

UC Berkeley
Boalt Working Papers in Public Law

Title

A New Dynamism in the Public Domain

Permalink

<https://escholarship.org/uc/item/2wq63359>

Author

Merges, Robert P

Publication Date

2004-03-01

A New Dynamism in the Public Domain

Robert P. Merges[†]

Many believe intellectual property has overreached, and that policymakers must respond. In this Essay, I argue that the critique may have merit, but private parties are in some cases taking matters into their own hands. Firms and individuals are increasingly injecting information into the public domain with the explicit goal of preempting or undermining the potential property rights of economic adversaries. Biotechnology firms invest millions of dollars in public domain gene sequence databases, to prevent hold-ups by firms with patents on short gene sequences. Major software firms fight entrenched rivals by investing millions of dollars, contributing to open source operating systems. In both cases, property-preempting investments (PPIs) are made to offset the effects of competitors' property rights. Individuals and nonprofits are joining in too, with initiatives such as the Creative Commons project. All of these major private investments in the public domain reveal a self-correcting feature of the intellectual property system that has been overlooked until now, and signal that public lawmaking is not the only arena in which the excesses of intellectual property may be addressed.

INTRODUCTION

The growing Conventional Critique in the intellectual property (IP) world is this: there are too many IP rights; they are too strong; “something” has to be done. No one knows for sure how accurate the Conventional Critique is, though those of us in the field all have our opinions.¹ This Essay is not really about the Conventional Critique, though; it is about what follows from it—the “something” that must be done. For the most part, IP scholars normally suggest changes in government policy. Rights must be rolled back, or at least counterbalanced, by some action: the courts, the Constitution, Congress, international treaties—whatever force can be brought to bear. I don’t take issue with these proposals here. Instead, I argue that while we policy types debate, private actors are taking action. From large-scale investments by pharmaceutical firms in public domain gene sequences, to massive investments by IBM in “open source” software, to the advent of the “Creative Commons” concept that permits any creator of digital content to specify open-access terms of use, we have been witnessing massive growth in private initiatives to expand the public domain. The simple point of this Essay is that

[†] Wilson, Sonsini, Goodrich & Rosati Professor of Law, U.C. Berkeley (Boalt Hall) School of Law, and Professor of Law, U.C. Davis School of Law. The author acknowledges the helpful comments of Anupam Chander and Mark Lemley, but the usual disclaimer applies.

¹ Mine is that in some areas the critique is overheated. See, for example, Robert P. Merges, *One Hundred Years of Solicitude: Intellectual Property Law 1900–2000*, 88 Cal L Rev 2187 (2001) (arguing that IP law has generally evolved in a functional and reasonably efficient manner). In others, it is long overdue. See note 5.

these investments are invigorating the public domain with a new dynamism stemming from private action.² These investments demonstrate that private action, and not just government policy, can augment the public domain.³

Because property rights have become so valuable, the public domain has become a more important resource. The pervasiveness of IP rights has raised our awareness of the importance and strategic uses of the public domain. This more intentional attitude constitutes a very important, but so far largely hidden, new development in the world of IP rights. At a minimum, this development ought to make us a bit less anxious about the consequences of what has been called the “second enclosure movement.”⁴ Even without major changes in government policy, the sky may not be falling quite yet. More speculatively, the increasing importance of the public domain may represent a partial self-correcting impulse in the IP system. Just possibly, the same private initiative that has led to the expansion of IP rights may be capable of partially counteracting this expansion. Simply put, conditions may have changed enough to increase private incentives to reduce property-related hassles. Whatever form these take—from private initiatives enabling the dissemination of “property-free” content, to large-scale corporate investments strategically preempting competitors’ property rights—they have one thing in common. They increase the scope and content of the public domain. The strengthening of IP rights, in other words, may in part account for the new dynamism in the public domain.

Because the care and feeding of the public domain is an important goal shared by everyone in the IP system, I argue below that we ought to find ways to encourage this behavior. Curiously, perhaps, our focus on rolling back property entitlements has led us to overlook some far simpler (and perhaps politically more feasible) ways to expand the public domain. One in particular—robust property disclaimers that make it easier to categorically dedicate works to the public domain—is spelled out at the end of Part IV.B.

² Active efforts by private firms and individuals to inject subject matter immediately into the public domain are a far cry from the traditional view of the public domain as a residual category of material that for various reasons is not protected by a property right. See, for example, *Compro Corp v Day-Brite Lighting, Inc.*, 376 US 234, 237 (1964) (“To forbid copying [under state unfair competition law] would interfere with the federal policy, found in Art. I, § 8, cl. 8, of the Constitution and in the implementing federal statutes, of allowing free access to copy whatever the federal patent and copyright laws leave in the public domain.”).

³ My focus on private action contrasts with past discussions, where government policy—typically legislation and court decisions—is seen as the only way to affect the size of the public domain. See, for example, David Lange, *Recognizing the Public Domain*, 44 L & Contemp Probs 147, 173–78 (Autumn 1981); Jessica Litman, *The Public Domain*, 39 Emory L J 965 (1990). For a good treatment of exactly what we mean by “the public domain,” see A. Samuel Oddi, *The Tragicomedy of the Public Domain in Intellectual Property Law*, 25 Hastings Commun & Enter L J 1, 1–8 (2002).

⁴ James Boyle, *The Second Enclosure Movement and the Construction of the Public Domain*, 66 L & Contemp Probs 33, 37 (2001).

Before diving into the substance of the Essay, let me address a potential misconception. It would be easy to read over this Essay quickly and come away with the conclusion that Merges thinks all is well in the IP world, and that even the most egregious excesses of the system will be offset by the mechanisms discussed here. This is incorrect, and I want to make that clear up front. I have a good deal of sympathy for some of the complaints that have been laid at the door of the current IP system; I have even identified a few myself, such as low patent quality and “private” patent bills.⁵ I do not think private investments in the public domain will always precisely counterbalance every excess the system foists upon our economy and society. But I do believe that public debate takes a long time. At worst, if those who have authored the Conventional Critique are right, some of the excesses we have witnessed may never be effectively rolled back. In any event, second-best solutions may be all we have to work with at times. It is in this spirit of realism that I offer this Essay.

