

# RECURRING DILEMMAS: THE LAW'S RACE TO KEEP UP WITH TECHNOLOGICAL CHANGE

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## I. INTRODUCTION

It is often stated that the law lags behind technology. As technology changes and creates new possibilities, lawyers and legal scholars struggle to deal with the implications. Many feel that these problems can be countered with improved statutory drafting techniques and call for legislation that is “technology-neutral” so that it operates effectively and fairly in different technological contexts. Technology-neutral drafting might ensure proper treatment of existing technologies. However, it will not always be effective in a changing technological environment. In order to design a legal system able to cope with rapid changes in technology, a broader perspective is required. The roles played by administrative agencies, courts, and law reform organizations are crucial. The goal should not only be technology-neutral legislation, but also a legal system that continues to treat different technologies fairly and effectively as technology evolves.

The legal implications of technological change can be observed in a variety of contexts. Throughout American history, lawyers have discussed the implications of technological change for law.<sup>1</sup> An early example of technology giving rise to legal problems is railroads. By 1858, two treatises were published dealing with the particular legal problems of the rail industry.<sup>2</sup> These discussed topics from property rights over track and eminent domain to liability for damages to employees, passengers, stock, and land.<sup>3</sup>

When computers took over important business functions in the mid-twentieth century, lawyers pondered over how computers would be classified

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1. Lawyers have also looked at the implications of technology for the legal practice, although that issue is beyond the scope of this Article.

2. EDWARD L. PIERCE, *A TREATISE ON AMERICAN RAILROAD LAW* (1857); ISAAC F. REDFIELD, *A PRACTICAL TREATISE UPON THE LAW OF RAILWAYS* (1858).

3. PIERCE, *supra* note 2; REDFIELD, *supra* note 2.

by judges. They asked what the consequences might be of treating a computer as a legal entity,<sup>4</sup> whether computer printouts ought to be admissible as evidence in court,<sup>5</sup> whether data stored in a computer might constitute a writing for the purposes of the Statute of Frauds and the Statute of Wills,<sup>6</sup> and whether computer software was tangible personal property subject to sales and use taxes,<sup>7</sup> among other questions.

When genetic testing allowed people to find out whether they were at risk for a genetic disease, litigation followed regarding whether a doctor had an obligation to disclose a patient's genetic information to affected relatives,<sup>8</sup> whether liability for negligent failure to perform a genetic test can extend to a minor patient's biological parent,<sup>9</sup> and whether an action exists for failure to inform patients about prenatal genetic testing<sup>10</sup> or for negligence in administering the tests.<sup>11</sup> Scholars have discussed whether genetic testing ought to be regulated,<sup>12</sup> the effect of genetic testing on the adoption process,<sup>13</sup> the use of genetic test results as evidence of causation in toxic tort litigation,<sup>14</sup> and the possibility of compulsory prenatal screening.<sup>15</sup> Various groups were also concerned that existing privacy and anti-discrimination laws failed to protect those at risk of genetic diseases against discrimination in employment and insurance.<sup>16</sup>

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4. E.g., John F. Banzhaf III, *When a Computer Needs a Lawyer*, 71 DICK. L. REV. 240, 240 (1967). This issue is compounded in an age of artificial intelligence; see Tom Allen & Robin Widdison, *Can Computers Make Contracts?*, 9 HARV. J.L. & TECH. 25, 26 (1996) (discussing legal implications of autonomous computers); Gunther Teubner, *Rights of Non-humans? Electronic Agents and Animals as New Actors in Politics and Law*, 33 J.L. & SOC'Y 497, 505-06 (2006) (discussing human interaction with automated systems).

5. E.g., John R. Brown, *Electronic Brains and the Legal Mind: Computing the Data Computer's Collision with Law*, 71 YALE L.J. 239, 248-49 (1961); Rigdon Reese, Note, *Admissibility of Computer-Kept Business Records*, 55 CORNELL L. REV. 1033, 1036 (1970).

6. E.g., Houston Putnam Lowry, *Does Computer Stored Data Constitute a Writing for the Purposes of the Statute of Frauds and the Statute of Wills?*, 9 RUTGERS COMPUTER & TECH. L.J. 93, 102-03 (1982).

7. E.g., Matthew A. Case, Note, *Sales and Use Tax of Computer Software – Is Software Tangible Personal Property?*, 27 WAYNE L. REV. 1503, 1503 (1981).

8. *Pate v. Threlkel*, 661 So. 2d 278, 279 (Fla. 1995); *Safer v. Estate of Pack*, 677 A.2d 1188, 1189 (N.J. Super. Ct. App. Div. 1996), *cert. denied*, 683 A.2d 1163 (N.J. 1996).

9. *Malloy v. Meier*, 679 N.W.2d 711, 713 (Minn. 2004).

10. *Munro v. Regents of the Univ. of Cal.*, 263 Cal. Rptr. 878, 882 (Cal. Ct. App. 1989).

11. *Curlender v. Bio-Sci. Labs.*, 165 Cal. Rptr. 477, 479 (Cal. Ct. App. 1980).

12. E.g., Anny Huang, *FDA Regulation of Genetic Testing: Institutional Reluctance and Public Guardianship*, 53 FOOD & DRUG L.J. 555, 555 (1998); David C. Bonnin, Comment, *The Need for Increased Oversight of Genetic Testing: A Detailed Look at the Genetic Testing Process*, 4 HOUS. J. HEALTH L. & POL'Y 149, 151 (2003); see also Susan M. Faust, Comment, *Baby Girl or Baby Boy? Now You Can Choose: A Look at New Biology and No Law*, 10 ALB. L.J. SCI. & TECH. 281, 295-96 (2000) (discussing regulation in the context of sex selection).

13. E.g., Demosthenes A. Lorandos, *Secrecy and Genetics in Adoption Law and Practice*, 27 LOY. U. CHI. L.J. 277, 277 (1996); Jessica Ann Schlee, Comment, *Genetic Testing: Technology That Is Changing the Adoption Process*, 18 N.Y.L. SCH. J. HUM. RTS. 133, 133 (2001).

14. E.g., Randi B. Weiss et al., *The Use of Genetic Testing in the Courtroom*, 34 WAKE FOREST L. REV. 889, 889 (1999) ("As testing methodologies become more sophisticated, the use of genetic test results is likely to expand, particularly in toxic tort litigation.").

15. E.g., Lori B. Andrews, *Prenatal Screening and the Culture of Motherhood*, 47 HASTINGS L.J. 967, 972 (1996).

16. E.g., Karen Rothenberg et al., *Genetic Information and the Workplace: Legislative Approaches and Policy Challenges*, 275 SCIENCE 1755, 1755-57 (1997); Council for Responsible Genetics, *Genetic Testing*,

Although not every technology<sup>17</sup> generates litigation and legal scholarship, technological change is often the occasion for legal problems. The tension between law and technology has been observed by multiple authors and is often reflected in metaphors involving competitors in a race with law the inevitable loser.<sup>18</sup> Those using these metaphors are generally concerned about the law's failure—whether or not they regard it as inevitable—to cope with technological change, especially rapid or accelerating change.<sup>19</sup> Scholars have used metaphors of the law falling behind technology in contexts as diverse as railroads,<sup>20</sup> *in vitro* fertilization,<sup>21</sup> computers,<sup>22</sup> and the Internet.<sup>23</sup> However, the frequent use of these metaphors is not reflected in

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Discrimination, and Privacy, <http://www.gene-watch.org/programs/privacy.html> (last visited Nov. 12, 2007); National Human Genome Research Institute, Policy Recommendations for Genetic Discrimination in Insurance or Employment, <http://www.genome.gov/11510228> (last visited Nov. 12, 2007); NIH-DOE WORKING GROUP ON ETHICAL, LEGAL, AND SOC. IMPLICATIONS OF HUMAN GENOME RESEARCH, GENETIC INFORMATION AND HEALTH INSURANCE REPORT OF THE TASK FORCE ON GENETIC INFORMATION AND INSURANCE (1993), <http://www.genome.gov/10001750>.

17. For a definition of this term, see *infra* Part II. It is used in its general sense, and is not limited to information technology.

18. See, e.g., *Mount Isa Mines Ltd. v. Pusey* (1970) 125 C.L.R. 383, 395 (Austl.) (Windeyer, J.) (“Law, marching with medicine but in the rear and limping a little . . . .”); GRANT GILMORE, *THE AGES OF AMERICAN LAW* 65 (1979) [hereinafter GILMORE, AGES] (“Rapid technological change unsettles the law quite as much as it unsettles people.”); Michael Kirby, *Medical Technology and New Frontiers of Family Law*, 1 AUSTL. J. FAM. L. 196, 212 (1987) (“The hare of science and technology lurches ahead. The tortoise of the law ambles slowly behind.”); John H. Pearson, *Regulation in the Face of Technological Advance: Who Makes These Calls Anyway?*, 13 NOTRE DAME J.L. ETHICS & PUB. POL’Y 1, 1 (1999) (“It has also become commonplace to note that these dizzying changes in science and technology can easily outstrip those systems by which we humans make critical decisions about what can and should be done by those who are responsible members of society and about how to protect those responsible members of society from those who are not so responsible.”); see also *infra* notes 20-23 (noting further specific instances of the law’s failure to keep pace with technology).

19. See, e.g., Joseph W. Rand, *What Would Learned Hand Do?: Adapting to Technological Change and Protecting the Attorney-Client Privilege on the Internet*, 66 BROOK. L. REV. 361, 361 (2000) (“For example, the unprecedented explosion of electronic mail . . . has spawned a myriad of legal problems . . . .”).

20. See JAMES W. ELY, JR., *RAILROADS AND AMERICAN LAW* vii (2001) (“The railroad industry raised a host of novel problems and placed unprecedented demands on the legal system.”); see also *Corwin v. N.Y. & Erie R.R. Co.*, 13 N.Y. 42, 47 (1855) (stating that the old common law rule that an owner of cattle could not maintain an action in negligence where the cattle were injured while trespassing was no longer appropriate “when applied to the new circumstances and condition of things arising out of the general introduction and use of railroads in the country”).

21. See Lyria Bennett Moses, *Legal Responses to Technological Change: The Example of in Vitro Fertilization*, 6 MINN. J. L. SCI. & TECH. 505, 516 n.35 (2005) [hereinafter Bennett Moses, *Legal Responses*] (citing instances where metaphors were used about the law falling behind *in vitro* fertilization technology).

22. E.g., CURTIS E. A. KARNOW, *FUTURE CODES: ESSAYS IN ADVANCED COMPUTER TECHNOLOGY AND THE LAW* 1 (1997) (“I have seen the fields of law and technology thrown against each other, necessarily but often antagonistically.”); I. Trotter Hardy, *Computer RAM “Copies”: A Hit or a Myth? Historical Perspectives on Caching as a Microcosm of Current Copyright Concerns*, 22 U. DAYTON L. REV. 423, 425 (1997) (“Technological change presents challenges to the law.”); Gregory E. Perry & Cherie Ballard, *A Chip by Any Other Name Would Still Be a Potato: The Failure of the Law and Its Definitions to Keep Pace with Computer Technology*, 24 TEX. TECH L. REV. 797, 799 (1993) (looking at the consequences when “the legal system fails to keep pace with computer technology”); Dana R. Wagner, *The Keepers of the Gates: Intellectual Property, Antitrust, and the Regulatory Implications of Systems Technology*, 51 HASTINGS L.J. 1073, 1074 (2000) (“It should therefore come as no surprise that, as computer technology has advanced rapidly in the past decade, the legal system has begun to question the applicability of its traditional doctrines to the digitized world.”).

23. E.g., Richard A. Epstein, *Privacy, Publication, and the First Amendment: The Dangers of First Amendment Exceptionalism*, 52 STAN. L. REV. 1003, 1004 (2000) (“Doctrinal analysis often requires us to reconcile traditional legal principle with modern technological innovation. Nowhere is this task of reconciliation more daunting than with cyberspace, where the speed and spread of information has been

concerted attempts to understand why they are appropriate.

The metaphors themselves reify both technology and law, suggesting that they are both things at a measurable stage of sophistication or progress.<sup>24</sup> Yet nothing in the literature explains why such reification—even as a metaphorical image—is appropriate. While it is common to find scholarly articles raising particular legal issues arising in the context of particular technologies—or even articles focusing on the utility of studying law through the lens of a single technology such as the Internet<sup>25</sup>—there is little discussion of why so many legal problems arise in the context of technological change, understood more generally. Because professional focus tends to be limited to a particular industry or area of law, few have considered what computer law might share with biomedical law or even the law of railways. Aside from brief but interesting comments in speeches<sup>26</sup> and symposia,<sup>27</sup> issues of law and technology in its broader sense remained largely unexplored,<sup>28</sup> at least until a recent symposium.<sup>29</sup> In the absence of analysis, the metaphors suggesting a

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ratcheted up to levels that were unimaginable even a generation ago.”); Edward Lee, *Rules and Standards for Cyberspace*, 77 NOTRE DAME L. REV. 1275, 1279 (2002) (“While the law has lagged behind technological developments in the past, the Internet seems to present challenges of an entirely different order.”).

24. Leo Marx, *Technology: The Emergence of a Hazardous Concept*, 64 SOC. RES. 965, 981-84 (1997).

25. See, e.g., Jonathan D. Bick, *Why Should the Internet Be Any Different?*, 19 PACE L. REV. 41, 43 (1998) (considering the ability of existing laws to regulate the Internet); I. Trotter Hardy, *The Proper Legal Regime for “Cyberspace”*, 55 U. PITT L. REV. 993, 994-95 (1994) (discussing whether the Internet raises novel issues of law, or whether analogies to current law are sufficient). Compare Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207, 208 (1996) (“Develop a sound law of intellectual property, then apply it to computer networks.”), and Joseph H. Sommer, *Against Cyberlaw*, 15 BERK. TECH. L.J. 1145, 1148-49 (2000) (“[F]ew of the legal issues posed by the new informatics technologies are novel.”), with David R. Johnson & David Post, *Law and Borders—The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367, 1367 (1996) (arguing that different laws are required to regulate Cyberspace than traditional physical territories), and Lawrence Lessig, *The Path of Cyberlaw*, 104 YALE L.J. 1743, 1743-45 (1995) (considering what is special about Cyberspace).

26. E.g., JUSTICE MICHAEL KIRBY, *THE LAW AND MODERN TECHNOLOGY* (1982); Julian Burnside QC, *Does the Law Cope with New Technology*, at the Australian Bar Association Conference, Noosa, Queensland, Australia, (July 3-7, 1994) (on file with author); Justice Michael Kirby, *The Commonwealth Lawyer: Law in an Age of Fantastic Technological Change* (June 4, 2001), available at [http://www.highcourt.gov.au/speeches/kirbyj/kirbyj\\_thecommonwealthlawyer.htm](http://www.highcourt.gov.au/speeches/kirbyj/kirbyj_thecommonwealthlawyer.htm).

27. See, e.g., Alan Heinrich et al., *At the Crossroads of Law and Technology*, 33 LOY. L.A. L. REV. 1035, 1036 (2000) (discussing how technological change has created new forms of property, generated new ethical and legal questions, challenged legal institutions, and changed law school curricula).

28. Exceptions are Gaia Bernstein, *Accommodating Technological Innovation: Identity, Genetic Testing, and the Internet*, 57 VAND. L. REV. 965, 966-68 (2004) [hereinafter Bernstein, *Accommodating Technological Innovation*] (comparing the impact of genetic testing and the Internet on identity interests, showing how similar problems arise in different settings); Gaia Bernstein, *The Paradoxes of Technological Diffusion: Genetic Discrimination and Internet Privacy*, 39 CONN. L. REV. 241 243-44 (2007) (discussing how, where a technology has a negative impact on social values, certain features of a technology’s diffusion can create inefficient situations); Arthur J. Cockfield, *Towards a Theory of Law and Technology*, 30 MAN. L.J. 383, 383 (2004); David Friedman, *Does Technology Require New Law?*, 25 HARV. J.L. & PUB. POL’Y 71, 71 (2001) [hereinafter David Friedman, *New Law*]; Monroe E. Price, *The Newness of New Technology*, 22 CARDOZO L. REV. 1885, 1888 (2001). In the field of international law, see generally Colin B. Picker, *A View From 40,000 Feet: International Law and the Invisible Hand of Technology*, 23 CARDOZO L. REV. 149 (2001); Joseph W. Dellapenna, *Law in a Shrinking World: The Interaction of Science and Technology with International Law*, 88 KY. L.J. 809 (1999-2000).

29. The on-line symposium, organized by the MINNESOTA JOURNAL OF LAW, SCIENCE & TECHNOLOGY, can be viewed on-line at <http://techtheory.blogspot.com/>. Papers were published in 8 MINN. J.L. SCI. & TECH. 441 (2007). See generally Lyria Bennett Moses, *Why Have a Theory of Law and Technological Change*, 8

conflict between law and technology seem to reflect nothing more than random critiques of law in particular technological contexts.

Although care is needed to avoid reifying both law and technology, the metaphor of law struggling to catch up with technological change does contain an important insight. Although law may not struggle with technology as such, many legal problems do arise in new technological contexts. This Article explains why technological change generates legal problems, and classifies the types of problems that arise. After clarifying what is meant by “technology” in Part II, Part III identifies four types of legal problems that frequently follow technological change. These are: (1) the potential need for laws to ban, restrict, or, alternatively, encourage a new technology; (2) uncertainty in the application of existing legal rules to new practices; (3) the possible over-inclusiveness or under-inclusiveness of existing legal rules as applied to new practices; and (4) alleged obsolescence of existing legal rules. These four types of problems are not limited to any one type of technology but rather have arisen in contexts as diverse as transportation, computing, and biotechnology. Examples from a variety of fields illustrate each of these four problem types.

Part IV employs the structured approach set out in Part III to demonstrate the problems with treating technological neutrality as a feature of statutes rather than as a feature of systems of laws. Technology neutrality is usually pictured as a drafting device to ensure that laws do not discriminate between technologies or that laws operate effectively in different technological contexts.<sup>30</sup> While these objectives can be achieved through statutory drafting for the time being, continuing technological change can render laws both unfair and undesirable. Techniques of statutory drafting cannot ensure that laws will *continue* to operate fairly and effectively in new technological contexts without reducing the operational impact of at least some types of laws. It is possible, however, to design a legal system that treats different technologies fairly and is resistant to difficulties associated with technological change. This requires factoring in the role played by administrative agencies, courts, and law reform organizations. While the precise role that can be played by each will only be sketched in Part IV, my goal is to highlight the need for discussions of technological neutrality to take place in this broader context.

## II. A PRACTICAL DEFINITION OF TECHNOLOGY

The Introduction identified several major developments that were perceived as giving rise to legal problems or causing the law to fall behind.<sup>31</sup> These developments were in the areas of transportation (railroads), medicine (*in vitro* fertilization and genetic testing), computing, and communication (the Internet). This Part explores the link between these diverse inventions through

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MINN. J.L. SCI. & TECH. 589 (2007) [hereinafter Bennett Moses, *Why Have a Theory*] (engaging in an extended discussion of the importance of a theory of law and technology, as opposed to narrower or broader theories).

