Towards a Law and Technology Theory

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INTRODUCTION

In a world mediated by complex technologies, technological developments can undermine important interests and values that the law seeks to protect. A better understanding of the ways that the law reacts to and provokes technological change could promote more informed policy analysis. This Article seeks to begin a discussion on the development of legal analysis that broadly considers the interplay between law and technology—a law and technology theory.

Part I provides background on the need for the development of this theory, which could draw from and inform traditional legal scholarship that studies discrete areas of technology law like intellectual property law. Part II scrutinizes cases and policy decisions within three non-traditional areas of technology law—contracts, tax, and privacy—to show how legal analysis in light of technological change can be broken down into two broad categories: (1) a 'liberal' approach that is more sensitive to the ways that technological change affects interests, while often seeking legal solutions that are less deferential to legal precedents and traditional doctrine; and (2) a 'conservative' approach that relies more on traditional doctrinal analysis and precedents.¹ The part concludes

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¹ This view draws on the insights from a book on the history of intellectual property law. In the mid-19th Century when traditional doctrine could not properly adapt to technological developments, English intellectual property law became more abstract and forward looking. See Brad Sherman & Lionel Bently, The Making of Modern Intellectual Property Law, The British Experience, 1760–1911 (Cambridge: Cambridge University Press, 1999) (arguing that in the mid-19th Century intellectual property law began moving away from a reactive and
by arguing that the liberal approach produces superior policy outcomes when technological changes undermine contemporary values and interests.

Part III elaborates on general principles of analysis that can be drawn from the liberal approach, which: (a) recognizes that the interplay between law and technology is complex and interactive; (b) requires flexible legal solutions when it is determined that technological developments are undermining interests ("law is technology"); (c) recognizes that the direct regulation of technology provides opportunities to indirectly regulate behaviour to promote optimal social policy ("technology is law"). In summary, the liberal approach scrutinizes whether, given current or anticipated technological settings, a legal rule will promote the attainment of policy objectives ("is the legal rule scientific?").

Part IV offers tentative observations on the ways that a law and technology theory can provide insight into the whole law by revealing that, for instance, during times of technological change the entire law adapts by becoming a more flexible and forward-looking system. This transformation occurs when the liberal approach becomes integrated in other areas of law that have been relatively unaffected by technological change.\(^2\) A downside of this transformation is that the liberal approach destabilizes the law by undermining the usefulness of precedents, making it more difficult for lawyers to predict the outcome of cases for their clients.

I. THE GROWING NEED FOR LAW AND TECHNOLOGY RESEARCH

This section explains why traditional legal analysis is incomplete when it fails to consider policy within a broader context of technological changes that may affect important interests and values.

As an initial matter, definitions of 'law' and 'technology' are needed to serve as the basis for subsequent analysis. The term 'law' can be broadly defined to include all government institutions that strive to regulate individual or business conduct, including court decisions, legislation, administrative rulings and government policies. For the purposes of this Article, technology is defined as the human modification of the environment for a useful purpose.\(^3\)

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\(^2\) This may be part of the process whereby, in the words of Lord Mansfield, the common law "works itself pure" over time by self-correcting any deficiencies that lead to inefficient and unjust outcomes. See *Omnichord v. Barker*, [1744] 1 Ark. 33 (K.B.). As law and economics scholars have observed, there is a strong tendency within the common law toward producing efficiency-enhancing legal rules. See Richard Posner, *Economic Analysis of the Law*, 5th ed. (New York: Aspen Law & Business, 1998) at 25–27.

\(^3\) This broad definition captures all forms of artifacts, including roads, buildings and all forms of infrastructure. The only exception is things that exclusively provide aesthetic appeal such as a Rembrandt painting. This definition is similar to the one developed by Edward
A. Need for Critical Evaluation of Role of Technology in Legal Developments

Prior to enactment of laws, legal scholars subject them to deliberation and review; however, technological developments that accompany these legal changes are less frequently debated. A more critical examination of the interplay between law and technology is necessary as technological developments determine certain paths and influence human behaviour, often in unanticipated ways. As Marshall McLuhan pointed out, "[W]e become what we behold; we first make the tools, then the tools will make us." Max Weber has similarly noted that when we surrender our goals and social practices to technologies, it forms an "iron cage" that restricts efforts to obtain desired policy objectives.

As our lives become more entwined with technology, many observers assert that technology exerts more influence on our values, norms, interests and culture. For instance, one view suggests that more embedded technologies are said

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4 For discussion, see Paul B. Thompson, "Justice, Human Rights and Ethics Issues in Science and Technology Policy" (2002) UNESCO Encyclopedia of Life Sciences 4 (noting, "Changes in technology affect people’s ability to produce, consume and exchange goods just as surely as a change in laws or regulations. As such, they are amenable to the same types of ethical evaluation as a proposal to change or redefine the laws and policies that govern human interaction in a modern society.").

5 See Marshall McLuhan, Understanding Media: The Extensions of Man (New York: McGraw Hill, 1964) at 23. McLuhan theorized that media, in the beginning, act as extensions of people, but over time people become extensions of media. When the technology is pushed to its limit, it becomes the driver of social change or the message itself.

6 For discussion, see Lawrence A. Scaff, Fleeting the Iron Cage: Culture, Politics, and Modernity in the Thought of Max Weber (Berkeley: University of California Press, 1989).

to be increasingly deterministic and present greater resistance to change. This view recognizes the double-edged nature of technology: for the most part, improvements in technology promote social interests by permitting individuals to enjoy wealthier and healthier lives, but technology can also lead to socially ambivalent results when the use of technologies leads to unanticipated outcomes. For example, as subsequently discussed, technology advancements in surveillance have arguably promoted state security, but enhanced surveillance could also undermine important democratic values like freedom of expression.

If the observation that technology is increasingly interwoven with our social, political, economic, and cultural fabric is accurate, then laws that respond to (or fail to respond to) technological change will increasingly have an impact on important values and interests. A law and technology theory could help us to understand the ways that technological developments can subvert policy goals, often in subtle ways.

B. Need for a Broader Perspective


"A technological system can be both a cause and an effect; it can shape or be shaped by society. As they grow larger and more complex, systems tend to be more shaping of society and less shaped by it." See Thomas P. Hughes, "Technological Momentum" in Merritt Roe Smith and Leo Marx eds., Does Technology Drive History? The Dilemma of Technological Determinism (Cambridge, Mass.: MIT Press 1994) 113.

See the discussion infra at Part II.C.

This view is consistent with views of observers who assert that technology developments cannot be separated from social, cultural, economic and political processes. To a certain extent, this view departs from what has been called the instrumental theory of technology where technologies should be adopted as long as they promote an instrumental purpose that enhances efficiency. For discussion, see Andrew Feenberg, Critical Theory of Technology (New York: Oxford University Press, 1991), at 5. For a review of different theories of technology, including those that depart from the instrumental theory, see Samuel Trosow, "Using Social Theory of the Information Age as a Tool for Policy Analysis" (2004) 30(3) Man. L. J. 417 (arguing against the instrumental theory of technology).

A critical examination of the relationship between law and technology could draw from legal theories that purport to clear away the fog that occurs when traditional legal analysis fails to illuminate the important interests at stake. See e.g. James Boyle, "The Politics of Reason: A Critical Legal Theory and Local Social Thought," (1985) 133 U. Penn. L. Rev. 685 (describing the development of legal theories that share assumptions concerning the use of social power in apparently rational discourse); A. Michael Froomkin, "Habermas@Discourse.Net: Toward a Critical Theory of Cyberspace" (2003) 116 Harv. L. Rev. 749 at 760-764 (describing how critical theories attempt to help "people understand their true interests by helping them escape from ideological coercion.").
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There exist many scholarly perspectives along with an extensive literature that attempt to promote a better understanding of how technology intersects with public policy and legal matters. Traditional research areas that fall within this rubric include copyright, trademarks, patents, anti-trust, telecommunications, and mass media. More recent research efforts include biotechnology, information technology, new media, cyberlaw and emerging technologies.

These areas are typically studied and evaluated as distinct legal topics so that any law and technology theory lacks overt coherence. To date, there has been no attempt to develop a broader theory that transcends this compartmentalization to help us more fully understand the law. The proposed law and technology approach would act as one more tool within a scholar's methodological toolbox to promote more fully informed legal analysis. It should not seek to replace existing avenues of enquiry such as intellectual property law, but should co-exist along with other areas of technology law. The discrete catego-

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12 By studying law and technology issues as matters that should be relegated to sealed boxes, legal scholarship has promoted a body of doctrine that is unfinished and, at times, inadequately informed. See, e.g., Dana R. Wagner, "The Keepers of the Gates: Intellectual Property, Antitrust and the Regulatory Implications of Systems Technology" (2000) 51 Hastings L.J. 1075 (noting that courts have struggled with limited success to apply legal precedents to disputes involving emerging technologies and "[i]n many cases, those law-and-technology issues that have been addressed have been resolved only partially or inconclusively").