I. PROPERTY-PREEMPTING INVESTMENTS

As the value of property increases, the value of preempting property rights increases as well. Firms have figured this out. In important industries such as biotechnology and software, private firms are spending significant sums of money to create assets that preempt intellectual property rights for strategic reasons. I term these “Property-Preempting Investments,” or “PPIs.”⁶ PPIs work because of a basic feature of our system: once in the public domain, information cannot be privatized. If it is in a firm’s interest to preempt an asset from being privatized, the firm will invest in creation of that asset and then inject it into the public domain. Thus, firms employing PPIs contribute to the public domain while pursuing their own private interests.

⁵ Robert P. Merges, *As Many as Six Impossible Patents before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 Berkeley Tech L J 577 (1999) (criticizing patent quality); Robert P. Merges and Glenn H. Reynolds, *The Proper Scope of the Patent and Copyright Power*, 37 Harv J on Legis 45 (2000) (criticizing private patent bills).

⁶ In an earlier draft, I called these investments “anti-property.” The thought was that anti-property is to property as antimatter is to matter. An asset covered by anti-property is designed to annihilate a proprietary asset, just as in physics antimatter annihilates matter. But around the same time I was writing my draft, a working paper appeared with the title “Of Property and Anti-property.” See Abraham Bell and Gideon Parchomovsky, *Of Property and Anti-property* (Working Paper No 3-03, Interdisciplinary Program for Law, Rationality, Ethics and Social Justice, Faculty of Law, Bar-Ilan University, May 2003), online at http://www.biu.ac.il/law/unger/working_papers/3-03.pdf (visited Dec 16, 2003). Bell and Parchomovsky use “anti-property” in a sense meant to play on the “anticommons” literature: for them, anti-property denotes disparate, discrete entitlements given to many holders with the intent of creating a socially desirable anticommons to inhibit resource development transactions and thereby promote conservation. I was planning to use the word in a different sense, but in the interest of reducing confusion, and out of deference to a former student (Parchomovsky), I settled on the longer phrase “property-preempting investments.”

In this Essay, I give two primary examples of PPIs, one from biotechnology and one from the software industry. As described in Part I.A, a number of firms in the biotechnology industry have invested in the creation of public domain databases designed to preempt property rights claims over potentially valuable inputs in the research process. In Part I.B, I explain private firm involvement in “open source” software in similar terms, drawing in particular on IBM’s investment in the Linux operating system. This investment, I argue, contributes to a nonproprietary operating system that undermines Microsoft’s Windows. Importantly, what makes Linux attractive to customers and developers of complementary products is that by distributing it under an “open source” licensing agreement, IBM preempts any exclusive property claims to the program. This amounts to a credible commitment that no one—including IBM itself—will be able to exercise the sort of hold-up power that comes with exclusive ownership of property rights in a computer operating system.

In both cases, private firms are adopting strategies to preempt property rights by making substantial investments in resources that are immediately dedicated to the public. These investments should interest property rights theorists for two primary reasons: (1) they indicate that strong rights lead to investments in the public domain; and (2) they suggest a private-ordering response to the phenomenon of the “anticommons.” Further, they stimulate a fascinating conjecture: as the value of property rights increases, so will the value of investments to preempt property rights—or PPIs. PPIs may reveal a self-regulating aspect of the IP world that is just now coming into focus.

A. Biotechnology: Private Investments in Response to an “Anticommons”

The recent controversy over biomedical research patenting is a prime example of what has come to be known as an “anticommons.” An anticommons results when many exclusive rights over a single resource are assigned to disparate rightholders. Assembling the rights to permit exploitation of the resource involves prohibitive transaction costs—with the result that the resource may go underutilized. The normative thrust of anticommons theory is that policymakers need to define property rights carefully, keeping in mind post-grant transaction cost considerations. In their celebrated article in *Science*, Heller and Eisenberg apply the anticommons concept to the problem of proliferating patents in the area of biomedical research and development.⁷ They conclude that it is possible for patents to create over-fragmentation in this area, and that

⁷ Michael A. Heller and Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 *Science* 698 (1998).

patents may therefore wind up deterring innovation instead of encouraging it.⁸ They call for the legal system to define “coherent” bundles of rights so as to prevent over-fragmentation.⁹ In addition, they argue that “policymakers should seek to ensure coherent boundaries of upstream patents and to minimize restrictive licensing practices that interfere with downstream product development.”¹⁰

Despite its elegance, anticommons theory has yet to generate much in the way of direct policy change. Nevertheless, Heller and Eisenberg are definitely on to something; the theory seems to have considerable descriptive power.¹¹ Given this theory, and in the absence of policy responses, how have firms responded to this emerging “tragedy”?

One example of a firm-level response comes in the area of genomics. Patents on short snippets of the human genetic code were thought to be emerging as a major threat to effective pharmaceutical research. A large number of independent firms were filing patent applications on gene sequences, prompting fears that a large number of discrete, independently held patents would have to be licensed if a biotechnology or pharmaceutical firm sought to develop an effective diagnostic for the presence of a particular gene or a therapeutic drug aimed at the product of that gene. In other words, a perfect anticommons setup. The National Institutes of Health had put these issues into sharp focus by filing test patent applications on “expressed sequence tags” (ESTs), short snippets of DNA associated with genes that are expressed in the human body. Some experts argued against the patentability of ESTs,¹² and there was widespread concern that these patents would proliferate and create serious transaction cost problems for downstream users in the biotechnology industry.

Into this picture stepped a number of private pharmaceutical firms, beginning with Merck Pharmaceuticals. In February of 1995, Merck announced the creation of the Merck Gene Index, in collaboration with Washington University in St. Louis. This is a public database of gene sequences corresponding to expressed human genes—that is, those genes that code for a protein product in the human body. Merck announced that it would characterize *and make freely available* as many gene sequences in as short a period of time as possible.¹³ By 1998, the Index had

⁸ Id at 701.

⁹ Id.

¹⁰ Id.

¹¹ See, for example, James M. Buchanan and Young J. Yoon, *Symmetric Tragedies: Commons and Anticommons*, 43 J L & Econ 1 (2000); Francesco Parisi, Norbert Schulz, and Ben Depoorter, *Simultaneous and Sequential Anticommons*, Eur J L & Econ (forthcoming), online at <http://papers.ssrn.com/id=388880> (visited Feb 8, 2004).

¹² See, for example, Rebecca S. Eisenberg and Robert P. Merges, *Opinion Letter as to the Patentability of Certain Inventions Associated with the Identification of Partial cDNA Sequences*, 23 AIPLA Q J 1, 51–52 (1995).

