ROBOTICS AND THE NEW CYBERLAW

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ABSTRACT: 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 robotics and artificial intelligence.

This article is the first to examine what the introduction of a new, equally transformative technology means for cyberlaw (and law in general). Robotics has a different set of essential qualities than the Internet and, accordingly, will raise distinct issues of law and policy. 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.

Cyberlaw can and should evolve to meet these challenges. Cyberlaw is interested, for instance, in how people are hardwired to think of going online as entering a "place," and in the ways software constrains human behavior. The new cyberlaw will consider how we are hardwired to think of anthropomorphic machines as though they were social, and ponder the ways institutions and jurists can manage the behavior of software. Ultimately the methods and norms of cyberlaw—particularly its commitments to interdisciplinary pragmatism—will prove crucial in integrating robotics, and perhaps whatever technology follows.

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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 nineteen nineties, 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 Internet, by which I mean the characteristics that distinguish the Internet from prior or constituent technology such as computers or phones.

Twenty years in, some early cyberlaw questions have seen a kind of resolution. Legislatures or courts have weighed in.[3] Vigorous debate continues—around "net neutrality," for instance, and the impossible wages of privacy.[4] But even here participants have at least a sense of the basic positions and arguments.

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

[1] *See infra*, Part I.

[2] *See infra*, Part I.

[3] *E.g.*, Digital Millennium Copyright Act of 1998, Pub. L. No. 105-304, 112 Stat. 2860 (1998) (codified as amended in scattered sections of 17 U.S.C.); Reno v. American Civil Liberties Union, 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. Federal Communications Commission, _ F.3d _ (D.C. Cir. 2004) (invalidating the FCC's net neutrality rules as enacted); Symposium, *Privacy and Technology*, 126 HARV. L. REV. 1880 (2013) (canvassing contemporary issues in privacy).

robotics competitions.[5] The same household name Internet companies that brought us search 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 "effective control" over its autonomous submarines, perhaps they are not entitled to passage through Chinese waters.[11] If a defendant injures a person while trying to vandalize an anthropomorphic robot, rather than a wall, it arguably furthers the purposes of criminal and tort law to transfer intent. These are not scenarios about which cyberlaw has much to teach.

But the parallels are equally 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

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[5] *See infra*, Part II.

[6] *See infra*, Part II.

[7] *E.g.*, S.B. 1298, 2012 Leg., Reg. Sess. (Cal. 2012) (authorizing driverless cars); A.B. 511, 2011 Leg., 76th Sess. (Nev. 2011); S.B. 140, 2011 Leg., 76th Sess. (Nev. 2011); S.B. 313, 2013 Leg., 77th Sess. (Nev. 2013) (same); 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. 2014) (same). *See also* John Bacon, *Google This: Nevada Issues License for Driverless Car*, USA TODAY (May 8, 2012).

[8] *See infra*, Part II.B.1.

[9] *See infra*, Part II.B.2.

[10] *See* Julie Carpenter, *Just Doesn't Look Right: Exploring the impact of humanoid robot integration into Explosive Ordnance Disposal teams*, *in* HANDBOOK OF RESEARCH ON TECHNOSELF: IDENTITY IN A TECHNOLOGICAL SOCIETY (Rocci Luppicini, ed. 2013); P.W. SINGER, WIRED FOR WAR: THE ROBOTICS REVOLUTION AND CONFLICT IN THE TWENTY-FIRST CENTURY 337-43 (2009). *See also infra* note 214.

[11] *See* Craig Allen, *The Seabots are ~~Coming~~ Here: Should They Be Treated as 'Vessels'?*, 65 J. NAVIGATION 749 (2012).

[12] *See, e.g.*, *Margot Kaminski, Drone Federalism: Civilian Drones and the Things They Carry*, 4 CAL. L. REV. CIRCUIT 57 (2013).

[13] *E.g.*, Julie E. Cohen, *Cyberspace As/And Space*, 107 COLUM. L. REV. 210 (2007); Mark Lemley, *Place and Cyberspace*, 91 CAL. L. REV. 521 (2003); *Dan Hunter, Cyberspace as Place and the Tragedy of the Digital Anticommons*, 91 CAL. L. REV. 439 (2003).

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.

My argument proceeds as follows. Part I 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 how and why cyberlaw might expand to encompass the study of robotics and the law. It asks whether robotics is legally "exceptional" and, if so, considers whether academics and jurists should study robotics entirely as a standalone subject. Some have linked regulatory policy to old generals: always doomed to fight the last battle.[15] Ultimately, however, the insights, methods, and norms of cyberlaw can and should help integrate into society yet a new transformative technology.

This project involves a degree of guesswork. Herbert Simon, the progenitor of behavioral economics,[16] wrote a lesser-known series of essays in the nineteen sixties on the societal effects of automation. In a preface to a 1965 book collecting his thoughts, Simon makes 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 participation. But they cannot be made at all without extrapolating from present certainties into future probabilities.*[17]

Simon goes on to distinguish between the technological and economic dimension of the analysis. He says of himself that he is "radical" about the technology, i.e., he believes computers will one day be able to do just about

[14] *See infra*, Part II.B.3.

[15] *See* MAURY KLEIN, UNFINISHED BUSINESS: THE RAILROAD IN AMERICAN LIFE 133 (1994).

[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 196 (1957).

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

everything people can.[18] But he is "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, i.e., a set of specific characteristics that distinguish the Internet from its predecessor and constituent technologies. What those qualities are and how they interact with law and policy is the subject of this Part. The first section identifies what is distinct about the Internet. The second section explores how the Internet's essential qualities, and the experiences these qualities generate, have come to inform specific doctrinal and theoretical debates within cyberlaw.

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 undertheorized: 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 make possible will determine the contours of any legal discourse. This insight turns out to be rather important. An academic and policy 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.

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[18] *Id.* at xii.

[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 (9th ed. 2009), cyberlaw. *But see* Jacqueline D. Lipton, *Law of Intermediated Information Exchange*, 64 FLA. L. REV. 1337, 1339 (2012) ("Despite the resilience of cyberlaw as a stable in today's legal curricula, no one has yet accurately explained the nature of the field.").

A. DEFINITIONS

According to the United States 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 up 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 a more resilient set of networks that, unlike a legacy telecommunications system, would continue to function if one segment were incapacitated by routing around it.[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 time.[28] Relatedly, the Internet supports shared digital spaces and objects that facilitate collaborative creation and governance.[29] Experiences in cyberspace are mediated, meaning that they take place *through* technology.[30] The fact of common mediation is precisely what enables two people to co-exist 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,

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[22] Reno v. American Civil Liberties Union, 521 U.S. 844, 849 (1997).

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

[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, 357 (2003).

[28] Jack 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).

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 on 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 tension in cyberlaw. The free flow of information enables new forms of peer production and governance, while simultaneously introduction or exacerbating threats to intellectual property and privacy. The Internet stiches communities together, but conflicts invariably burst out at the seams. The Internet invokes a distinct sense of 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 non-exhaustive sampling of examples, touching upon jurisdiction, intermediary liability, digital property, copyright, free speech, and privacy, among other challenges.

B. LAW MEETS THE INTERNET

Perhaps the simplest way the Internet disrupts 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 conversation 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 of any other. But for a state to exercise jurisdiction

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[32] *See* Joel Reidenberg, *Lex Informatica: The Formulation of Information Policy Rules Through Technology*, 76 TEX. L. REV. 543 (1997); LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE (1999) (hereinafter "CODE").

[33] Eugene Volokh, *Cheap Speech And What It Will Do*, 104 YALE L.J. 1804 (1995).

[34] *See supra* notes 28-30.

[35] *See supra* note 32.

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

over an out-of-state defendant, consistent with constitutional principles of due process, that defendant must have "purposefully availed itself of the privilege of conducting activities within the forum State."[37] The question of whether Internet activity constitutes purposeful availing 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 question attends choice of law and enforcement. In *Yahoo! Inc. v. La Ligue Contre Racisme et L'antisemitisme et al.*, 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 but 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 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

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[37] Hanson v. Denckla, 357 U.S. 235, 253 (1958), citing International Shoe Co. v. Washington, 326 U.S. 310, 319 (1945).

[38] 952 F.Supp. 1119 (W.D. Pa. 1997).

[39] *Id.* at 1124.