30. See *infra* Part IV.A.

31. See *supra* Part I.

analyzing the nature of technology.

There is much controversy over the definition of “technology.”<sup>32</sup> Because “technology” is not a univocal term,<sup>33</sup> it is misleading to talk about a single definition, and more accurate to speak of a family of phenomena to which the label has been applied.<sup>34</sup> It has been used to refer to: (1) tools and techniques; (2) organized systems such as factories; (3) applied science; (4) those methods that achieve, or are intended to achieve, a particular goal such as efficiency, the satisfaction of human needs and wants, or control over the environment; and (5) the study of or knowledge about such things.<sup>35</sup> Philosophers and historians have sometimes used the word expansively to cover the use of conceptual tools (thus including abstract thought as a form of technology),<sup>36</sup> organizations and hierarchies,<sup>37</sup> and legislation and government.<sup>38</sup>

Because the term “technology” has many usages, it does not make sense to enquire about *the* definition of technology. Instead, most scholars explore an aspect of technology that ties in with the topic of their work.<sup>39</sup> A historian might be interested in describing the history of technical knowledge<sup>40</sup> or particular techniques,<sup>41</sup> a sociologist might choose to focus on how a particular tool has affected society,<sup>42</sup> a philosopher might equate technology with means or with rationality,<sup>43</sup> an environmentalist might conceptualize technology as the means by which man exercises power over nature,<sup>44</sup> and an economist

32. PAUL T. DURBIN, *DICTIONARY OF CONCEPTS IN THE PHILOSOPHY OF SCIENCE* 313-15 (1988) (entry on “Technology”); JOSEPH C. PITT, *THINKING ABOUT TECHNOLOGY* 1-12 (2000); Robert E. McGinn, *What is Technology*, 1 *RES. IN PHIL. & TECH.* 179, 179 (1978). *See generally* STANLEY F. KASPRZYK, *TECHNOLOGY* (1973) (discussing the different ways in which technology has been defined).

33. CARL MITCHAM, *THINKING THROUGH TECHNOLOGY: THE PATH BETWEEN ENGINEERING AND PHILOSOPHY* 152 (1994); Marx, *supra* note 24.

34. For a history of the term “technology” in America, see RUTH OLDENZIEL, *MAKING TECHNOLOGY MASCULINE* 19-50 (1999) (discussing the narrowing of the term from its broader nineteenth century usage to the modern, machine-focused usage); Eric Schatzberg, *Technik Comes to America: Changing Meanings of Technology before 1930*, 47 *TECH. & CULTURE* 486 (2006) (analysing the origins of the term with reference to its European origins).

35. LARRY A. HICKMAN, *PHILOSOPHICAL TOOLS FOR TECHNOLOGICAL CULTURE: PUTTING PRAGMATISM TO WORK* 11 (2001); MITCHAM, *supra* note 33, at 116-17, 150, 160, 308 n.21.

36. HICKMAN, *supra* note 35, at 26, 34, (following the theme in 5 JOHN DEWEY, *What I Believe*, in *THE LATER WORKS, 1925-1953*, at 267, 270 (Jo Ann Boydston & Kathleen E. Poulos eds., 1984)).

37. URSULA FRANKLIN, *THE REAL WORLD OF TECHNOLOGY* 12 (1992); PITT, *supra* note 32, at 10, 44.

38. MITCHAM, *supra* note 33, at 116, 150; PITT, *supra* note 32, at 10, 44.

39. MITCHAM, *supra* note 33, at 153; McGinn, *supra* note 32, at 157.

40. *See, e.g.*, GOVINDAN PARAYIL, *CONCEPTUALIZING TECHNOLOGICAL CHANGE: THEORETICAL AND EMPIRICAL EXPLORATIONS* 9, 146 (1999) (defining technological change as a “process of knowledge change”).

41. *See* Carroll W. Pursell, Jr., *History of Technology*, in *A GUIDE TO THE CULTURE OF SCIENCE, TECHNOLOGY, AND MEDICINE* 70, 75 (Paul T. Durbin et. al. eds., 1980) (explaining how one approach to studying the history of technology is to develop a precise history of techniques).

42. *E.g.*, LYNN WHITE, JR., *MEDIEVAL TECHNOLOGY AND SOCIAL CHANGE* 38, 41 (1962) (looking at the social consequences of the invention of the stirrup and plough).

43. *E.g.*, JACQUES ELLUL, *THE TECHNOLOGICAL SOCIETY* 19 (John Wilkinson trans., Vintage Books 1967) (1964); LEON R. KASS, *LIFE, LIBERTY AND THE DEFENSE OF DIGNITY: THE CHALLENGE FOR BIOETHICS* 31-33 (2002); Marx W. Wartofsky, *Technology Power and Truth*, in *DEMOCRACY IN A TECHNOLOGICAL SOCIETY*, 1992, at 15, 18-19 (Langdon Winner ed., 1992).

44. *E.g.*, JOHN ASHTON & RON LAURA, *THE PERILS OF PROGRESS* 1-2 (1998) (describing technology as a “tool for the rape of the earth” and the driving force behind technology as “the lust for control over the

might equate technology with the industrial arts.<sup>45</sup> Lawyers may, in some contexts, be interested in each of these aspects of technology. A patent lawyer will look at the state of technical knowledge (prior art) when assessing whether a patent claim was obvious,<sup>46</sup> an environmental lawyer may comment on the effectiveness of technology-forcing in polluting industries,<sup>47</sup> and other lawyers may be interested in litigation and regulation in the context of injuries caused by technical objects in a modern workplace.<sup>48</sup> But no real insight can be gained grouping cases involving technical knowledge, technical objects or technical production. It would be akin to preparing for rural legal practice by studying “the law of the horse” and reading only those cases that concern horses rather than gaining a general understanding of the law of torts, contracts, property, crime, and so forth.<sup>49</sup> A student will gain a better understanding of the law if taught traditional subjects without being confined to cases involving technical knowledge, technical objects, and technical production. For example, one would not want to learn antitrust and business law by reference solely to cases involving technological industries.

There is one aspect of technological change, however, that links those technologies that have the most direct impact on law. This is the capacity of new technology to enable new forms of conduct, including alteration of the means by which similar ends are achieved. The current state of technology limits in practice what actions we *can* perform, what objects we *can* create, and what relationships we *can* form. Some technological change has a significant impact on what is possible. *In vitro* fertilization, for example, allowed infertile couples to bear and raise a genetically related child, created a new industry, and gave rise to a new thing, the *in vitro* embryo. The introduction of such significant changes into a world of rules that govern what actions we *may* perform, what objects we *may* create and use, and what relationships will be *recognized* can create legal problems. As will be illustrated in Part III, new regulation may be necessary, existing rules may be rendered obsolete, and the application of existing rules to new situations may generate uncertainty or may lead to seemingly inappropriate results.

Thus some technologies generate legal dilemmas by virtue of their capacity to enable new forms of conduct. This is emphasized in the definition of technology put forward by Donald Schön in 1967, being “any tool or

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environment”); DAVID HAMILTON, *TECHNOLOGY, MAN AND THE ENVIRONMENT* 17 (1973) (defining technology as “the means by which Man extends his power over his surroundings”).

45. Michael Fores, *Technology and Innovation: Some Comments on the Literature*, 8 *TECHNOLOGY AND SOCIETY* 94, 94-96 (1972).

46. See 35 U.S.C. § 103 (2000) (defining conditions for patentability in terms of non-obvious subject matter).

47. E.g., Thomas O. McGarity, *Radical Technology-Forcing in Environmental Regulation*, 27 *LOY. L.A. L. REV.* 943, 944 (1994) (discussing technology forcing as an approach to environmental problems).

48. E.g., Sheryl Gordon McCloud, *Pink Collar Blues: Potential Hazards of Video Display Terminal Radiation*, 57 *S. CAL. L. REV.* 139, 140 (1983) (discussing the potential adverse effects of video display terminals).

49. The “law of the horse” reference is from Easterbrook, *supra* note 25, at 207-08 (comparing teaching cyberlaw to the futility of teaching torts, property and commercial law solely by reference to cases involving horses).

technique, any product or process, any physical equipment or method of doing or making, by which human capability is extended.”<sup>50</sup> While this is clearly not the only aspect of technology worthy of examination, it is the most likely to have a direct impact on law. The technologies that are perceived to race ahead of law and generate new fields of legal scholarship, such as railroads, *in vitro* fertilization, genetic testing, computers, and the Internet, are all associated with significant new possibilities for action.

Of course, not all technologies that extend human capacity will generate legal problems. The electric can opener may save time compared to its manual cousin, but it does not necessitate any change to the law. Similarly, the fact that a widget can be manufactured marginally faster or cheaper rarely requires a direct legal response in the sense that the legal framework is no longer sufficient, certain, or appropriate, simply because the new technique exists. Ultimately, such developments, taken cumulatively, may have social and economic impacts that influence both government budgets and law. Legal changes, such as economic, industrial, or tax reforms, might be traced back in some circumstances to a series of technological changes. Such changes are not motivated by the mere existence of a new possibility, but rather by a chain that might begin with technological change, but includes resulting impacts on society and the economy. The focus here will be on technologies that motivate legal change by their very existence.

The focus on technological change looks to changes in what is practically possible, rather than ordinary changes in behavior or cultural practices. This excludes changes in social norms and customs that alter what we might be willing or wanting to do.<sup>51</sup> Such changes are rarely so sudden and dramatic that the law’s ability to keep pace is questioned. Where the law does respond to social change, it is rarely for the same reasons as it responds to technological change. While few would argue that the legal subordination of African-Americans was ever justified (despite prevailing cultural norms), no one would suggest that a law for vehicles moving on a fixed track was required before transportation by rail became a technical possibility.<sup>52</sup> While the law does adapt to social change, such adaptations are not necessarily made because of the social change, but rather because of changed perceptions of what is right or what is normal.<sup>53</sup>

Also excluded from the notion of technology used here are technologies in the form of legal regulation.<sup>54</sup> These topics raise different issues to those technologies associated more closely with applied science and engineering. New regulatory techniques are themselves legal change, so an examination of

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50. DONALD SCHÖN, *TECHNOLOGY AND CHANGE* 1 (1967); *see also* LANGDON WINNER, *AUTONOMOUS TECHNOLOGY* 98, 178-79 (1977) (discussing the extension of human capability by technology).

51. *See generally*, Bennett Moses, *Why Have a Theory*, *supra* note 29 (explaining how legal issues resulting from technological change are distinguishable from legal issues resulting from changes in behavior).

52. *Id.* at 598-601.

53. *Id.*

54. *See, e.g.*, Kieran Tranter, ‘*The History of the Haste-Wagons: The Motor Car Act 1909 (Vic), Emergent Technology and the Call for Law*, 29 MELB. U. L. REV. 843, 869-75, 878-79 (2005) (suggesting that legislation regulating technology becomes technology itself).



the impact on law is circular. On the other hand, a lawyer's "invention" such as a new tax loophole or takeover strategy, can necessitate legal change. Such technologies, if unforeseen by legislators, may generate similar dilemmas to those presented in Part III. These dilemmas are, however, more commonly designed rather than incidental. For example, a lawyer discovering a new tax loophole is deliberately trying to make the relevant tax provisions under-inclusive by altering a client's conduct. Technologies such as railroads, genetic testing, *in vitro* fertilization, computing and the Internet were not designed to evade law or employ it for gain but were rather created for independent reasons. Their relationship with the law is not intentional. It is worth noting that under some definitions of technology, this Article is itself a technology. It uses techniques of legal analysis to reason about legal implications of technology. The question of whether an Article such as this is an overly technical response to problems raised by technology, as might be suggested by substantive theories of technology,<sup>55</sup> must be left for another day.<sup>56</sup>

The decision as to which of the many possible definitions of technology to employ in this Article was not arbitrary. The purpose of the decision was to expose some important aspects of the relationship between technological change and legal dilemmas.<sup>57</sup> As Part III demonstrates, general observations can be made about legal problems that arise from technological change.<sup>58</sup> Further, some of the insights yielded by examination of the relationship between law and technological change cease to apply if a broader focus is adopted, for example, law and knowledge change or law and social change.<sup>59</sup> While some of the observations made here will apply to changes that are not "technological" as that term is defined in this Part, no alternative definition would allow the same observations to be made without further qualification.

### III. CATEGORIZING LEGAL PROBLEMS FOLLOWING TECHNOLOGICAL CHANGE

As noted in Part I, lawyers and legal scholars frequently comment on the law's inability to keep up with technological change. They make these observations in various contexts. Over the course of history, the law has been observed to be in need of reform due to changes in transportation, computer, medical and communications technologies, among others. In all of these

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55. See Louis E. Wolcher, *The End of Technology: A Polemic*, 79 WASH. L. REV. 331, 367 (2004) (recommending that we depart from "the superstructure of technological thinking"). See generally ELLUL, *supra* note 43 (suggesting technology has detrimental effects on society); Martin Heidegger, *The Question Concerning Technology*, in THE QUESTION CONCERNING TECHNOLOGY AND OTHER ESSAYS 3 (William Lovitt trans., 1977) (discussing the investigation of technology to experience its essence).

56. See Margaret Thornton, *Technocentrism in the Law School: Why the Gender and Color of Law Remain the Same*, 36 OSGOODE HALL L.J. 369, 378 (1998) ("Technocratic law cloaks the partiality of justice so as to disguise its masculinist, class, race, heterosexual, and corporatist predilections.").

57. For a discussion of the benefits in examining legal problems that arise from technological change, see Bennett Moses, *Why Have a Theory*, *supra* note 29, at 595 (arguing that one of the greatest benefits is avoiding the exaggeration of the dilemmas posed by new technology).

58. *Id.*

59. *Id.* at 597.

different contexts, the alleged reasons why the law needs to change are broadly similar. There are four main reasons why advocates may urge legal change as a response to technological change, namely:<sup>60</sup>

- (A) *The Need for Special Laws.* There may be a need to regulate certain new forms of conduct using new, specially tailored, laws. In some cases, it may even be appropriate to ban a particular technology or particular applications of that technology. Alternatively, there may be proposals to mandate or encourage a new activity.
- (B) *Uncertainty.* The law may be uncertain as it applies to new forms of conduct. In other words, it may not be clear whether such conduct is commanded, prohibited, or authorized. Existing legal rules may need to be clarified.
- (C) *Over-inclusiveness and Under-inclusiveness.* Where existing legal rules were not formulated with new technologies in mind, those rules may inappropriately include or exclude new forms of conduct.
- (D) *Obsolescence.* Some existing legal rules may be justified, explicitly or implicitly, on the basis of a premise that no longer exists.

#### A. *Technological Change Creates a Need for Special Laws*

A new technology carries with it new possibilities, and these can potentially conflict with existing social, environmental and cultural values.<sup>61</sup> The establishment of railroad networks in the 1800s caused social disruption, conglomerated economic power, and posed physical dangers to railroad employees and local communities.<sup>62</sup> The ability to conceive a child using technology in place of sexual intercourse can be seen as unnatural and inappropriate, as well as, in the case of *in vitro* fertilization, a health risk to mother and child.<sup>63</sup> The Internet can be used to spread child pornography and

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60. I have mentioned these categories previously. Lyria Bennett Moses, *Legal Responses to Technological Change: The Example of in Vitro Fertilization*, 6 MINN. J. L. SCI. & TECH. 505, 517 (2005).

61. See Gaia Bernstein, *The Socio-Legal Acceptance of New Technologies: A Close Look at Artificial Insemination*, 77 WASH. L. REV. 1035, 1060-71 (2002) [hereinafter Bernstein, *Socio-Legal Acceptance*] (discussing the moral acceptance of artificial insemination); Christopher T. Hill, *The Public Dimension of Technological Change: Impact on the Media, the Citizenry, and Governments—A U.S. Perspective*, 25 CAN.-U.S. L.J. 153, 155 (1999) (discussing how new technology can change the emphasis society places on certain values); Emmanuel G. Mesthene, *The Role of Technology in Society*, in TECHNOLOGY AND THE FUTURE 65, 70 (Albert H. Teich ed., 1997) (describing these impacts as negative externalities that result from “innumerable individual decisions to develop individual technologies for individual purposes without explicit attention to what all these decisions add up to for society as a whole and for people as human beings”); Michael H. Shapiro, *Lawyers, Judges and Bioethics*, 5 S. CAL. INTERDISC. L.J. 113, 113 (1997) (referring to the lack of fit between innovation and ways of thinking and feeling).

62. ELY, *supra* note 20; see also Aryeh S. Friedman, *Law and the Innovative Process: Preliminary Reflections*, 1986 COLUM. BUS. L. REV. 1, 2 (1986) (discussing the effect of technological innovations on legal rules).

63. See Bernstein, *Socio-Legal Acceptance*, *supra* note 61, at 1061-62 (outlining the moral evolution of assisted reproduction); Bennett Moses, *Why Have a Theory*, *supra* note 29, at 517 (discussing the criticisms of *in vitro* fertilization); Congregation for the Doctrine of the Faith, *Instruction on Respect for Human Life* (Feb. 22, 1987), [http://www.vatican.va/roman\\_curia/congregations/cfaith/documents/rc\\_con\\_cfaith\\_doc\\_19870222\\_respect-for-human-life\\_en.html](http://www.vatican.va/roman_curia/congregations/cfaith/documents/rc_con_cfaith_doc_19870222_respect-for-human-life_en.html) (discussing the morality of interventions upon human procreation).

copy music illegally, as well as for more productive purposes.<sup>64</sup> Computers, the Internet and genetic testing pose potential threats to privacy.<sup>65</sup> Technological change thus has the potential to negatively impact the environment, human physical and mental health, and culture and ethics.<sup>66</sup>

There are various ways in which a clash between a new technology and existing values might be resolved. Our ethics and thought processes may eventually adapt so that the technology becomes integrated into the social world.<sup>67</sup> Public concerns may be ignored or dismissed as ignorance.<sup>68</sup> They may instead be directly taken into account in the design process.<sup>69</sup> Alternatively, government may ban<sup>70</sup> or limit<sup>71</sup> the use of a technology in order to reduce its impact, protect traditional values or resolve moral arguments about the adoption of a technology.<sup>72</sup> In other situations, government might allow the technology to be used, but establish public or private remedies for those harmed.<sup>73</sup> A failure to take action where new technology is perceived to cause harm, threaten social values, or require central planning might well lead to claims that law has fallen behind the times. In fact, new technologies have often led to specialist agencies designed to

64. David McGuire, *Report: Kids Pirate Music Freely*, WASHINGTONPOST.COM (May 18, 2004), <http://www.washingtonpost.com/wp-dyn/articles/A37231-2004May18.html>. Child pornography generates approximately three billion dollars annually. Safe Families, Statistics on Pornography, Sexual Addiction and Online Perpetrators, <http://www.safefamilies.org/sfStats.php> (last visited Nov. 12, 2007). Also, a researcher at Stockholm University's Institute of Computer and System Science reported counting 5561 messages or postings about child pornography in four electronic bulletin boards listed in USENET during a seven day period between late December 1994 and early January 1995. JONATHAN ROSENOER, CYBERLAW 311 (1996).