¹³ See Merck & Co, Press Release, *First Installment of Merck Gene Index Data Released to*

published over eight hundred thousand gene sequences.¹⁴ According to one estimate, the firm spent several million dollars to preempt the threat that patents would stall research projects that depended on gene sequence data.¹⁵ Recent evaluations of the threat of EST patents indicate that the Merck strategy has contributed to a significant easing of the anticommons threat in this area.¹⁶

Merck sees gene sequences as inputs, rather than end products.¹⁷ Company officials also stated that rapid diffusion of the index would speed the development of worldwide research efforts. But the key strategic significance of the Merck Index is that it precludes patents for any sequence published prior to another firm's isolation of the sequence. In response to the threat that one of its key inputs would be encumbered with excessive licensing fees and transaction costs, Merck set out to preempt the anticommons dynamic that was emerging.

Richard Epstein, in a very thoughtful and (thankfully) moderate paper on EST patenting issues, notes that many firms have filed patent applications on gene sequences even where their "first best" preference was to keep these inputs in the public domain:

[Merck] made that decision in the knowledge that other firms would be able to free ride on its decision to engage in unilateral publication of the information. The only reason for making this judgment is that the blocking value of the ESTs (at least at the time these decisions were made) was far greater than their use value. It was worth in a word privately creating some form of a public good. The quiescence with the EST cases suggests that other firms share this vision. No individual firm could simply pull its application with the knowledge that other firms might prevail on their own. So the applications remain in place, even when submitted by firms who think that the first best solution in cases of this sort is for all ESTs

Public Databases: Cooperative Effort Promises to Speed Scientific Understanding of the Human Genome (Feb 10, 1995), online at http://www.ncbi.nlm.nih.gov/Web/Whats_New/Announce/merck_feb10_95.html (visited Dec 16, 2003).

¹⁴ *1998 Merck Annual Report*, online at <http://www.merck.com/overview/98ar/p17.htm> (visited Dec 16, 2003).

¹⁵ Rebecca S. Eisenberg, *Intellectual Property at the Public-Private Divide: The Case of Large-Scale cDNA Sequencing*, 3 U Chi Roundtable 557, 569–70 (1996), citing David Dickson, 'Gene Map' Plan Highlights Dispute over Public vs Private Interest, 371 Nature 365 (1994).

¹⁶ See Bradley J. Levang, Comment, *Evaluating the Use of Patent Pools for Biotechnology: A Refutation to the USPTO White Paper Concerning Biotechnology Patent Pools*, 19 Santa Clara Computer & High Tech L J 229 (2002), which states that:

[D]espite the countless number of patent applications, experts believe that most of these patent applications will never be granted. . . . To date, the USPTO has only granted about 2,000 full-length gene patents. Gene databases like [the] Merck [Index], the Institute for Genomic Research, and the Human Genome Project will further reduce the number of granted genomic patents by placing genomic information into the public domain.

Id at 241 (internal citations omitted).

¹⁷ See Eisenberg, 3 U Chi Roundtable at 571 (cited in note 15).

to fall within the public domain. So long as no one succeeds, everyone is better off. But if one firm succeeds then the usual logic of the prisoner's dilemma game exerts its corrosive effect: all will want to obtain blockade positions if one does.¹⁸

Another example of private investment to preempt an anticommons comes in the area of Single Nucleotide Polymorphisms, or SNPs.¹⁹ In the late 1990s, scientists were beginning to appreciate the value of SNPs as "disease markers," which could make them extremely valuable as diagnostic tools. French biotechnology firm Genset was said to have begun filing patent applications in this area.²⁰ SNPs represent a perfect example of a potential anticommons, since in theory many SNPs might be present in an important gene, such as a common mutated gene that causes a disease. Any firm wishing to do research on the gene or its protein product, or to devise a therapy to treat the disease, would in theory have to license every patented SNP associated with the gene.

Into this fray stepped a group of private firms and nonprofit research organizations, intent on preempting the emerging anticommons problem. According to a trade magazine:

The prospect of SNP patents led ten major pharmaceutical companies to create the SNP Consortium in April, 1999. The Consortium's goal is to place 300,000 SNPs, evenly spaced throughout the genome, in the public domain. ([As of 2000], about 10,000 [had] been released.) That's to facilitate whole-genome disease gene association studies, considered the key to unlocking the genetic roots of complex diseases like diabetes, heart disease and schizophrenia.²¹

In fact, as the Consortium got rolling, it generated and posted 1.8 million SNPs,²² with members contributing at least \$45 million to the effort.²³

¹⁸ Richard A. Epstein, *Steady the Course: Property Rights in Genetic Material* 48–49 (Working Paper No 152 (2d Series), Olin Program in Law and Economics, University of Chicago Law School), online at <http://www.law.uchicago.edu/Lawecon/index.html> (visited Dec 16, 2003). For a less sanguine view, see Rochelle Cooper Dreyfuss, *Varying the Course in Patenting Genetic Material: A Counter-proposal to Richard Epstein's Steady Course* (Public Law Research Paper No 59, NYU School of Law, Apr 2003), online at <http://papers.ssrn.com/id=394000> (visited Dec 16, 2003).

¹⁹ An SNP is a tiny variation in a gene—a one base pair variation in the genetic code that is sometimes associated with disease susceptibility. See National Center for Biotechnology Information, *SNPs: Variations on a Theme* (Mar 27, 2003), online at <http://www.ncbi.nlm.nih.gov/About/primer/snps.html> (visited Dec 16, 2003).

²⁰ Ken Garber, *Homestead 2000: The Genome*, *Signals Magazine* (Mar 3, 2000), online at <http://www.signalsmag.com/signalsmag.nsf/publish/find?SearchView&Query=homestead> (visited Dec 16, 2003):

It was Genset's SNP discovery partnership with Abbott Laboratories that first alarmed other drug companies and led to the formation of the SNP consortium. [Genset officials] won't say how many SNPs Genset has filed patent applications on, but the eventual total is likely to be large. "For every major patent issued on genes, we expect to have several SNPs involved."