[40] *E.g.*, M. Shamsuddin v. Vitamin Research Products, 346 F.Supp.2d 804, 813 (D. Ma. 2004). *See also id.* at 810-11 (citing cases and law review articles critical of *Zippo Dot Com*).

[41] 433 F.3d 1199 (9th Cir. 2006).

[42] *Id.* at 1199.

[43] *Id.* at 1223.

[44] *Id.*

[45] Reno v. American Civil Liberties Union, 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.").

not grounds for state action in *Layshock v. Hermitage School District*,[46] whereas the threating electronic messages at issue in *Wynar v. Douglas County School District* were.[47] Adventurous scholars would take this melding of contexts further into, for instance, the realm of employment.[48]

The Internet does more than connect disparate contexts; it creates in many 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 understand as a separate sovereign, beholding to no particularly 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 norms and even to arrive at civic consensus.[54] At a minimum, the Internet enables groups to organize around particular political concerns.

The Internet also democratizes the market. Whereas once we all gathered by the radio and television taking in whatever happened to be broadcast, we select now 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 in 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

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[46] 650 F.3d 205 (3d Cir. 2011).

[47] 728 F.3d 1062 (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* BENKLAR, *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").

[55] *See* Balkin, *supra* note 28 at 6-7.

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

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

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. The fact of common mediation opens exciting new paths for community, but also invites exquisite new forms of surveillance and control. Many of the central debates among policymakers, industry, activists, and academics involve 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 represents a third lens by which to understand a variety of 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, i.e., 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 (non-land) 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, i.e., the set of rules that purport to govern the relationship between website and user, if in doing so they cause one of several types of harm.[62]

Others debate 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 in policing their rights against consumers and peer-to-peer services aggressive. The DMCA 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

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[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 in 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* BARBARA VAN SCHEWICK, INTERNET ARCHITECTURE AND INNOVATION (2010); DANIEL SOLOVE, THE DIGITAL PERSON: TECHNOLOGY AND PRIVACY IN THE DIGITAL AGE (2004).

[60] 962 F. Supp. 1015 (S.D. Ohio 1997).

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

[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, 112 Stat. 2360 (1998) (codified as amended at 17 U.S.C. §§ 1201-1205).

[64] Online Copyright Infringement Liability Limitation Act, 17 U.S.C. § 512(a)(1) (2006).

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] Thinking of cyberspace as a place, though perhaps inevitable to a degree, imports a stifling, inefficient, or otherwise undesirable tendency to enclose information, to lock it away. We risk a "tragedy of the digital anti-commons," 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 a debate over control 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 applications on their popular phone or tablet platform.[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

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[65] Timothy K. Armstrong, *Digital Rights Management and the Process of Fair Use*, 20 HARV. J. L. & TECH. 49 (2006). *But see* MGE UPS Systems, Inc. v. GE Consumer and Indus., Inc., 622 F.3d 361 (5th Cir. 2010) (permitting circumvention for fair use).

[66] *See* Hunter, *supra* note 13; JAMES BOYLE, THE SECOND ENCLOSURE MOVEMENT AND THE CONSTRUCTION OF THE PUBLIC DOMAIN (2008); Cohen, *supra* note 13. *See also* Lawrence Lessig, *The Architecture of Innovation*, 51 DUKE L.J. 1783 (2002).

[67] Hunter, *supra* note 13, at 439.

[68] Patricia L. Bellia, *Defending Cyberproperty*, 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 Crawford, *The Internet and the Project of Communications Law*, 55 UCLA L. REV. 359, 395-98 (2007) (defining network discrimination at "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 201-02.

[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 along at it emanates from private, not public sources. *Compare* Adam Thierer, *Who Really Believes in 'Permissionless Innovation'?*, The Tech Liberation Front Blog (Mar. 4, 2013) ("I believe a strong case can be made that permissionless innovation should be our default position in public policy deliberations about technological change."), available online at http://techliberation.com/2013/03/04/who-really-believes-in-permissionless-innovation/, *with* Adam Thierer, *'Net Neutrality' Digital Discrimination or Regulatory Gamesmanship in Cyberspace?*, Cato Policy Analysis No. 507 (Jan. 12, 2004) ("Even if

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, mean 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 government to follow, often without realizing it.[77] Much law and scholarship explores these harms and how best to mitigate them.[78]

More recent scholarship focuses on a different form of control: the control that holding information about a consumer, citizen, or institution permits.[79] Intermediaries meticulously study the personal and other data they gather by virtue of providing a service and have 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.

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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* Ryan Calo, *Against Notice Skepticism in Privacy and Elsewhere*, 87 NOTRE DAME L. REV. 1027, 1039 (1039).

[78] *E.g.*, Symposium, *Cyberspace and Privacy: A New Legal Paradigm?*, 52 STAN. L. REV. 1201 (2000).

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

[80] *See* Ryan Calo, *Digital Market Manipulation*, 83 GEO. WASH. L. REV. (forthcoming 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).

II. THE RISE OF ROBOTICS

The essential qualities of the Internet, and the experiences these characteristics generate, led more or less directly to a specific legal discourse we know collectively by the name cyberlaw. Several of these discussions are ongoing. The various stakeholders have yet to resolve how much control, and for what purpose, 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 "measured 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 addressed—as much as any question can be in a system, like law, that tolerates disparate outcomes and invites reexamination. Eleven years ago Mark Lemley had already assembled a few examples. 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 or 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 their own information has evolved into a conversation about the control information affords over individuals to whoever holds it. Any deep participant in these debates

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[82] *See, e.g.*, Verizon v. Federal Communications Commission, _ F.3d _ (D.C. Cir. 2004) (invalidating the FCC's net neutrality rules as enacted).

[83] Dodd S. Griffith, *The Computer Fraud and Abuse Act of 1986: A Measured Response to a Growing Problem*, 43 VAND. L. REV. 453, 455-56 (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 1 (2013) (same).

[86] Lemley, *supra* note 13, at 529-30.

[87] *Id.* at 531.

[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. Content ID is a system Google developed to identify and address infringing content on its video service YouTube.

[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.

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 "the Internet gets more interesting, more valuable, and more transformative moving forward, making these questions of law and governance more interesting, and more important, over time."[91] I am suggesting, rather, that the Internet is much more familiar and mature today than 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.

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 Mohave Desert, some of the same universities that operated the first nodes of the ARPAnet found themselves competing to build 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. As Peter Singer chronicles, the Armed Forces itself has invested massively in ground, air, and sea robotics in a bid to remake warfare.[94]

Market forces have 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 nine robotics or artificial intelligence companies for sums totaling in the billions.[95] This after the company revealed a fleet of well-tested driverless cars. Amazon, the online marketplace, purchased a robotics company to organize its many warehouse for $770 million and, late last year, announced a plan to deliver some packages by drone.[96] The editor in chief of Wired Magazine,

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[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), available online at http://mashable.com/2014/01/01/us-law-robotics-future/.

[93] *See* SINGER, WIRED FOR WAR, *supra* note 10.

[94] *See generally id.*

[95] John Markoff, *Google Puts Money On Robots, Using the Man Behind Android*, N.Y. TIMES (Dec. 4, 2013).

[96] John Letzing, *Amazon Adds That Robotic Touch*, WALL ST. J. (Mar. 20, 2012), available online at http://online.wsj.com/news/articles/SB10001424052702304724404577291903244796214; Timothy B. Lee, *Amazon Envisions Eventually Delivering Packages in Thirty Minutes via Drones*, WASH. POST

arguably the publication of record for the digital revolution, left the magazine to found a robotics company.[97] Capital that once flowed exclusively to software is diverting (back) to hardware. Today there are several venture capital funds devoted to robotics start ups.[98] Law firms, including the largest labor law firm in the world, have entire practice groups around robotics and artificial intelligence.[99]

This is not the first wave of excitement over robotics. For a time in the nineteen eighties 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.[100] Widely adopted by amateur and professional roboticists alike, the Kinect cuts the cost of one of the more expensive components of robots by a factor of ten. Second, and relatedly, roboticists have embraced an open ecosystem that permits individuals and firms to build on another's work.[101] The Kinect comes with a set of software development tools (a software developer "kit" or SDK) that supports the ability of third parties to build and share applications for the device.[102] 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.[103]

So I join a chorus of voices, from Bill Gates[104] to the White House,[105] to assume that robotics represents an idea whose time has come, the next transformative technology after computers and the Internet. 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.