65. Gaia Bernstein, *The Paradoxes of Technological Diffusion: Genetic Discrimination and Internet Privacy*, 39 CONN. L. REV. 241, 255-77 (2006) (discussing the potential threats of computers, the Internet, and genetic testing on privacy); Aryeh S. Friedman, *supra* note 62, at 27.

66. *E.g.*, NEIL POSTMAN, TECHNOLOPOLY: THE SURRENDER OF CULTURE TO TECHNOLOGY xi-xii (1992); BERNARD STIEGLER, TECHNICS AND TIME, 1: THE FAULT OF EPIMETHEUS 15 (Richard Beardsworth & George Collins trans. 1998) ("Technics evolves *more quickly* than culture."); Aant Elzinga, *Theoretical Perspectives: Culture as a Resource for Technological Change*, in THE INTELLECTUAL APPROPRIATION OF TECHNOLOGY: DISCOURSES ON MODERNITY, 1900-1939, at 17, 24 (M. Hård & A. Jamison eds., 1998) ("[T]he introduction of new technologies involves not only new modes of organization of social relations but also a triggering of cultural nerves."); A. Jamison & M. Hård, *The Story-Lines of Technological Change: Innovation, Construction and Appropriation*, 15 TECH. ANALYSIS & STRATEGIC MGMT. 81, 86-90 (2003) (discussing the cultural appropriation of technology).

67. Bernstein, *Socio-Legal Acceptance*, *supra* note 61, at 1035-36; Shapiro, *supra* note 61, at 115.

68. Jesper Lassen & Andrew Jamison, *Genetic Technologies Meet the Public: The Discourses of Concern*, 31 SCI., TECH. & HUM. VALUES 8, 27 (2006).

69. ROBERT POOL, BEYOND ENGINEERING: HOW SOCIETY SHAPES TECHNOLOGY 279-80, 301 (1997); Johan Schot, *The Contested Rise of a Modernist Technology Politics*, in MODERNITY AND TECHNOLOGY 257, 272-76 (Thomas J. Misa et al. eds., 2003).

70. *See, e.g.*, CAL. HEALTH & SAFETY CODE § 24185 (West 2006) (prohibiting human cloning).

71. According to a 2003 survey in Australia, a majority of Australians agree with the statement, "It is important for governments to regulate new technologies." Michael Gilding & Christine Critchley, *Technology and Trust: Public Perceptions of Technological Change in Australia*, 1 AUSTL. J. EMERGING TECH. & SOC'Y. 52, 59 (2003).

72. *See generally* Tony Honoré, *The Dependence of Morality on Law*, 13 O.J.L.S. 1 (1993) (discussing the relationship between morality and law); Gregory N. Mandel, *Technology Wars: The Failure of Democratic Discourse*, 11 MICH. TELECOMM. & TECH. L. REV. 117 (2005) (developing a framework for understanding technology controversies).

73. *See, e.g.*, Barry R. Furrow, *Governing Science: Public Risks and Private Remedies*, 131 U. PA. L. REV. 1403, 1403 (1983) (arguing that private action can deal with scientific risks). On the tendency of government to choose regulation over a ban, see Tranter, *supra* note 54, at 867, 878-79.

regulate and control new fields of endeavor.<sup>74</sup>

Conversely, government may also be asked to enact laws designed to reap the benefits from technologies that are perceived to be beneficial for society. In the past, governments have subsidized the construction of railways and high performance computing,<sup>75</sup> and required health insurance organizations to provide cover for *in vitro* fertilization.<sup>76</sup> They have also enacted rules aimed at coordinating the use of technologies, as in the case of traffic rules and technical standards.<sup>77</sup> Thus both perceived benefits and harms can cause a government to enact special laws to address issues raised by technological change.

### B. Technological Change Gives Rise to Legal Uncertainty

Not only will new technology frequently ground new law, it generates uncertainties as to the application of existing law. A common complaint among scholars of law and technology is the fact that their new field is rife with uncertainty, as seen in the early literature in areas as diverse as *in vitro* fertilization,<sup>78</sup> genetic testing,<sup>79</sup> computing processes,<sup>80</sup> and nanotechnology.<sup>81</sup>

#### 1. Legal Uncertainty as a Persistent Problem

Uncertainty in law exists in many forms. The outcome of litigation may depend on any one of a number of factors including establishing what took place (especially if witness accounts differ), the possibility that it may settle (being difficult to determine in advance), the possibility that the plaintiff will drop the case, and the difficulty of applying the law to the facts. These can perhaps be reduced (but not eliminated) by various means such as mock juries, early mediation, and contingency fees. The uncertainties involved in litigation are, however, distinct from what might be called legal uncertainty, which is the problem of determining the legal consequences of known conduct.

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74. Robert L. Rabin, *Federal Regulation in Historical Perspective*, 38 STAN. L. REV. 1189, 1262 (1986) (discussing radio, air travel, and energy).

75. E.g., High-Performance Computing Act of 1991, 15 U.S.C. §§ 5501-5503, 5511-5513, 5521-5528 (2000); *Legislation*, 9 AM. JURIST & L. MAG. 185, 192 (1833) (summarizing a Pennsylvania Act No. 102 of 1831-1832 appropriating funds for railroad and canal construction); see also ELY, *supra* note 20, at 19-30 (discussing legal issues surrounding public funding for railroads).

76. Bennett Moses, *Legal Responses*, *supra* note 21, at 533.

77. For a description of different types of standards, see Standards.gov, What are Standards?, [http://standards.gov/standards\\_gov/Standards.cfm](http://standards.gov/standards_gov/Standards.cfm) (last visited Nov. 12, 2007).

78. E.g., Lorne Elkin Rozovsky, *Legal Aspects of Human and Genetic Engineering*, 6 MAN. L.J. 291, 294-95 (1975).

79. E.g., Richard H. Hunderwood & Ronald G. Cadle, *Genetics, Genetic Testing, and the Specter of Discrimination: A Discussion Using Hypothetical Cases*, 85 KY. L.J. 665, 667-68 (1996-1997) (listing a variety of problems and commentary concerning genetic testing).

80. E.g., Nancy Blodgett, *Computer Law Quicksand: Pioneers in Burgeoning Field Have Little to Guide Them*, A.B.A. J., Nov. 1984, at 32, 32; Robert P. Bigelow, *The Challenge of Computer Law*, 7 W. NEW ENG. L. REV. 397, 398-99 (1985).

81. See, e.g., Frederick A. Fiedler & Glenn H. Reynolds, *Legal Problems of Nanotechnology: An Overview*, 3 S. CAL. INTERDISC. L.J. 593, 595 (1994) (discussing nanotechnology and the scope of legal problems created).

There is no single, agreed definition of legal uncertainty. One might say the law is uncertain if there is no (near) consensus within the legal community (or among reasonable members)<sup>82</sup> as to the legal consequences of particular conduct,<sup>83</sup> and/or there are powerful arguments recognizable within the legal system for more than one legal consequence.<sup>84</sup> Because there is no single view of what constitutes sufficient consensus or what arguments are sufficiently powerful, uncertainty is not a simple dichotomy, but is rather a scale. There are some situations where the legal consequences can be determined objectively, others where there might be some dispute but most would agree on the legal conclusion, and others where it is impossible to decide between multiple answers to a legal problem.<sup>85</sup> Legal uncertainty is not the same as indeterminacy. A claim that the meaning of a rule is uncertain is an epistemic claim; a person can believe that there is only one correct answer to a problem but be uncertain as to what that answer is.<sup>86</sup> Thus, if the meaning of a rule is indeterminate it will necessarily be uncertain, but the converse does not hold.<sup>87</sup>

Uncertainty in law can follow from the difficulty of matching words to their intended meanings. Words used in legal rules might be ambiguous, vague, or contestable.<sup>88</sup> A word is ambiguous if it can have two vastly different meanings; for example, a bank might be a financial institution or a river bank.<sup>89</sup> This is rarely a problem for words used in context, as they are in legal rules.<sup>90</sup> However, as explained below, new ambiguities can arise as a result of technological change. Words and expressions can be vague, in that one may not know whether to attribute the term to an object or instance, and this not knowing is not due to failure to understand the term or to ignorance of the facts.<sup>91</sup> In addition, a word or expression might be contestable, in that

82. David O. Brink, *Legal Theory, Legal Interpretation, and Judicial Review*, PHIL. & PUB. AFF., Spring, 1988, at 105, 105-06 (1988).

83. See, e.g., H.L.A. HART, *Problems of the Philosophy of Law*, in *ESSAYS IN JURISPRUDENCE AND PHILOSOPHY* 88, 106 (1983) ("The clear cases are those in which there is general agreement that they fall within the scope of a rule . . .").

84. E.g., Kent Greenawalt, *How Law Can Be Determinate*, 38 UCLA L. REV. 1, 29 (1990).

85. TIMOTHY A. O. ENDICOTT, *VAGUENESS IN LAW* (2000); RICHARD POSNER, *THE PROBLEMS OF JURISPRUDENCE* 42-43, 234-35, 254 (1990) [hereinafter POSNER, *PROBLEMS*]; Greenawalt, *supra* note 84, at 85-86; Ken Kress, *Legal Indeterminacy*, 77 CAL. L. REV. 283, 283 (1989); Richard A. Posner, *The Jurisprudence of Skepticism*, 86 MICH. L. REV. 827, 875-79 (1988); Frederick Schauer, *Easy Cases*, 58 S. CAL. L. REV. 399, 427 (1985); Lawrence B. Solum, *On the Indeterminacy Crisis: Critiquing Critical Dogma*, 54 U. CHI. L. REV. 462, 472, 494-95 (1987). This proposition is not beyond dispute. E.g., Anthony D'Amato, *Aspects of Deconstruction: The "Easy Case" of the Under-Aged President*, 84 NW. U. L. REV. 250, 251, 255-56 (1990); Kenney Hegland, *Goodbye to Deconstruction*, 58 S. CAL. L. REV. 1203, 1203-16 (1985); see also Joseph William Singer, *The Player and the Cards: Nihilism and Legal Theory*, 94 YALE L.J. 1, 13-19 (1984) (arguing that legal doctrine is largely indeterminate).

86. This seems to be the position taken by Ronald Dworkin. RONALD DWORIN, *A MATTER OF PRINCIPLE* 119-45, 153, 162, 171-72 (1985); RONALD DWORIN, *TAKING RIGHTS SERIOUSLY* 104 (1977); Ronald Dworkin, *On Gaps in the Law*, in *CONTROVERSIES ABOUT LAW'S ONTOLOGY* 84, 84 (Paul Amselek & Neil McCormick eds., 1991).

87. ENDICOTT, *supra* note 85, at 95.

88. Jeremy Waldron, *Vagueness in Law and Language: Some Philosophical Issues*, 82 CAL. L. REV. 509, 512-14 (1994).

89. *Id.* at 512.

90. *Id.* at 515.

91. PAUL GRICE, *STUDIES IN THE WAYS OF WORDS* 177 (1989) (using the example of not knowing

there is a normative force in determining its meaning and, as a consequence, a history of using it in two or more different ways. For example, the concept of democracy or personhood is contestable.<sup>92</sup> The use of vague and contestable expressions in a rule may be deliberate. Vague terms might be used in order to provide flexibility,<sup>93</sup> contestable terms might guarantee that debate takes place along particular lines,<sup>94</sup> and both vague and contestable terms can allow rule-makers to finesse their disagreement. In addition, the use of vague and contestable terms may be desirable in order to prevent citizens from “finely calibrating their action in very close proximity to legal boundaries.”<sup>95</sup> Ambiguity, on the other hand, offers little advantage.

Uncertainty is not necessarily tied to vagueness and contestability inherent in individual words. A rule as a whole may be unclear. A ban on vehicles in the park may or may not allow a truck used in war to be used as part of a veterans’ memorial, despite the fact that a truck is clearly a vehicle.<sup>96</sup> In addition, it is common: for two or more conflicting legal rules to apply to the same situation;<sup>97</sup> for requirements of legal rules to be circular; for legal rules to be based on distinctions without a difference; and for confusion to arise when the same label refers to more than one rule.<sup>98</sup> Where a rule is found in the common law, a case may depend on how the holding of a case is formulated, a process itself mired in choice.<sup>99</sup> Even where there is a complete legal answer to a legal question based on a particular rule, that rule may be merely permissive, such that the answer is not required.<sup>100</sup>

Given the pervasiveness of legal uncertainty, the degree of concern about uncertainty arising from new technologies seems peculiar. It is not sufficient to point out that when a technology is new, there may be no rules about that technology.<sup>101</sup> Oliver Wendell Holmes mocked a Vermont justice of the peace

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whether a man is bald despite knowing how many hairs he has); Waldron, *supra* note 88, at 513. This notion of vagueness is similar to H.L.A. Hart’s concept of open texture and the penumbra of uncertainty surrounding legal rules. See H.L.A. HART, *THE CONCEPT OF LAW* 124-154 (2d ed. 1994) [hereinafter HART, *CONCEPT OF LAW*]; H.L.A. Hart, *Positivism and the Separation of Law and Morals*, 71 HARV. L. REV. 593, 607-12 (1958) [hereinafter Hart, *Positivism*].

92. Waldron, *supra* note 88, at 513-14.

93. H.L.A. HART, *JHERING’S HEAVEN OF CONCEPTS AND MODERN ANALYTICAL JURISPRUDENCE* (1970), *reprinted in* *ESSAYS IN JURISPRUDENCE AND PHILOSOPHY* 265, 269-70 (1983) (“It is a feature of the human predicament, not only of the legislator but of anyone who attempts to regulate some sphere of conduct by means of general rules, that he labors under one supreme handicap—the impossibility of foreseeing all possible combinations of circumstances that the future may bring. . . . This means that all legal rules and concepts are ‘open’; and when an unenvisioned case arises we must make a fresh choice, and in doing so elaborate our legal concepts, adapting them to socially desirable ends.”).

94. Waldron, *supra* note 88, at 538.

95. *Id.* at 536.

96. It is irrelevant for current purposes whether this is thought of as uncertainty in the rule itself, or uncertainty as to whether the rule will be ignored in certain situations.

97. Stephen Munzer, *Validity and Legal Conflicts*, 82 YALE L.J. 1140, 1140-48 (1973).

98. See generally JULIUS STONE, *PRECEDENT AND LAW* 63-74 (1985) (describing categories of illusory reference).

99. *Id.* at 32-33.

100. John Gardner, *Concerning Permissive Sources and Gaps*, 8 O.J.L.S. 457, 458 (1988).

101. Oliver Wendell Holmes, *The Path of the Law*, 10 HARV. L. REV. 457, 474-75 (1897), *reprinted in* 78 B.U. L. REV. 699, 702, 712-13 (1998).

for stating he was unable to decide a case involving a butter churn because there was no law of churns.<sup>102</sup> This example suggests that existing laws are often capable of disposing of issues involving a new technology without controversy.

## 2. *New Technology as a Cause of Legal Uncertainty*

Nevertheless, the problems of uncertainty tend to be compounded when technological change gives rise to new forms of conduct. The permissibility of conduct relating to new artifacts, activities, and relationships will depend on the fit with existing legal categories and concepts. In many cases, technological change does not result in anything that cannot be easily classified. For instance, a passenger car is still a vehicle for the purposes of existing traffic rules despite the fact that it has electronically operated windows, even though most traffic rules pre-date this invention. However, in some cases, a new artifact, activity, or relationship is not easily classified. Numerous examples of legal uncertainty surrounding the introduction of a new technology occur in a wide variety of fields.

Transportation by rail was once a new technology giving rise to uncertainty. The ability to run a vehicle over a track dates from 1676 near Newcastle in England, where carriages transported coal on wooden track.<sup>103</sup> By the late eighteenth century, owners of coal mines and stone quarries used iron track extensively to convey material short distances.<sup>104</sup> To move goods via rail from one place to another, some rights needed to be acquired in the land over which the rail was laid.<sup>105</sup> The right acquired from the landowner was known as “way leave.”<sup>106</sup> There was some uncertainty, at least prior to judicial determination, about the nature of way leave.<sup>107</sup> In particular, it was unclear whether it was proprietary, thus capable of surviving a change in ownership, or merely contractual.<sup>108</sup> It was later decided that a covenant to erect a railway across the land of another in exchange for payment of a toll was proprietary,<sup>109</sup> but not a covenant to use an existing railway in exchange for payment of a toll.<sup>110</sup> One could hardly say that this result could have been known in advance.<sup>111</sup>

The law of Illinois provides another example of uncertainty caused by the introduction of railroads. The question was whether rail lines were analogous

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102. *Id.*

103. ISAAC F. REDFIELD, A PRACTICAL TREATISE UPON THE LAW OF RAILWAYS 1 (2d ed. 1858).

104. *Id.*

105. *Id.*

106. *Id.*

107. *Id.* at 2.

108. *Id.*

109. *Hemingway v. Fernandes*, (1842) 60 Eng. Rep. 89, 92 (Ch.). The judge considered himself bound by *Spencer's Case*, (1582) 77 Eng. Rep. 72, 74 (K.B.), which held that a covenant by a lessee to build a wall on the premises was binding between the lessor and the assignee of the lessee.

110. *Keppell v. Bailey*, (1834) 39 Eng. Rep. 1042, 1048 (Ch.).

111. Contrary positions were considered arguable by counsel. *E.g.*, *Hemingway*, 60 Eng. Rep. at 92; *Keppell*, 39 Eng. Rep. at 1045.

to highways or private property; the choice affected the nature of liability for damage when animals were injured.<sup>112</sup> In *Alton & Sangamon R.R. Co. v. Baugh*,<sup>113</sup> the Illinois Supreme Court held that rail lines were not private property but a form of public thoroughfare.<sup>114</sup> In that case, the decision that rail lines were public was used to argue that railroads had no obligation to protect their neighbors under the principle of *sic utere*<sup>115</sup> by constructing a fence.<sup>116</sup> A contrary decision was reached in a subsequent case, again resulting in a victory for the railroad.<sup>117</sup> In this case, uncertainty led to inconsistency, and arguably, unfairness in application.

The original drafters of the Federal Rules of Civil Procedure in the 1930's almost certainly did not foresee the computer age.<sup>118</sup> The original rule on discovery was limited to "documents, papers, books, accounts, letters, photographs, objects, or tangible things."<sup>119</sup> By 1970, computers were in high enough use that it was considered important to resolve the question of whether electronic data was discoverable. The rule was then amended to explicitly include computer data in order "to accord with changing technology."<sup>120</sup> Evidently, drafters believed that without the clarification, the law would be too uncertain. Since the birth of e-commerce, similar uncertainties have arisen, and been resolved, regarding the status of electronic documents as writings and the status of digital signatures.<sup>121</sup>

The creation of software also led to uncertainty as to its classification: as a good or service (relevant in determining applicability of Article 2 of the Uniform Commercial Code);<sup>122</sup> as a product or service (relevant in determining whether liability for errors in medical computer programs that cause injury is based on negligence or strict liability);<sup>123</sup> as property (relevant

112. *Alton & Sangamon R.R. Co. v. Baugh*, 14 Ill. 210 (1852).