13 Cyberlaw, which typically focuses on information technology and Internet developments, may be the best attempt to develop a broader theory that at times strives to derive general principles through discussions of the evolving intersection between law and activity associated with the Internet. Nevertheless, cyberlaw has been criticized as unhelpful because, like "the law of the horse", cyberlaw leads to an overly specialized perspective that removes legal conflicts from their broader context. See Frank H. Easterbrook, "Cyberspace and the Law of the Horse" (1996) 11 U. Chi. Legal F. 207.

14 This approach is used by many non-legal academic disciplines, which have developed mature theories of technology. See, e.g., Paul Stoneman, The Economics of Technological Diffusion (Oxford: Blackwell, 2002) (providing an economist's perspective on theories of technology); Merritt Rose Smith & Leo Marx, Does Technology Drive History? (Cambridge, Mass.: MIT Press, 1994) (setting out historians' views on technology theories); Nasser Behnagel, Leo Strauss, Max Weber and the Scientific Study of Politics (Chicago: University of Chicago Press, 2003) (discussing different scientific approaches to the study of political science); Langdon Winner, Autonomous Technology: Technics-out-of-control as a Theme in Political Thought (Cambridge: MIT Press, 1977) (analyzing the politics of technology and criticizing the uncritical acceptance of new technologies). At times, academic disciplines have developed more focused theories involving certain technologies, which co-exist with broader theories of technology. For example, a sociologist might explore the impact of information technologies on workplace environments within broader attempts to examine technological interactions with social structures. See, e.g., Donald MacKenzie & Judy Wajcman, eds., The Social Shaping of Technology, 2nd ed. (Buckingham: Open University Press, 1999).
ries could inform a law and technology theory, which in turn could reflect back onto these disciplines and provide scholars with a broader perspective to promote a fuller understanding of their areas of study.\textsuperscript{15}

II. LOOKING AT LAW THROUGH A TECHNOLOGICAL LENS

Through the use of examples involving contracts, tax and privacy law, this section explores two broad approaches used by courts and regulators when confronted with situations where changing technologies appear to affect values and interests. On some occasions, courts and regulators can ignore or misjudge the ways that law interacts with technology, in part because they employ analysis that is overly rigid and case specific, often failing to contemplate how technological developments can undermine interests. At other times, courts and regulators use an approach that is sensitive to the ways that technology can affect interests by employing forward-looking and flexible analysis that is less deferential to precedent and traditional doctrine. This Part concludes that the latter approach does a better job at protecting traditional interests and values.

A. Challenges to the Bargain Theory of Contract Law

The modern approach to contract law is premised on a ‘bargain theory’ whereby courts tend to enforce only those contracts that fulfill offer and acceptance and consideration rules.\textsuperscript{16} In some circumstances, changes in technology have challenged traditional legal concepts built upon this exchange theory.

1. Shrinkwrap Agreements and Offer and Acceptance Rules

The first example involving contract law and changing technologies surrounds so-called ‘shrinkwrap’ agreements. This refers to the licence agreement between a consumer and a vendor of software where the off-the-shelf software comes wrapped in plastic or cellophane. The back of the box typically provides notice

\textsuperscript{15} This Article serves as an example of this approach as its views are influenced by writings produced by, among others, intellectual property law and cyberlaw scholars. For example, Lessig has argued that cyberlaw courses provide valuable insight into the limits of traditional law as a regulator of behavior. See Lawrence Lessig, “The Law of the Horse: What Cyberlaw Might Teach” (1999) 113 Harv. L. Rev. 501. A law and technology theory could also assist with ongoing efforts in other academic disciplines to create a form of unified theory of technology. For efforts in this regard, see, e.g., Thomas R. DeGregori, \textit{A Theory of Technology: Continuity and Change in Human Development} (Ames, IA: Iowa State University Press, 1985) (developing theories to understand how technological processes promote beneficial social results).

\textsuperscript{16} These developments in part were influenced by the view that mere gratuitous promises should not be enforced by a court. See e.g. Barry J. Reiter, “Courts, Consideration, and Common Sense” (1978) 27 U.T.L.J. 468 (discussing the development of modern contract law in England beginning in the seventeenth century).
of a licence agreement within the box (either printed on a manual and/or encoded on a CD-ROM disk) that sets out the relevant elements of the purported contract between the consumer and the software manufacturer. Vendors intend that purchasers will be bound by the terms of the licence agreement after they open the plastic wrap and use the software.

Under traditional contract analysis, however, a consumer is not bound by the terms of the licence because the contract was formed when the consumer purchased the goods from the retail vendor. In order to bind the consumer, contractual provisions must be accepted by the buyer at the time of purchase, not after. According to the traditional analysis, shrinkwrap agreements at most can be regarded as proposed modifications to an existing contract, requiring the explicit or implied assent of the consumer to take effect.

However, certain courts have radically departed from traditional analysis in favor of a liberal approach that protects the interests of consumers as well as businesses. The rationale behind this more forward-looking analysis was set out by Judge Easterbrook in ProCD v. Zeidenberg. Easterbrook recognized that upholding the license agreement permitted private ordering to arrive at the most economically efficient route that protected the interests of consumers as well as businesses.

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17 Under the common rules of offer and acceptance, a binding contract is formed when the offeror offers all of the important elements of a contract and the offeree accepts all of these terms. See e.g. Step-Saver Data Systems, Inc. v. WYSE Technology, 939 F.2d 91 (3d Cir. 1991). For an overview of case law that supports the view that U.S. courts have traditionally refused to enforce shrinkwrap agreements, see Mark Lemley, "Intellectual Property and Shrinkwrap Licences" (1995) 68 S. Cal. L. Rev. 1239 at 1259 (concluding that "virtually no reported decisions have actually enforced shrinkwrap licence provisions as written"). Courts in countries such as Canada have similarly held that shrinkwrap agreements are normally not enforceable under traditional analysis. See e.g. North American Systemshops Ltd. v. King, [1989] A.J. No. 512 (Alb. Q.B.).

18 86 F. 3d 1447 (7th Cir. 1996). ProCD had spent more than $10 million to compile a computer database called SelectPhone that drew from over 3,000 telephone directories. Zeidenberg purchased a shrinkwrapped software package from ProCD that contained a license agreement within the box. The terms of the license agreement, among other things, limited use of the ProCD software to non-commercial purposes. Zeidenberg ignored this term and used the software to resell the information contained in the SelectPhone database through his own commercial website. Zeidenberg argued that, under traditional analysis, he was not bound by the copyright restriction because he did not agree to this provision when he purchased the product. The district court agreed and held that Zeidenberg was not bound by the terms of the license agreement. In addition, the court held that federal intellectual property law preempts Wisconsin state law. See ProCD, Inc. v. Zeidenberg, 908 F. Supp. 640 (Dist. Ct. 1996).

19 Ibid. Consumer interests would be protected because companies such as ProCD engage in price discrimination by selling software at lower prices to consumers and higher prices to businesses that are permitted to commercially exploit the product. This way, consumers enjoy a consumer surplus because they pay a lower price than they otherwise would be
Easterbrook held that shrinkwrap agreements are valid as long as notice of additional contractual terms within the box is given somewhere on the box and a consumer is provided with a right to return the product after she has read these additional terms. Easterbrook argued that the older view should not carry the day in light of new technological developments, otherwise it would "return transactions to the horse-and-buggy age." He arrived at an eminently sensible solution that focuses on the nature of the evolving technology along with the policy consequences that would result from following traditional analysis. In so doing, he departed from traditional analysis that supported the technical common law requirements of offer and acceptance.

2. **Web Site Notices and Contract Modification**

Ongoing or relational contracts have often presented challenges to traditional contract law doctrine, which is premised on one-time or discrete transactions. In *Kanitz v. Rogers Cable Inc.*, a consumer entered into a contract with Rogers Cable for the supply of a high-speed Internet connection through a cable mo-

charged if the company was forced to sell the product at one price to both consumers and businesses. For example, ProCD could charge a reduced price of $150 to consumers. A consumer who valued the information contained with the database at, say, $200 would hence enjoy a consumer surplus of $50 under this pricing arrangement. If ProCD was forced to charge a higher price to consumers at some amount above $200 then this consumer surplus would evaporate. *Ibid.*

20 86 F. 3d 1447 (7th Cir. 1996).

21 The view is supported by commentators who have noted that technological innovations have reduced transaction costs in many circumstances (by say, lowering the cost of communication). In this environment, less rigid judicial supervision of the process of contracting is required to permit the parties to order their economic relationships as they fit. See I. Trotter Hardy, "Property (and Copyright) in Cyberspace" (1996) 11 U. Chi. Legal F. 217 at 259; Robert P. Merges, "The End of Friction? Property Rights and Contract in the 'Newtonian' World of On-Line Commerce" (1997) 12 Berkeley Tech. L.J. 115. But see Julie E. Cohen, "Lochner in Cyberspace; The New Economic Orthodoxy of 'Rights Management' " (1998) 97 Mich L. Rev. 462.