(Dec. 1, 2013), available online at http://www.washingtonpost.com/blogs/the-switch/wp/2013/12/01/amazon-wants-to-deliver-packages-in-30-minutes-with-drones/.

[97] *See* Wired Staff, *Wired Editor-in-Chief Chris Anderson Steps Down to Run Robotics Startup*, WIRED MAG. (Nov. 2, 2012), available online at http://www.wired.com/about/2012/11/wired-editor-in-chief-chris-anderson-steps-down/.

[98] Examples include Grishin Robotics, Bosch Venture Capital, and Lemnos Labs.

[99] Ryan Calo, *Even (Some) Law Firms Think Robots Are The Next Big Thing*, FORBES (Jan. 31, 2014), available online at http://www.forbes.com/sites/ryancalo/2014/01/31/even-some-law-firms-think-robots-are-the-next-big-thing/.

[100] *See* Evan Ackerman, *Microsoft Releases Kinect SDK, Robotocists Cackle with Glee*, IEEE SPECTRUM (Jun. 17, 2011), available online at http://spectrum.ieee.org/automaton/robotics/diy/microsoft-releases-kinect-sdk-roboticists-cackle-with-glee.

[101] *See* Ryan Calo, *Open Robotics*, 70 MD. L. REV. 571, 582-83 (2011).

[102] *See* Ackerman, *supra* note 100.

[103] *See* Calo, *supra* note 101, at 586.

[104] Bill Gates, *A Robot in Every Home*, SCI. AM. 58 (Jan. 2007).

[105] Phil Larson, *We the Geeks: Robots*, White House Blog (Aug. 6, 2013), available online at 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.")

Against the backdrop of Part I, Part II unpacks these emerging challenges. Section A defines robotics and makes the case for what distinguishes robots and artificial intelligence from previous and constituent technologies. Section 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.[106] 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.[107] If they 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. But that is cheating.

Consider a thought experiment we might call the "Copy or Vote Paradox." Imagine, with James Boyle, that an artificial intelligence announces it has achieved self-awareness, a claim no one seems able to discredit.[108] Boyle examines the difficulty we might face in shutting this system down and explores some sensible arguments on either side. 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."[109] 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, then, the fundamental right to copy, or the deep, 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

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[106] *E.g.*, Christopher D. Stone, *Should Trees Have Standing? Revisited: How Far Will Law and Morals Reach? A Pluralist Perspective*, 59 S. CAL. L. REV. 1, 14 (1985); 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 Intelligence Artifacts*, 83 TEMP. L. REV. 405 (2011).

[107] The work of Jerry Fodor, though contested, suggests that artificial intelligence may never overcome the so-called Frame Problem. *See* J.A. FODOR, THE MODULARITY OF MIND 114 (1983) ("How … does the machine's program determine which beliefs the robot ought to re-evaluate given that it has embarked upon some or other course of action?"). *See also* JOHN R. SEARLE, MINDS, BRAINS, AND SCIENCE 28-32 (1984) (questioning the prospect of artificial meaning); ROGER PENROSE, THE EMPEROR'S NEW MIND (1991) (same). *But see* Goldberg, *supra* note 106, at 673-80 (critiquing Searle and Penrose). To Fodor, John Searle, and Roger Penrose's credit, there were so few gains in artificial intelligence in the decade or following their critique that the period is know as the "AI Winter."

[108] *See* James Boyle, *Endowed by Their Creator?: The Future of Constitutional Personhood*, Governance Studies at Brookings whitepaper (March 9, 2011), available online at http://www.brookings.edu/research/papers/2011/03/09-personhood-boyle.

[109] 316 U.S. 535, 541 (1942).

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 thought and doctrine.

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.[110] 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 human operator for processing. The idea of a robot or robotic system is that the technology combines all three.[111]

Each of these characteristics of sensing, processing, and acting exists on a spectrum. Some robots sense the world but little. The popular 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.[112] Other robots can leverage data from most 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.[113]

Well-known robots like the Mars Rover, the Da Vinci surgical robot, and the infamous Predator B drone are substantially teleoperated, meaning that a human being sees what the machine sees and controls its movements. Yet these systems also "think" to a degree. The Mars Rover has self-directed modes and will not necessarily take certain actions suggested by NASA, like drive off a Martian cliff,

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[110] 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: FOUNDATIONS IN CLASSICAL ARTIFICIAL INTELLIGENCE AND COGNITIVE SCIENCE 37 (1999). *See also* Rodney A. Brooks, *Intelligence Without Reason*, PROCEEDINGS OF 12TH INT. JOINT CONF. ON ARTIFICIAL INTELLIGENCE 569-95 (Aug. 1991) (referring to "sense-model-plan-act" or SMPA).

[111] SINGER, WIRED FOR WAR, *supra* note 10, at 67 (adopting this view).

[112] *See* David Pogue, *A Bundle of Potential in a Ball*, N.Y. TIMES (Dec. 11, 2011), available online at www.nytimes.com/2011/12/22/technology/personaltech/remote-controlled-ball-holds-potential-delights-state-of-the-art.html.

[113] *See* Willow Garage, *PR2 Hardware Specs*, available online at https://www.willowgarage.com/pages/pr2/specs.

if doing so will imperil the robot.[114] The Da Vinci integrates what it sees with doctor input in a continuous effort to improve precision and safety.[115] 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.[116] 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 in or manipulate the world. But acting begs 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 a smart phone. 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 of software—can induce a range of emotions and physiological responses.[117] Flashing lights have been known to induce epileptic fits;[118] concentrate light enough and one can cut metal. You and I sometimes act just by speaking, too, as when we agree to an oral contract.[119]

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.[120] But again, I would talk 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 the other definitional elements are clearly met. Imagine a room in which there is projected an image of a person that 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.

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[114] *See* NASA Jet Propulsion Laboratory, Press Release, *NASA'S Mars Curiosity Debuts Autonomous Navigation* (Aug. 27, 2013), available online at http://www.jpl.nasa.gov/news/news.php?release=2013-259.

[115] [cite]

[116] *See* SINGER, WIRED FOR WAR, *supra* note 10, at 69. This is true of some commercially available drones as well, such as the quodcopter "Iris" from 3D Robotics. 3D Robotics, *Iris Documentation*, available online at http://3drobotics.com/iris/info/.

[117] *See, e.g.*, Ian 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 TECHNOLOGIES: USING COMPUTERS TO CHANGE WHAT WE THINK AND DO (2003).

[118] *See* Kevin Poulsen, *Hackers Assault Epilepsy Patients Via Computer*, WIRED MAGAZINE (Mar. 28, 2008).

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

[120] This is the sense in which "embodiment" is typically used in the literature. *E.g.*, H.R. EKBIA, ARTIFICIAL DREAMS 259 (2008).

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 room and the people in it.

Indeed, a working definition of what it means for technology to act, as opposed to inform, is of particular interest to legal analysis, where this distinction so often matters. As we will see in the sections that follow, that very line between informing and acting will face officials and courts more and more, and is one of a handful of places that cyber-scholars are already grappling 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 cuts off. The debates that attend the Internet are not about packet switching as such but the massive, asynchronous, distance-insensitive communication this technique permits. I turn now from a technical definition of a robot to the essential qualities—on my account, embodiment, emergence, and social valence—that characterize robotics as a transformative technology.

Data is disembodied; robots are not. 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 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."[121] 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.[122] These categories are distinct but mutually reinforcing. For instance: a physical embodiment coupled with apparently spontaneous action leads people to lend robots social valence.

[121] *See infra* Part II.B.2.

[122] *See* Peter H. Kahn et al., *The New Ontological Category Hypothesis in Human-Robot Interaction*, PROCEEDINGS OF HRI (Mar. 6-9, 2011).

B. ROBOTICS AND THE LAW

Embodiment, emergence, and social meaning. These three features—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, maritime law, to name but a few. The remainder of this Part 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.[123] The digital age is a collaborative one. Professor Zittrain refers to personal computers and the Internet, the central vehicles of data to date, as "generative" technologies, by which he means "a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences."[124] 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 vary 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 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.[125] Early decisions about software liability invoked the economic loss doctrine, limited loss an intangible for insurance purposes, and aggressively upheld warranties, all to avoid allocating responsibility among the many movers, shapers, and consumers of data.[126] Courts are still acting to

[123] *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).