²¹ *Id.*

²² See SNP Consortium website, online at <http://snp.cshl.org> (visited Jan 16, 2004). Many

PPIs in the biotechnology industry suggest that policymakers pondering an emerging anticommons situation should examine responses in the private sector before implementing major changes. Private action may offset some of the effects of an anticommons, making it less necessary to act on the normative agenda of anticommons theory, an agenda that involves restricting property rights and carries obvious risks and costs. The biotechnology industry illustrates this point: it comprises both large and small firms interacting through a wide array of joint ventures and licensing deals²⁴—an industry structure that at least some economists argue is responsible for its overall success.²⁵ Therefore to the extent that patents prompt inter-firm contracting by small entrants and other industry players, a change in patent policy making it harder to obtain patents or restricting how they are licensed could change the way the industry works, perhaps for the worse. Some recent evidence suggests that innovation has not suffered despite the presence of a patent-related anticommons dynamic in the industry.²⁶ In such a setting, the emergence of PPIs should provide an additional reason to go slow in adopting a restrictive patent policy. If in addition to “contracting around” some property rights, firms can preempt other potentially costly rights, there is less reason to restrict those rights in the first place.

B. The Slightly Different Case of Computer Operating Systems

Academics seem fascinated with the advent of “open source” software—software developed by a loose body of volunteer programmers and disseminated without restrictive proprietary claims. In this brief Part, I avoid the debate over why open source software first emerged and whether it will survive the commercialization stage that is rapidly overtaking the original “movement.” Instead, I want to focus on why private firms such as IBM would invest substantial resources in further developing and promoting open source software.²⁷ These investments are

members of the SNP Consortium have now moved on to a more ambitious project: mapping associated groups of SNPs in “haplotype blocks” to form a “haplotype map” (or “HapMap”). See National Human Genome Research Institute, *International HapMap Project*, online at <http://www.genome.gov/10001688> (visited Dec 16, 2003).

²³ See Kristen Philipkoski, *Making Medicine to Fit*, *Wired News* (Apr 16, 1999), online at <http://www.wired.com/news/technology/0,1282,19159,00.html> (visited Dec 16, 2003).

²⁴ See, for example, Josh Lerner and Robert P. Merges, *The Control of Technology Alliances: An Empirical Analysis of the Biotechnology Industry*, 46 *J Indus Econ* 125 (1998).

²⁵ Consider Bharat N. Anand and Tarun Khanna, *The Structure of Licensing Contracts*, 48 *J Indus Econ* 103, 131 (2000) (finding evidence that licensing activity is higher in industries where patents are stronger, such as pharmaceuticals).

²⁶ See John P. Walsh, Ashish Arora, and Wesley M. Cohen, *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, in Wesley M. Cohen and Stephen A. Merrill, eds, *Patents in the Knowledge-Based Economy* 285 (National Academies 2003).

²⁷ See Steven Shankland, *IBM: Linux Investment Nearly Recouped*, *CNET News* (Jan 29, 2002), online at <http://news.com.com/2100-1001-825723.html> (visited Dec 16, 2003) (noting that IBM invested one billion dollars in Linux software development in 2001).

similar in some ways to pharmaceutical firms' investments in EST sequences and SNPs. They are designed to preempt the emergence of an anticommons in the domain of Microsoft-competitive operating systems. The absence of property rights in Linux permits firms to cooperate on developing a software platform that competes with Microsoft's software products without the threat of becoming entangled in property rights disputes. In this context, investment in property-free assets serves a pre-commitment and coordination function that differs in some ways from the preemptive strategy of the pharmaceutical firms. But in one key respect, the two sets of investments are similar: they forgo property rights to reduce downstream transaction costs.

In the case of the Merck database and the SNP Consortium, revealing data precludes property rights. The data are free inputs, available to all; property rights are eliminated when the data are posted. Open source software is different; writing a complex program is a collaborative enterprise. Each piece of code must work with the preexisting code. Because intellectual property law (in particular, copyright) permits a contributor to claim rights in works that build on preexisting public domain works, open source contributors need to restrict property claims of downstream contributors. They accomplish this through various "open source license agreements." As explained in an article by Yochai Benkler: "In free software, the risk of defection through . . . appropriation is deemed a central threat to the viability of the enterprise, and the GNU GPL [open source license agreement] is designed precisely to prevent one person from taking from the commons, appropriating the software, and excluding others from it."²⁸ In other words, by eschewing property rights,²⁹ a large number of independent contributors can create and integrate components into a single, useable asset with minimal transaction costs.

Why would firms such as IBM, entering the scene long after an open source project has been launched, invest heavily in improving, applying, and disseminating it further—and do so knowing that they cannot claim property rights in their contributions?³⁰ My answer tracks the

²⁸ Yochai Benkler, *Coase's Penguin, or, Linux and The Nature of the Firm*, 112 Yale L J 369, 441 (2002), citing Free Software Foundation, *GNU General Public License* (June 1991), online at <http://www.fsf.org/copyleft/gpl.html> (visited Dec 16, 2003).

²⁹ Or, more accurately, by adopting a "restrictively open" property rights model. For the sake of accuracy, it should be pointed out that technically, open source software is subject to full copyright protection; the difference is that all contributors agree *by contract* to forgo full enforcement of property rights in their contributions. Open source agreements are not, therefore, "good against the world" in the manner of a true property right—a potential source of vulnerability discussed briefly below. See generally Robert P. Merges, *The End of Friction? Property Rights and Contract in the "Newtonian" World of On-Line Commerce*, 12 Berkeley Tech L J 115 (1997).

³⁰ A recent empirical study documents the large number of private firms making open source software investments. See Karhim R. Lakhani and Robert G. Wolf, *Why Hackers Do What They Do: Understanding Motivation Effort in Free/Open Source Software Projects* (MIT Sloan School of Management Working Paper 4425-03, Sept 2003), online at <http://papers.ssrn.com/>

logic of the biotechnology industry investments described earlier: to preclude property rights entanglements on a key input.

To see the similarity, it is important to understand IBM's current business strategy. IBM sees its primary growth in the sale of "infrastructure" software such as network management, collaboration tools, and databases; it also has huge investments in consulting services and computer hardware. For it, an operating system program is increasingly an input into its main product lines.³¹ But this is clearly not the case with Microsoft, for whom its operating system is the prime business asset. Microsoft's dominance of the PC operating system platform has been a major source of concern for IBM for a number of years. As long as Microsoft controls the PC operating system, IBM will have difficulty competing in markets such as application software that depend on that operating system. This explains IBM's efforts over the years to introduce its own competitive, proprietary operating system.³²

Then came Linux. Now IBM has a different strategy: massive investment in a public domain operating system. IBM wants to control its own fate, which requires a non-Microsoft operating system. The open source nature of Linux allows IBM to invest heavily in a rival operating system that, to potential customers, looks very different from Microsoft's. Linux comes without the threat of leverage and dominance that are always present with a proprietary operating system. IBM customers can commit to Linux without any fear that IBM will take advantage of them. And this in turn makes Linux a good investment for IBM.