22 See Klocek v. Gateway, Inc., 104 F. Supp. 2d 1332 (D. Kan., 2000) (criticizing the analysis in ProCD and holding that the purchaser of a Gateway computer was not bound by Gateway's contract contained in the computer's packing box). It is worth mentioning that Easterbrook relied on another traditional common law view that the vendor is "master of the offer" and can dictate what kind of conduct constitutes acceptance of the offer.


The contract included a term that permitted the cable company to modify the agreement at its discretion as long as it posted notice of these changes on its corporate website.

After Rogers Cable amended the contract to include a mandatory arbitration term, the consumer argued that website notice did not constitute adequate notice. However, the court interpreted the contract in such a way that it imposed an obligation on consumers to check the website from time to time if they were concerned about contractual amendments. Justice Nordheimer employed forward-looking analysis that took into consideration the changing technological landscape:

I am also mindful, in reaching my conclusion on this point, of the fact that we are dealing in this case with a different mode of doing business than has heretofore been generally considered by the courts... It does not seem unreasonable for persons, who are seeking electronic access to all manner of goods, services and products along with information, communication, entertainment and other resources, to have the legal attributes of their relationship with the very entity that is providing such electronic access, defined and communicated to them through that electronic format.

In interpreting the notice provision, Justice Nordheimer properly took into account the broader context of evolving technologies to discern the reasonable expectations of the parties.

B. Challenges to Laws that Govern Tax Jurisdiction
This section reviews how courts and policy makers have responded to technological changes that challenge traditional laws that determine how cross-border transactions are taxed in the context of (i) U.S. state and local sales taxes and (ii) international income taxes.

1. U.S. State and Local Sales Tax Laws
By engaging in more rigid and backward-looking analysis, certain courts have failed to protect important interests in the context of U.S. state and local sales and use taxes. Governments depend on business intermediaries to charge and collect sales taxes; for example, laws typically force retailers to charge sales taxes on purchases and remit the taxes to the state or local government. The alternative would be to permit consumers to self-assess the amount of tax owed on each transaction, but this approach is not efficient or feasible. Beginning in the 1940s, state governments became increasingly concerned as technological

25 Ibid. at para. 24.
26 Ibid. at para. 32. Consumer interests can also be protected by other common law developments such as the requirement of clear notice that is not buried in “fine print.” Ibid. at para. 27. See Tilden Rent-A-Car v. Clendenning (1978), 18 O.R. (2d) 601 (C.A.). A harder case would involve situations where, after providing notice, the vendor significantly changes the nature of the promise.
developments such as television ads, telephones and the postal service encouraged out-of-state mail order sales. As a result, these governments passed legislation to try to force out-of-state businesses to collect their sales taxes and it was necessary for the U.S. Supreme Court to set out the scope of tax jurisdiction for state and local tax authorities as a result of Constitutional concerns surrounding the possible interference with inter-state commerce.28

In a series of decisions beginning with National Bellas Hess v. Illinois, the U.S. Supreme Court articulated and refined a "substantial nexus" test that prevents state and local governments from imposing their sales taxes on economic activity unless this activity emanates from a physical presence within the taxing state's borders.29 Accordingly, mail order companies that do not maintain sales offices or sales forces within target states generally cannot be forced to collect sales taxes by state or local governments.30 For this reason, consumers can often purchase, on a sales tax-free basis, mail order goods like clothes because the mail order companies are based in states that do not have any sales taxes. The loss of tax revenues to the state of consumption created a cause for concern, but was perhaps not overly worrisome as the losses were not perceived to be too significant.31

Yet the sales tax decisions represent an interesting case study on the relationship between law and technology. As the U.S. Supreme Court clearly understood in a later decision, Quill v. North Dakota, the physical presence test served as an incentive for greater resort to cross-border mail order as consumers could generally enjoy sales tax-free purchases:


28 The need for a substantial nexus test arises as a result of the Commerce Clause of the U.S. Constitution that prohibits undue interference with interstate commerce. See National Bellas Hess v. Illinois, 386 U.S. 753 (1967).

29 See National Bellas Hess v. Illinois, 386 U.S. 753 (1967). The decisions mainly surround mail order companies whose only physical presence within their consumers' states involved the use of the telephone system to complete customer orders and the postal system to mail catalogs and products to end consumers.


31 At the time of the Quill fact pattern, mail order sales had reached roughly $180 billion a year and evidence was introduced to estimate state sales tax losses at $3.2 billion a year when the Court issued its ruling. Ibid.
Indeed, it is not unlikely that the mail-order industry's dramatic growth over the last quarter century is due in part to the bright-line exemption from state taxation created [by the Court's holding in] Bellas Hess.32

Nevertheless, the majority followed its own precedent despite evidence that revenue losses to state governments were increasing under the physical presence rule.33

Justice White's partial dissent in Quill, however, pointed out,

"Perhaps long ago a seller's 'physical presence' was a sufficient part of a trade to condition imposition of a tax on such presence. But in today's economy, physical presence frequently has very little to do with a transaction a State might seek to tax."34

Later, he added,

Moreover, the Court's seeming but inadequate justification of encouraging settled expectations in fact connotes a substantive economic decision to favor out-of-state direct marketers to the detriment of other retailers. ...[T]he Court is effectively imposing its own economic preferences in deciding this case.35

Justice White preferred a more flexible test that would have scrutinized the activities of the out-of-state seller to see whether imposing collection obligations would be a barrier to inter-state commerce. In contrast to the physical presence requirement, the more flexible approach would arguably have done a better job at respecting state interests while taking into account Constitutional concerns surrounding interference with inter-state commerce.

Justice White's decision showed how a traditional legal rule—the requirement of a physical presence within a taxing state—could promote the use of a certain form of technology (the post office) and even change the structure of the marketplace. The rule provided an incentive for businesses to base themselves in states without sales tax systems and to use the postal service for generating out-of-state sales. The law in this area should therefore evolve to take into account the increased reliance on mail order sales as the majority decision to maintain the status quo in an environment of technological/commercial change could have significant economic consequences. In particular, an increase in remote consumer sales related to Internet transactions has led to billions of dollars in estimated revenue losses to state and local government and, according to the Multistate Tax Commission, placed "federalism at risk."36

32 Ibid.at 316.
34 Ibid. at 327.
35 Ibid. at 331.
36 See Multistate Tax Commission, "Federalism at Risk" (2003) 30 State Tax Notes 7. For revenue loss estimates, see U.S., General Accounting Office, Sales Taxes: Electronic Commerce Growth Presents Challenges: Revenue Losses are Uncertain (GAO/GGD/OCE-00-165)
2. International Income Tax Laws

Similar concerns exist with respect to jurisdiction to tax issues at the international level. A traditional international tax principle has been that tax treaty partner countries agree they will not tax non-resident businesses unless these companies maintain a physical presence within the taxing country (called a 'permanent establishment' within tax treaties). Recent commercial developments, such as e-commerce, challenge the traditional rule because companies can now engage in significant cross-border transactions without maintaining the requisite physical presence: as occurs in the U.S. state example above, countries are concerned that the traditional rules will lead to revenue losses for e-commerce importing nations.

After several years of deliberation, the Organization for Economic Cooperation and Development (OECD) member countries agreed that a computer server (i.e., a computer that has been networked to the Internet) will fulfill the physical presence requirement. Millions of computer servers around the world will now constitute permanent establishments if the software within the servers performs the integral functions of a cross-border transaction, enabling countries to tax any profits attributable to the servers' operations. The new legal rule may lead to adverse and unanticipated results such as tax planning where companies locate their servers in low tax jurisdictions or tax havens, which would lead to revenue losses for countries with relatively high tax regimes like the United States and Canada. Moreover, the new server/permanent establishment rule will not effectively share tax revenues between exporting and importing countries, which may lead to international double taxation as importing nations come up with new ways to impose income taxes on cross-border transactions.

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(2000); Donald Bruce & William Fox, "State and Local Revenue Losses From E-Commerce: Estimates as of July 2004" (Knoxville: University of Tennessee, Center for Business and Economic Research, 2004) (estimating losses between U.S.$21.5 billion and U.S.$33.7 billion by 2008). Moreover, the physical presence test has led to a tax planning strategy called entity isolation where retailers incorporate a separate subsidiary for remote sales in order insulate these sales from sales tax obligations: the physical presence requirement hence provided an incentive to engage in tax planning that has led to even greater revenue losses. See Arthur J. Cockfield, "Walmart.com: A Case Study in Entity Isolation" (2002) 25 State Tax Notes 633 (arguing state tax authorities can use attributional nexus theories to pierce entity isolation strategies).