[124] ZITTRAIN, *supra* note 29, at 2-3. *See also* Jonathan Zittrain, *The Generative Internet*, 119 HARV. L. REV. 1974 (2006).

[125] *E.g.*, Trans. Corp. of Am. v. Int'l Bus. Machs. Corp., 30 F.3d 953, 960 (8th Cir. 1994) (barring recovery under the economic loss doctrine for last data). For most examples, see Calo, *supra* note 101, at 598-61.

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

domesticate liability in the digital context to this day, but you probably would not even think to sue Microsoft of Dell because Word froze and ate your manuscript.[127] 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.[128]

Robotics also relies on data. 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 "cloud robotics").[129] But the mainstreaming of robots also signals a shift back to the physical. Robots 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 physical harm to 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.[130] 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.[131] The question of 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,[132] but it is not novel in any meaningful sense.

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 impossible, as matter of physics, entirely to predict its influence.[133] Code can also have complicated origins. Software can have one or many authors. It can originate anywhere, from a multimillion-dollar corporate

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[127] *See* David E. Jordan, *The Tortious Computer—When Does a EDP Become Errant Data Processing?*, 4 Computer L. Serv. § 5-1, art. 2, at 4, 8 (1972) (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").

[128] *E.g.*, Zeran v. America Online, Inc., 129 F.3d 327 (4th Cir. 1997), cert. denied, 524 U.S. 937 (1998); Communications Decency Act of 1996, Pub. L. No. 104-104, 110 Stat. 56, 133-43 (1996) (codified as amended in scattered sections of 47 U.S.C.).

[129] *See* Erico Guizzo, *Cloud Robotics: Connected to the Cloud, Robots Get Smarter*, IEEE SPECTRUM (Jan. 24, 2011).

[130] The writ of trespass and trespass on the case dealt with direct and indirect injury, respectively, of person or property.

[131] *See* Herrin v. Sutherland, 241 P. 328 (Mt. 1925).

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

[133] [cite] *See also* Curtis E.A. Karnow, *Liability for Distributed Artificial Intelligence*, 11 BERKELEY TECH. L.J. 147, 162 (1996) (amassing evidence of "inherent problems with software liability" and noting that is "practically impossible to test software thoroughly").

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 in the context of personal computers or smart phones. 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. This has a number of legal repercussions. In a recent essay, Nora Engstrom explores how the mainstreaming of 3D printers—a close cousin, at least, of robotics—stands to interact with product liability law.[134] 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 cost as little as a few hundred dollars and can be used in the home.[135] 3D printing is often linked with robotics in that is uses some of the same underlying software and hardware.[136]

Under existing doctrine, plaintiffs injured by the products they buy can generally avail themselves of strict liability.[137] They do not need to show negligence. But strict product liability only applies to "one engaged in the business of selling or otherwise distributing products."[138] It is well established that noncommercial "sellers" (think hand crafts or lemonade) are only liable for defects in products if they were negligent.[139] Were individuals to print the objects they buy at home instead of picking them up at a store, it is not at all clear strict liability would apply in the event of an injury. This may be fine where 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.

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

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[134] Nora Freeman Engstrom, *3-D Printing and Product Liability: Identifying the Obstacles*, 162 U. PENN L. REV. ONLINE 35 (2013).

[135] *Id.* at 35.

[136] 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.

[137] *See* Engstrom, *supra* note 134, at 40.

[138] *Id.* at 37, quoting RESTATEMENT (THIRD) OF TORTS: PROD. LIAB. § 1 & cmt. c.

[139] *Id.*

catches fire in minute three. Why not 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 product liability actions.[140] Thus, for instance, a guidebook claiming that a particular beach was nice to swim in 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.[141] 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 examples show how the interaction of product liability law and embodiment presents the prospect of systematically undercompensating victims. But 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.[142] Lane correction features in luxury vehicles range from alerting the driver of a lane drift with an expectation the driver will react, to actually holding providing resistance in the steering wheel. Robotic surgery lets surgeons "feel" organs through resistance.[143] 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.[144]

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[140] *Id.* at 38-39.

[141] *Id.* at 39, citing Winter v. G.P. Putnam's Sons, 938 F.3d 1033 (9th Cir. 1991).

[142] 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." N.R.S. § 482A.030 (2011), repealed by NV LEGIS 377 (2013). The new definition makes clear that driver assistance is not necessarily autonomous. N.R.S. § 482A.020 (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.").

[143] *See, e.g.*, Fredrik Rydén & Howard Chizeck, *Forbidden-Region Virtual Fixtures from Streaming Point Clouds: Remotely Touching and Protecting a Beating Heart*, PROCEEDINGS OF INTERN CONF. ON INTELLIGENT ROBOTS AND SYS. (IROS) (Oct. 2012); Jake J. Abbott et al., *Haptic Virtual Fixtures for Robot-Assisted Manipulation*, SPRINGER TRACTS IN ADVANCED ROBOTICS Vol. 28, 49-64 (2007).

[144] *See* Sean Follmer et al., *inFORM: Dynamic Physical Affordances and Constraints through Shape and Object Actuation*, PROCEEDINGS OF UIST'13 (Oct. 8–11, 2013). 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 for purposes of serving an advertisement with a virtual spider. According

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 engines behind the digital economy from significant liability, thereby promoting innovation, precisely because information was at issue.[145] The economic loss doctrine does not apply, by its terms, to physical harm.[146] Indeed, where glitches in software have resulted in physical injury, as when a medical device over-delivers radiation, the courts have allowed actions in tort to proceed.[147]

Congress shielded the Internet more directly: Section 230 of the Communications Decency Act of 1996 expressly immunizes Internet platforms for what users say there.[148] The Act does so, however, by providing that the platform will not be treated as the "publisher" of the offending information.[149] Congress will be harder pressed to immunize manufacturers of robotic platforms where (a) physical harm can result and (b) the free speech arguments that animated Section 230 are less pronounced.[150] But the need to promote an open ecosystem in robotics no less pronounced.[151]

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 doctrine 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—could quite plausibly unwind in the coming decade.

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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.

[145] *See* Calo, *supra* note 101, at 598-601.

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

[147] *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 101, at 599-600 (citing examples).

[148] 47 U.S.C. § 230 (2006).

[149] *Id*. at § 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.").

[150] *Id*. at § 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. 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.

[151] *See* Calo, *supra* note 101, at 612-13.

2. Emergence

Today robots do a variety of tasks that people could do, but end up not doing for reasons of cost or preference.[152] Moving more tasks into the category of automation could in and of itself could 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 American would have to reexamine their tax laws.[153] I would characterize this change as in a way superficial, however, akin to having to change anti-tailgating or texting laws to accommodate driverless cars. To this day there are jurisdictions that technically require elevators to have seats for the operator;[154] we just ignore them.

The dream of researchers in a variety of contexts is 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.[155] Robotic systems might be faster than people at reacting to battlefield developments, especially ones initiated by other machines.[156] 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.[157]

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 the train the system to accomplish them.[158] Further, because an emergent system learns from previous

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[152] *See* Leila Takayama et al., *Beyond Dirty, Dangerous and Dull: What Everyday People Think Robots Should Do*, PROCEEDINGS OF HRI (Mar. 12-15, 2008) ("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.").

[153] [string cite] The United States Department of Treasury once received a proposal asking manufacturers to pay income tax when replacing works with robots, to which the department responded: "inanimate objects are not required to file income tax returns." TAX NOTES 20 (Oct. 1, 1984). This example comes from Stone, *supra* note 106, at 14 n.52.

[154] *E.g.*, N.Y. LAB. LAW § 203-a ("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…").

[155] *See* Kenneth Anderson & Matthew Waxman, *Law and Ethics for Robot Soldiers*, POLICY REVIEW NO. 176 (Dec. 1, 2012) (noting the inevitability of greater automation).

[156] *Id. See also*, SINGER, WIRED FOR WAR, *supra* note 10, at 64.