113. *Id.* at 212.

114. *Id.*; HOWARD SCHWEBER, *THE CREATION OF AMERICAN COMMON LAW, 1850-1880*, at 68-69 (2004).

115. *Sic utere* is the requirement that an owner of private property use their land so as not to injure another. SCHWEBER, *supra* note 114, at 16.

116. *Id.* at 68-69.

117. *Chi. & Miss. R.R. Co. v. Patchin*, 16 Ill. 198, 202 (1854); *see also* SCHWEBER, *supra* note 114, at 72-78 (summarizing the decision in *Patchin* and its impact).

118. *Nat'l Union Elec. Corp. v. Matsushita Elec. Indus. Co.*, 494 F. Supp. 1257, 1262 (E.D. Pa. 1980) ("It may well be that Judge Charles Clark and the framers of the Federal Rules of Civil Procedure could not foresee the computer age.").

119. Proposed Amendments to the Federal Rules of Civil Procedure Relating to Discovery, 48 F.R.D. 487, 525 (1970).

120. *Id.* at 527.

121. *See generally* Leif Gamertsfelder, *Electronic Bills of Exchange: Will the Current Law Recognise Them?*, 21 U. NEW S. WALES L.J. 566 (1998) (discussing whether electronic bills of exchange satisfy writing and signature requirements, and whether an electronic bill of exchange can be adduced as evidence in civil proceedings).

122. MICHAEL D. SCOTT, *COMPUTER LAW* § 7.09[A] (2002) (noting a split of opinion on whether software not sold as a bundle with hardware qualifies as goods for the purposes of the Uniform Commercial Code ("UCC")). Cases differed, holding that: it is an issue of fact; that it is services and outside UCC; and that it is goods and governed by the UCC. *Id.*

123. SCOTT, *supra* note 122, at § 15.09[B] (citing *Winter v. G.P. Putnam's Sons*, 938 F.2d 1033, 1036 (9th Cir. 1991) and concluding that only software licensed without significant modification as a standard packaged system is a product); Vincent M. Brannigan & Ruth E. Dayhoff, *Liability for Personal Injuries Caused by Defective Medical Computer Programs*, 7 AM. J. L. & MED. 123, 130-34, 144 (1981) (concluding



for laws of theft);<sup>124</sup> or as a tangible item (relevant for tax purposes).<sup>125</sup> With the development of “intelligent” software, we might also ask whether it is capable of being treated as a person for the purposes of entering into contract, serving as a trustee, or being sued.<sup>126</sup>

*In vitro* fertilization is an example of a biomedical technology where similar problems were encountered. The case of *Davis v. Davis* involved a dispute between a divorced husband and wife over what would be done with their cryopreserved embryos.<sup>127</sup> The law could potentially treat cryopreserved embryos as children, whose custody would be determined in the best interests of the child, or as property, in which case they would be jointly owned by the parties.<sup>128</sup> Trial court Judge W. Dale Young found that “human life begins at the moment of conception” and that the best interests of the child would be served by granting custody of the embryos to Mrs. Davis.<sup>129</sup> The *Davis* case was appealed to the Court of Appeals of Tennessee, which held that the trial court’s decision violated the reproductive rights of Mr. Davis, and ordered that the parties be given joint control over the embryos.<sup>130</sup> On appeal from that decision, the Tennessee Supreme Court struck a middle ground between the two positions.<sup>131</sup> Embryos were neither persons nor property, but were entitled to “special respect because of their potential for human life.”<sup>132</sup> Ultimately, neither analogy was considered appropriate; the court instead resolved the dispute by balancing the parties’ interests.<sup>133</sup> Prior to *Davis v. Davis*, there was real uncertainty as to how disputes over cryopreserved embryos would be viewed. Even after *Davis*, there have been continuing controversies.<sup>134</sup>

In each of these examples, new artifacts, activities, and relationships generated by technological change in diverse fields did not fit easily into existing categories. In other cases, there might be no difficulty with categorization, but rather with issues that arise where a new artifact, activity, or relationship is the first entity to fall within two separate categories. Different systems of rules that might never have operated on the same entity might come into contact for the first time. This creates the potential for inconsistencies and conflict. The operator of an elevator, for example, arguably stood in relation to

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that even specially-designed medical computer programs will be treated as products). *But see* Roy N. Freed, *Products Liability in the Computer Age*, 17 *JURIMETRICS J.* 270, 275-79 (1977) (concluding that it would not be appropriate to treat computer programs as products).

124. *Ward v. Superior Court*, 3 *Computer L. Serv. Rep.* (Callaghan) 206, 208 (Cal. Super. Ct. 1972).

125. Case, *supra* note 7, at 1504.

126. Allen & Widdison, *supra* note 4, at 29 (for purposes of contract); Lawrence B. Solum, *Legal Personhood for Artificial Intelligences*, 70 *N.C. L. REV.* 1231, 1240 (1992) (for purpose of serving as a trustee); Leon E. Wein, *The Responsibility of Intelligent Artifacts: Toward an Automation Jurisprudence*, 6 *HARV. J.L. & TECH.* 103 (1992) (for purposes of liability).

127. *Davis v. Davis*, No. E-14496, 1989 WL 140495, at \*1 (Tenn. Cir. Ct. Sept. 21, 1989).

128. *Id.* at \*9.

129. *Id.* at \*9, 11.

130. *Davis v. Davis*, No. 180, 1990 WL 130807, at \*2-3 (Tenn. Ct. App. Sept. 13, 1990).

131. *Davis v. Davis*, 842 S.W.2d 588, 604-05 (Tenn. 1992).

132. *Id.* at 597.

133. *Id.* at 603-04.

134. Bennett Moses, *Legal Responses*, *supra* note 21, at 612-15.

passengers as both occupier and common carrier.<sup>135</sup> Railroads could be treated as property owners, common carriers, operators of a dangerous machine, holders of a corporate charter, and providers of a public service.<sup>136</sup> The Internet shares features in common with different communications technologies, which have historically been subject to different regulation, and combines aspects of common carriers, broadcasting, and print transactions.<sup>137</sup> Further the outcome of cases involving the Internet frequently depends on whether the Internet is characterized from the user's perspective, as a virtual reality, or from an external perspective, as a physical reality.<sup>138</sup> Patent law becomes uncertain where new technologies combine aspects of more than one field of technology, where such fields had previously been treated differently in the case law.<sup>139</sup> Where a new artifact, activity or relationship can be classified in more than one way, incompatible rules intended to govern different things can both apply, giving rise to uncertainty.

Technologies that cause greater interaction across jurisdictional boundaries can also lead to uncertainty regarding inconsistent requirements, as well as which set of rules to apply. These problems arose in the context of railroads<sup>140</sup> and continue to arise in the context of the Internet.<sup>141</sup> Even where technologies do not themselves give rise to greater inter-jurisdictional activity, the ability of people to avoid restrictions on a technology in one jurisdiction by traveling to another can be a cause for concern. For example, there has been some comment on the issue of reproductive tourism, whereby people cross borders to avoid restrictions on *in vitro* fertilization and surrogacy.<sup>142</sup>

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135. *Haseldine v. Daw*, [1941] 2 K.B. 343, 358, 373. Although, in that case, treatment as a common carrier or occupier did not affect the duty owed. *Id.* at 358.

136. SCHWEBER, *supra* note 114, at 78.

137. Bick, *supra* note 25, at 55-56.

138. See Orin S. Kerr, *The Problem of Perspective in Internet Law*, 91 GEO. L.J. 357, 362 (2003) ("In effect, we not only have two Internets, but two versions of Internet law."); see also Brett M. Frischmann, *The Prospect of Reconciling Internet and Cyberspace*, 35 LOY. U. CHI. L.J. 205, 207 (2003) (responding to Kerr's conclusion that we must choose between perspectives); Stephanie A. Gore, "A Rose by Any Other Name": *Judicial Use of Metaphors for New Technologies*, 2003 U. ILL. J.L. TECH. & POL'Y 403, 425-31 (2003) (discussing the different metaphors which have been used to describe the Internet).

139. Amir A. Naini, *Convergent Technologies and Divergent Patent Validity Doctrines: Obviousness and Disclosure Analyses in Software and Biotechnology*, 86 J. PAT. & TRADEMARK OFF. SOC'Y 541, 543 (2004).

140. See James W. Ely, Jr., "The Railroad System Has Burst Through State Limits": *Railroads and Interstate Commerce: 1830-1920*, 55 ARK. L. REV. 933 (2003) (discussing railroad's influence on the appropriate spheres of state and federal authority); Robert L. Rabin, *Federal Regulation in Historical Perspective*, 38 STAN. L. REV. 1189, 1206 (1986) (explaining the passage of the Interstate Commerce Act in 1887).

141. See, e.g., BRIAN FITZGERALD ET AL., *JURISDICTION AND THE INTERNET* 3 (2004); Michael A. Geist, *Is There a There There? Toward Greater Certainty for Internet Jurisdiction*, 16 BERKELEY TECH. L.J. 1345, 1347 (2001) ("Since websites are instantly accessible worldwide, the prospect that a website owner might be haled into a courtroom in a far-off jurisdiction is much more than a mere academic exercise; it is a very real possibility."); see also *Macquarie Bank v. Berg*, [1999] NSWSC 526 (Austl.), available at [http://www.austlii.edu.au/au/cases/nsw/supreme\\_ct/1999/526.html](http://www.austlii.edu.au/au/cases/nsw/supreme_ct/1999/526.html) (refusing to grant an injunction to restrain defamation because of concerns about variation in defamation laws across jurisdictions); David R. Johnson & David G. Post, *Law and Borders—The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367, 1372 (1996) (noting that the United States only exerts jurisdiction over physical goods that cross territorial borders, not the flow of information via the Internet).

142. E.g., Todd M. Krim, *Beyond Baby M: International Perspectives on Gestational Surrogacy and the*

Sometimes the problem is not with placing a new artifact, activity or relationship into a pre-existing category, but rather with the category itself. Some legal categories and concepts become ambiguous in light of technological change. Consider the example of “mother.” Prior to the use of *in vitro* fertilization, a mother (other than in cases of adoption) was the woman who bore a child and contributed to its genetic identity. Following the introduction of *in vitro* fertilization, it became possible for the concept of “mother” to fragment<sup>143</sup> into at least two people: the woman contributing an ovum, and the woman gestating and delivering the child.<sup>144</sup> Thus a legal rule giving custody of a child to its “mother,” without further definition, becomes uncertain. A similar split can be observed in the notion of “author” in the context of computer-generated works.<sup>145</sup>

Thus new technology can give rise to new uncertainties to which there are no clear answers. In other situations, a legal rule might provide the answer, but this is considered unsatisfactory due to problems of over-inclusiveness, under-inclusiveness, or obsolescence, all of which are discussed below. In these situations, uncertainty might result from concern that the rule will be changed prospectively by a legislature or agency, or retrospectively by courts.

### 3. *The Specialness of Uncertainty Generated by Technological Change*

While the above discussion illustrates how new technologies might be a source of legal uncertainty, it does not indicate what is special about that uncertainty. For that, it is useful to look at the concept of “open texture” as originally used by Frederick Waismann.<sup>146</sup> Waismann argues that language has open texture in that no matter how a sentence is crafted, there is always the ineliminable *possibility* of vagueness.<sup>147</sup> For example, despite the fact it might seem obvious what a finch is, it is always possible to confront an example (such as a finch that spontaneously exploded) that would be difficult to classify. By this logic, it would be impossible to craft a legal rule that was impervious to future uncertainty.<sup>148</sup> The world could always change in such a way that the rule’s interpretation would be affected.

This is different from the concept of open texture employed by H.L.A.

*Demise of the Unitary Biological Mother*, 5 ANNALS HEALTH L. 193, 216 (1996).

143. This term is borrowed from Michael H. Shapiro, *Lawyers, Judges and Bioethics*, 5 S. CAL. INTERDISC. L.J. 113, 118, 130 (1997).

144. Two other women are also possible candidates for motherhood, depending on the circumstances: the woman raising the child, and the woman coordinating or intending the child’s conception.

145. See Darin Glasser, *Copyrights in Computer-Generated Works: Whom, If Anyone, Do We Reward?*, 2001 DUKE L. & TECH. REV. 24, 25-26 (discussing copyright in computer-generated fractals); see also Banzhaf, *supra* note 4, at 240 n.1 (discussing debate over whether computer-generated works are copyrightable).

146. Frederick Waismann, *Verifiability*, in LOGIC AND LANGUAGE (FIRST SERIES) 122, 125 (Antony Flew ed., 1965).

147. *Id.* at 126.

148. See *id.* at 126 (explaining that no concept is ever “limited in such a way that there is no room for doubt”).

Hart.<sup>149</sup> When he referred to open texture, it was to explain the problem of the inherent vagueness of language.<sup>150</sup> He used the example of the term “vehicle,” which has a core of certainty (functional automobiles) and a penumbra of uncertainty (bicycles, roller skates and toy automobiles).<sup>151</sup> Using Hart’s notion of open texture, a sufficiently thoughtful lawmaker can decrease the frequency of cases where uncertainty arises. The statute might, for example, define “vehicle” as including or excluding particular objects. This might increase the law’s certainty at the expense of its simplicity, or it might take too much time to draft, but the balance between certainty and other factors are within the lawmaker’s control.

Thus ordinary uncertainty in law, which can be identified with Hart’s notion of open texture, can be reduced when a law is created, whereas Waismann’s notion cannot. Where technological change could not have been foreseen at the time a law was created,<sup>152</sup> any uncertainty arising as a result of that change may be outside the lawmaker’s control. In this sense, legal uncertainty caused by unforeseen technological change is more problematic than ordinary legal uncertainty.

### *C. Legal Rules may be Over-Inclusive or Under-Inclusive in New Contexts*

The third type of legal dilemma resulting from technological change is the over-inclusiveness or under-inclusiveness of pre-existing laws when applied to new contexts. Like uncertainty, this problem is pervasive but nevertheless distinctive in the context of technological change.

#### *1. Over-Inclusiveness and Under-Inclusiveness as a Persistent Problem*

In order to understand what is meant by over-inclusiveness and under-

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149. HART, CONCEPT OF LAW, *supra* note 91, at 127-28; *see also* Hart, *Positivism*, *supra* note 91, at 607-08 (using the term “penumbra” instead of “open texture”). Although the metaphor of the penumbra is usually attributed to Hart, it previously appears in the writings of both Benjamin Cardozo and Glanville Williams. ENDICOTT, *supra* note 85, at 8 (2000). *See* ANDREI MARMOR, INTERPRETATION AND LEGAL THEORY 132-34 (1992); FREDERICK SCHAUER, PLAYING BY THE RULES: A PHILOSOPHICAL EXAMINATION OF RULE-BASED DECISION-MAKING IN LAW AND IN LIFE 35-36 n.26 (1991); Michael Moore, *The Semantics of Judging*, 54 S. CAL. L. REV. 151, 201 n.128 (1981) for a discussion of the difference between the Hart and Waismann formulations.

150. HART, CONCEPT OF LAW, *supra* note 91, at 127-28; Hart, *Positivism*, *supra* note 91, at 607-08.

151. Hart, *Positivism*, *supra* note 91, at 607.

152. *See* ALVIN TOFFLER, FUTURE SHOCK 191 (1970) (giving examples of dramatic failures of technology prediction); Grant Gilmore, *On Statutory Obsolescence*, 39 U. COLO. L. REV. 461, 467 (1967) [hereinafter Gilmore, *Obsolescence*] (“Our best informed guesses about what is going to happen next have an uncomfortable habit of missing the mark completely.”); David E. Nye, *Technological Prediction: A Promethean Problem*, in TECHNOLOGICAL VISIONS: THE HOPES AND FEARS THAT SHAPE NEW TECHNOLOGIES 159, 161 (Marita Sturken et al. eds., 2004) (referring to a study demonstrating the common failure of technology predictions made by experts); Eugene Volokh, *Technology and the Future of Law*, 47 STAN. L. REV. 1375, 1375-76 (1995) (reviewing M. ETHAN KATSH, LAW IN A DIGITAL WORLD (1995) and identifying four failures of technological prediction).

inclusiveness, it is necessary to discuss the relationship between a rule and its purpose or goal. A person crafting a rule will always have some reason for doing so. In a few cases, the rule might be simply for appearances, but usually the rule-maker hopes that if people act in accordance with the rule, some goal will be achieved. In fact, there will often be multiple parallel and sequential goals. For example, the rule “no vehicles in the park” might be passed because the rule-maker believes that this will reduce the amount of noise that park-users are exposed to, which will make park-users happy, which will, in turn, increase his chances of retaining power. In addition, it will help protect the environment, which the hypothetical rule-maker might believe to be inherently moral.

But the relationship between the rule and any of these goals may be merely probabilistic.<sup>153</sup> There will still be noise in the park if people disobey the rule, if a large crowd gathers for a protest march, or if airplanes regularly fly overhead, amongst other possibilities. Further, the rule will prevent conduct that would not harm—or might even further—one or more higher level goals. For example, park users might be angered at the loss of convenience and mount a political campaign against those voting for the rule. With respect to a particular goal, one can ask whether there are circumstances in which its application is not directed to the goal (over-inclusiveness with respect to that goal) or whether there are circumstances falling outside its scope where its application would further the goal (under-inclusiveness with respect to that goal). The hypothetical “no vehicles in the park” rule, like a rule in the real world, is both over- and under-inclusive with respect to each of its goals. Henceforth, I use the term “targeted” to describe the extent to which a rule is formulated to avoid over- and under-inclusiveness with respect to a particular goal. A single term is useful in this context because over-inclusiveness and under-inclusiveness are not necessarily distinct concepts. A rule might be over-inclusive because another rule (which is an exception to the first) is under-inclusive, or vice versa.

It is, of course, possible to draft a rule that is highly targeted with respect to a single goal by enacting the goal itself. Thus, rather than prohibiting vehicles in the park, one could increase the probability relationship between the rule and one of its goals by, for example, prohibiting conduct that creates noise that disturbs other park-users. This would not, however, necessarily make the rule more targeted when compared against a parallel or higher-level goal. It might, for example, force cancellation of a planned campaigning event.