37 The OECD acts as the most important international body at promoting international tax developments; changes to the OECD model tax treaty are eventually incorporated into the tax treaties of the member states, including the United States and Canada. See OECD, Committee on Fiscal Affairs, Model Tax Convention on Income and on Capital, Condensed Version (5th ed., 2003) at 102–105.


39 See India, Ministry of Finance, Report of the High Powered Committee on E-Commerce and
The development of a new server/permanent establishment category shows how well-meaning reform efforts could lead to adverse social consequences when policy-makers do not take into account how a legal rule will ‘fit’ within a given technological environment. The search to replace a traditional physical presence requirement with a cyberspace analog (a server/permanent establishment) is inappropriate for a commercial forum that enables significant cross-border economic activity without resort to traditional business intermediaries.  

In other words, the OECD employed a rigid approach that looked back to traditional principles instead of using a more flexible and forward-looking approach that took into account the nature of the new technologies and how these technologies could undermine interests.  

C. Challenges to Laws that Protect the Right to Privacy  
This section discusses how governments have failed to take fully into account the complex interplay between technological changes and the law in the context of legal reform efforts to promote national security by increasing state surveillance.  

1. Legal and Technological Developments Relating to Government Surveillance  
As a result of the terrorist attacks on the United States on 11 September 2001, governments around the world, to a greater or lesser extent, have modified their laws to facilitate surveillance of their citizens, residents, and foreign individuals. These legal changes include: making it easier to obtain warrants to use  

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40 For discussion on the ways that e-commerce challenges traditional tax laws, see Jinian Li, *International Taxation in the Age of Electronic Commerce* (Toronto: Canadian Tax Foundation, 2003).  

41 How should jurisdiction to tax laws change to reflect the increase in “borderless” transactions attributable to technological developments? One solution could involve the adoption of economic presence tests (instead of physical presence tests) that permit nations or subnational governments to extend their tax laws over businesses and consumers outside of their borders. State and local governments may be moving in this direction, as discussed in Part IV.C., to counter developments at the federal level. This is also in fact the approach of the European Union where, as of July 2003, non-European Union retailers will need to charge and collect value-added taxes on sales to European Union consumers. See European Council, Council Regulation 792/2002 amending temporarily Regulation (EEC) 218/92 on administrative cooperation in the field of indirect taxation (VAT) as regards additional measures regarding electronic commerce (May 7, 2002).  


43 The analysis in this section draws from Arthur J. Cockfield, “Who Watches the Watchers?
electronic surveillance against terrorist suspects; abolishing the need to obtain warrants in cases of perceived threats to national security; reducing legal thresholds to obtain electronic records; enhancing the government's ability to share personal information among different government agencies or with foreign governments; and increasing the powers to deport residents for violations of immigration laws.

Technological innovations and developments have accompanied legal reforms surrounding government surveillance. New software programs allow police to sift through electronic information to obtain an ISP's 'traffic data', which generally includes information such as web site visits, the destination of e-mails or information concerning routing information. The FBI has announced that it will increase the use of its DSC 1000 program (previously named "Carnivore"), which permits investigators to sift through an ISP's e-mails. In addition to ISP monitoring, the FBI is reportedly developing a surveillance technology called 'Magic Lantern' that is essentially a computer program that can be installed remotely on the hard drive of a suspect's computer; once installed, the program logs all keystrokes on the computer.

In addition to government efforts, the private sector has embraced technological developments that enhance the ability of businesses to collect detailed information on customers or employees. Businesses have always tracked their customers' behavior (e.g., through credit card purchases) and sold this information to third parties so it is not so much a question of novelty, but more a question of scale and context. Information technological developments now permit

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In addition, the United States, Canada and several other nations participate in a program called Echelon that permits investigators to monitor e-mails or chat room conversations. According to one report, 90% of Internet traffic is scanned by Echelon, which searches for words such as "heroin" or "child pornography" in order to focus investigators on their targets. See European Parliament, Scientific and Technology Technology Options Assessment: Development of Surveillance Technology And Risk of Abuse of Economic Information (Vol. 2: Interception Capabilities, 1999).

an enormous quantity of detailed transactional information to be gathered and stored and for relationships to be drawn between formerly discrete identities.46

3. Implications of Emerging Government/Private Sector Surveillance
At some point, these surveillance technologies could become integrated within large private sector and government databases. Many of the proposed government initiatives would link government databases with industry databases and could create powerful tools for a surveillance society. The merged databases could contain detailed personal information about individuals, including their e-mail records, health problems, credit history and credit card purchases, criminal records or interactions with the police, employment histories, telephone records, television shows watched, vacation destinations, and website visits. Under the guise of national interest, these merged databases could be scrutinized by a government employee without the knowledge of the individual in question.

Some might argue that governments can simply decide one day to stop using these surveillance technologies, if and when the risk of terrorism declines. However, as noted previously, technology is partly deterministic in nature, as advancing technology can shape and change the way we live. It is unclear whether the clock can be turned back on the use of surveillance technologies. As suggested earlier, one view suggests that technological determinism depends in part on whether specific technologies are widespread and embedded within social structures.47 Technology—such as the trend towards deployment of powerful surveillance technologies that scrutinize private and public spaces—tends to shape our social structures once this embedding takes place.

While the anti-terrorism laws were subject to explicit evaluation prior to implementation, less attention has been paid to the technological developments that surround these policy changes. The problem is that such inattention to

46 See generally Allan Westin, Privacy and Freedom (Toronto: Antheneum, 1967); Simson Garfinkel, Database Nation: The Death of Privacy in the 21st Century (Sebastopol, California: O'Reilly & Associates, 2000) at 70 (providing a historical discussion of the emergence of detailed digital dossiers or 'data shadows'). In addition to Internet technologies, the private sector has begun employing a variety of different mechanisms that have privacy-encroaching implications. These technologies include: (a) cell phones that report the precise geographic location of telephone calls; (b) the use by supermarket chains of smart cards that track details surrounding all purchases; (c) computer chips within consumer products that provide information on location and usage for inventory control purposes; (d) the use of radio frequency identification (RFID) tags in different products for inventory purposes that potentially provide information concerning product usage and location; (e) video or camera surveillance to inhibit crimes and (f) a variety of electronic monitoring techniques in the workplace to monitor phone calls and computer usage (e.g., keystroke logging programs that store information on every computer keystroke made by an employee).

47 See the discussion accompanying notes 7 to 11.
technological developments leads to an increased risk that unanticipated adverse social outcomes will take place—technology traps us within Weber's "iron cage".48

In fact, many observers have discussed how surveillance technological advances heighten the risk of unanticipated adverse social consequences.49 These outcomes include repression of political dissent as surveillance technologies are used to target identifiable groups such as Muslims despite no evidence of individual wrongdoing. Further, pervasive and unseen scrutiny by state agents could inhibit freedom of expression as individuals fear their speech and actions could be monitored by the police. Finally, nations become less democratic to the extent that citizens have greater difficulty in holding state agents accountable for their actions—technological developments increase the risk that police and intelligence officers will abuse their new surveillance powers without fear of detection. The failure of legal analysis to consider fully the interplay between law and technology in the context of state surveillance has raised the risk that important interests will be undermined.

D. Summary: Evaluating the Liberal and Conservative Approaches

According to two contemporary observers, prior to the mid-1850s intellectual property law was reactive and dogmatic in that the law responded to technological changes when they arose.50 For example, early cases provided different legal protections for such things as the printing of designs on calicos, muslins and linens. In contrast, modern intellectual property law became more "abstract and forward-looking" in the sense that the law attempted to be more flexible and less deferential to precedent.51

Based on these insights, the examples in previous sections discussed two different approaches that legislators and courts use when examining the relationship between law and technology. 52 On the one hand, some legal analysts em-

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48 See discussion accompanying note 6.


50 See Sherman & Bently, supra note 1.

51 Ibid. at 3–4.

52 It is recognized that there will often be a significant blur between the two broad analytical approaches that are subsequently discussed.
ploy a forward-looking approach that considers how the law can best protect interests and values when they are threatened by technological developments. Moreover, these analysts recognize, at least inferentially, that technology developments are embedded within economic processes (in the contracts examples), political processes (in the tax examples), and social processes (in the surveillance and privacy examples). On the other hand, legal analysis can also be more ‘conservative’ in the sense that it emphasizes the need to follow traditional doctrine without fully taking into account how the interplay between law and technological developments can undermine interests and values. This latter view is more closely aligned with the instrumental theory of technology that views technological developments as separated from economic, political, cultural and social processes.

The interests at stake throughout this process are traditional in the sense that the liberal judges attempted to identify the most critical interests that the law currently protects, then sought legal analysis and solutions that could support the protection of these interests. Preserving traditional interests is particularly important, since technologies themselves affect, change and mask interests. As such, the liberal approach, in a seeming paradox, better protects traditional interests. When technological changes undermine interests, the liberal approach to scrutinizing the relationship between law and technology will produce superior policy outcomes in comparison to the conservative approach.