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

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

behavior, it will improve at a task over time even unaided.[159] You see this aspiration, at least, in a recent demo by Carnegie Mellon and Intel of its robotic butler, which appears to try various methods to separate an Oreo cookie.[160] Importantly, emergent behavior can lead to solutions no human would have come to on her or his own. Something approaching creativity can emerge from feeding data into a complex system and allowing it to iterate toward a semi-arbitrary goal. Thus, the company Gillette reportedly entered various parameters into an algorithm with emergent properties, called a "Creative Machine," which in turn spit out a patentable innovation in toothbrushes.[161]

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, but pretending contemporary robots exhibit anything like intent.[162] Instead I would draw on the work in emergence that Steven Johnson famously highlights 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.[163] 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 designers of intelligent systems rely on the principles of emergence with greater and greater frequency.[164]

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[159] *See, e.g.*, Aaron Saenz, *Robot Learns How to Flip Pancakes...But Not on the First Try*, SINGULARITY HUB (Jul. 27, 2010), available online at http://singularityhub.com/2010/07/27/robot-learns-how-to-flip-pancakes-but-not-on-the-first-try-video/; Guizzo, *supra* note 128 ("[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.").

[160] *See* Tim Hornyak, *Knife-wielding robot HERB separates Oreo Cookies*, CNET (Mar. 12, 2013), available online at 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. *See infra*.

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

[162] A recent book purports to advance a "legal theory for autonomous agents" that boils down to treating software as though it held intent, regardless of whether it does—what the authors call the "intentional stance." *See* SAMIR CHOPRA & LAURENCE F. WHITE, A LEGAL THEORY FOR AUTONOMOUS AGENTS (2011). The trouble with this approach is that sometimes treating software as though it possessed 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 Intelligence*, 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).

[163] *See* STEVEN JOHNSON, EMERGENCE: THE CONNECTED LIVES OF ANTS, BRAINS, CITIES, AND SOFTWARE 18-19 (2001).

[164] *Id*. at 18, 21, 126.

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 currently configured cannot vest ownership of the copyright in a procedurally generated work in the work's author-in-fact," Bridy argues, "because the works author-in-fact—a generative software program—has no legal personhood."[165] Tim Wu recently 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."[166] Stuart Benjamin, in contrast, believes a "fundamental reorientation" of First Amendment law is necessary to accommodate the increasing relevance of algorithm-based decisions.[167]

Bridy, Wu, Benjamin and others are looking at what speech gets protected by copyright or the Constitution. I believe the larger question will turn out to be who is liable for infringement that an emergent system occasions. A claim of fault is often where the proverbial rubber meets the road. We see the beginnings of this issue presented in cases, such as *Cartoon Network, LP v. CSC Holdings, Inc.*, that turn on whether the user or the automated system "copied" a protected work.[168] But we can readily imagine more fundamental changes. Take, for instance, the difference between expression, which is copyrightable, and style, which is not.[169] Imagine a musical assistant that helps a musician emulate the style of her favorite guitarist. Query whether and why a guitar riff that closely approximates a real

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[165] Annemarie Bridy, *Coding Creativity: Copyright and the Artificially Intelligent Author*, 2012 STAN. TECH. L. REV. 5, 21 (2012). Bridy's focus is copyright but one might ask similar questions around patent. 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*, 1185 U. PITT. L. REV. 47 (1985).

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

[167] Stuart Minor Benjamin, *Algorithms and Speech*, 161 U. PENN. L. REV. 1445 (2013).

[168] 536 F.3d 121 (2d Cir. 2008).

[169] Or at least, not necessarily. *See* MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT VOL. 4, § 13.03 (2004) (noting that courts treat "format, theme, style, or setting" as ideas and hence do not protect them under copyright); Midler v. Ford Motor 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).

song by the original musician would, assuming the work has yet to be released and so there is no access by the defendant, qualify as an independent creation.

The same questions can be asked of liability for false speech. The popular television host Stephen Colbert created an account on the social network Twitter recently that automatically swaps in the names of personalities from the Fox News Network for movies reviewed on the website Rotten Tomatoes.[170] "The TV show's most compelling element of all is [Sarah] Palin," one tweet reads, "wandering the nighttime streets trying to find her lover."[171] To the initiated, the account is clearly satirical. Yet clearly even a simple system of this kind could generate a claim that, were it uttered by a person, would be defamatory. The law would then face a choice between holding someone accountable for a result she did not intend, or permitting without recourse what most any observer would take for defamatory or libelous speech.

Further along the continuum of embodiment, in the sense of an unmediated impact upon the world, we find monetary transactions. Tom Win recently examines the role of high frequency trading algorithms in contemporary investment, noting that "cyborg finance" challenges certain assumptions around risk management and culpability.[172] 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,[173] but generally about how to deal with learning algorithms which arrive at information that would constitute insider trading were it revealed to the investor directly.[174] Contract law, too, grapples with the minimum intentionality a person must display before he will be held to the terms of a transaction a software program he initiated negotiated.[175]

The prospect of systems that are both emergent and fully, physically embodied provides more acute challenges. The law is in general far quicker to locate responsibility in the event of physical harm,[176] and loathe to let innocent

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

[171] *Id.*

[172] 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.").

[173] *Id.* at 703-10.

[174] 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 Network and Insider Trading: An Explanation and Recommendations*, 32 REV. BANKING & FIN. L. 245 (2013).

[175] The commission behind the Uniform Commercial Code amended the UCC in 2003 to including a discussion of "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) (withdrawn). *See also* Tom Allen & Robin Widdison, *Can Computers Make Contracts*, 9 HARV. J.L. & TECH. 25 (1996).

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

plaintiffs 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, for good reason, sometimes disavowed.

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 way that, in addition to being unexpected, happens severely to injure a person or damages her property. Criminal law would look to the state of mind of the defendant: did he intend, know, or have reason to know his robot would hurt the victim? Tort law would look to foreseeability: should the defendant have appreciated the risk of harm and its magnitude, or "fairly foreseen" the activity as a part of the robot's assignment?[177]

This category of hypothetical presents, 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 aimed at addressing this particular problem. For instance, writing in 1981, Sam Lehman-Wilzig explores various models of accountability for artificial beings.[178] These include: product liability, dangerous animals, slavery, diminished capacity, children, agency, and personhood. 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?[179]

This set of questions is fascinating and important; the law will need to sort out analogies for robots or else create a new category.[180] 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 for the need to show

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

[178] Sam N. Lehman-Wilzig, *Frankenstein Unbound Towards a Legal Definition of Artificial Intelligence*, FUTURES 442 (Dec. 1981). *See also* Peter M. Asaro, *A Body to Kick but No Soul to Damn: Legal Perspectives on Robotics*, in ROBOT ETHICS: THE ETHICAL AND SOCIAL IMPLICATIONS OF ROBOTICS (Patrick Lin et al., eds. 2012) (invoking the same categories).

[179] This turns out to be tricky! While the rule applies to horses and sheep, there are animals, such as dogs and cats, that we permit to roam without liability because of prevailing custom. *See* GLANVILLE 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.

[180] *See infra*, Part III.

negligence where the "thing speaks for itself."[181] The paradigmatic case remains the plaintiff who is struck by a barrel that rolls out of a warehouse window.[182] The plaintiff need not demonstrate the warehouse owner was negligent because reasonable people 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.[183] 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.[184] Importantly, for a plaintiff successfully to invoke *res ipsa*, she must show that the defendant had "exclusive control" over the instrumentality of her injury.[185] This is an antecedent question: the burden does not shift to the defendant in the absence of a showing of exclusive control.

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 "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.[186] 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 or 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.[187] (The harm of electronic trespass to chattels, according to sympathetic courts, was the hassle to consumers of wading through unwanted electronic messages.[188]) 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

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[181] BLACK'S LAW DICTIONARY (9th ed. 2009), *res ipsa loquitur*.

[182] Byrne v Boadle, 159 Eng. Rep. 299 (Exch. 1863).

[183] *See* JOHN C. P. GOLDBERG ET AL., TORT LAW: RESPONSIBILITIES AND REDRESS 211 (2D ED. 2008).

[184] *E.g.*,Ybarra v. Spangard, 154 P.2d 687 (Cal. 1945).

[185] *E.g.*, Larris v. St. Francis Hotel, 188 P.2d 513 (Cal. App. 1948).

[186] *See* Timothy Hay, *The Robots Are Coming to Hospitals*, WALL ST. J. (Mar. 15, 12) ("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 robots, one with a sophisticated brain and an unlimited tolerance for menial tasks.").