Even where a rule has a single or dominant purpose, a rule-maker may choose not to simply enact the goal itself. The rule-maker might, for example, want to ensure that the rule is easy to apply, both for those whose conduct is affected and for those who adjudicate cases involving alleged breach of the rule. As part of this, the rule-maker will want to ensure that the rule’s meaning can be understood from the text. The rule-maker might also take into account

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153. SCHAUER, *supra* note 149, at 33.

that citizens usually find it easier to comply with the law if there are fewer rules relating to a particular class of conduct,<sup>154</sup> if these rules require little expertise to interpret and apply, and if there are few decision-making institutions involved.<sup>155</sup> And of course, where there are multiple rule-makers, as in the case of a legislature, compromise may be necessary.<sup>156</sup> This will not necessarily mean that the compromise reached cannot be treated as having a goal or purpose.<sup>157</sup>

Creating rules that are perfectly clear and easy to apply, yet perfectly targeted is virtually impossible, and often these factors will need to be traded off against each other.<sup>158</sup> How that is done is a question for the rule-maker, although others might criticize a rule for over-emphasizing one of these at the expense of another.<sup>159</sup>

## 2. *New Technology as a Cause of Over-Inclusiveness and Under-Inclusiveness*

As was the case for legal uncertainty, technological change aggravates problems of targeting. New artifacts, activities, and relationships may fall within a rule despite being irrelevant to their goals, or they may fall outside it despite a clear connection. For example, the rule stating that vehicles may not drive through a park will include hypothetical “bubble cars” that create no pollution, make no noise and bounce harmlessly off whatever they hit.<sup>160</sup> At the same time, it may not include hypothetical “hover cars” that generate noise and pollution but fly above the park rather than travel through it.<sup>161</sup> Creative interpretation may be able to solve some of the problems of targeting, but not

154. See CARLOS E. ALCHOURRÓN & EUGENIO BULYGIN, *NORMATIVE SYSTEMS* 78 (Mario Bunge ed., 1971) (discussing norms); POSNER, *PROBLEMS*, *supra* note 85, at 48 (pointing out that even clear rules can be confusing if there are too many to learn).

155. Cf. PETER H. SCHUCK, *THE LIMITS OF LAW* 4 (2000) (discussing problems of complexity in the legal system).

156. McNollgast, *Legislative Intent: The Use of Positive Political Theory in Statutory Interpretation*, 57 *LAW & CONTEMP. PROBS.* 3, 16-21 (1994).

157. *Id.*; cf. JEREMY WALDRON, *LAW AND DISAGREEMENT* 142-146 (1999) (pointing out the difficulty in defining any sort of intention for a large, complicated legislative body).

158. Colin S. Diver, *The Optimal Precision of Administrative Rules*, 93 *YALE L.J.* 65, 70-71 (1983). For instance, it has been suggested that a clear, but imprecise rule might increase ease of application. See Isaac Ehrlich & Richard A. Posner, *An Economic Analysis of Legal Rulemaking*, 3 *J. LEGAL STUD.* 257, 264-67 (1974) (discussing the effects of precise rule making on behavior in the legal system); see also GERALD POSTEMA, *BENTHAM AND THE COMMON LAW TRADITION* 447 (1986) (“But rules achieve clarity, certainty, and determinateness, at the price of including either more or fewer cases in the legal categories defined by the rules than the rationale underlying the rules calls for”); Werner Z. Hirsch, *Reducing Law’s Uncertainty and Complexity*, 21 *U.C.L.A. L. REV.* 1233, 1240 (1974) (discussing negative consequences of attempting to enhance certainty).

159. See Diver, *supra* note 158, at 74 (discussing the difficulty in balancing transparency, accessibility and congruence).

160. Larry Alexander, *All or Nothing at All*, in *LAW AND INTERPRETATION* 357, 358 (Andrei Marmor ed., 1997).

161. In this sense, Gilmore is wrong to assert that the only problem that a lawmaker should fear is over-inclusiveness. See GILMORE, *AGES*, *supra* note 18, at 96 (“With luck, the statute will turn out to have nothing to say that is relevant to the new issues, which can then be decided on their own merits.”). In the absence of a rule, the default norm is permission, not whatever a court thinks it ought to be.

all.<sup>162</sup>

Those exploring legal issues related to new technologies often draw attention to instances where existing laws are poorly targeted when applied to new contexts. For example, in her Article entitled *Accommodating Technological Innovation: Identity, Genetic Testing and the Internet*,<sup>163</sup> Professor Gaia Bernstein explores how the Internet and genetic testing both have the capacity to change our perceptions of identity, and in particular the relative dominance of communitarian and liberal meta-narratives.<sup>164</sup> She is critical of the law's failure to recognize that these identity interests have been impacted by genetic testing and the Internet.<sup>165</sup> Existing legal rules, such as privacy rules, that previously protected identity interests are failing to do so in the new technological contexts.<sup>166</sup> Professor Bernstein's complaint about the failure of existing laws to protect identity interests in the contexts of the Internet and genetic testing can be seen as a problem of the under-inclusiveness of existing privacy laws, when viewed against the goal of protecting identity interests.

Another legal problem arising out of new technology that involves under-inclusiveness is genetic discrimination. Remedies available to victims of discrimination in the Americans with Disabilities Act ("ADA") do not protect victims of genetic discrimination, even though the issue it addresses is analogous. The ADA prohibits discrimination in an employment context (where there are more than fifteen employees) on the grounds that a person has a disability.<sup>167</sup>

The ADA specifically defines "disability." "The term 'disability' means, with respect to an individual—(A) a physical or mental impairment that substantially limits one or more of the major life activities of such individual; (B) a record of such an impairment; or (C) being regarded as having such an impairment."<sup>168</sup> This clearly protects against discrimination on the basis of an existing impairment, whether or not it was caused by a genetic disease. However, it may not protect against discrimination on the basis of pre-symptomatic information regarding one's genetically determined propensity to a particular disease. The Equal Employment Opportunity Commission stated in its compliance manual written in 1995 that the ADA covers discrimination against a person on the basis of pre-symptomatic genetic information because such discrimination involves "regarding the individuals as having impairments that substantially limit a major life activity."<sup>169</sup> However, the Commission's view seems to have been implicitly rejected by the Supreme Court. The Court

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162. *Id.*

163. Bernstein, *Accommodating Technological Innovation*, *supra* note 28, at 966-69.

164. *Id.* at 968.

165. *Id.* at 968-69.

166. *Id.* at 968.

167. 42 U.S.C. § 12111(5)(A) (2000). *See generally* 42 U.S.C. §§ 12101-12117 (prohibitions on employment discrimination).

168. 42 U.S.C. § 12102.

169. *Definition of the Term Disability*, EEOC Comp. Man., § 902, available at <http://www.eeoc.gov/policy/docs/902cm.html> (last visited Nov. 12, 2007).

has stated that the use of the present indicative verb “limits” means that the ADA does not protect individuals who face discrimination on the basis of potential disabilities.<sup>170</sup> The “being regarded as” prong of the definition does not help because it only applies when the employer mistakenly believes that the individual has a current impairment or mistakenly believes that the impairment substantially limits one or more major life activities.<sup>171</sup> Thus an individual has a remedy if an employer mistakenly believes that the person’s genetic status is currently disabling but not if the employer is concerned about the future health of the employee.<sup>172</sup> A person facing discrimination on the ground of pre-symptomatic information about a genetic disease might be able to argue that the ADA applies where their “defective” genes *currently* limit a major life activity such as reproduction.<sup>173</sup> This is how people with HIV are able to fall within the protection of the ADA.<sup>174</sup> However, it is not clear whether those with a genetic predisposition would be able to rely on this argument.<sup>175</sup> While HIV status will always affect a decision to conceive, this is not the case with all genetic information. For example, there might be no chance (other than through mutation) that a recessive condition would affect one’s children, although it may reappear in subsequent generations. Also, embryos might be genetically screened through an *in vitro* fertilization program to avoid passing on the “defective” genes. While not everyone will agree that the ADA should extend to genetic discrimination, there are many who believe that similar protection should be available.<sup>176</sup>

Railroad lawyers, dealing with the new technology of their time, had experienced similar problems with targeting. For example, railroads could hardly be expected to make actual delivery of goods to consignees on their own premises, as was normally the duty of common carriers.<sup>177</sup> In addition, the rule that an easement in gross could not be assigned<sup>178</sup> was a particular problem for railroads, who often held easements at a distance from their own property.<sup>179</sup> Courts therefore decided to carve out an exception for easements in gross of a commercial character.<sup>180</sup>

Another railroad example can be seen in the history of the rules (fellow servant rule and assumption of the risk) limiting the liability of employers for

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170. Sutton v. United Air Lines, 527 U.S. 471, 482 (1999).

171. *Id.* at 489-90.

172. Bragdon v. Abbott, 524 U.S. 624, 641-42 (1998).

173. *Id.*

174. *Id.*

175. See *Laws v. Pact, Inc.*, 2000 U.S. Dist. LEXIS 8473, at \*8-9 (N.D. Ill. Apr. 19, 2000) (mentioning the issue, although the court did not need to reach a decision). See generally Sheri Mezoﬀ, Note, *Forcing a Square Peg Into a Round Hole: The Negative Ramifications of Misaligned Protection for Predisposed Individuals Under the ADA*, 85 B.U. L. REV. 323 (2005) (considering the applicability of the ADA to discrimination against individuals with a genetic predisposition to disease).

176. See sources cited *supra* note 16.

177. ELY, *supra* note 20, at 182.

178. See JESSE DUKEMENIER & JAMES KRIER, PROPERTY 830 (4th ed., 1998) (noting that some early cases held an easement in gross was not transferable, but some recent cases allow it in certain instances).

179. JOHN E. CRIBBET, PRINCIPLES OF THE LAW OF PROPERTY 342 (2d ed. 1975).

180. DUKEMENIER & KRIER, *supra* note 178.



employee injuries. The fellow servant rule was originally used in a simple master-servant context in *Priestley v. Fowler*.<sup>181</sup> The judge in that case was concerned that, because the servant was in at least as good a position as the master to know whether the van was overloaded, a finding of liability on the part of the master might “be an encouragement to the servant to omit that diligence and caution which he is in duty bound to exercise on behalf of his master.”<sup>182</sup> This logic was applied to a railway case in the United States in *Farwell v. Boston & Worcester Railroad*,<sup>183</sup> which created the assumption of risk defense. Chief Justice Shaw pointed to similar concerns in that case, noting that the safety of all was best ensured by placing liability on the employee, although he also pointed to other considerations. Even if that was the case on railroads in 1842, the invention of safety devices such as driver brakes, power brakes, and automatic couplers changed the situation.<sup>184</sup> By 1891, President Benjamin Harrison addressed the Senate and the House of Representatives, observing that consistent deployment of air brakes and automatic couplers would “very greatly reduce the present fearful death rate among railroad employees.”<sup>185</sup> Yet, in the year 1890, of the 94,787 new freight cars in the United States, only 16,287 were equipped with train brakes, and only about a third were fitted with automatic couplers.<sup>186</sup> It would seem that the railroads, rather than the employees, were now in the best position to ensure safety.<sup>187</sup> Without legal change, they had little incentive to do so.<sup>188</sup> On this basis, the Federal Railroad Safety Appliances Act of 1893 was passed to mandate certain safety apparatus and to provide that, where such devices were not used, an employer would not be entitled to rely on the assumption of the risk defense.<sup>189</sup>

From the field of computing, an example of poor targeting bred of technological change can be seen in the fate of the business entries exception to the hearsay rule. Under this rule, a business record was only admissible as evidence without its author appearing as a witness if: (1) the entry was original or the first permanent copy, (2) its author is not available to testify, (3) the record was based upon the first-hand observation of someone in a position to know the facts recorded, and (4) the record was made in the usual course of

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181. *Priestley v. Fowler*, (1837) 150 Eng. Rep. 1030-31 (Exch.).

182. *Id.*

183. 45 Mass. 49, 56-58 (1842).

184. Ehrlich & Posner, *supra* note 158, at 277.

185. President Benjamin Harrison, Address to the Senate and House of Representatives (Dec. 9, 1891) in PUBLIC PAPERS AND ADDRESSES OF BENJAMIN HARRISON, TWENTY-THIRD PRESIDENT OF THE UNITED STATES, at 122 (1893).

186. H.R. Rep. No. 52-1678, at 5 (1892).

187. *See* *St. Louis, Iron Mountain & S. R.R. Co. v. Taylor*, 210 U.S. 281, 295-96 (1908) (implying that employees are helpless to change their situation, and that “Congress, contemplating the inevitable hardship of such injuries, and hoping to diminish the economic loss to the community resulting from them, should deem it wise to impose their burdens upon those who could measurably control their causes, instead of upon those who are, in the main, helpless in that regard”).

188. JOHN FABIAN WITT, *THE ACCIDENTAL REPUBLIC: CRIPPLED WORKINGMEN, DESTITUTE WIDOWS, AND THE REMAKING OF AMERICAN LAW* 31 (2004) (describing environment in which railroads had no incentive to change due to limited liability and profit motive).

189. *See* Act of Mar. 2, 1893, 27 Stat. 531, 531-32 (mandating railroad standards and safety equipment).

business shortly after the transaction to which it relates.<sup>190</sup> This rule no longer made sense when business records were kept in a computer. In a computerized system, records are constantly updated and stored cumulatively, so that the original record is discarded, bringing them outside the business records exemption.<sup>191</sup> Additionally, since the computer record itself could not be produced, the only option was a printout, usually made especially for trial.<sup>192</sup> When confronted with computer printouts that would be rendered inadmissible due to the under-inclusiveness of the business records exception to the hearsay rule, many courts altered the rule to admit the evidence.<sup>193</sup>

### 3. *The Specialness of Over-Inclusiveness and Under-Inclusiveness Generated by Technological Change*

The above examples show that problems of targeting can arise as a result of a wide variety of new technologies. These targeting problems that arise as a result of technological change are qualitatively different from targeting problems that exist at the time a rule is formulated. Only in the latter case is the poor correlation between a rule and its goal usually deliberate, perhaps to ensure greater clarity or ease of application, due to haste, or as part of a compromise. On the other hand, it is possible that, had the rule's creator foreseen the new technology, the rule would have been worded so as to correspond more closely to one of its goals. For instance, had bubble cars and hover cars been invented when the hypothetical "no vehicles in the park" rule was enacted, the rule may have been worded differently. Technological change has the effect of upsetting the balance reached at the time of the rule's creation.

#### *D. Technological Change Renders Some Laws Obsolete*

It has been said that "law must be contemporary to be viable."<sup>194</sup> Rules that are considered bad by virtue of their age have been described as obsolescent,<sup>195</sup> anachronisms,<sup>196</sup> or simply old.<sup>197</sup> The problem of

190. EDITH L. FISCH, *FISCH ON NEW YORK EVIDENCE*, §§ 831-37, 410-16 (1959) (illustrating a specific example of this rule); CHARLES T. MCCORMICK, *HANDBOOK OF THE LAW OF EVIDENCE* §§ 281-88, 596-606 (1954).

191. Brown, *supra* note 5 at 248 (referring to the relevant rule as "an anachronism"); Reese, *supra* note 5 at 1035 (detailing cumulative storage).

192. Brown, *supra* note 5, at 248.

193. *E.g.*, King v. State *ex rel.* Murdock Acceptance Corp., 222 So. 2d 393, 397-99 (Miss. 1969); *Transp. Indemn. Co. v. Seib*, 132 N.W.2d 871, 873-75 (Neb.1965).

194. ROBERT E. KEETON, *VENTURING TO DO JUSTICE* 17 (1969) *see also* FRANCIS LIEBER, *LEGAL AND POLITICAL HERMENEUTICS* 135 (1839) ("[I]f obsolete laws are not abolished by the proper authority, practical life itself, that is, the people, will and must abolish them, or alter them in their application . . .").

195. *See generally* Gilmore, *Obsolescence*, *supra* note 152, at 476-77 (discussing the tendency of statutes to become obsolete).

196. *See generally* Roscoe Pound, *Anachronisms in Law*, 3 J. AM. JUDICATURE SOC'Y. 142 (1920) (discussing the evolution of the science of law and its effects on society).

197. *See generally* Robert C. Berry, *Spirits of the Past: Coping with Old Laws*, 19 U. FLA. L. REV. 24 (1966) (discussing the applicability of old laws in today's society).

obsolescence has led some scholars to urge judges to be more willing to abandon old common law,<sup>198</sup> and even statutory,<sup>199</sup> rules and to call for the creation of bodies able to direct the cause of law reform.<sup>200</sup> As Felix Frankfurter commented: “If facts are changing, law cannot be static. So-called immutable principles must accommodate themselves to the facts of life, for facts are stubborn and will not yield.”<sup>201</sup>

Rules are devised in a particular technological context, with explicit and implicit assumptions as to what is possible. Traffic rules, for example, are created with assumptions as to the capacity of automobiles. They can be capable of great speeds which can result in harmful collisions (thus, making speed limits necessary), but not of vertical movement (thus eliminating the need for rules regulating altitude).

Technological change may render existing rules obsolete or less useful for different reasons:

- (1) the conduct that was targeted by the rule may have been replaced with new forms of conduct (such as if teleporters were to replace cars as the primary mode of transportation);
- (2) the invention and diffusion of new technologies may change the underlying facts that had justified some legal rules (for example, if cars in the future could bounce harmlessly off one another);
- (3) the availability of new technologies may alter the cost of violating and enforcing legal rules<sup>202</sup> (as where radar detectors<sup>203</sup> help speeders avoid detection).<sup>204</sup>

### 1. *Technological Change can Reduce the Importance of Regulated Conduct*

A rule implicitly assumes that the conduct it regulates is something that does or could take place. A rule may thus become obsolete where patterns of conduct have changed so that this assumption is no longer accurate. For example, the mailbox rule in contract law is no longer required where written communication is usually conducted instantaneously.<sup>205</sup> Although this may appear harmless, in the sense that the rule will no longer play a role, it can be a

198. *E.g.*, ROBERT E. KEETON, *VENTURING TO DO JUSTICE* (1969) (reasoning that judges are adopting a new view on old common law); Brown, *supra* note 5, at 243-44.

199. *See generally* GUIDO CALABRESI, *A COMMON LAW FOR THE AGE OF STATUTES* (1982).

200. *E.g.*, Henry J. Friendly, *The Gap in Lawmaking – Judges Who Can’t and Legislatures Who Won’t*, 63 COLUM. L. REV. 787, 802 (1963) (supporting Roscoe Pound’s proposal that “what is needed is ‘a ministry of justice, charged with the responsibility of making the legal system an effective instrument of justice’”).

201. FELIX FRANKFURTER, *The Zeitgeist and the Judiciary*, in FELIX FRANKFURTER ON THE SUPREME COURT 1, 3 (Phillip B. Kurland ed., 1970).

202. David Friedman, *Does Technology Require New Law?*, 25 HARV. J.L. & PUB. POL’Y 71, 71 (2001) [hereinafter David Friedman, *New Law*].

203. *See e.g.*, VA. CODE ANN. § 46.2-1079 (2007) (making radar detectors illegal).

204. *See* David Friedman, *New Law*, *supra* note 202 (providing a similar analysis of obsolescence as a result of new technologies).

205. Gregory E. Perry & Cherie Ballard, *A Chip by Any Other Name Would Still Be a Potato: The Failure of the Law and its Definitions to Keep Pace with Computer Technology*, 24 TEX. TECH. L. REV. 797, 824 (1993).

problem if the regulated conduct has been replaced by conduct that causes harm of a type the rule sought to avoid, but does not fall within the rule itself. An example of legislation that has become less relevant is the Audio Home Recording Act of 1992.<sup>206</sup> This was enacted to ensure that copyright owners would be compensated for digital copying, which at the time involved digital tapes.<sup>207</sup> Because it was designed specifically for this context, and not digital copying more generally, it has failed to provide compensation for the vast amount of digital copying that now occurs (generally over the Internet).<sup>208</sup> There is no real reason to repeal the Audio Home Recording Act, but other legislation would be necessary in order to work towards the original goal.<sup>209</sup>

## 2. *Technological Change can Undermine the Justification for Legal Rules*

As discussed in Part III.C above, a rule will generally be formulated in order to achieve one or more goals, but will usually be less than perfectly targeted. The link between a rule and its goals is based on assumptions about the world. For example, the “no vehicles in the park” rule might be thought to further the goal of allowing users to enjoy the park in peace because vehicles make noise that disturbs park-users. If some new vehicles are designed that do not make noise, a rule banning vehicles in order to eliminate noise is over-inclusive. If all vehicles are designed in this way, the entire rule may become an anachronism.