III. DEVELOPING GENERAL PRINCIPLES

The last section highlighted two different possible approaches that courts and regulators could use when confronted by technological changes that affect important interests. This section elaborates on those aspects of the more forward-looking and flexible analysis—the liberal approach—that courts and regulators, at least inferentially, use to try to obtain better policy outcomes. By making these different ways of looking at the relationship between law and technology more explicit, a law and technology theory can begin to develop general principles to improve the chances of reaching just decisions.

The liberal approach employed by courts and policy makers is categorized for organizational purposes into the following discrete but related enquiries where legal analysis: (a) explores the complex interplay between law and technology; (b) recognizes that the law should respond directly to technology developments that threaten values and interests (“law is technology”); (c) acknowl-

53 See the discussion in note 10.

54 There is admittedly room for debate concerning what constitutes a critical interest, which may determine the ultimate policy prescription.

55 See the discussion accompanying notes 4 to 6.
edges situations where the law can encourage uses of technologies that protect interests ("technology is law"); and (d) promotes consequential analysis that strives to fit policy developments within current and anticipated technological environments ("is the legal rule scientific?").

A. The Interactive Relationship between Law and Technology

Legal rules and principles have an interactive, dynamic and complex relationship with technological developments.\textsuperscript{56} Take the example of laws that have regulated automobiles, "arguably the most disruptive technology of the past hundred years".\textsuperscript{57} Laws promoted the mass adoption of automobiles in some countries, which in turn created more—often unanticipated—areas that could be subjected to legal regulation. The development of roads in turn fuels demand for more cars, calls for laws to protect driver safety, and even changes how our communities are organized by encouraging commutes from suburbs.\textsuperscript{58} In addition, the emissions from cars have promoted global warming, influencing domestic and international law efforts to promote energy conservation. Finally, the fuel required for cars shapes, at least to a certain extent, international foreign policy as gas importing nations tailor their policies to ensure continued supply.

The examples in the previous section similarly demonstrate that courts recognized that the relationship between law and technology is complex and nonlinear when they use the more liberal approach in analyzing fact patterns at the intersection of law and technology. The dissent in Quill asserted that the physical presence espoused by the Court inadvertently changed the structure of the marketplace by providing legal incentives for remote consumer sales that would be free of sales taxes. Easterbrook in ProCd similarly understood that traditional doctrinal analysis could inhibit private ordering, ultimately harming the

\textsuperscript{56} Similarly, law and society scholars have noted, "The output of the legal system—laws, decisions, orders, and administrative behaviour—leads in turn to more social change, which affects the legal culture, influences demands on the system, and starts the cycle over again." See Lawrence M. Friedman, "The Law and Society Movement" (1986) 38 Stan. L. Rev. 763 at 770; A. Javier Trevino, The Sociology of Law: Classical and Contemporary Perspectives (New York: St. Martin's, 1996) at 439–445 (discussing how laws follow social changes and the ways that laws can instigate social change).

\textsuperscript{57} See Po Bronson, "Valley 3.0: Learning to Love Life in the Rust Belt" Wired 11:06 (June 2003) 138 at 140.

\textsuperscript{58} For discussion, see Lawrence M. Friedman, American Law in the 20th Century (New Haven: Yale University Press, 2002) at 553–555. Innovation provokes legal changes to accommodate the new forms of transportation and its required infrastructure. For discussion, see Steven W. Usselman, Regulating Railroad Innovation: Business, Technology and Politics in America, 1840-1920 (Cambridge: Cambridge University Press, 2002) at 382 (discussing, from a historical perspective, U.S. government efforts to regulate railway innovations, including how regulatory decisions reinforced certain interests).
interests of consumers and businesses. Finally, the view that technological developments in combination with legal changes surrounding surveillance can serve to amplify the risk of anti-democratic outcomes relies on the notion that the interplay between law and technology is complex and dynamic.

This non-linear relationship between technology and other aspects of society has been explored in detail by legal and non-legal theorists. For instance, the dynamic change and internal diversity of the Internet, along with the complex interdependent interaction among law, norms, cyberspace and the network, can be analogized to a 'digital biosphere'. The digital biosphere model helps to show that, as technology becomes more pervasive in our lives, technology becomes interwoven with our norms in a complex, dynamic—almost organic—relationship. In another example, McLuhan developed a framework called a tetrad to evaluate the complex relationship between different media and technologies and our social structures. The tetrad allowed McLuhan to apply four laws, framed as questions, to better understand how media and technologies interact with our culture. The first question is "What does the medium or technology extend?" The second question is "What does it make obsolete?" The third question asks, "What is retrieved?" The fourth question asks, "What does the technology reverse into if it is over-extended?"

Efforts by legal scholars to develop similar explanatory models for the relationship between law and technology may also bear fruit. With respect to the interplay between the law and surveillance technologies, for example, the new technologies: extend the nervous system by permitting digital eyes and ears to

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60 Cockfield, Digital Biosphere, ibid. at 362 (arguing that law must co-exist in a dynamic equilibrium with the other elements of the digital biosphere, namely cyberspace norms, real world norms and the network).


62 Returning to the automobile example, McLuhan suggested that cars extend the foot by enabling greater mobility, make horses and buggies obsolete, retrieve a sense of adventure or quest, and reverses into a longing for a more leisurely pedestrian lifestyle. Another example involves television. Television extends the ability of humans to hear and see over distances, renders radios obsolete, retrieves the campfire as a center for family gathering, and reverses into new forms of individual isolation. Id.
communicate and collect information; render physical searches by the police less useful; retrieve a concept of privacy from earlier communal lifestyles; and reverse contemporary democratic values like the right to express political dissent without fear of reprisal.

The main point here is that the liberal approach recognizes the dynamic interplay between law and technology, which teaches us that linear analysis may not be appropriate when scrutinizing the ways that technological developments can undermine interests.

B. Law is Technology
While recognizing the difficulties in disentangling legal developments from technological developments, it is nevertheless helpful to ask: at what point should law respond to technological developments?

In the clearest cases, legal reform in light of technological change is more obviously called for. Consider international treaties to stop the development or proliferation of biological or nuclear weapons. Or laws that promote safety by, for example, mandating warnings on products such as cleaners that contain toxic substances. Or laws that ban the use of a certain type of tin to avoid food poisoning in canned foods. In these circumstances where legal reform or policy change results directly from technological developments, it could be said that 'law is technology'.

The harder cases will involve situations where it is less clear that technology is undermining important interests, which would call for the more flexible and less dogmatic analysis under the liberal approach. The starting point could begin with a superior understanding of how law has responded to technological developments over time: a better understanding of history might shed light on present and future legal developments. For example, in what circumstances has technology caused doctrinal re-evaluation of existing areas of law like tort law in the past?

63 For discussion on the connection between global security, international law and growing inequalities in terms of technology between wealthier and poorer countries, see Aaron Schwabach & Arthur Cockfield, "The Role of International Law and Institutions" in Encyclopedia of Life Support Systems (Oxford, UK: UNESCO Publishers, 2002) at 611.

64 There are clearly many historic links between law, technology and values. See Jared Diamond, Guns, Germs and Steel: The Fate of Human Societies (New York: W.W. Norton & Company, 1997) (illustrating the interplay among technology, geography and political power); Pierre Teilhard De Chardin, The Phenomenon of Man (New York: Harper, 1959) (attempting to ground technological progress in terms of value judgments); Rene Descartes, Principia Philosophiae (Londini: Excudebat J.F. pro Jona Hart, 1664) (founding a philosophical vision of reality on the view that nature is a machine and that all living creatures are merely intricate machines).

65 See e.g. Robert L. Rabin, "Tort Law in Transition: Tracing the Patterns of Sociolegal
Another interesting avenue of inquiry would be to ask whether the current categorizations of technology law areas make doctrinal sense. For instance, even the well-known ‘old’ categories of intellectual property law—patents, copyrights, and trademarks—arose not from natural law, but through complex social processes involving business lobbying, Victorian sensibilities and judicial misunderstanding of certain scientific principles.66 How has this categorization influenced subsequent legal developments?

Lawmaking is often a slow and tedious process, but technology often changes at break-neck speed. What are the implications of this apparent temporal gap between technological innovation and legal change? On the downside, the gap in time promotes legal uncertainty where affected parties cannot fully understand their legal rights and obligations.67 For example, the rapid technological evolution that permitted the development of sophisticated financing techniques through derivative securities, along with a lack of response by securities regulators, may have, in part, caused a number of recent financial scandals.68

On the upside, the gap in time would seem to permit more analysis and sober thought prior to policy implementation. Moreover, the unpredictable nature of technological developments suggests that, in many circumstances, legal reform may not be suitable, at least not until the implications of the technological changes can be better understood.69

At other times, law must struggle with technological indeterminacy as best as it can and move forward to protect interests and values. Efforts to constrain the use of technologies that allegedly promote global warming serve as an example: the science behind global warming and the impact of human-made

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66 See Sherman & Bently, supra note 1.