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

[188] *See supra*.

certain, wonderful way. Unlike in the case of animal training, A put in no additional labor in enhancing the value of the robot.[189] Courts will have to determine whether the loss is still market value.

The questions go beyond civil and criminal liability.[190] Craig Allen, a maritime law scholar, recently considers whether unmanned submarines with autonomous capabilities qualify for the full panoply of writes generally afforded vessels in international waters.[191] International law premises these rights on the ability of a flag state to retain, again, "effective control" over the behavior of the vessel and crew.[192] 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 of whether autonomous systems are beholden to the United 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 exhaustively 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 Meaning

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.[193] Julie Cohen and others see a danger, at any rate, in over-physicalizing the virtual.[194] 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.[195]

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[189] *Cf.* Paguio v. Evening Journal Ass'n, 21 A.2d 667, 668 (N.J. Super. Ct. App. Div. 1941) (value of stage dog calculated on the basis of loss profit while retraining).

[190] 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 (2007) (noting the role of private vendors in state automated decision-making systems).

[191] Allen, *supra* note 12.

[192] *Id.*

[193] *See* Hunter, *supra* note 13, at 443.

[194] *See generally* Cohen, *supra* note 13.

[195] *See* Kerr, *supra* note 27, at 367-68.

Robots also evoke responses in people. Demonstrably so: 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.[196] The threshold is low: early psychological studies show how people attribute social roles to shapes that move around on a page.[197] Any robot that exists physically in the world (acts) and appears to navigate the world with a measure of deliberation (senses and thinks) could invoke a social response. But robots are often designed on purpose to be anthropomorphic because it makes them more engaging.[198] The effects, moreover, persist over time, and do not depend on one's familiarity with the technology.[199]

Thus, to a greater degree than perhaps any technology in history, robots have social meaning. 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."[200] 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 were they dealing with an objection.[201] 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

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[196] *See* BYRON REEVES & CLIFFORD NASS, THE MEDIA EQUATION: HOW PEOPLE TREAT COMPUTERS, TELEVISION, AND NEW MEDIA LIKE REAL PEOPLE AND PLACES (1996); 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 hard-wired to equate voice with people and to act quickly on that identificaition."). The notion of "computers as social actors," while well-evidenced, is not without criticism. Ben Shneiderman at the University of Maryland, for instance, believes the effect is overrated and, to the extent presented, problematic.

[197] The seminal examples is Fritz Heider & Marianne Simmel, *An experimental study in apparent behavior*, AM. J. PSYCH. 57, 243-59 (1944). The animation itself is quite fascinating and available online at http://www.youtube.com/watch?v=VTNmLt7QX8E.

[198] *See* 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 467 (2004).

[199] In one study of how placing a pictures of eyes over a collection basked 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 Cues of Being Watched Enhance Cooperation in Real-World Setting*, 2 BIOLOGY LETTERS 412, 412-13 (2006). Reeves and Nass have found that the pro-social effects of robots are the same in people who have never interacted with a robot before as people who are very familiar with the technology (because, for instance, they design and build robots). *See* REEVES & NASS, *supra* note 196, at 252.

[200] *See* Kahn et al., *supra* note 122.

[201] *Id.*

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."[202]

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*, as discussed. 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.[203] A man intends to run down one person with his car for excitement and instead runs over a person, we transfer the specificity of this intent.[204] Had he intended to run over a fire hydrant, we hold him responsible commensurate with a tragic mistake.

The fact that we have a difficult time placing robots in one category or another, and in general 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.[205] But a robot introduced into the home could implicate privacy merely by creating the sense of being observed.[206] At the same time, robotic surveillance reintroduces certain cues of observation that were missing in cyberspace.[207] The domestic use of drones for surveillance has triggered a uniquely visceral privacy backlash, likely due to cultural associations around robots.[208]

Courts, juries, prosecutors, and various other legal actors will have to decide, in innumerate contexts, whether to sort anthropomorphic technology as having social meaning or not. One of the main drivers of medical malpractice claims is, reportedly, the frequency and character of the patient's interactions with the

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[202] *Id.*

[203] *See* RESTATEMENT (SECOND) OF AGENCY § 228.

[204] *See* GLANVILLE 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 felon to furnish the *mens rea* sufficient to uphold a conviction for murder under the felony-murder rule.

[205] *See* Calo, *supra* note 198, at 817-25.

[206] *See* Ryan Calo, *Robots and Privacy*, in ROBOT ETHICS: THE ETHICAL AND SOCIAL IMPLICATIONS OF ROBOTICS 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.

[207] *See* Ryan Calo, *Against Notice Skepticism in Privacy (And Elsewhere)*, 87 NOTRE DAME L. REV. 1027 (2012).

[208] *See* Ryan Calo, *The Drone As Privacy Catalyst*, 64 STAN. L. REV. ONLINE 28 (2011).

doctor.[209] Hospitals accordingly design and implement protocols that ensure doctor-patient contact, for instance, 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 their design.[210] The more anthropomorphic the robot, the more subjects tended to share blame with the robot for failure and praise for success.[211] Consider how this affects decision-making by officials in the context of policing—another arena in which robots are becoming prevalent.[212] 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.[213]

Then there are the risks humans will foreseeably take on behalf of machines. Anecdotal accounts for years, and a formal study out of the University of Washington in 2013, suggest that soldiers' attachments to robots in the battlefield could affect battle outcomes due to risks the solider is or is not willing to take regarding the machine.[214] 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.[215] And it

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[209] *See* Philip Moore et al., *Medical Malpractice: The Effect of Doctor-Patient Relations on Medical Patient Perceptions and Malpractice Intentions*, 173(4) WEST. J. OF MED. 244 (2000).

[210] *See* Victoria Groom et al., *I Am My Robots: The Impact of Robot-Building and Robot Form on Operators*, PROCEEDINGS OF HRI (Mar. 11-13, 2009).

[211] *Id*.

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

[213] 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 et al., *Do People Hold a Humanoid Robot Morally Accountable for the Harm it Causes?*, PROCEEDINGS OF HRI (Mar. 5-8, 2012).

[214] 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.'" *See* SINGER, SUPRA note 10, at 339. *See also id.* at 337-43 (describing solider 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*, PhD Dissertation, on file with author.

[215] *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").

is a matter of black letter law that, while danger invites rescue, tort will not compensate plaintiffs for injuries sustained rescuing their possessions (including pets).[216] But can we ask the same of plaintiffs who form deep and predictable attachments to machines? Moreover, to return again to damages, how to we compensate losses for objects with not only objective sentimental value, but with an emotional attachment the marketplace cannot replicate?[217]

Robotics may also trigger a broader role for the concept of moral harm in law. Moral harm refers to the harm that accrues to the actor, rather than another victim or society, of committing an immoral act.[218] The theory is that certain objectionable but otherwise victimless behavior still morally compromises the actor behind it.[219] 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.[220] 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.[221] 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.[222] 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 *res*. And I believe the law will have to make room for this category.

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[216] *Compare* Wagner v. International Railway, 232 N.Y. 176 (1926) (plaintiff who rescued fallen rider on train can recover under rescue doctrines) *to* Wignes v. Bottger, 518 N.YS. 2d 936 (N.Y. Sup. 1987) (plaintiff who rescued cat from roof of house cannot recover under rescue doctrine).

[217] 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. I note these films insofar as art sometimes imitates life.

[218] *See* JOEL FEINBERG, THE MORAL LIMITS OF THE CRIMINAL LAW 65-70 (1987)

[219] *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).

[220] *See* Kate Darling, *Extending Legal Rights to Social Robots*, in ROBOT LAW (Ryan Calo, Michael Froomkin, Ian Kerr, eds.) (forthcoming 2015), available online at http://ssrn.com/abstract=2044797.

[221] *Id.*

[222] And vice versa. *See, e.g.*, O.R.S. § 609.650 ("The Legislative Assembly finds that … [t]here is a clear link between animal cruelty and crimes of domestic violence, including child abuse.").

III. THE PATH OF CYBERLAW: FROM INTERNET TO ROBOTICS

To summarize the argument so far: transformative technologies tend to have essential qualities that help 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, a new set of technologies ascends with a markedly different emphasis. The essential, in the sense of distinguishing, facets of robotics foreground a new set of challenges around embodying data, harnessing unpredictability, and disentangling person from instrument.