While this example may appear far-fetched, rules are often said to be obsolete due to technological changes that affect the perceived necessity of particular rules.<sup>210</sup> Consider section 1962(5) of the California Code of Civil Procedure, enacted in 1872, which states, “the issue of a wife cohabiting with her husband, who is not impotent, is indisputably presumed to be legitimate.”<sup>211</sup> The purpose of this provision was presumably to avoid speculation where paternity was difficult to determine, thus protecting the institution of marriage and the children of that marriage,<sup>212</sup> but to recognize

206. Pub. L. No. 102-563, 106 Stat. 4237 (1992) (codified as 17 U.S.C. 1001 (2000)).

207. Aaron L. Melville, *The Future of the Audio Home Recording Act of 1992: Has It Survived the Millennium Bug?*, 7 B.U. J. SCI. & TECH. L. 372, 379-80 (2001).

208. *Id.* at 381-82 (citing Recording Indus. Ass’n of Am. v. Diamond Multimedia Sys., Inc., 180 F.3d 1072 (1999) as indicating the limitations of the Audio Home Recording Act).

209. Another example of legislation that no longer plays as important a role as originally envisaged is the Semiconductor Chip Protection Act. Pub. L. No. 98-620, 98 Stat. 335 (1986) (codified at 17 U.S.C. §§ 901-914 (2007)); see Dan L. Burk, *Biotechnology in the Federal Circuit: A Clockwork Lemon*, 46 ARIZ. L. REV. 441, 452 (2004) (explaining that the Semiconductor Chip Protection Act is essentially irrelevant to the industry); Morton D. Goldberg, *Semiconductor Chip Protection as a Case Study*, in GLOBAL DIMENSIONS OF INTELLECTUAL PROPERTY RIGHTS IN SCIENCE AND TECHNOLOGY 329, 331-32 (Mitchel B. Wallerstein et al. eds., 1993) (concluding that the Semiconductor Chip Protection Act failed in its goals).

210. *E.g.*, CASS SUNSTEIN, *LEGAL REASONING AND POLITICAL CONFLICT* 131-32 (1996) (giving two examples: (1) the development of automated teller machines and prohibitions on branch banking, and (2) the rise of cable television and regulations designed for a small number of networks); Cass Sunstein, *Problems with Rules*, 83 CAL. L. REV. 953, 993 (1995); see also R v. Iby (2005) 63 N.S.W.L.R. 278, 288 (Austl.) (“The born alive rule is, as I have indicated above, a product of primitive medical knowledge and technology and of the high rate of infant mortality characteristic of a long past era.”).

211. CAL. CIV. PROC. § 1962(5) (1872).

212. Jana Singer, *Marriage, Biology, and Paternity: The Case for Revitalizing the Marital Presumption*,

alternative paternity where the husband could not have been the father. Although we cannot be sure, the rule seems to assume that impotence and lack of co-habitation are the only obvious ways of knowing that the husband is not the father. But it is easier to exclude paternity today than it was in 1872. Since the 1930s, blood tests have been used as evidence in paternity suits, and more recently, DNA tests can determine paternity with a high degree of accuracy.<sup>213</sup> The distinction made in the rule (between impotent and fertile men) and the availability of testing are in tension.<sup>214</sup> In 1980, the rule was changed to allow the husband's non-paternity to be determined by blood tests.<sup>215</sup> Of course, it may be appropriate to prevent or limit the ability of a husband to deny paternity through DNA testing,<sup>216</sup> but this would require development of a new rationale or balancing of the interests involved. The original rule would be arbitrary in the modern era.<sup>217</sup>

Another example can be found in the changing technology of radio. Immediately prior to the enactment of the Radio Act of 1927, interference on radio was common.<sup>218</sup> There was concern that, without order imposed by law, listeners would hear nothing but noise on their radio sets.<sup>219</sup> The only technical mechanism for avoiding interference at the time involved transmitting separate signals on different frequencies.<sup>220</sup> Techniques dating back to the 1940s allow two or more transmitters to co-exist on the same frequency without interference.<sup>221</sup> The modern technology most frequently discussed in this context is spread spectrum, which allows for low power signals to be sent simultaneously over the same band of frequencies without interference,<sup>222</sup> but there are other means to share spectrum without interference.<sup>223</sup> Various arguments have been made that the availability of such technology undermines the justification for government grants of exclusive rights in the use of particular frequencies.<sup>224</sup> These arguments have been partially successful, and increasing amounts of spectrum have been allocated to common—rather than property-based—uses.<sup>225</sup> Arguably, we

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65 MD. L. REV. 246, 256 (2006).

213. See John M. Maguire, *A Survey of Blood Group Decisions and Legislation in the American Law of Evidence*, 16 S. CAL. L. REV. 161, 164-65 (1943) (discussing the use of blood grouping technique as evidence in cases of disputed paternity).

214. Donald C. Hubin, *Daddy Dilemmas: Untangling The Puzzles Of Paternity*, 13 CORNELL J.L. & PUB. POL'Y 29, 50 (2003).

215. 1980 Cal. Stat. 1310 (effective Sept. 30, 1980) (codified at Cal. Fam. Code §§ 7540-41). Other states have made similar amendments. *E.g.*, NEV. REV. STAT. §§ 126.121-.131.

216. See, *e.g.*, Singer, *supra* note 212 (suggesting options for paternity reform, including a consideration that paternity tests be mandatory when a child is born).

217. *Id.*

218. JAMES MORTON HERRING & GERALD C. CROSS, *TELECOMMUNICATIONS: ECONOMICS AND REGULATION* 244-46 (1936).

219. DAVID LOTH & MORRIS L. ERNST, *THE TAMING OF TECHNOLOGY* 127 (1972).

220. *Id.* at 126-27.

221. Kevin Werbach, *Supercommons: Toward a Unified Theory of Wireless Communication*, 82 TEX. L. REV. 863, 874 (2004).

222. LAWRENCE LESSIG, *THE FUTURE OF IDEAS* 73-84, 218-33 (2001).

223. Werbach, *supra* note 221 at 874, 898-99.

224. *Id.* at 875-76.

225. *Id.* at 878.

should go further. It is also arguable that, despite the availability of new technologies, private ownership is still optimal.<sup>226</sup> However, it is difficult to deny that technological change has reduced the primary rationale for the current regime of radio regulation and that re-evaluation is desirable.

An older example can be found in the invention of barbed wire.<sup>227</sup> At common law, the owner of an animal was liable for damage caused on another's land.<sup>228</sup> Because the right of drovers to use the open range was considered important, some state legislatures "passed fencing-out statutes, declaring that farmers and other landowners could only recover for damage caused by rampaging cattle if they had erected a lawful fence of material and dimensions calculated to prevent the entrance of cattle."<sup>229</sup> The introduction of barbed wire turned the intention of this statute on its head.<sup>230</sup> Once it was cheap to fence large tracts of land, statutes designed to allow animals to range no longer had that effect.<sup>231</sup> Ultimately, the farmers—who had previously lost in the legislature—prevailed.<sup>232</sup>

In each of these examples, the rule became obsolete because at some level, a goal it was meant to serve became redundant. It is no longer necessary to distinguish between men who *could not be* fathers and men who *are not* fathers, to divide up the radio spectrum, or to allow animals to roam over unfenced private land, there being little of it left. Changing technology can also lead to policy shifts on a larger scale. For example, it has been argued that improvements in technology generally have enhanced arguments for free enterprise policies.<sup>233</sup>

### 3. *Technological Change can Reduce Cost-Effectiveness*

Laws may also be described as obsolete where technological change has made them prohibitively difficult to enforce. Arguments have been made that traditional copyright laws are obsolete due to the introduction and increased use of the Internet,<sup>234</sup> that rules banning the use of drugs in sporting

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226. See Stuart Minor Benjamin, *Spectrum Abundance and the Choice Between Public and Private Control*, 78 N.Y.U. L. REV. 2007, 2007 (2003) (discussing the advantage of private ownership).

227. CALABRESI, *supra* note 199, at 244.

228. *Id.*

229. *Id.*

230. See *id.* (indicating that it was not feasible until the invention of barbed wire to fence out cattle).

231. See *id.* (noting that some common law courts reverted to the older rule).

232. See *id.* (noting that the reversion to the traditional rule would put the cost back on the owner of the animals).

233. CATO INST., *The HALF LIFE OF POLICY RATIONALES: HOW NEW TECHNOLOGY AFFECTS OLD POLICY ISSUES 2-3* (Fred E. Foldvary & Daniel B. Klein eds., 2003) (giving numerous examples of how technology has reduced transaction costs, increased complexity, and reduced centralization and the need for monopolies).

234. E.g., John Kelsey & Bruce Schneier, *The Street Performer Protocol and Digital Copyrights*, FIRST MONDAY, June 1999, <http://www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/view/673/583>. Enhanced copyright regimes, such as the Digital Millennium Copyright Act, are less susceptible to these problems, however they are only effective due to the inability of most users to break through the protection measures. See Digital Millennium Copyright Act of 1998, Pub. L. No. 105-304, § 103, 112 Stat. 2860, 2863-76 (1998) (codified at 17 U.S.C. § 1201) (providing penalties for circumventing technological protection measures).

competitions cannot withstand the introduction of undetectable drugs,<sup>235</sup> and that ordinary wiretapping statutes are insufficient in light of telecommunications advances.<sup>236</sup>

### *E. Summary of Part III*

There are thus four different types of legal problems that might arise in a context of technological change. These, together with subcategories, can be set out as follows:

- (A) The need for special rules to deal with a new situation;
- (B) Uncertainty as to how the law applies to new forms of conduct, in particular: uncertainty as to how a new activity, entity, or relationship will be classified; uncertainty where a new activity, entity, or relationship fits into more than one category, so as to become subject to different and conflicting rules; uncertainty in the context of conflicts of laws; and uncertainty where an existing category becomes ambiguous in light of new forms of conduct;
- (C) Over-inclusiveness and under-inclusiveness (sometimes described as problems of targeting in new contexts);
- (D) Obsolescence where conduct regulated by an existing law is no longer important, a rule can no longer be justified, or a rule is no longer cost-effective.<sup>237</sup>

These categories connect the legal problems encountered in the context of technological change in very different industries from transportation and medicine, to computing and communications.<sup>238</sup> Although similar problems exist in the absence of technological change, there is an important difference.<sup>239</sup> When laws are generally too unclear, poorly targeted, irrelevant, or inefficient, the blame can be placed on the lawmaker. Where technological change intervenes, lawmakers might be accused of responding too slowly but not necessarily of having made an initial error.<sup>240</sup> This also distinguishes our reaction to technological change from our reaction to changes in information, behavior, and cultural norms.<sup>241</sup>

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235. David Galluzzi, *The Doping Crisis in International Athletic Competition: Lessons from the Chinese Doping Scandal in Women's Swimming*, 10 SETON HALL J. SPORT L. 65, 93 n. 222 (2000). Examples of supplements that have been undetectable, at least temporarily, are tetrahydrogestrinone, human growth hormone, and erythropoietin. *I Was THG Whistleblower, Admits Gatlin Coach*, ABC ONLINE, Aug. 23, 2004, <http://www.abc.net.au/sport/content/200408/s1182730.htm>.

236. *But cf.* Communications Assistance for Law Enforcement Act, 47 U.S.C. §§ 1001-1010 (2000) (addressing wiretapping and new technology, but placing limitations on design, information services, private networks and encryption).

237. *See generally* Lyria Bennett Moses, *Why Have a Theory of Law and Technological Change*, 8 MINN. J. L. SCI. & TECH. 589 (2007) (discussing the rationale for a legal theory of technological change).

238. *Id.* at 595-97.

239. *Id.*

240. *See id.* (discussing legal reform).

241. *Id.* at 598-605.

#### IV. THE IMPOSSIBILITY OF TECHNOLOGY-NEUTRAL DRAFTING AND THE NEED FOR A BROADER INSTITUTIONAL APPROACH

The classification set out in Part III will be used in this Part to discuss the notion of technological neutrality in law. Technological neutrality is often seen as a positive feature of legislation, since being independent of any particular technology ensures the law will apply effectively and fairly in different technological contexts. However, the use of seemingly technology-neutral language will not always achieve this goal, at least in areas where technologies are evolving. Instead, this Part presents an alternative vision: the design of a legal system better able to operate in a world of constantly shifting technology. This is not simply a question of how legislation is worded and structured, but rather requires a broader institutional approach. In order to create a legal system that operates effectively in a world of rapidly evolving technology, the roles of administrative agencies, courts, and law reform bodies are crucial. Thus only when technological neutrality is reconceived as a property of systems of law, rather than as a characteristic of particular statutes, does it become an achievable objective.

##### A. *The Goals of Technological Neutrality*

It is often stated that, generally speaking, laws should be drafted in a technology-neutral way, especially where they are intended to fulfill a broadly conceived goal.<sup>242</sup> What is less clear is precisely what this involves or how it might be achieved. Of the more than four hundred articles referring to technology-neutral laws,<sup>243</sup> few consider the ambiguity involved in this expression and discuss how technology-neutral lawmaking might be achieved.<sup>244</sup>

Where the term “technology-neutral” is employed, it is usually in the context of either of two benefits that technology-neutral drafting is seen to confer. First, technology-neutral legislation would not unfairly or inefficiently discriminate between technologies. In other words, legislation should not treat

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242. Technological neutrality is not necessarily a good thing. Alberto Escudero-Pascual & Ian Hosein, *Questioning Lawful Access to Traffic Data*, COMM. OF ACM, Mar. 2004, 77, 77. There may also be situations where technology neutrality is not an appropriate goal. As the Earl of Northesk stated during the House of Lords debate on the Regulation of Investigatory Powers Act 2000: “One of the many difficulties I have with the Bill is that, in its strident efforts to be technology neutral, it often conveys the impression that either it is ignorant of the way in which current technology operates, or pretends that there is no technology at all.” 28 PARL. DEB., H.L. (5th ser.) (2000) 1012.

243. A search on LexisNexis on June 11, 2006 in the category of United States and Canadian Law Reviews for “technolog! w/2 neutral” found 506 articles, of which exactly one hundred used those terms in a different context.

244. See generally Ysolde Gendreau, *A Technologically Neutral Solution for the Internet: Is it Wishful Thinking?*, in COPYRIGHT IN THE NEW DIGITAL ERA: THE NEED TO REDESIGN COPYRIGHT (Irina A. Stamatoudi & Paul L.C. Torremans eds., 2002) (considering the issue of technological neutrality in some detail); Bert-Jaap Koops, *Should ICT Regulation be Technology-Neutral?*, in STARTING POINTS FOR ICT REGULATION: DECONSTRUCTING PREVALENT POLICY ONE-LINERS 77, 77 (Bert-Jaap Koops et al. eds., Nat’l Programme for Info. Tech. and Law, Information Technology and Law Series No. 9, 2006) (analyzing the starting point that regulation should be technology-neutral).



different technologies differently if the rationale behind the legislation would apply equally to each technology. In particular, legislation should not force the use of one technology where an equivalent alternative technology is available. In the language of Part III, laws should not be over-inclusive or under-inclusive with respect to a particular technology. Secondly, technology-neutral drafting might be seen as having broader benefits. As well as being well-targeted, technology-neutral legislation ought not to become obsolete merely because technology has changed. Further there ought to be no difficulty in deducing how its provisions apply merely because the technological context has changed. In this second sense, technological neutrality aims to avoid uncertainty, poor targeting and obsolescence as the technological context evolves.

*B. Drafting Techniques Cannot Always Avoid Discrimination between Technologies*

Technological neutrality is often used to describe statutes that do not confer an advantage on one technology where equivalent alternatives exist. Used in this sense, technology neutrality involves nondiscrimination between competing technologies.<sup>245</sup> The merits of technology neutrality in the sense of nondiscrimination between competing or potentially competing technologies are most frequently discussed in the contexts of telecommunications regulation<sup>246</sup> and electronic signature legislation.<sup>247</sup> Nondiscrimination between technologies is particularly important where legislation would otherwise force the use of one technology despite the existence of alternatives that could achieve equivalent outcomes.

According to a policy of nondiscrimination, one would treat different technologies equally provided that there are no relevant differences between them, but discriminate on the basis of relevant difference. Discrimination on the basis of relevant difference may require statutes to adopt technology-specific language. For example, due to differences in costs, it is arguably appropriate to restrict the sending of unsolicited faxes to a greater degree than the sending of unsolicited e-mails.<sup>248</sup> Technology neutrality is not about treating all technologies the same irrespective of difference; it is about ensuring that only relevant differences result in different treatment. In other words, technology neutrality avoids favoritism among equivalent options.

Crafting a rule that treats comparable technologies the same requires

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245. The federal government of Australia committed itself to a technologically neutral approach to e-commerce regulation on this basis. PARLIAMENT OF THE COMMONWEALTH OF AUSTRALIA, HOUSES OF REPRESENTATIVES, EXPLANATORY MEMORANDUM: ELECTRONIC TRANSACTIONS BILL 1999, at 3 (Austl. 1999), available at <http://www.aph.gov.au/parlinfo/billsnet/1e99131.pdf> ("Technology neutrality means that the law should not discriminate between different forms of technology . . .").

246. E.g., Douglas C. Sicker, *The End of Federalism in Telecommunication Regulations?*, 3 NW. J. TECH. & INTELL. PROP. 130, 149-50 (2005) (exploring the effects of regulation on telecommunications technology).

247. E.g., Adam White Scoville, *Clear Signatures, Obscure Signs*, 17 CARDOZO ARTS & ENT. L.J. 345, 373-74 (1999) (discussing the rigidity of technology-specific laws in the field of electronic signatures).

248. Koops, *supra* note 244 at 83 n.17 (citing 47 U.S.C. § 227).

parity between the formulation of a rule and its goals. The difficulty of achieving this can be seen in the following hypothetical example. Consider a rule in the following form:

*All vehicles sold within the jurisdiction must be fitted with ABS braking technology.*

A hierarchy of goals for such a rule might look something like this:

*It is important that vehicles can stop quickly in different weather conditions.*

*It is better if there are fewer accidents on the roads.*

*It is important that fewer people die on the roads.*

*It is important that fewer people die.*

*Human life is valuable.*

Avoiding discrimination between existing technologies is relatively straightforward. There are in existence different types of technologies that can be used to achieve short stopping distances. There is no reason to favor one of these (ABS brakes) over any other, provided the other technologies are relevantly the same (in this case, are able to stop within the same distance in similar weather conditions).<sup>249</sup> Thus, rather than mandating ABS brakes, one can draft a series of rules in the following form:

*All road vehicles sold within the jurisdiction must be able to come to a complete stop from a speed of  $x$  within  $y$  meters on a road containing  $z$  millimeters of water.*

This rule does not on its face discriminate between braking technologies; rather, it evaluates each according to performance. Care must still be taken when choosing the required stopping distances for different conditions that one does not give preference to a particular technology by default.<sup>250</sup> For example, one braking technology might be particularly good under a certain condition, while performing relatively poorly in other conditions. Where existing technologies are known, it will be possible to draft a sensible but fair set of requirements.