How is this different from IBM's previous investments in its own *proprietary* operating systems? It is different because IBM's contribution to and backing of Linux comes free of property right claims. IBM's work product becomes part of the public domain. This both permits IBM to draw on the work of previous contributors, and (key for this argument) encourages downstream users to adopt Linux without the fear of being held hostage by IBM. IBM's investments are PPIs, precluding anyone (including IBM itself) from claiming property rights in the operating system. This credibly assures other firms that IBM will not assert the kind of control over the Linux operating system that other firms fear Microsoft will assert or has asserted over Windows.³³

id=443040 (visited Dec 16, 2003) (surveying 684 developers contributing to 287 different open source projects and revealing that 40 percent of open source contributors are paid by their employers for their time spent participating in the open source projects, although most contributors report that intrinsic (nonpecuniary) interests are what drive their work on these projects).

³¹ John Fontana and Ann Bednarz, *IBM Software Strategy: Knock off Microsoft*, Network World Fusion (Jan 6, 2003), online at <http://www.nwfusion.com/news/2003/0106ibmssoftware.html> (visited Dec 16, 2003).

³² Remember IBM's OS/2?

³³ As the literature on "network externalities" makes so clear, a firm that has property rights in a standard platform has enormous power over its customers. It is no surprise that opponents of Microsoft proposed compulsory licensing and other open-access remedies as a means of mitigating

IBM's investment thus parallels those made by the biotechnology firms described earlier. IBM creates and disseminates assets free of property right claims, thereby lowering the cost of a key input. The difference is that IBM's investment is meant to undermine one key opponent—Microsoft—whose market power interferes with IBM's goals, whereas Merck and others aim to preempt multiple firms whose overlapping property right claims will be a hindrance. In this case, IBM uses PPIs, not to counteract an anticommons, but to counteract a strategic threat. IBM's anti-Microsoft strategy requires IBM to offer its operating system on a nonproprietary (or "restrictively open") basis, which preempts any attempt to claim property rights in the operating system. Thus IBM's investments in this operating system are PPIs as I use the term.

II. WHAT'S SO NEW?

Those who know patent law will understand that what I call "PPIs" have existed for many years. The strategy of "defensive publication" is an old one in patent law, perhaps best exemplified by IBM's longstanding practices in this area. IBM has long published a "Technical Disclosure Bulletin" aimed at precluding other firms from obtaining patents on technical advances that IBM itself chooses not to patent.³⁴ Other firms followed IBM, and a publication called "Research Disclosure" was even launched to facilitate the practice. Now IBM has turned this function over to a commercial website that publishes defensive prior art not only for IBM, but also for other firms such as Motorola, Siemens, Abbott Labs, and PPG Industries.³⁵

Defensive publication has even found its way directly into the Patent Act. At the urging of corporate researchers, Congress passed an amendment to the Patent Act in 1984 aimed directly at facilitating "defensive publications" within the patent system, via Statutory Invention Registration (SIR).³⁶ SIRs were designed to have several advantages over straight publication. First, they are usually prepared by patent lawyers and hence are more likely to meet the "enablement" test required for a prior art publication to eliminate later patents. Second, a SIR is effective as of its filing date, whereas a publication is effective only as of

Microsoft's monopoly position in PC operating systems software. As long as Microsoft has a fully enforceable copyright in its operating system software, it has control over a strategic input required by customers and rival applications makers alike.

³⁴ IBM's Technical Disclosure Bulletin (TDB) began publication in 1958. See Douglas Lichtman, Scott Baker, and Kate Kraus, *Strategic Disclosure in the Patent System*, 53 Vand L Rev 2175, 2216 n 78 (2000).

³⁵ See <http://www.IP.com/affiliates.jsp> (visited Dec 16, 2003). Other defensive publication efforts are under way as well. See FIZ Karlsruhe, *Defensive Publication Database Launched* (May 12, 2003), online at <http://www.manufacturingtalk.com/news/fiz/fiz104.html> (visited Dec 16, 2003) (announcing a new European-based defensive publication).

³⁶ Patent Law Amendments Act of 1984 § 102, Pub L No 98-622, 98 Stat 3383, codified at 35 USC § 157 (2000). See generally Donald Chisum, 1-3 *Chisum on Patents* § 3.07[2] (Bender 2003).

the date it is published. Hence a SIR can conceivably create patent-defeating prior art that is effective before the date the SIR is published.

To date, over two thousand such registrations have been published by the Patent and Trademark Office.³⁷ This is a fairly modest number in comparison to the millions of patents issued in the same period, and the number of SIRs issued has remained fairly constant.³⁸ Lichtman, Baker, and Kraus point out one reason why SIRs remain relatively unpopular: their effect is limited to the United States.³⁹ Other major patent systems do not recognize the “priority date” of a SIR, so in these patent systems a SIR preempts the work of other inventors only when it is published. This discrepancy eliminates one of the major advantages of the SIR; straight publication is cheaper, and therefore preferable. Because many U.S.-based inventors also pursue rights overseas, the attractiveness of the SIR is reduced even for domestic inventors.

Scholars have also shown an interest in defensive publication. In a series of recent articles, Doug Lichtman and Gideon Parchomovsky have shown how defensive publication can interject an interesting twist into “patent races”—situations where multiple firms are racing to invent and patent a particular valuable technology.⁴⁰ An earlier literature on patent races had shown that, consistent with the general literature on rent dissipation, patent policy needs to take account of the fact that firms sometimes invest more than is socially optimal when engaged in a patent race. Lichtman and Parchomovsky have demonstrated that the laggard in a patent race can sometimes play the spoiler by publishing research results that undermine the chances of the firm leading the race to obtain a patent. This can occur when the laggard has gotten far enough in the race to render the leader’s prospective invention “obvious” under patent law. Despite the limited domain of the patent racing models,⁴¹ in-

³⁷ See Patent Full-Text and Full-Page Image Databases, online at <http://www.uspto.gov/patft/index.html> (database search performed Jan 16, 2004).