The question naturally arises of how legal academics and others should engage now with robotics. Even accepting for argument's sake that the advent of this technology will raise issues across a diverse array of legal subjects, 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 is the formation of a separate community of academics, government, industry, and other stakeholders indicated?

I turn to these questions in this final Part. I discuss what it means for a technology like robotics to be "exceptional" in the legal sense, such that it makes sense 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, as an example, toward the risk management model now seen in financial and environmental regulation.[223] And I show why robotics may join railroads, radio, vaccines, and other technologies (though not the Internet) in occasioning a standalone regulatory institution.

I close by examining the advantages and disadvantages of expanding cyberlaw beyond the Internet to encompass robotics. There are key differences between robotics and the Internet that impede a straightforward translation of principles and methods. But we should not miss the forest for the trees. Robotics also 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—the attention to metaphor, for instance, and a kind of interdisciplinary

[223] *See generally* Daniel Farber, *Uncertainty*, 99 GEO. L. J. 901 (2010) (noting role of uncertainty and risk management in economic and environmental regulation).

pragmatism—that could not but inform a law of robotics.[224] On balance, I see robotics blooming under the canopy of cyberlaw even as it changes the flora forever. This represents a real test for cyberlaw: if it passes, it may be capable of broader application to emerging technology.

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, American exceptionalism represents the (contested) idea that the United States is unlike any other nation in existence or history.[225] 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 than perhaps we should engage in a standalone analysis. If, on the other hand, America is just modern day Athens then treating it separately if anything impoverishes our understanding.[226]

One problem with this line of reasoning is that not all differences are the same. Obviously America is different from, and similar to, England in a variety of ways. What ways matter? In particular for our purposes, what ways 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.[227] The early Internet exceptionalists, however, adopted what might be described as a "strong" position. They hold that the Internet constitutes a separate sovereign ungovernable by any contemporary legal system.[228] On this view, the Internet joins, for instance, maritime law as one of the few sources of novel and distinct rules and institutions.[229] 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 or thought that cyberlaw should be its own body of law.

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[224] *Cf.* Neil Richards & Bill Smart, *How Should the Law Think About Robots?*, in ROBOT LAW (Ryan Calo, Michael Froomkin, and Ian Kerr, eds.) (forthcoming), available online at http://ssrn.com/abstract=2263363, *See also infra*.

[225] *See* SEYMOUR MARTIN LIPSET, AMERICAN EXCEPTIONALISM: A DOUBLE EDGED SWORD 18 (1996), citing ALEXIS DE TOCQUEVILLE, DEMOCRACY IN AMERICA 51 (1948) (referring to America as "qualitatively" different from other nations).

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

[227] [string cite]

[228] *See, e.g.*, Johnson & Post, *supra* note 52.

[229] *See, e.g.*, Harris v. Pennsylvania, 50 F.2d 866 (4th Cir. 1931) ("The maritime law developed the rule that a ship master was required to make reasonable efforts to rescue a seaman who fell overboard.").

At the opposite extreme are those who see next to no meaningful difference between the Internet and any other technology. For this set, whom David Post calls the "unexceptionalists,"[230] it makes no more sense to speak in terms of a law of the Internet than a law of the horse. Indeed, 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 Internet exceptionalism.[231] For Wu, various communications technologies follow a similar arch from open to closed that reflects certain diachronic political and market commitments.[232] This insight only emerges by studying the technologies together.[233]

There are one or more intermediate positions. Clearly a transformative technology like the Internet at least changes the available facts, and hence the doctrine to a degree. Lawrence Lessig sees the Internet as, in a sense, unexceptional, but believes the technology still reveals certain ambiguities that were "latent" in the law all along.[234] 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 conclusion 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.[235] But at base his project is one of translation.[236]

The various positions call to mind David Hume's rejection of Pyrrhonian skepticism in favor of a moderate or "academic" skepticism that provides room for knowledge to advance.[237] In this spirit, I propose a moderate conception of legal exceptionalism. 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

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[230] *See* David Post, *supra* note 36, at 167.

[231] *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).

[232] *See generally* WU, THE MASTER SWITCH, *supra* note 23.

[233] For an early suggestion that Tim Wu will treat robotics, if at all, as unexceptional, see Wu, *supra* note 116, at 1496, 1496-97 (noting that "The 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).

[234] *See* LESSIG, CODE, *supra* note 32, at 25.

[235] *Id.* at 255-56.

[236] Justin Hughes embraces a similar project of "translation" whereby we apply existing values to emerging technology. Justin Hughes, *The Internet and the Persistence of Law*, 44 B.C. L. REV. 359 (2003).

[237] DAVID HUME, ENQUIRIES CONCERNING HUMAN UNDERSTANDING 116-31 (1777),

balance of values.

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.[238] 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 launched a central pillar of the modern administrative state.[239] 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.[240] These major recalibrations of laws or institutions were perceived as necessary to preserve human values in the face of new technology.[241] To keep the law doing what the law does "when it works."[242]

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. The Internet, different as it is in ways, has not necessarily occasioned this level of change. We have laws that relate specifically to the Internet, but, for now, I find I am hard-pressed to point to systemic innovations in doctrine that owe their origin to cyberspace. Unlike, say, maritime law, cyberlaw has not exported doctrines the way it has imported them.[243] And unlike the radio, the Internet did not lead to a new agency.[244] In contrast, the essential qualities of robotics may lead to systematic shifts in doctrine and perhaps

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[238] *See* PERCY HENRY WINFIELD, 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).

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

[240] *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 every invented").

[241] *Cf.* WILLRICH, *supra* note 239, at 328 ("Since 1987, 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.").

[242] *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 works, 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").

[243] Comparative negligence and the duty to rescue, for instance, originated in maritime law. Of the doctrines that originated with the Internet, non-discrimination probably has the best chance of general application.

[244] The Internet is, on the other hand, unique in that is governed at one level by quasi-public institutions with few analogs in history. *See generally* Froomkin, *supra* note 53.

even new institutions as this technology permeates society.

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. We could equally imagine an increased role for strict liability in criminal law. Today, criminal law is skeptical of strict liability[245]—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). We at least require the defendant to be reckless. 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 of "no soul to damn; no body to kick."[246] Here we lack even the sense that a wrong, or even a mistake, was committed in the first instance.[247] No one expected, much less intended, the technology to do what it did, which is part of what makes the robot so useful.[248] 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,[249] 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 broader role for risk mitigation within law represents another candidate. The combination the promiscuity of data with the capacity to do physical harm can make unpacking liability impracticable.[250] 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,[251] for instance, or the 2010 market flash crash[252]—resulted from the interaction of two or

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[245] 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).

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

[247] *Cf.* Asaro, *supra* note 178.

[248] *See supra*, Part II.B.

[249] *E.g.*, Model Penal Code § 242.1 ("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.").

[250] *See supra* Part II.A.

[251] *See* David Murphy, *Amazon Algorithm Price War Leads to $23.6-Million Book Listing*, PC MAG. (Apr. 23, 2011), available online at http://www.pcmag.com/article2/0,2817,2384102,00.asp.

[252] *See* Lin, *supra* note 172.

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.[253] The focus of this body of law and literature is on setting defaults and liability rules that keep risk at tolerable levels.[254] Robotics could result in the far greater deployment of these approaches such that they become a part of the everyday life of the law.

These or other doctrines may expand or shift with the ascendance of robotics. Will public institutions change? 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 integrating drones into domestic airspace.[255] The National Highway Traffic Safety Administration has developed guidance around driverless cars.[256] The Food and Drug Administration approves robots for use in medicine.[257] The Occupational Health and Safety Administration issued directives regarding the safe use of industrial robotics dating back to 1987.[258]

But we should not reflexively discount the prospect of a Federal Robotics Commission (FRC). Ostensibly the reason legislatures create, and courts defer to, agencies is that they foster justice and efficiency through the development of expertise.[259] Each of the three essential qualities of robotics invites a deeper examination by policymakers than current configurations allow. I alluded to the challenges the Securities and Exchange Commission faces around algorithmic trading.[260] 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 (NASA) engineers with expertise in computer-controlled electronic systems, electromagnetic interference, and software

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[253] *See generally* Farber, *supra* note 233.

[254] *Id.* at 901-02.