Laws of this type are not original, and many have argued for performance-based standards rather than design-based standards in order to achieve fairness and economic efficiency through nondiscrimination between technologies. The argument is frequently made, for example, in the context of laws aimed at reducing pollutants in the air.<sup>251</sup>

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249. See, e.g., Jennifer A. Manner, *Achieving the Goal of Universal Access to Telecommunications Services Globally*, 13 COMM.LAW CONSPECTUS 85, 100 (2004) (“[I]t is important that the regulatory regime . . . does not discriminate among technologies.”).

250. See Richard B. Stewart, *Regulation, Innovation, and Administrative Law: A Conceptual Framework*, 69 CAL. L. REV. 1256, 1268-69 (1981) (explaining potential overlap between performance and specification standards).

251. E.g., Byron Swift, *How Environmental Laws Work: An Analysis of the Utility Sector's Response to Regulation of Nitrogen Oxides and Sulfur Dioxide Under the Clean Air Act*, 14 TUL. ENVTL. L.J. 309, 390 (2001).

While this may ensure that existing technologies are treated fairly, it will not be enough to ensure fair treatment of future, as yet unknown, technologies.<sup>252</sup> By suggesting that laws are technology-neutral, lawmakers and commentators usually mean that there is no discrimination between existing technologies, and that the legislation does not force the use of any particular technology in circumstances where equivalents already exist. Avoiding unfair discrimination among existing technologies is obviously a useful objective for legislation. However, it does not guarantee that legislation will continue to avoid discrimination among technologies in the future.

Suppose now that a company develops a car that does not have very efficient brakes, but that protects its passengers and other road users differently. For example, the car might bounce harmlessly off any object with which it comes into contact, or it might be equipped with a radar that gives earlier warning of potential hazards. Such vehicles might satisfy the same ultimate goal of preserving human life without satisfying the immediate requirement, which is based on ability to stop quickly. To take account of such future developments, the law would need to be drafted thus:

*All road vehicles sold within the jurisdiction must be tested to ensure that no harmful collision with a stationary object can occur if the object becomes visible to a driver heading towards it at a distance of y meters, where the driver is driving at x speed and the road has z millimeters of water.*

The difficulty is that, even moving up the ladder of abstraction, it is possible to imagine technologies that will not be treated fairly with respect to a higher level goal. One needs to enter the realms of science fiction to see technologies that might not be treated fairly under the above proposal. Cars that maneuver in three dimensions from *Back to the Future*,<sup>253</sup> beaming technology from *Star Trek*,<sup>254</sup> or technology that allows one to pass through a solid object from *Stargate SG-1*<sup>255</sup> would not be covered by the rule despite the fact that it might still be important to ensure that such technologies are safe.

The only way to guarantee technology neutrality into the future so that new technologies will be treated fairly is to enact a law whose level of generality corresponds with the highest level goal that the lawmakers wish to achieve. However, a rule such as:

*All must act so as to preserve human life*

is ridiculous for other reasons. In particular, it is subject to possible disagreement about how this goal is to be prioritized against other goals—such as *all must act so as to maximize economic efficiency*, or *all must act so as to enhance overall health and well-being*. It is unlikely to have a significant

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252. See Stewart, *supra* note 250, at 1281 (referring to the enhanced impact of regulatory burdens on newer products and processes).

253. BACK TO THE FUTURE (Universal Pictures 1985).

254. *Star Trek* (NBC television broadcast 1966-1969).

255. *Stargate SG-1* (Showtime television broadcast 1997-2002, Sci Fi Channel television broadcast 2002-2007).

practical effect on manufacturers in the automobile industry, who are unlikely to design safer cars in response to such a loose standard.

Thus, while it may be possible to avoid discriminating among known technologies, it will not always be possible to avoid discriminating against future, unknown technologies. This is not to say that it is never possible to do so. Some goals are meaningful and operable at very high levels of generality. For example, rules limiting accumulation of market power are likely to treat unforeseen technologies fairly.<sup>256</sup> However, as was clear from the above example, not all goals can be achieved through such general rules.

### C. Drafting Techniques Cannot Always Make Laws “Future-Proof”

A second context in which technology neutral laws are thought to be desirable is their ability to continue to operate effectively as technology evolves. In other words, technology neutrality can be a device used to withstand the range of problems encountered in Part III. Although the expression “technology-neutral” is primarily used to refer to nondiscrimination between technologies, it has been used in the secondary sense of “future-proof” by scholars and in the political context.<sup>257</sup> Technology neutrality in this second sense is broader than the goal of nondiscrimination, but includes it. In the language of Part III, the nondiscrimination standard corresponds to the need to ensure laws are neither over-inclusive nor under-inclusive in new contexts; the future-proof standard is aimed at avoiding all problems associated with technological change.

Merely ensuring nondiscrimination, as hard as this might be, is not enough to ensure that law applies efficiently and fairly in new technological contexts. In order to future-proof such laws, it would also be necessary to draft rules that are unlikely to become uncertain or obsolete in new contexts. Of course, lawmakers will not want all laws to apply equally to new and unforeseen situations. In some circumstances, it might be appropriate to limit legislation to ensure it only deals with a limited problem involving a particular technology or industry.<sup>258</sup> Future-proofing such laws might simply involve

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256. J. Scott Marcus, *Beyond Layers* (Apr. 24, 2006) (unpublished manuscript), available at <http://ssrn.com/abstract=901477> (indicating that European reliance on economic criteria allows for a more fluid regulatory response to changing technology).

257. Michael A. Geist, *Is There a There There? Toward Greater Certainty for Internet Jurisdiction*, 16 *BERKELEY TECH. L.J.* 1345, 1359 (2001) (“‘Technology neutral’ in this context refers to statutory tests or guidelines that do not depend upon a specific development or state of technology, but rather are based on core principles that can be adapted to changing technologies”); see also S. REP. NO. 102-294, at 36 (1992) (designing legislation to prevent “Congress from having to revisit this issue almost annually in order to keep pace with the rapidly changing technological world.”); WILLIAM J. CLINTON & ALBERT GORE, JR., *A FRAMEWORK FOR GLOBAL ELECTRONIC COMMERCE* 3 (1997) (“[G]overnment attempts to regulate are likely to be outmoded by the time they are finally enacted, especially to the extent such regulations are technology-specific.”).

258. Lionel Bently, *Copyright and the Victorian Internet: Telegraphic Property Laws in Colonial Australia*, 38 *LOY. L.A. L. REV.* 71, 175-76 (2004) (exploring the advantages and dangers of technology specific laws); see also Dan Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 *VA. L. REV.* 1575, 1630-38 (2003) (discussing whether there is a need for different treatment for different industries in patent law).

ensuring that they are not over-inclusive, thus covering situations for which they were not intended. Where different lawmakers within one lawmaking body have different goals in mind, a technologically-specific solution may be the only compromise. In those circumstances, legislators at least need to be aware of the (perhaps relatively small) costs of compromise.

Even where future-proofing is both desirable and politically attainable, it remains difficult. The difficulty is that the path of technological change is clouded in mystery.<sup>259</sup> Vast resources would be required if a government were to seek to predict this path, and there are no guarantees that even experts will get it right. It is difficult to make laws future-proof without predicting the future. In addition to the problems raised above in relation to over-inclusiveness and under-inclusiveness, there are problems with avoiding future uncertainty and future obsolescence.

As explained in Part III.B, uncertainty can arise in different ways, including: (1) it may not be clear whether a new entity, activity, or relationship falls within an existing category; (2) a new entity, activity, or relationship may fall into more than one category, giving rise to inconsistent rules; and (3) an existing category may become ambiguous in light of new possibilities. Problems of the second and third types are inherently difficult to prevent, even with forward-planning and the avoidance of technology-based terminology in legislation. The third can only be fixed by predicting the future. One can hardly imagine a lawmaker in the year 1800 questioning rules referring to “mother” on the ground that it might one day become possible for one woman to carry another’s genetic child. The second would not only require an equivalent degree of foresight to prevent, but would also assume the lawmaker was familiar with the entire range of laws in the jurisdiction.

The first problem, ensuring that classifications and categories retain a clear meaning in new contexts, cannot be entirely eliminated, but it can be reduced. On some occasions, there are reasons for drafting laws with inherently vague terms such as “property,” “goods,” and “tangible.” The legislature may deliberately intend the expression to be interpreted by others, such as courts or agencies. On other occasions, however, there is no intention to be vague, but rather a word is used as shorthand for conveying another concept. For example, words such as “highway” and “document” are used as shorthand for describing a potentially broader concept. In the context of a particular statute, highway might be used to describe a public route and document to describe a preserved communication. At the time the legislation is drafted, the shorthand expressions might seem to cover the whole field, so that the longer forms are laborious. It is a difficult but possible exercise to unpack language in this way, if not in each section of legislation, then in a definition provision. Alternatively, a more general term can be defined in a

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259. See TOFFLER, *supra* note 152, at 191 (giving examples of dramatic failure of technology prediction); Gilmore, *Obsolescence*, *supra* note 152, at 467 (stating that “we know not the future at all”); Nye, *supra* note 152, at 161 (discussing the difficulty of technological prediction); Volokh, *supra* note 152, at 1375-76 (commenting on the difficulty of foreseeing technological advances).

definition section, accompanied by a non-exclusive list of examples.<sup>260</sup> It does not require predictions as to the future, rather careful choice of words. Thus there are statutory drafting techniques that can help prevent future uncertainty. Nevertheless, it is impossible to draft legislation that is entirely insulated against all types of potential future uncertainty. Reducing obsolescence faces similar problems.

There are three bases on which rules could become obsolete, namely: (1) the regulated conduct may no longer be important; (2) the reason why rules were enacted may no longer apply; and (3) rules may become less cost-effective. The first problem is irrelevant unless the conduct has been replaced by other conduct that ought to be treated the same way but falls outside the terms of existing rules. This equates to a problem of under-inclusiveness. The third problem is difficult to resolve without predicting the path of technological development.

The second problem is best analyzed in terms of hierarchies of goals, discussed above. High-level goals, such as, *preserve human life* or *improve economic efficiency* are relatively immune to waves of technological change. They may be more or less prominent in the socio-political sphere, but they are unlikely to be directly affected by mere invention. The sorts of goals that become obsolete are lower-level goals, such as, *ensure no two stations transmit on the same radio frequency*. The higher level goal, *avoid interference between transmitting stations*, is still important, but now this can be achieved through more than one path. There was only one route to achieve it, however, in 1927 when the Radio Act was passed; at that time, technological neutrality could not have been achieved at the same time as operational effectiveness.<sup>261</sup>

In conclusion, it would seem that there are some techniques that might be used to promote technology-neutral drafting. Where there is concern to make laws future-proof, they should be drafted in terms of the highest level goal at which the law is operationally effective. Further, terminology that is only contingently synonymous with the object intended should be avoided or clarified in a definition. These techniques will only minimize difficulties associated with technological change; they will not avoid them.<sup>262</sup> It is possible to be overconfident about the benefits of technology-neutral drafting.<sup>263</sup>

#### *D. The Role Played by Administrative Agencies in Enhancing Adaptability*

As illustrated above, it is often impossible to draft a rule that will be both

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260. See Richard W. Downing, *Shoring Up the Weakest Link: What Lawmakers Around the World Need to Consider in Developing Comprehensive Laws to Combat Cybercrime*, 43 COLUM. J. TRANSNAT'L L. 705, 716-19 (2005) (discussing drafting techniques designed to avoid future obsolescence).

261. See generally JAMES MORTON HERRING & GERALD C. CROSS, TELECOMMUNICATIONS: ECONOMICS AND REGULATION 239-86 (1936) (describing the evolution of federal regulation of radio communication).

262. Koops, *supra* note 244, at 105-107.

263. See, e.g., David Friedman, *New Law*, *supra* note 28, at 85 ("If legal rules are defined in sufficient breadth, legal innovation is never necessary.").

operationally effective and immune from problems related to technological change. To solve these problems, it is necessary to move beyond the oversimplified model of lawmaking as statutory drafting. Thus far, I have assumed a single rule-maker or rule-making body creating rules in statutory form. Modern systems of government, however, are significantly more complicated than this.<sup>264</sup> Legislation does not exist in isolation but as part of a broader government network, largely made up of administrative agencies.<sup>265</sup> The lawmaking function is clearly not restricted to a single law-making entity.

This does not mean that the above analysis is irrelevant. Wherever there are rules—however they may be enacted—there is potential for uncertainty, targeting errors, and obsolescence. A rule promulgated by an agency is subject to the same potential problems in new technological contexts as a rule enacted by a legislature. A rule promulgated by a legislature is subject to the same potential problems whether it is directed primarily to a government entity (in Professor Rubin’s terminology, it is intransitive), or to its ultimate target (in Professor Rubin’s terminology, it is transitive).<sup>266</sup> A statute allocating resources or granting jurisdiction to an agency can become uncertain, poorly targeted, or obsolete as a result of technological change.<sup>267</sup> Uncertainty can also arise where multiple agencies end up having overlapping jurisdiction as what were different technologies converge.<sup>268</sup>

However, the existence of more complex rule-making structures makes a difference to the impact of these problems. An agency—especially an agency equipped with technical experts—is able to make changes to outdated rules more quickly than a typical legislature.<sup>269</sup> Thus, although the same problems will arise in a multi-level government, they are easier to contain. A legislature can enact high-level rules, leaving operational details to another level of government.

To return to the example in Part IV.B above, although the legislature may wish to have more control over the ultimate operation of the rules than a law providing that *all must act so as to preserve human life*, it need not get into the level of operational detail. It might create an agency to enact appropriate safety regulations, for example:

*X Agency may promulgate regulations to ensure the safe design of vehicles sold within the jurisdiction.*

This intransitive rule is not immune from targeting problems or future

264. See EDWARD L. RUBIN, BEYOND CAMELOT: RETHINKING POLITICS AND LAW FOR THE MODERN STATE 45 (2005) (“[T]he central administration has grown to gigantic proportions.”).

265. *Id.* at 39-73 (describing modern government as a network rather than three separate branches).

266. Edward L. Rubin, *Law and Legislation in the Administrative State*, 89 COLUM. L. REV. 369, 381 (1989) [hereinafter Rubin, *Law and Legislation*].

267. *Id.* at 369.

268. See generally H. COMM. ON SCIENCE AND ASTRONAUTS, REPORT OF THE NAT’L ACAD. OF SCIENCES ON TECHNOLOGY: PROCESSES OF ASSESSMENT AND CHOICE IV.B.3 (Comm. Print 1969) (discussing the structuring of the problems and the design of an organizational framework for the technology assessment function within the federal government).

269. CORNELIUS M. KERWIN, RULEMAKING: HOW GOVERNMENT AGENCIES WRITE LAW AND MAKE POLICY 30-31 (3d ed. 2003).

obsolescence. For example, the agency will have no authority to provide for safe travel by means other than vehicles. However, the delegation is less likely to run into problems than the operational rules set out in Part IV.B. In this scenario, those operational rules or their equivalents would be promulgated by an agency. If problems arise due to unforeseen circumstances, the agency will usually be in a better position than a legislature to ensure the rules are promptly updated. A legislature can thus reduce the impact of problems arising as a result of technological change by enacting intransitive laws in terms of a relatively high-level goal and avoiding micro-management.<sup>270</sup>

There are two difficulties with this approach, both of which are only sketched here. First, there is a small possibility that laws enacted in terms of a high-level goal will constitute an unconstitutional delegation of power.<sup>271</sup> The failure of the Supreme Court to strike down laws on this basis in recent times makes this unlikely but nevertheless possible. Second, laws enacted in general terms with broad delegation might be criticized as inappropriate or illegitimate. The argument presented here combines with the argument put forward by Professor Rubin to illustrate the inappropriateness of such criticism in a modern state.<sup>272</sup>

Express delegation to agencies thus allows a legislature to avoid the potential serious consequences of an enactment becoming obsolete, over-inclusive, or under-inclusive. It is, however, implied delegation to agencies that most effectively reduces the problems of uncertainty. Thus the well-known *Chevron* doctrine reduces the impact of uncertainty in the context of legislation.<sup>273</sup> Under this doctrine, an agency may be authorized—expressly or by implication—to resolve ambiguities by choosing between possible interpretations of a statute.<sup>274</sup> The agency’s interpretation of a rule will then bind the courts. Certainty is thus re-established with greater speed than would be the case if interpretation were left entirely in the hands of a court.<sup>275</sup> The *Chevron* doctrine has its limits, described by Professor Sunstein as “Step Zero” problems.<sup>276</sup> For example, an agency may have minimal discretion where there is ambiguity in the grant of jurisdiction itself.<sup>277</sup> However, most uncertainties in legislation managed by an administrative agency can be resolved efficiently.

Administrative agencies have an important role to play in designing a

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270. Rubin, *Law and Legislation*, *supra* note 266, at 399, 410, 414.

271. See David Schoenbrod, *The Delegation Doctrine: Could the Court Give it Substance?*, 83 MICH. L. REV. 1223, 1252-1260 (1985) (discussing how good statutes delegate legislative power).

272. Rubin, *Law and Legislation*, *supra* note 266, at 415-16.

273. See generally *Chevron U.S.A., Inc. v. Natural Res. Def. Council*, 467 U.S. 837 (1984) (explaining administrative agencies’ rulemaking authority and deference to its interpretation of a statute).

274. *Id.* at 843-44.

275. Cass R. Sunstein, *Beyond Marbury: The Executive’s Power to Say What the Law Is*, 115 YALE L.J. 2580, 2588 (2006) [hereinafter Sunstein, *Beyond Marbury*].

276. Cass R. Sunstein, *Chevron Step Zero*, 92 VA. L. REV. 187, 191 (2006) [hereinafter Sunstein, *Chevron*].

277. See generally Ernest Gellhorn & Paul Verkuil, *Controlling Chevron-Based Delegations*, 20 CARDOZO L. REV. 989 (1999) (discussing jurisdictional step zero problems); Sunstein, *Chevron*, *supra* note 276 (discussing step zero problems and questioning whether the *Chevron* framework even applies).



legal system able to adapt to ongoing technological change. By using administrative agencies, legislatures can draft legislation at a relatively high level, delegating operational detail elsewhere. This minimizes the conflict outlined in Part IV.B above. The incidence of targeting problems and obsolescence can be reduced. The *Chevron* doctrine also allows uncertainties to be resolved efficiently.<sup>278</sup> However, some problems remain. In some circumstances, a legislature may wish to retain some control over the design of a regulatory scheme. To the extent such control is retained, future problems of targeting and obsolescence remain. While *Chevron* allows for many uncertainties to be resolved by administrative agencies, they will not always have the power or the will to do so. Not all legislation is administered by an agency. Even where legislation is administered by an agency, that agency will have little power to resolve uncertainties in a grant of jurisdiction. Further, where a technology comes under more than one agency's jurisdiction, it is beyond the power of any single agency to resolve the conflicts that result. Thus problems of uncertainty, poor targeting and obsolescence may still come before the courts.