³⁸ In fact, the number seems to be declining. From 1986 to 1990, there were 850 SIRs, but between 1991 and 1995, this number declined to 636. There was an additional drop between 1996 and 2002, to 536. See *id.* (database search performed Jan 19, 2004).

³⁹ Lichtman, Baker, and Kraus, 53 Vand L Rev at 2216 n 78 (cited in note 34).

⁴⁰ See Gideon Parchomovsky, *Publish or Perish*, 98 Mich L Rev 926 (2000); Lichtman, Baker, and Kraus, 53 Vand L Rev 2175 (cited in note 34). This in turn bears some resemblance to some earlier work by Anton and Yao, who modeled situations where a firm could effectively deploy an intellectual asset without a need for property rights by using the threat of destroying a potential licensee’s exclusivity via disclosure to rivals. James J. Anton and Dennis A. Yao, *Expropriation and Inventions: Appropriable Rents in the Absence of Property Rights*, 84 Am Econ Rev 190 (1994). Like Parchomovsky, Anton and Yao take advantage of the fact that economic value can be undermined by actions that destroy exclusivity. In their model, however, the threat of disclosure to others enables an innovator to extract rents from an exclusive licensee in the absence of a patent.

⁴¹ Consider Rebecca S. Eisenberg, *The Promise and Perils of Strategic Publication to Create Prior Art*, 98 Mich L Rev 2358, 2369 (2000):

Although both the SNP Consortium and the Human Genome Project appear to be pursuing a strategy of prior art creation to limit future patents, neither is quite like the lagging rival in a patent race that Parchomovsky’s model contemplates. The private pharmaceutical firms that

teresting consequences follow from a publish-to-spoil strategy, and it may in fact play a part in the decisions of some firms to publish research results.⁴² It is certainly true that corporate researchers routinely vet proposed publications with management and legal staff, and it is entirely possible that patent race-related strategies occasionally play a part in decisions to publish.

Well before the recent interest in defensive publications, a sizeable literature explained why researchers from private firms publish so much. The assayed motives vary from career concerns of employees, to a desire to signal that one is keeping up technologically (to attract employees and generally raise prestige), to simply serving as the continued price of admission to “technological communities” from which the firm derives informational benefits.⁴³ But simply because the firm (or its employees) has other motives does not mean that strategic disclosure does not play a part in decisions to publish. These considerations may well join the calculus of interests that are considered prior to publication.

Despite similarities between traditional defensive publishing and the use of SIRs, I would argue that the pharmaceutical industry and IBM investments examined in Part I differ from these more traditional “defensive publications” in one important respect: they represent a much more sophisticated and systematic strategy of preempting property rights than occurred with traditional defensive publications. In the past, defensive publication was seen as a sort of salvage strategy. When research did not lead to a patentable invention, or to an invention perceived as worth patenting, the invention could be published. The published information was an offshoot of the main project, rather than its primary goal.⁴⁴ This is no doubt a form of PPI as defined in this Essay.

belong to the SNP Consortium are more like potential customers than rivals of the firms assembling private databases of SNPs, and their motivation for defeating potential patent claims has more to do with future cost containment than with preserving their ability to participate in a future market as sellers. The same could be said of the public sponsors of the Human Genome Project, who are likely to be funding future research that builds upon knowledge of the human genome, and therefore want to keep the costs of access to this information down. These examples of strategic prior art creation thus do not demonstrate Parchomovsky’s model in action.

⁴² At the same time, some of the assumptions underlying the defensive publication literature seem, in many cases, rather unrealistic. In particular, two assumptions are troubling: (1) these models assume the spoiler possesses robust information on which to base a guess about where one is in the race, relative to other firms; and (2) they assume that a firm can make a good prediction about the application of the legal test for nonobviousness. This is crucial because one must know exactly how much information must be published to render obvious the invention that represents the “end point” in the race. In most real-world cases, it is not clear that a spoiler could confidently meet these informational requirements.

⁴³ See generally Diana Hicks, *Published Papers, Tacit Competencies, and Corporate Management of the Public/Private Character of Knowledge*, 4 *Indus & Corp Change* 401, 412–13 (1995).

⁴⁴ See Wendell Ray Guffey, *Statutory Invention Registration: Defensive Patentability*, 16 *Golden Gate U L Rev* 291, 292 (1986) (stating that defensive publications “usually occur[] when research has resulted in a patentable invention that is of limited commercial value, or an organization,

But the large-scale PPIs, such as the genome databases and IBM's backing of Linux, go much further.

III. THE CREATIVE COMMONS

Because of their scale, I have focused so far on large, privately funded contributions to the public domain. There are also smaller, but (in the aggregate) perhaps more important contributions. These range from formal initiatives such as the Creative Commons championed by Larry Lessig, and discussed in this Part, to the many less formal efforts of individual creators to make it known that others are free to use their works.⁴⁵ Whatever they call it, these people are trying to do the same thing: publicly disclaim property rights. Their motives no doubt vary. Some, like Lessig, are forming a counterthrust to overpropertization. Others are simply trying to reduce the hassles that come with claiming property rights. And many of course are trying to "seed" the market for their works by giving away "free samples" to generate interest. For the public, motive is irrelevant. These are additions to the public domain, freely given and freely available, and therefore a good thing.

Because of its scale and ambitious purpose, I will focus here on the Creative Commons. The Creative Commons is a new initiative to disseminate standard-form licenses that allow creators to waive some or all of their legal rights over digital content (including text, music, photos, films, and the like). According to the Creative Commons website:

Creative Commons is a non-profit corporation founded on the notion that some people may not want to exercise all of the intellectual property rights the law affords them. We believe there is an unmet demand for an easy yet reliable way to tell the world "Some rights reserved" or even "No rights reserved." Many people have long since concluded that all-out copyright doesn't help them gain the exposure and widespread distribution they want. Many entrepreneurs and artists have come to prefer relying on innovative business models rather than full-fledged copyright to secure a return on their creative investment. Still others get fulfillment from contributing to and participating in an intellectual commons. For whatever reasons, it is clear that many citizens of the Internet want to share their work—and the power to reuse, modify, and distribute

particularly a governmental agency, decides that it is unlikely that the rights obtained under a patent against an infringer will be enforced").