69 See, e.g., Harvard College v. Canada (Commissioner of Patents) [2002] 4 S.C.R. 45 (holding that the Patent Act does not permit the patenting of higher life forms such as a transgenic mouse and that legislative action, rather than judicial interpretation, is necessary to take into account the changing technological environment).
technologies on the environment is still uncertain, but the risk of inaction may be too great.\textsuperscript{70}

In summary, the law is technology view could teach us to determine when interests have been undermined by technological change such that the more flexible analytical approach is called for.

\section*{C. Technology is Law}

The discussion in the previous section raises an important question. In what circumstances should regulators seek more explicit control over technological developments?\textsuperscript{71} For the most part, we accept that law should only indirectly influence technological innovations by providing a legal framework for these developments to take place: capitalist democracies accept that law enables private property regimes under the values of liberalism or in an attempt to promote wealth creation by protecting the interests of innovators.\textsuperscript{72} Markets in turn determine whether technologies persist or become obsolete.

In certain circumstances, however, regulators should take more direct steps to mandate the use of technologies to protect interests and values. One of the central insights of the cyberlaw literature suggests that, in many circumstances, regulators should pass laws that determine the development of the Internet to

\begin{itemize}
  \item \textsuperscript{70} See e.g. J.T. Houghton et al., "Climate Change 2001: The Scientific Basis" Contribution of the Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change (2001) (concluding that most global warming over the last 50 years was caused by human-made chemicals). But see Bruce Pardy, "Changing Nature: The Myth of the Inevitability of Ecosystem Management" (2003) 20 Pace Envr. L. Rev. 675 at 692 (arguing that certain views on global ecosystem management may be misguided as they are based on faulty science and ideology).
  \item \textsuperscript{71} For efforts in this direction from a historian's perspective, see Ian Inkster, "The National Imperative: The State, Science and Technology, and Policy Evolution Circa 1400–2000" in Encyclopedia of Life Sciences (2002).
  \item \textsuperscript{72} For a discussion of the economics of innovation and technological diffusion, see generally Paul Stoneman, The Economics of Technological Diffusion (Oxford: Blackwell, 2002) at 306 (noting the need to link policy to theorizing on welfare optimality). See John Locke, Two Treatises of Government, Book 2 (London: A. & J. Churchill, 1690) at 41 (arguing that all free individuals have the right to promote self-preservation and that this right can only be secured by the right to property whereby an individual can secure the fruits of her labour). One fascinating historical footnote in the development of science and political philosophy is the friendship between Locke and Isaac Newton in the 17th Century. It may be the case that Locke based his views on the 'natural law' of individuals within society on insights developed by Newton that the entire universe operates on the basis of universal laws or principles. By the first few decades of the 18th Century, the views of Locke and Newton had edged out their Cartesian rivals, who had argued that knowledge sprang from the relationship between human and divine ideas. For discussion on this last point, see Michael Ayers, Locke (New York: Routledge, 1999) at 4–5.
\end{itemize}
indirectly influence the behavior of Internet users. Consider the ways that the 'code is law' approach can assist state and local governments in protecting interests such as the need to collect tax revenues. The main concern of the majority in Quill was that inter-state commerce would be inhibited if state and local governments were permitted to impose collection obligations on out-of-state businesses. This concern is being addressed by the Streamlined Sales Tax Project—a consortium of U.S. state tax authorities—where it is proposed that online vendors (or any remote vendors) will register on-line once with a central registration system (remote vendors must currently register with each state through a paper registration system). The states will maintain an on-line database with all relevant tax rates (assigned to zip codes) that can be accessed by the software programs employed by the remote vendors.

If implemented, the proposed technological solution could represent a practical solution to the daunting compliance issues for many remote retailers by automating the tax collection process. The growing use of 'Automated Tax Collection Systems', however, in turn creates concerns surrounding other interests such as consumer privacy and anonymity.

In fact, the 'code is law' approach can amount to a double-edged sword in many circumstances. As noted, governments are embracing or developing powerful surveillance technologies to promote national security interests. But this approach raises the risk that abusive state practices could take place, inhibiting important democratic values. Governments could counter-balance this risk by mandating the use of other technologies that could, for instance, track government computer searches.

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75 See Arthur J. Cockfield, "Transforming the Internet into a Taxable Forum: A Case Study in E-Commerce Taxation" (2001) 85 Minn. L. Rev. 1171.

76 Governments could, for example, pass legislation that would (a) govern how state agents can use technologies to collect and store personal information; (b) mandate the 'scrubbing' of personally identifying information from large databases; (c) mandate the use of logs to track government searches; and (d) provide for 'low tech' solutions such as forcing governments to publish lists of public spaces that are subject to police surveillance. See Cockfield, *Who Watches the Watchers*, supra note 43, at 400-402.
The point is that the code is law school of thought recognizes that technology imposes constraints on the behaviour of individuals and businesses. In a world increasingly mediated by complex technologies, the lesson may be that broader areas of technology could be subject to legal regulation as an effective mechanism to protect interests. Under this view, 'technology is law'.

Consider the ongoing debate surrounding whether and how law should regulate technologies that concern our bodies and reproductive rights in areas such as cloning, human organ transplants, abortion and stem cells.\(^77\) Governments must clearly tread warily when they take steps to exert control over the evolution of these technologies.\(^78\) But the debate seems to be particularly important in an era where technology can alter the very nature of human beings through 'reprogenetic' (reproductive and genetic) technologies that permit DNA to be altered at the fetal stage. Jurgen Habermas argues that these new reprogenetic technologies permit us to 'play God' by self-transforming our own species, undermining the relations between free and equal human beings.\(^79\) It may be necessary for regulators to ban certain DNA changes by indirectly regulating the scientists (the 'code writers' under cyberlaw theory) who are developing the new technologies.

More saliently, control by law is subject to the ability to enforce the law, given a specific technological environment. There are clearly limits in the ability of 'technology is law' solutions to assist, with efforts to enforce the law.\(^80\) These sorts of solutions may be particularly fruitless in an environment where control can be evaded when the subject of regulation moves to an unregulated jurisdiction.\(^81\) For example, a ban on human cloning probably impedes the de-


\(^78\) For discussion, see Yvonne M. Cripps, Controlling Technology: Genetic Engineering and the Law (New York: Praeger, 1980) at 9–19.

\(^79\) See Jurgen Habermas, The Future of Human Nature (Cambridge: Polity Press, 2003) (arguing that the genetic alteration of human embryos will lead to a lack of human freedom because it deprives future generations of autonomy); Bill McKibben, Enough: Staying Human in an Engineered Age (New York: Times Books, 2003) (asserting that the use of technologies to create 'designer families' will lead to a loss of meaning surrounding what it means to be human).

\(^80\) Witness the ongoing difficulties to embed copyright protection devices in digital goods to prevent unauthorized copyright infringement through peer-to-peer file sharing services. See e.g. Neil Netanel, "Impose a Noncommercial Use Levy to Allow Free Peer-to-Peer File Sharing" (2003) 17 Harv. J. L. & Tech. 1.

\(^81\) For discussion, see A. Michael Froomkin, "The Internet as a Source of Regulatory Arbitrage" in Brian Kahin & Charles Nesson, eds., Borders in Cyberspace (Cambridge: MIT Press, 1997) at 129.
velopment of this technology, but ultimately may simply push the technology offshore to an unregulated country where scientists will pursue their work without government interference.

In other areas, technology is law solutions can encourage better end results than the law itself because technology can prevent an activity from taking place. If a government wants a crime free state, it could mandate that DNA of all state residents should be altered to delete any crime-prone genes.\footnote{In a well-known work, Huxley satirized a similar approach where governments strive to promote individual happiness through a drug called soma. See Aldous Huxley, A Brave New World (Toronto: Granada Publishing Ltd., 1932).} The law, however, is normally limited to punishing individuals after they have committed a crime. Unlike law, technology offers the potential to avoid undesirable behaviours before they happen.

D. Summary: Is the Legal Rule Scientific?

As discussed, law more rarely attempts to direct technological change due to the view that markets do a better job, in the absence of market failures, at determining which technologies will be adopted.\footnote{For a recent treatment on the role that governments and private sector actors play in economic activity, see Michael J. Trebilcock & Edward M. Iacobucci, "Privatization and Accountability" (2003) 116 Harv. L. Rev. 1422. But see Samuel E. Trosow, "The Illusive Search for Justificatory Theories: Copyright, Commodification and Capital" (2003) 16 Can. J. Law & Juris. 217 at 218 (arguing for an approach rooted in neo-Marxian political economy and critical social theory).} Perhaps a better way to approach the relationship between law and technology is to ask how law should adjust to a given and expected technological environment, an approach that may ultimately prove to be more successful at promoting desired behaviour and policy objectives.

