ashkan-soltani-chief.

294. *E.g.*, EVGENY MOROZOV, TO SAVE EVERYTHING, CLICK HERE: THE FOLLY OF TECHNOLOGICAL SOLUTIONISM (2013).

295. For instance, an influential project at Stanford University bridges the Law School and School of Engineering to study the legal and policy aspects of driverless cars. *See* Sven A. Beiker, *Legal Aspects of Autonomous Driving*, 52 SANTA CLARA L. REV. 1145 (2012) (describing the program).

In short, the essential qualities of robotics suggest a separate academic inquiry from cyberlaw, one that reflects the differences between the two technologies and the new human experiences they support. New juridical insights are likely to emerge from the study of robots to complement the legal innovation the Internet made possible. But we should not be starting from scratch. Decades of cyberlaw scholarship surfaced lessons to the study of any new technology, let alone one with as many commonalities as robotics. These include the role of analogy in common law decision making around technology, the propensity of scholars and courts to embrace certain metaphors, the prospect that architecture constrains, and, in particular, the importance of collaboration across disciplines. Few important issues exist in contemporary society that can be solved by reference to law alone or to any one discipline.

CONCLUSION

The ascendance of the Internet brought great changes to society and triggered a movement among legal academics known as cyberlaw. The themes of this literature reflect the essential qualities of the Internet—connectivity, community, and control. Even as the law adapts to these changes, technology has rushed forward. The same government and hobbyists that developed the Internet, and the handful of private companies that have come to characterize it, have begun a significant shift toward robotics and artificial intelligence. The legislative bodies that wrote Internet-specific laws in the late 1990s now draft bills about drones and driverless cars.

Robotics, meanwhile, has a different set of essential qualities—embodiment, emergence, and social valence. The coming years will accordingly be marked by a new and distinct struggle, one in which academics and policymakers strive to develop a theoretical and doctrinal infrastructure capable of integrating this exciting new technology. The best way forward is to open new pathways of understanding without discarding the knowledge and methods cyberlaw has carefully collected.

I want to return briefly to Herbert Simon in closing. Simon recognized the utility of those closest to an emerging technology speculating about its impact on society.[296] But he also appreciated that his thoughts were necessarily a beginning, not an end, of public participation.[297] Early interpreters of the Internet made the same caveat.[298] My deepest hope for this project is that many words will follow it. Perhaps I have underestimated the pace at which robotics

296. *See* SIMON, *supra* note 17, at vii.

297. *Id.*

298. *E.g.*, Froomkin, *supra* note 53, at 856 ("It is too early to predict, but not too early to hope, that the Internet supplies at least a partial answer to the powerful challenge raised against the possibility of ever applying discourse theory to broad ranges of public life."); Hughes, *supra* note 246, at 364 ("As Robert Nozick reminded us at the beginning of his own intellectual journeys, 'There is room for words on subjects other than last words.'" (citation omitted)).

will evolve, or overestimated the impact the technology will have. Perhaps I have misdiagnosed robots' essential qualities or chosen an unwise path forward. But robotics will transform our lives in ways prosaic and profound. How the law reacts is up to us.