⁴⁵ See, for example, Epitonic website, online at <http://www.epitonic.com> (visited Jan 16, 2004) (providing free music downloads offered by artists and "independent" record labels); music.download.com website, online at <http://music.download.com> (visited Jan 16, 2004) (announcing a soon-to-be-opened website where artists post music and encourage listeners to download it for free); Free-eBooks.net website, online at <http://www.free-ebooks.net> (visited Jan 19, 2004) (providing free literature); findpoetry.com website, online at <http://www.findpoetry.com> (visited Jan 16, 2004) (providing free poetry).

their work—with others on generous terms. Creative Commons intends to help people express this preference for sharing by offering the world a set of licenses on our Website, at no charge.⁴⁶

The recommended Creative Commons logo contains the phrase “some rights reserved,” which sums up the licenses quite well. Yet creators have several varieties of licenses available. The website again offers a helpful summary:

These licenses will help people tell the world that their copyrighted works are free for sharing—but only on certain conditions. For example, if you don’t mind people copying and distributing your online photograph so long as they give you credit, we’ll have a license that helps you say so. If you want the world to copy your band’s MP3 but don’t want them to profit off it without asking, you can use one of our licenses to express that preference. With the help of our licensing tools, you’ll even be able to mix and match such preferences from a menu of options: **Attribution**. Permit others to copy, distribute, display, and perform the work and derivative works based upon it only if they give you credit. **Noncommercial**. Permit others to copy, distribute, display, and perform the work and derivative works based upon it only for noncommercial purposes. **No Derivative Works**. Permit others to copy, distribute, display and perform only verbatim copies of the work, not derivative works based upon it. **Share Alike**. Permit others to distribute derivative works only under a license identical to the license that governs your work.⁴⁷

Once a creator selects the options he or she wants, several different mechanisms for giving notice are provided.⁴⁸ From a legal perspective, the Creative Commons is a copyright license. Thus the entire scheme operates by virtue of contract. Because the terms of use are linked tightly to the content, including at the technical level, the hope is that the contract terms “run with the content.” Despite the perhaps optimistic labeling of the shorthand notices as “deeds,” for content to stay in the semicommons envisioned by the Creative Commons device, there must

⁴⁶ *Frequently Asked Questions: What Is Creative Commons?*, online at http://creativecommons.org/faq#faq_entry_3311 (visited Dec 16, 2003).

⁴⁷ *Frequently Asked Questions: So What, Exactly, Does Creative Commons Plan to Do?*, online at http://creativecommons.org/faq#faq_entry_3314 (visited Dec 16, 2003).

⁴⁸ The website states as follows:

When you’ve made your choices, you’ll get the appropriate license expressed in three ways: 1. Commons Deed. A simple, plain-language summary of the license, complete with the relevant icons. 2. Legal Code. The fine print that you need to be sure the license will stand up in court. 3. Digital Code. A machine-readable translation of the license that helps search engines and other applications identify your work by its terms of use.

Id (visited Dec 16, 2003).

be an unbroken chain of privity of contract between each successive user of the content. This is especially important in the case of the “share and share alike” licensing option which, like the open source software licenses on which it is based, passes on the limited-rights restriction to contributors of independently copyrightable material that is added to a licensed work.

As the Creative Commons website makes clear, complete dedication to the public domain is only one option. For example, a creator can license all noncommercial uses, reserving the right to exclude (and earn compensation) only from commercial users. This is in effect a *partial dedication* to the public domain, rather than a complete one. The user selects some of the sticks in the metaphorical bundle and waives the right to enforce them, dedicating those particular rights to the public. The various Creative Commons licenses can thus be seen as a menu of waiver options from which creators themselves can select. While not every work subject to a Creative Commons license will enter the public domain, certain attributes of every work will. It is therefore a potentially powerful force for adding to the aggregate of works that are freely available to various users and various uses.

The Creative Commons project strives to regularize a certain type of transaction. Creators granted certain rights under copyright law publicly disclaim some or all of those rights. They in effect leave some of the rights that they might have claimed “on the table,” thereby giving a gift to other users.

Although there is not space in this Essay to fully spell out the implications, I do want to make one brief point. The stronger the property rights in the background, the greater the potential value of the gift. Of course, digital content no one wants to use is no more valuable when it is covered by stronger property rights. But for content that someone would actually use, presumably stronger rights enhance the value. Thus when some or all of the rights are disclaimed, the value of the gift goes up. My point here is simple: to the extent people get some benefit out of giving a gift, some people at least presumably get *more* benefit from giving a gift of *greater value*. To the extent this is true, it means that strengthening property rights creates an additional source of value (besides the usual incentive effects). Stronger rights may increase the benefit of giving creative works away, at least for some people.

This does not necessarily mean society as a whole is always better off with stronger rights. That depends on whether the increased asset value that comes with stronger rights—including the value of gift-giving mentioned above—is greater than the overall costs. It is not clear by any means whether this will always be so. A dyed-in-the-wool “weak copyright” proponent who writes a story or takes a picture may actually be less well off in giving the story or picture away when it is covered by stronger property rights. Such a person gets no value from the extra

rights, in fact is offended by them, and must expend (at least some) time and energy disclaiming the portion of the rights bundle he or she wants to give away. To know if society were better off after strengthening rights, we would need to know how many people fit this description. If their number or their creative contributions outweighed those who did in fact gain a net benefit from stronger rights, strengthening rights would be a mistake.

I have no idea how this calculus would play out in the current debate over stronger copyright protection for digital works, for example. What I am sure of is that stronger property rights increase the “gift value” of creative works in addition to increasing incentives in the well-known manner. This may help to explain why the Creative Commons was founded when it was, and why it may prove increasingly attractive over time.

IV. LOOKING AHEAD: TRENDS AND POLICY INITIATIVES

A. Explaining Increases in PPIs over Time

There is widespread consensus that intellectual property rights have become increasingly valuable since the 1970s.⁴⁹ As discussed earlier in this Essay, investments in patent-defeating prior art have increased significantly over this period as well. To summarize:

In 1976, industry pushed for, and Congress enacted, a defensive publication program within the patent system, the SIR.

Firms such as IBM have continuously invested in defensive publication programs as an outgrowth of normal R&D operations, most recently investing in web-based versions. At least one interested observer claims that defensive publication is currently on the upswing.⁵⁰

Private firms have embarked on several large, systematic PPIs designed explicitly to preempt property rights in the biotechnology and software industries.