Law and economics asks 'is a legal rule efficient' when determining whether a legal rule achieves its goal in promoting certain types of behaviour that maximize societal wealth.\footnote{See A. Mitchell Polinsky, An Introduction to Law and Economics, 2nd ed. (Reading, MA.: Addison Welsley, 1989) at 7–10.} Law and technology could similarly use consequential analysis by asking whether a legal rule, given a current or anticipated technological environment, will promote a desired policy outcome. Another way of phrasing the question would be to ask: 'is a legal rule scientific'?\footnote{By 'scientific' it is not meant to suggest that the legal rule should be able to generate a desired outcome in a way that could be measured by a scientific method. Rather, the term is meant to focus attention on the ways that legal rules interact with technological environments.} This is in fact the approach employed by courts, at least inferentially, in the examples in Part II when they used the liberal approach to scrutinize fact patterns within a
broader context of changing technologies to determine how law should move forward.

Figure A

Law + Technology = Individual or Group Behaviour = Policy Outcome

Figure A sets out a simple model to assist in the understanding of this proposed consequential analysis. The model focuses attention on the fact that the interaction between law and technology influences how individuals behave. The model attempts to isolate the role of technology with respect to legal developments (although it is recognized that markets, norms and other social institutions also influence individual and group behaviour). This in turn will determine the end result or policy outcome, which focuses attention on the interests at stake. This end result could be measured in terms of the social or economic cost of having individuals engage in such behaviour.

An example where this approach might have helped involves the OECD’s server/permanent establishment rule where national tax authorities are now permitted to tax profits attributable to a computer server’s software functions. In addition, the new rule ignores the fact that information goods—such as the software program within a server—have common attributes such as high fixed costs of production and low or nil costs for reproduction and distribution. The fact that it is almost costless to ship digital goods and services and software programs to servers located around the world suggests that the new rule that focuses tax nexus on these information goods is not ‘scientific’ in the sense that it does have a good fit with current or anticipated technological environment. As discussed, server/permanent establishments may lead to end results such as revenue losses under tax planning and increase the risk of double taxation which inhibits international trade and investment.

The main point of the model is to illustrate that a more explicit consideration of the relationship between law and technology, through the development of general principles that scrutinize this relationship, will promote a more informed legal analysis. A problem with the model is that it might be seen to portray a linear relationship between law and technology. In fact, this relationship is complex and interactive in that both law and technology provoke changes to

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86 For discussion on different ‘modalities’ of regulation, see Lessig, “Law of Horse”, supra note 15. For discussion on the ways that technology, market forces and norms constrain individual behaviour, see also Lawrence Lessig, “The Zones of Cyberspace” (1996) 48 Stan. L. Rev. 1403 at 1407–1409.

the other, which subsequently influences the next outcome; as discussed, linear analysis is often not an appropriate way to approach the relationship between law and technology. Social science models typically assume that causality is iterative so that the outcomes of one iteration influences the interaction of law and technology in subsequent iterations. Accordingly, the model could be used to generate a dynamic perspective on different policy choices and outcomes. This approach could incorporate empirical analysis, which would be consistent with a trend towards the development of legal scholarship that is less jurisprudential and more like the theories found within the natural or social sciences.

IV. LAW, TECHNOLOGY AND THE TRANSFORMATION OF THE WHOLE LAW

This section discusses how a critical examination of the interplay between law and technology can provide insight into the whole law. It begins with a brief discussion on the need for law and technology theory to provide better predictions concerning policy outcomes, which necessarily must take into account how policy solutions provoke changes throughout the whole law. The Part then turns to a tentative discussion on the different ways that the liberal and conservative approaches transform the whole law.

A. Discerning the Path of the Law

According to Holmes, the law involves giving predictions on legal outcomes to given fact patterns: “The prophecies of what courts will do in fact, and nothing more pretentious, are what I mean by the law.” In addition, he wrote, “Far the

88 As discussed, technology cannot be completely disentangled from other social institutions or, for that matter, law. Rather, the model is useful to think about the probabilities of a particular outcome based on this environment: law and technology, working together, determine an opportunity set for affected parties. It might even be possible to calculate probable results of choices of law.


90 The discussion is tentative because it only purports to provide a few initial observations that can be explored in greater detail by future research efforts.

91 See Oliver Wendell Holmes, Jr., “The Path of the Law” (1897) 10 Harv. L. Rev. 457 at 461.
most important and pretty nearly the whole meaning of every new effort of legal thought is to make these prophecies more precise, and to generalize them into a thoroughly connected system.\textsuperscript{92} Similarly, Cardozo pointed out,

A philosophy of law will tell us how law comes into being, how it grows, and whither it tends ... It is these generalities and abstractions that give direction to legal thinking, that sway the minds of judges[...]. \textsuperscript{93}

While H.L.A. Hart might disagree with the emphasis on law as a series of rules, he similarly recognized that all legal "rules have a penumbra of uncertainty where judges must choose between alternatives."\textsuperscript{94}

For these reasons, legal theories are primarily pre-occupied with analysis that can provide guidance to courts and policy makers so that they can generate socially desired outcomes. The challenge for a law and technology theory would similarly be to assist in providing prescriptions to courts and others who seek optimal policy solutions. Two sets of interests must be taken into account by courts and regulators when they consider a proposed policy solution: (1) the interests at stake for a particular person in a given fact pattern; and (2) the broader interests at stake for other current or future parties.\textsuperscript{95} As a result, law and technology theory should strive to teach us how to protect interests in particular cases as well as how a decision will affect other interests once it is integrated within the whole law.

\textbf{B. The Liberal Approach and the Transformation of the Whole Law through the Principle of Technological Neutrality}

Because the law strives to ensure that substantively similar activities are treated the same way, it generally operates on the basis of what could be called the principle of technological neutrality.\textsuperscript{96} This occurs due to the desire for law to

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{92} \textit{Ibid.} at 457–458.
\item \textsuperscript{93} See Benjamin N. Cardozo, \textit{The Growth of the Law} (New Haven: Yale University, 1924) at 24–25, 55.
\item \textsuperscript{94} See H.L.A. Hart, \textit{The Concept of Law} (Oxford: Clarendon Press, 1961) at 7, 12–13. (arguing that the conception of law as merely a matter of rules is misplaced and that law is best understood as a branch of morality or justice).
\item \textsuperscript{95} Courts employ this approach because their decisions act as future precedents for other courts. Policymakers must also take into consideration how a particular law or policy will affect certain fact patterns as well as broader social interests.
\item \textsuperscript{96} This view of technological neutrality is to be distinguished from the 'neutrality of technology' view where "technology is a passive tool in which no values are embedded and it is apolitical in that it is not concerned with relations of power or domination." See Trosow, \textit{supra} note 10 at 442.
\end{itemize}
\end{footnotesize}
be applied consistently to similar fact patterns that involve different technologies. Criminal law does not care whether someone has been murdered with a hammer or shot with a gun; it is only concerned that the alleged perpetrator had the requisite mental state to intend the murder. Similarly, Brandeis argued in his dissent in *Olmstead* that constitutional prohibitions against unreasonable searches should be applied consistently in cases where state agents wish to barge through your front door to collect evidence of wrong-doing as well as situations where they prefer to employ wiretaps to accomplish the same objective. Brandeis and Warren also noted that the law tries to preserve the right of each individual to communicate her thoughts and emotions with others regardless of the "particular method of expression adopted. It is immaterial whether it be by word, or by signs, in painting, by sculpture, or in music."  

The principle of technological neutrality is also evident in contract law. Under this view, laws should normally be applied in the same way no matter what technologies are employed to carry out the contract. As a result, legislatures have passed laws to ensure that e-commerce contracts will attract the same legal analysis as traditional contracts. Lawmakers have even taken steps to ensure that contracts between two machines are enforceable, just as contracts would be if they were entered into between two human beings.  

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97 Brandeis argued that warrantless wiretap searches by the police violated the Fourth Amendment because this form of search amounted to the same (or worse) invasion of privacy as a physical search of the premises by state agents. Brandeis famously noted, "The makers of our Constitution ... conferred, as against the government, the right to be let alone—the most comprehensive of rights and the right most valued by civilized men. To protect that right, every unjustifiable intrusion by the government upon the privacy of the individual, whatever the means employed, must be deemed a violation of the Fourth Amendment." *Olmstead v. United States*, 277 U.S. 438 (1928) (Brandeis J., dissenting). Brandeis recognized that, while wiretapping was designed to protect against crime, the over-extension of the new technology could lead to an environment that is less secure. The majority in *Olmstead*, however, pursued a more conservative approach by relying on precedent to hold that the Fourth Amendment only contemplated protection against physical searches of households.


99 In certain areas, contract law provides different treatment for different technologies. For example, under the general rule of offer and acceptance, a contract is formed when the offeree communicates acceptance of the offer to the offeror. The exception to the general rule is the postal acceptance rule whereby parties that contract via the mail will be bound when the offeree puts the acceptance in the mail (despite the fact that the offeror has not actually received communication of the acceptance).