### *E. The Role of Judges in Enhancing Adaptability*

Judges—as interpreters of common law rules, statutory rules, and administrative regulations—have an important role to play in ensuring that the legal system adapts well to technological change. The best means of enhancing legal flexibility in a context of ongoing technological change is to adopt a purposive approach to interpretation.<sup>279</sup> This avoids some of the targeting problems encountered with a more textual approach and provides guidance where laws are uncertain.<sup>280</sup> It is also superior to an alternative proposed by Guido Calabresi.<sup>281</sup> Calabresi proposed permitting judges to effectively repeal outmoded legislation.<sup>282</sup> While this would avoid the problem of obsolescence, it overestimates the role that this type of problem plays in the context of technological change.

#### *1. Purposive Interpretation Increases Flexibility in the Context of Technological Change*

Both common law and statutory rules can be interpreted either rigidly or flexibly with varying degrees of weight given to their underlying purposes. A judge applying a rule rigidly will enforce the rule without considering whether such application is in line with the rule's purposes, whereas a flexible judge will seek to preserve the rule's intended effect in spite of its wording.<sup>283</sup> A

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278. Sunstein, *Beyond Marbury*, *supra* note 275, at 2588.

279. See generally Cockfield, *supra* note 28 (discussing a flexible analysis that deviates from precedent where interests are affected by technological change).

280. *Id.* at 388-95.

281. See generally CALABRESI, *supra* note 199.

282. *Id.* at 81-82.

283. See Cockfield, *supra* note 28, at 383 (using the terms “conservative” and “liberal” in place of “rigid”

judge adopting a purposive approach in dealing with cases involving new technologies is more likely to reach the result that would have been reached at the time of the rule's creation, had the future been foreseen.

The potential of a flexible interpretative approach is even more powerful in the context of common law rules.<sup>284</sup> Common law decision-making carries within it the potential to avoid problems of over-inclusiveness and under-inclusiveness.<sup>285</sup> Common law rules, for example, can be treated as applicable only in those situations where such application is consistent with the rules' justifications.<sup>286</sup> Common law rules are formulated through a process of comparing fact situations and are only strictly binding where the material facts in the precedent cases and the instant case are shared or the differences between them either: (1) are deemed irrelevant by virtue of other precedents, or (2) do not justify different treatment when considered in the context of the rule's purpose.<sup>287</sup> If a new situation arises where application of a rule would not be consonant with the judge's understanding of the rule's purpose, it is open to the judge to distinguish the new case. And the converse applies if the purpose could be furthered by the rule's extension by analogy to a new situation. The judge deciding the scope of a common law rule need not be greatly concerned with the precise form of words in which the rule had previously been articulated. However, while the potential of common law rules in this context may be great, it will not necessarily result in better outcomes.<sup>288</sup> Common law rules can become fossilized, in some times and

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and "flexible"); Lawrence Lessig, *Fidelity in Translation*, 71 TEX. L. REV. 1165, 1169-71 (1993) (arguing that flexible constitutional interpretations may be faithful to the Constitution's original meaning).

284. See generally Lyria Bennett Moses, *Adapting the Law to Technological Change: A Comparison of Common Law and Legislation*, 26 U. NEW S. WALES L.J. 394 (2003) (discussing the differences between judicial and legislative responses to technological change).

285. See RONALD DWORKIN, *TAKING RIGHTS SERIOUSLY* 110-12 (1977) (describing the use of precedent and statutory interpretation in the common law); HENRY M. HART, JR. & ALBERT M. SACKS, *THE LEGAL PROCESS: BASIC PROBLEMS IN THE MAKING AND APPLICATION OF LAW* 126 (William N. Eskridge & Philip P. Frickey eds., 1994) (stating that the "*ratio decidendi*" is not imprisoned in any single set of words; and this gives it a flexibility which the statute does not have"); EDWARD H. LEVI, *AN INTRODUCTION TO LEGAL REASONING* 2 (1948) (describing the process of legal reasoning and statutory interpretation); Roscoe Pound, *What of Stare Decisis?*, 10 FORDHAM L. REV. 1, 7-8 (1941) (defending the role of precedent). This may explain why the benefits of common law over statutory regulation have been noted in scholarship in the areas of both Internet law and biomedical law. E.g., ROGER B DWORKIN, *LIMITS: THE ROLE OF THE LAW IN BIOETHICAL DECISION MAKING* 12-14 (1996); Suzanna Sherry, *Haste Makes Waste: Congress and the Common Law in Cyberspace*, 55 VAND. L. REV. 309, 310-11 (2002); Thomas K. Richards, Note, *The Internet and Decisional Institutions: The Structural Advantages of Online Common Law Regulation*, 10 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 731, 734-35 (2000).

286. SCHAUER, *supra* note 149, at 178.

287. See LEVI, *supra* note 285, at 1-2 (describing the process of legal reasoning and statutory interpretation); Cass R. Sunstein, *Commentary: On Analogical Reasoning*, 106 HARV. L. REV. 741, 745 (1993) (discussing the process of determining whether two situations are legally analogous); see also Scott Brewer, *Exemplary Reasoning: Semantics, Pragmatics, and the Rational Force of Legal Argument by Analogy*, 109 HARV. L. REV. 925 (1996) (describing the process of common law reasoning by analogy as comprising (1) abduction which is the search for an analogy-warranting rule, (2) confirmation which involves a kind of reflective equilibrium between the proposed rule, prior examples, and rationales for the proposed rule, and (3) application).

288. See SCHAUER, *supra* note 149, at 179-80 (pointing out that over time, common law rules become just as encrusted as statutes or regulations, and may lose accuracy).

places more than others.<sup>289</sup> In particular, there can be a tendency to treat a new entity as part of an old category without thinking through the consequences of that classification.<sup>290</sup> Flexibility in interpretation is thus even more important in the common law context than in the statutory context, where other considerations might apply.

Use of the purposive approach to interpretation varies across judges, epochs or jurisdictions. The view has been expressed, for example, that flexibility in interpretation is largely a matter of judicial temperament.<sup>291</sup> Other writers have opined that courts in the nineteenth century were more willing than courts in the eighteenth century to view rules from functional or purposive perspective,<sup>292</sup> and that American courts are more willing to do so than English courts.<sup>293</sup> Given this diversity, it is worthwhile encouraging the purposive approach in those contexts where it is under-utilized.

## 2. *Assessing Calabresi's Proposal as a Solution to Problems Posed by Technological Change*

The slow pace of legislative response to obsolescence<sup>294</sup> was behind Guido Calabresi's suggestion that courts ought to treat statutory rules in the same way as they do common law rules, effectively repealing them when they fail to achieve their purposes or no longer fit in the legal landscape in light of changing conditions.<sup>295</sup> Calabresi felt that courts ought to be even more willing to do this in circumstances of rapid technological change.<sup>296</sup> Calabresi's proposal was heavily criticized, but many of those criticisms were based on empirical assumptions.<sup>297</sup> For example, some critics believe that the problem of obsolescence is relatively small compared to the likelihood of

289. P.S. ATIYAH & ROBERT S. SUMMERS, FORM AND SUBSTANCE IN ANGLO-AMERICAN LAW 418-19 (1987). See generally Peter M. Tiersma, *The Textualization of Precedent*, 82 NOTRE DAME L. REV. 1187 (2007) (comparing the trends in common law in the United States and England).

290. Monroe E. Price & John F. Duffy, *Technological Change and Doctrinal Persistence: Telecommunications Reform in Congress and the Court*, 97 COLUM. L. REV. 976, 1012 (1997).

291. POSNER, PROBLEMS, *supra* note 85, at 48-49.

292. MORTON J. HORWITZ, THE TRANSFORMATION OF AMERICAN LAW: 1780-1860, at 3 (1977).

293. See generally ATIYAH & SUMMERS, *supra* note 289, at 418 (describing the American conception of the law incorporating its underlying reasons, while English courts have a more formal conception of laws operating independently of the reasons for them).

294. Calabresi's concept of obsolescence is different to the one used here, and in particular, it was not limited to obsolescence resulting from technological change. He regarded a statute as obsolete if: (1) it no longer "fit" with the "current legal landscape," and (2) it has—in the court's view—ceased to enjoy majority support. CALABRESI, *supra* note 199, at 2.

295. *Id.* at 82, 164; see also GRANT GILMORE, THE AGES OF AMERICAN LAW 97 (1977) (supporting the proposition that obsolete statutes be effectively repealed).

296. CALABRESI, *supra* note 199 at 7, 46, 73.

297. E.g., Samuel Estreicher, *Judicial Nullification: Guido Calabresi's Uncommon Common Law for a Statutory Age*, 57 N.Y.U. L. REV. 1126, 1128 (1982) (reviewing GUIDO CALABRESI, A COMMON LAW FOR THE AGE OF STATUTES (1982)); Abner J. Mikva, *The Shifting Sands of Legal Topography*, 96 HARV. L. REV. 534, 534 (1982) (reviewing GUIDO CALABRESI, A COMMON LAW FOR THE AGE OF STATUTES (1982)); Robert Weisberg, *The Calabresian Judicial Artist: Statutes and the New Legal Process*, 35 STAN. L. REV. 213, 217-18 (1983) (critical review of Calabresi's proposal). But see Dan Rosen, *A Common Law for the Ages of Intellectual Property*, 38 U. MIAMI L. REV. 769, 828 (1984) (supporting Calabresi's approach in intellectual property cases).

judicial error in assessing whether a statute is obsolete and the loss of legitimacy involved in enhancing judicial power at the expense of legislatures.<sup>298</sup>

It is thus crucial to Calabresi's proposal that obsolescence was a serious problem requiring drastic measures. However, it seems unlikely that the problems with which Calabresi was concerned would be sufficiently significant to outweigh concerns about extending judicial power. The problem he was addressing only resolves a small proportion of problems arising as a result of changed circumstances. A judicial power to repeal statutes would only resolve problems related to obsolescence (discussed in Part III.D above). A power to repeal statutes that are redundant (Part III.D.1) is not very useful. Courts are poorly equipped to consider repeal of statutes on the ground that they are no longer cost-effective (Part III.D.3). This leaves situations where the justification for a rule has failed (Part II.D.2), which are rare and only within judicial competence where the goal of a statute is clear.

*F. The Role of Law-Reform Organizations in Creating a Future-Proof System of Laws*

Even if laws are drafted with the need for future adaptability in mind, agencies are used to provide operational details and interpretive assistance, and courts adopt a purposive approach to interpretation, laws may nevertheless become uncertain, over-inclusive, under-inclusive, or obsolete. Also, none of the techniques discussed above will ensure that appropriate laws are passed to deal with new situations. Thus it is important to monitor both law and technology to ensure a good fit. This is a role that can be played by public or private law reform organizations or scholars proposing reform.

There is nothing in this Article that would contribute to an intelligent choice as to the type of body that ought to be responsible for advising the government as to what is necessary in order to keep the law up to date. In Australia, the Australian Law Reform Commission and the state law reform commissions have primary responsibility in this area; in the United States, the sources of law reform proposals tend to be more diverse. It does, however, suggest how a person or entity proposing law reform might go about completing its task. An understanding of why the law struggles to cope with technological change gives rise to an algorithm for predicting legal problems that could result from a new technology. The algorithm would look something like this:

*List all of the new things, activities, and relationships enabled by the new technology, and if relevant, any old things, activities, and*

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298. Samuel Estreicher, *Judicial Nullification: Guido Calabresi's Uncommon Law for a Statutory Age*, 57 N.Y.U. L. REV. 1126, 1129 (1982); Allan C. Hutchinson & Derek Morgan, *Calabresian Sunset*, 82 COLUM. L. REV. 1752, 1753 (1982); Abner Mikva, *The Shifting Sands of Legal Topography*, 96 HARV. L. REV. 534, 541 (1982); Robert Weisberg, *The Calabresian Judicial Artist: Statutes and the New Legal Process*, 35 STAN. L. REV. 213, 257 (1983); cf. EDWARD L. RUBIN, BEYOND CAMELOT: RETHINKING POLITICS AND LAW FOR THE MODERN STATE ch. 5 (2005) (criticizing the concept of legitimacy).

*relationships that have been superseded.*<sup>299</sup>

*Ask whether any of these things, activities, or relationships ought to be banned or restricted (in the view of the person performing the algorithm or a person with a given set of values and preferences).*

*List all the common law and statutory rules that apply in a given jurisdiction, and to the extent they can be determined, the goals or purposes of each.*

*For each rule for which the goals can be guessed, ask whether part of the reason why the rule furthers its goal (or does so cost-efficiently) is either the existence of superseded things, activities, or relationships, or the non-existence of new things, activities, or relationships.*

*For each rule and each new thing, activity, or relationship, ask whether the rule applies and note any uncertainties.*

*For the rules that do not apply, ask whether it would be in accordance with each of the rule's purported purposes that it should apply.*

*For the rules that do apply, ask whether this is in accordance with each rule's purported purposes.*

Performing this rigorously might take a professional life-time, but experience will usually be sufficient to narrow the range of rules worth examining in the context of a particular technological change. For example, an examination of securities regulation may be unnecessary to a person studying the legal ramifications of genetic testing. Of course, not everyone performing the algorithm will reach the same conclusions; disagreement on such matters as to which of a statute's goals are the most important will lead people to different conclusions as to whether the statute ought to be repealed, amended, or left alone. Yet it is a fairly reliable means of flagging the legal issues likely to arise and the arguments that will be made in response to a particular technological change. Even if the algorithm is not performed in its entirety, it provides a useful checklist for those considering the consequences of a particular technological change in a particular area of the law.

The above algorithm can also help those proposing law reform to get a sense of the scope of legal problems generated by a particular technological change. There is a tendency, especially in the early years of a particular technology, to think that existing law is completely inappropriate in the new context.<sup>300</sup> Others argue that the problem is overstated and that new problems

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299. See, e.g., Lyria Bennett Moses, *Legal Responses to Technological Change: The Example of in Vitro Fertilization*, 6 MINN. J. L. SCI. & TECH. 505, 514-15 (2005) (performing this task for *in vitro* fertilization).

300. E.g., David R. Johnson & David Post, *Law and Borders: The Rise of Law in Cyberspace*, 48 STAN. L. REV. 1367 (1996); John Perry Barlow, A Declaration of the Independence of Cyberspace (Feb. 8, 1996), <http://www.eff.org/~barlow/Declaration-Final.html> (rebuking traditional governments for attempting to regulate the Internet under old models of governance).

can be resolved in existing frameworks.<sup>301</sup> People have taken position on both sides of the question in areas such as the handling of genetic information<sup>302</sup> and communication over the Internet.<sup>303</sup> There were even different positions taken on the effects of railroading on law.<sup>304</sup>

The algorithm proposed above creates a means of quantifying any lack of fit between existing legal rules and a new technology. Completing the exercise for a given technology and area of law will allow one to get a sense of the scope of the problems raised. Some might still perceive these problems as greater than others, but it will avoid excessive hype where that is unjustified.

It will also flag arguments for law reform purporting to be based on the need for revision in light of technological change, but in fact based on other considerations. In other words, it will indicate when a lawmaker uses technological change as an excuse to change a rule he or she does not like.<sup>305</sup> This will allow observers to distinguish arguments for law reform based on a need to keep the law up to date from ordinary arguments dressed up in the language of obsolescence. Of course, there is nothing wrong with technological change provoking critical examination of existing legal problems.<sup>306</sup> But knowing whether technological change has itself upset the legal balance can help to evaluate arguments for legal change.

## V. CONCLUSION

This Article has sought to understand and classify the types of legal problems that result from technological change. There are four reasons why the law might be called on to change in response to changing technology: (1) there may be a need to create special rules designed to ban, restrict, encourage, or co-ordinate use of a new technology; (2) there may be a need to clarify how existing laws apply to new artifacts, activities, and relationships; (3) the scope

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301. See Richard A. Epstein, *The Static Conception of the Common Law*, 9 J. LEGAL STUD. 253, 254 (1980) (“Social circumstances continually change, but it is wrong to suppose that the substantive principles of the legal system should change in response to new social conditions.”); Monroe E. Price, *The Newness of New Technology*, 22 CARDOZO L. REV. 1885, 1888, 1896 (2001) (“It is much less the case that technological change eliminates either the need for law or reduces the capacity for establishing and enforcing norms to nothingness.”).

302. Compare George J. Annas, *Genetic Privacy: There Ought to Be a Law*, 4 TEX. REV. L. & POL. 9, 9-13 (1999) (explaining why there should be a law protecting genetic interests), and Ronald M. Green & Mathew Thomas, *DNA: Five Distinguishing Features for Policy Analysis*, 11 HARV. J.L. & TECH. 571, 571 (1998) (arguing that DNA samples should be treated differently than tissue samples not subject to DNA analysis), with Douglas H. Ginsburg, *Genetics and Privacy*, 4 TEX. REV. L. & POL. 17, 22-23 (1999) (adopting the view that genetic information is rather similar to any other medical information).

303. See sources cited *supra* note 25.

304. Compare commentary *supra* note 20, with ALAN LESLIE, *THE LAW OF TRANSPORT BY RAILWAY* 1 (2nd ed. 1928) (arguing that existing statutory regulation and common law predating the introduction of railways were merely “inadequate, not inapplicable”).

305. See Richard A. Epstein, *The Static Conception of the Common Law*, 9 J. LEGAL STUD. 253, 256-65 (1980) (citing examples of cases where a judge treated a rule as obsolete and discarded it despite the fact that no social change affected the justification for the original rule).

306. See Jennifer S. Geetter, *Coding for Change: The Power of the Human Genome to Transform the American Health Insurance System*, 28 AM. J.L. & MED. 1, 3 (2002) (reasoning that technological change could be the catalyst to bring existing legal problems to the forefront).

of existing legal rules may be inappropriate in the context of new technologies; and (4) existing legal rules may become obsolete. Many changes in technology will cause no problems at all, while others may only give rise to some of the above problems. Yet examples of each type of problem can be found in the context of diverse technologies.

By employing this classification, it is possible to demonstrate the fallacy in approaching the question of technological neutrality purely as an issue of statutory drafting. Unless one is prepared to deny operational effectiveness to many laws, drafting techniques alone cannot prevent some laws from operating unfairly or poorly in a rapidly changing technological environment. Rather than focusing on the need for technology-neutral legislation, we need to consider how the legal system deals with dilemmas raised by technological change in a broader institutional context. The role played by administrative agencies, courts, and law reform bodies in helping the law adapt to technological change is crucial.

Our metaphors of law struggling to keep pace with technology reflect an important truth: as technology changes, legal dilemmas arise. As technological change becomes increasingly rapid, the need for a methodical approach to these problems becomes increasingly urgent. We need to closely analyze the roles played by different legal institutions and the methodologies they adopt in easing the law's transition to the future.