It appears that as intellectual property rights have grown more valuable, firms have made greater investments in PPIs. The canonical property rights theory of Harold Demsetz posits that when a resource becomes more valuable, it is worthwhile to spend more money defining and enforcing property rights over that resource.⁵¹ PPIs reveal a mirror world in which stronger property rights create incentives to make preemptive investments to prevent propertization of key resources. This turns Demsetz on his head. Demsetz viewed property rights as a mecha-

⁴⁹ See, for example, Wesley M. Cohen and Stephen A. Merrill, *Introduction*, in Cohen and Merrill, eds, *Patents in the Knowledge-Based Economy* 1, 1–2 (cited in note 26).

⁵⁰ See Oren Bar-Gill and Gideon Parchomovsky, *The Value of Giving Away Secrets*, 89 Va L Rev 1857 (2003).

⁵¹ Harold Demsetz, *Toward a Theory of Property Rights*, 57 Am Econ Rev 347, 348 (1967).

nism for private actors to internalize externalities.⁵² After property rights, resources that had been open to all are brought under the control of a single owner. A PPI creates an externality to prevent a rival from internalizing the benefits of a resource. After a PPI, a resource that might have been privatized is made open to all, preventing privatization and saving money for the firm making the PPI. At the same time, it creates an externality for others, as the now-unowned resource becomes part of the public domain.

B. Policies to Promote PPIs

PPIs add to the public domain—a good thing in the IP world. How can IP policy be shaped to encourage more PPIs? This brief Essay is not the place to spell out proposals in depth, but two suggestions seem important enough to note here. The first relates primarily to patents, the second primarily to copyrights. Both center on issues of notice.

United States patent law permits a patentee or a patent applicant to place a patent-related notice on items sold in commerce.⁵³ Congress should enact a parallel provision permitting items to be sold, or information to be published, with a “Patent Waived” notice. This would permit buyers or users to rely on the public domain status of the item or information. Without such a notice, there is no assurance that patent rights will not eventually attach to the item or information. Public announcements of intent not to patent—such as those by pharmaceutical firms publishing genome information in the databases described in Part I—may at most give rise to an estoppel claim by someone relying on the public domain status of the resulting data. Statutory notice would be a more robust and enforceable mechanism.

A similar proposal under copyright law might make sense. Part III.A above discussed restrictive licenses accompanying digital content, such as the General Public License. As a device for preempting unwanted property rights (such as derivative work rights for downstream contributors), this mechanism makes sense and seems to be working. There are, however, two potential problems with it. The first is that there are several forms of restrictive licenses in use, all of which differ—in some respects significantly—from each other, creating the potential for confusion. Users will have to read these contracts carefully to understand their rights. I suggest a simple alternative: the Copyright Act could be amended to provide a statutory “safe harbor” capturing at least some of the attributes of GPL-type licenses. It would become available simply by following statutory notice provisions, such as affixing an “L in a circle” notice (for “Limited Copyright Claimed—Full Copyright Waived”).

⁵² See Thomas W. Merrill, *Introduction: The Demsetz Thesis and the Evolution of Property Rights*, 31 *J Legal Stud* S331, S332 (2002).

⁵³ 35 USC § 287.

While recent initiatives such as the Creative Commons license might ultimately achieve the same effect, no private initiative will ever quite match the ability of the statute to channel copyright owners into a uniform, widely understood standard practice.

In addition, statutory notice sidesteps a second problem with licensing schemes—the issue of contractual privity. Although it may be difficult as a practical matter to strip out licensing information from digital content, it is probably not impossible. And if licensing terms were detached from a piece of content, downstream users would not be bound by them. A statutory notice provision has one key attribute that contracts cannot quite emulate: it creates a property right that is “good against the world.” Privity is unnecessary, as the restrictions on use are inherent in the content by virtue of the property right that covers it.

CONCLUSION

In a recent article, Polk Wagner points out the inherent flexibility of intellectual property rights, arguing that they can be used to enhance the public domain as well as detract from it. By creating an “intellectual easement of sorts,” owner-creators can effectively deploy property rights to prevent excessive restrictions on the uses of their works.⁵⁴

Like Wagner, I am interested in the ways that property rights can be deployed to dedicate works to the public. In addition to the Creative Commons, I have discussed incentives to invest directly in the public domain to preempt others’ property claims. These phenomena reveal the reverse side of a point that property scholars came to recognize some time ago. An important empirically centered literature taught us in the 1980s and 1990s that property-like governance mechanisms could and often do emerge in the absence of formal property rights. Scholars such as Robert Ellickson⁵⁵ and Elinor Ostrom⁵⁶ uncovered fascinating governance regimes that evolved to allocate resources and coordinate activities when property rights were nonexistent or ineffective. In the process, we learned that order, allocation, and coordination were not always synonymous with formal property rights. In the same vein, this Essay has described some interesting real-world situations where in effect *public resources* emerge against a backdrop of *private entitlements*. Private parties are working around the proliferation of property rights to maintain open channels of commerce and exchange. Instead of “order without law,” as Ellickson titled his influential book, we have “order despite law.”

⁵⁴ R. Polk Wagner, *Information Wants to Be Free: Intellectual Property and the Mythologies of Control*, 103 Colum L Rev 995, 1032–33 (2003).

⁵⁵ Robert Ellickson, *Order Without Law* (Harvard 1991).

⁵⁶ Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge 1990).

The upshot is the same: private re-engineering of the entitlement structure, in the interest of people getting things done.

Does this mean to imply that I believe new developments in the public domain will perfectly offset whatever excesses the IP regime foists upon the economy? No. Just as Ellickson, Ostrom, and others did not argue that property rights are never necessary, I do not believe that property-preemption and licensing schemes such as the Creative Commons demonstrate a perfect equilibrating tendency in the IP system. I am an optimist, perhaps, but not enough of one to believe we have hit upon Nirvana. Rather than a perfect counterbalance, it is just as likely in a given case that these new initiatives represent a creative response to a second-best situation, one where property rights ought never have been granted in the first place. But these trends may represent an important phenomenon just the same. At a minimum, those anxious about the state of the IP regime can take some comfort: individuals and firms are not powerless in the face of an onslaught of rights that threatens to choke off incentives to create. While we struggle with the right combination of IP policies, we can take some solace in the knowledge that we as a society are adapting and muddling through.