[255] Federal Aviation Administration, *Integration of Civil Unmanned Aircraft Systems (UAS) in the National Airspace System (NAS) Roadmap*, *Federal Aviation Administration* (Nov. 7, 2013), available online at http://www.faa.gov/about/initiatives/uas/media/UAS_Roadmap_2013.pdf.

[256] National Highway Traffic Safety Administration, *Preliminary Statement of Policy Concerning Automated Vehicles* (May 30, 2013), available online at http://www.nhtsa.gov/About+NHTSA/Press+Releases/U.S.+Department+of+Transportation+Releases+Policy+on+Automated+Vehicle+Development.

[257] Sarah Glynn, *FDA Approves First Medical Robot for Hospital Use*, MEDICAL NEWS TODAY Jan. 26, 2013, available online at http://www.medicalnewstoday.com/articles/255457.php.

[258] Occupational Safety and Health Administration, *Guidelines for Robotics Safety*, Directive Number STD 01-12-002 (Sep. 21, 1987), available online at https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=1703.

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

[260] *See* supra Part II.B.

integrity to write the report.[261]

At some point, it arguably becomes inefficient for every agency to develop expertise in the complexities of embodiment and emergence. An FRC (or even a reconfigured NASA) could routinely assist officials, states, and other agencies—from the Department of Justice to the U.S. Copyright Office—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 insurance is the best way to manage the risks that attend robotics,[262] or that the technology should be registered in some way,[263] an FRC could coordinate.

C. WHY A NEW CYBERLAW?

Even accepting that robotics will prove exceptional enough to study separately, 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 the cyberlaw scholars engaged with today's transformative technology pivot with the times? Both approaches have advantages. On balance, however, a central role for cyberlaw seems indicated.

The argument that cyberlaw is *not* the proper intellectual home for robotics begins with the observation at the heart of Part II: robotics simply presents different problems than the Internet. Accordingly, its absorption by cyberlaw would be arbitrary. Worse than arbitrary: cyberlaw scholars lack the diversity of expertise necessary to recognize the full legal and policy import of the robotics revolution.[264] It takes a close student of maritime law, for instance, to assess what rights international treaties afford to autonomous submarines. It takes a tax scholar or practitioner to anticipate an imbalance in government revenue schemes as expenditures move from payroll to capital.

Indeed, in researching this article, I spoke to specialists in maritime, labor, tax, intellectual property, criminal law and other areas. Each furnished one or more examples of how the essential qualities of robotics might pose challenges or upset settled doctrine. There exists a robotics, law, and policy conference, now in

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[261] Which NASA did in 2011, absolving Toyota and attributing the problem to human error.

[262] *See* Calo, *supra* note 101, at 609-11 (exploring consumer insurance markets for robots).

[263] *Cf.* Joseph Lorenzo Hall, *'License Plates' for Drones?*, CEN. DEM. TECH. (Mar. 8, 2013) ("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…").

[264] Hughes suggests that cyberlaw scholars tend to have training in "constitutional, criminal, commercial, and copyright law." Hughes, *supra* note 236, at 361.

its fourth year, with a quorum of participants who have but a passing interest in the Internet.[265] I cannot help but picture, with bemusement, scholars of torts or critical race theory or constitutional law or evidence drawn to the supposedly large tent of robotics only to find it already crowded with cyberlaw professors.

The counter-argument is strong but complex. The project of cyberlaw is, again, to determine the best legal and policy infrastructure for a specific and unique technology. The field built up a conceptual and methodological toolkit for this purpose. The quintessential example is Lawrence Lessig's observation regarding the different modalities of regulation.[266] Lessig joins Joel Reidenberg and William Mitchell in observing that software itself ("code") amounts to a regulatory tool, and that by controlling the architecture of the Internet one effectively constrains human behavior.[267] Thus, for instance, the state can make copying and sharing digital music unlawful, or the content owner could make it impossible.[268]

Lessig's assertion that "code is law" changed the way people talk about Internet regulation.[269] Actual Internet case law more commonly turns on finding the proper metaphor or analogy.[270] 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 asked whether email is more like a postcard or a sealed letter for purpose of determining its level of protection under the Fourth Amendment.[271] A lawmaker might ponder whether cryptography is best understood as "speech" before deciding whether and how to regulate it.[272]

Both the prospect of control by code and the importance of analogy and metaphor remain highly relevant to the context of robotics.[273] The degree to which the government or industry can control the architecture of robots will strongly influence academic and policy analysis, as indeed will the growing use of robotics to enforce existing laws. 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

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[265] [cite]

[266] *See* Lawrence Lessig, *The New Chicago School*, 27 J. LEG. STUD. 661 (1998) (describing the four modalities as law, architecture, norms, and markets).

[267] *See supra* note 32.

[268] *See* Dan L. Burke & Julie E. Cohen, *Fair Use Infrastructure for Rights Management Systems*, 15 HARV. J.L. & TECH. 41, 50-51 (2002).

[269] A February 27, 2014 search on Westlaw of the phrase "code is law" within the journals database reveals 184 documents.

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

[271] *See* Kerr, *supra* note 27.

[272] *See* Froomkin, *supra* note 270.

[273] *See* Richards & Smart, *supra* note 224.

constrain robot behavior.

The FDA already embraces analogy where, for instance, it approves surgical robots on an expedited basis because of the resemblance to laparoscopic surgery.[274] Existing and surely future work asks whether a robot is "like" an animal or a child or a slave.[275] And, as allude to above, cyberlaw scholars puzzled extensively the question of 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's greatest legacy, however, may be its emphasis on what one might call "interdisciplinary pragmatism." A bit of 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.[276] Sure, many cases involve horses as a factual matter. Disputes arise when horses are bought and sold, cared for by veterinarians, or if they 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 unifying principles."[277] Less remarked was Easterbrook's admonition that lawyers should not interpret technology because they do not understand it. "I regret to report," said 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."[278]

Think what you will about Easterbrook's first point, he was dead wrong about the second. Cyberlaw is today a deeply interdisciplinary enterprise, full of meaningful collaboration across a wide variety of training.[279] Many of its brightest scholars and advocates take great pains to follow the technology and social science. Not only have lawyers risen to the occasion of learning about technology and its effects, the community around cyberlaw has spurred technologists to develop a deeper understanding of law and policy.[280] The solution space,

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[274] [cite]

[275] *See supra* note 178 and accompanying text.

[276] Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207 (1996).

[277] *Id.* at 207.

[278] *Id.*

[279] 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.

[280] 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.

meanwhile, inevitably contains not just legal but technological prescriptions—so much so that critics of cyberlaw bemoan its "technological solutionism."[281] 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 begin to crop up around driverless car and drone regulation.[282] 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.

Hosting the conversation around robotics will, of course, also change cyberlaw. Scholars interested in the way we are hardwired to think of going online as entering a "space" may now study the literature that people are hardwired to treat social machines as though a person were present. Cyberlaw will have to engage, to a far greater degree, with the prospect of data causing physical harm, and to the line between speech and action. Rather than think of how code controls people, cyberlaw will of what people can do to control code. A cyberlaw accustomed to immunity for intermediaries and a growing arsenal of speech defenses may need to study and deploy strict liability.

This is, in essence, a test of cyberlaw—among the first tests of its kind. Should cyberlaw prove capable of integrating a second transformative technology than perhaps the movement amounts to a lens by which to approach emerging technology in general. If so, a kind of blueprint emerges: isolate what distinguishes the new arrival from previous and constituent technologies, and search systematically for how these essential features will interact with existing law and institutions. If cyberlaw proves ineffective at integrating robotics, we might expect each transformative technology of a particular kind to merit standalone treatment. Either way, this is an exciting time to be in the field.

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

[282] 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.

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 who wrote Internet specific laws in the late nineteen nineties now draft bills about drones and driverless cars.

Robotics, meanwhile, has a different set of essential qualities—embodiment, emergence, and social meaning. 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. If cyberlaw proves capable of integrating robotics, it may well be capable of integrating the next transformative technology as well.

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.[283] But he also appreciated that his thoughts were necessarily a beginning, not an end, of public participation.[284] Early interpreters of the Internet made the same caveat.[285] My deepest hope for this project is that many words will follow it. Perhaps I have underestimated the pace at which robotics 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.

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[283] *See* SIMON, *supra* note 17, at xi.

[284] *Id.*

[285] *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 236, at 354 ("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).