100 See *Uniform Electronic Transactions Act* (1999).

101 See *Uniform Electronic Transactions Act*, § 14(1) (1999). See also *Uniform Computer Information Transactions Act*, § 107 (1999), and the *Uniform Electronic Commerce Act*, § 21 (1999) (Can.). Observers have noted that machine-contracting raises problems for tra-
larly, courts have strived to enforce online contracts by drawing analogies between electronic communications and written agreements.102

These court decisions as well as the electronic commerce statutes are consistent with the principle of technological neutrality as they strive to ensure that technological developments do not undermine interests such as the need to preserve efficient private bargaining while ensuring that consumer interest are respected. But the principle of technological neutrality has implications that are perhaps not as obvious: once a court or policy analyst accepts that more flexible analysis is required to protect interests affected by technology developments, these same principles will likely be applied to situations where technology changes have not significantly affected values.

We have seen that courts in cases like Pro CD have accepted a more flexible interpretation of the doctrine by holding that parties are bound by shrink-wrap agreements that provide notice of additional terms in some other document. This new approach will have to be squared at some point with the traditional analysis. If client interests can be supported by a broader view of consideration, lawyers will argue that the new more flexible interpretation should be applied to cases involving, say, steel suppliers and construction companies and so earlier decisions that upheld a stricter view of the exchange doctrine will need to be revisited. The main deficiency of this approach in the area of con-

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102 Courts have generally taken care to enforce 'clickwrap agreements' (i.e., an online agreement where consumers can 'click' on an icon to signify their assent to be bound by the agreement) just as they would traditional written agreements. See, e.g., In re RealNetworks, Inc. Privacy Litigation, No. 00C1366, 2000 WL 631341 (N.D. Ill. May 8, 2000); Hotmail Corp. v. Van$ Money Pie, Inc., No. C 98-20064, 1998 WL 388389 (N.D. Cal. 1998). In upholding provisions within a clickwrap agreement, a court has noted, "Plaintiffs must be taken to have known that they were entering into a contract; and no good purpose, consonant with the dictates of reasonable reliability in commerce, would be served by permitting them to disavow particular provisions or the contracts as a whole." See Caspi v. The Microsoft Network, L.L.C., 732 A.2d 528 (N.J. App. 1999). But see America Online, Inc. v. Superior Court of Alameda County, No. A092813 (Cal. Dist. Ct. App. June 21, 2001) (rejecting the use by AOL of a forum selection clause as being contrary to California public policy). When consumers have argued that they could not read all of the contract on the screen because they had to scroll through the agreement to find provisions, another court pointed out, "Admittedly, the entire Agreement cannot be displayed at once on the computer screen, but this is not materially different from a multi-page written document which requires a party to turn pages." See Rudder v. Microsoft Corp. [1999] O.J. No. 3778, 2 C.P.R. (4th) 474, 480-481 (Ont. C.A.).
tracts is that it could undermine business certainty as the flexible approach is less deferential toward precedents.

Similar changes may take place throughout the whole law as the liberal approach is deployed in areas that have been relatively unaffected by technology changes. The point here is that the law evolves by integrating different perspectives and, in times of technology change that destabilizes values and interest, the law will integrate the more flexible and forward looking approach. In fact, this transformation may form part of the ability of the common law to "work itself pure" by self-correcting deficiencies that lead to unjust and inefficient results. 103

This transformation of the entire law is not without drawbacks. It would undermine the common law principle of stare decisis because old decisions may be less helpful as precedents for present or future cases. This in turn makes it more difficult for lawyers to predict the outcome of a case when they advise clients. As discussed, a goal of law and technology theory would be to assist in determining when interests have been sufficiently destabilized by technology development so that the more liberal approach is called for. 104 Policy decisions at the intersection of law and technology must thus take into account the need to protect interests through the more flexible approach while at the same time respecting the need to follow traditional doctrinal analysis when a departure from this analysis would unduly harm other interests such as the need for certainty in the provision of legal advice.

C. The Conservative Approach and the Transformation of the Law

The conservative approach employed by regulators and courts whereby they tend to follow traditional doctrine will also transform the whole law, but in ways that are likely even more difficult to predict. Consider, for example, the Streamlined Sales Tax Project (SSTP) where state tax authorities are striving toward radical unification and simplification of the forty-five state and over 7,000 local sales tax systems: these developments are directly attributable to the U.S. Supreme Court decisions that prevent states from imposing collection obligations on out-of-state retailers. 105 Under the SSTP, all state and local governments will adopt the same sales tax base to simplify filing requirements. 106 If successful,

103 See text accompanying note 2.

104 See the discussion in the text accompanying notes 63 to 70.

105 By simplifying and harmonization sales taxes, the states hope to assuage concerns that collection obligations on remote retailers interfere with inter-state commerce. See the discussion accompanying note 27.

106 It is unclear, however, whether the efforts by state tax authorities will ultimately bear fruit due to continued efforts by the federal government to preempt state taxing powers.
state governments will have sacrificed a significant amount of their fiscal sovereignty by agreeing for the first time to forego their ability to choose any tax they see fit.

The new state of affairs would thus fundamentally shift the balance of powers between state and national government within a federation. This proposed harmonized sales tax regime will in turn affect other areas that have been unaffected by technological changes. That is, the new regime will be deployed with respect to all sales within the state and not only remote sales encouraged by new technologies. A state that previously exempted food from sales taxation (under the view that low income state residents should be able to buy tax-free food) could be forced to tax food under the proposed harmonized sales tax system.

The conservative approach used by the majority of the Supreme Court may hence lead to a dramatic transformation of state and local sales taxation in areas that have been relatively unaffected by technological change. Other areas of law may witness similar disruptive change when they become transformed in ways that are difficult to foresee. For example, the liberal approach employed by the Brandeis dissent in 

Olmstead—where he recognized that wiretap searches should be subject to traditional legal safeguards against unreasonable searches—was eventually adopted by the majority of the U.S. Supreme Court, but this process took almost forty years. 107 The conservative approach by the majority in 

Olmstead hence led to significant uncertainty within the law during this period.

In the example of state taxes as well as surveillance practices, the conservative approach has been or will be revisited to protect interests, so in a sense the law has also “worked itself pure.” But the ultimate preservation of interests was accomplished through a more disruptive path. In other words, the conservative approach creates even greater uncertainty concerning the transformation of the law in comparison to the uncertainty created by the liberal approach. This provides further support for the use of the liberal approach that calls for more technologically sensitive ways of looking at the law.

107 Brandeis’ dissent eventually became the majority view in 

Katz v. United States, 389 U.S. 347 at 361 (1967). The U.S. Supreme Court recently held that police use of thermal imaging to scan for the use of high intensity grow lamps inside private residences constitutes an impermissible search. 

Kyllo v. United States, 533 U.S. 27 (2001). The Ontario Court of Appeal has similarly held that the use by the police of airplanes equipped with Forward Looking Infra-Red (FLIR) to detect heat emanations indicative of marijuana growing constituted a search that required prior judicial authorization under s. 8 of the 

V. CONCLUSION

Law influences and reacts to technological change: holes are patched up—sometimes the job is done properly while, at other times, the job is botched—and the entire process moves forward seemingly inexorably to repeat itself again and again. This Part made the case that it is time to develop a theory of law and technology to be applied broadly to the entire law to generate more informed legal analysis. Three examples surrounding contracts, tax law and privacy law, show that courts and regulators are struggling with technological/legal developments with uneven results. The better approach—the so-called liberal approach—is to employ flexible and forward-looking analysis that broadly considers the interplay between technology and law to protect values and interests when they are threatened by technological developments.

This liberal approach could involve a critical examination of the questions at the intersection of law and technology: How does the complex and non-linear relationship between law and technology affect interests that the law seeks to protect? When should the flexible legal analysis be employed to protect traditional interests from being undermined by technological developments ("law is technology")? When should law act as a catalyst for technological change to indirectly promote desired social ends ("technology is law")? In summary, given a current or anticipated technological landscape, how can legal rules ensure that values and interests are protected ("is the legal rule scientific")?

Law and technology theory can provide insight into the ways that the whole law is transformed by policy decisions at the intersection of law and technology. For example, the liberal approach transforms the entire law when this analysis is brought to bear on other areas that have been relatively unaffected by technological developments. The main downside of this transformation is that it may destabilize the law by undermining the doctrine of precedent.

As discussed by Sherman and Bentley, in the mid-19th century when traditional doctrine could not properly adapt to technological developments, English intellectual property law became more abstract and forward looking: "the law was not only concerned with the objects that it was regulating, it was also interested in the shape that the law itself took." Similarly, the development of a system of analysis—a law and technology theory—that could apply general principles to situations involving technological change could help to promote more informed policy analysis. The hope of this essay is to begin a discussion on the directions that such a theory might take.