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THE MISUNDERSTOOD FUNCTION OF DISCLOSURE IN PATENT LAW

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I. INTRODUCTION

The patent system brings inventors' obscure technological feats to the public eye.[1] Without an intellectual property ("IP") regime, inno-

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1. *See* Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 150–51 (1989); Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480–81 (1974); Scott Paper Co. v. Mar-

vators would keep their discoveries safely secured from competitors, consumers, and the general public.[2] Society would be starved of knowledge, science would limp forward, and useful information would be stored in a clandestine fashion.

It is not hard to see why conventional wisdom holds this view.[3] To derive value from her insights, an inventor must transform abstract conceptions into a commercial product or license her discovery to a third party who will do the same. But if an inquisitive rival can inspect the end product and derive the underlying invention for himself, the inventor's ability to reap pecuniary reward from her innovation will be jeopardized.[4] To counter this dilemma — a problem deemed endemic in public goods — an inventor will have to manufacture complexity into her end product, artificially rendering it unsusceptible to reverse engineering. Like the myriad inventions that Da Vinci put to paper in impenetrable fashion, innovators would do everything within their power to mask their discoveries from unwelcome eyes.[5]

The patent system should be celebrated for making such obfuscation unnecessary and promoting disclosure,[6] which undoubtedly brings about a variety of social benefits.[7] Such disclosure augments the storehouse of knowledge, thereby promoting incremental invention; facilitates efficient bargaining by clarifying property rights; and limits the scope of patents by preventing overclaiming.[8] Despite these

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calus Mfg. Co., 326 U.S. 249, 255 (1945); Univ. of Rochester v. G.D. Searle & Co., 358 F.3d 916, 922 n.5 (Fed. Cir. 2004); Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539, 541 (2009).

2. *See* United States v. Dubilier Condenser Corp., 289 U.S. 178, 186 (1933); Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 277–78 (1977). Of course, without an IP system or other reward structure, at least some inventors would choose not to innovate at all.

3. *See generally* Fromer, *supra* note 1 (describing the importance of disclosure to innovation).

4. *See* Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 247 (1994) ("[T]he patent system prevents others from reaping where they have not sown and thereby promotes research and development . . . .").

5. I would like to thank Professor John Golden of the University of Texas Law School for bringing this example to my attention.

6. *See* Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 MINN. L. REV. 917, 994 n.291 (2005).

7. *See* Suzanne Scotchmer & Jerry Green, *Novelty and Disclosure in Patent Law*, 21 RAND J. ECON. 131, 132, 134–35 (1990); Ryan Crockett, Note, *Balancing Burdens for Accused Infringers: How* In re Seagate *Got It Right*, 58 DEPAUL L. REV. 1047, 1064 (2009); Gerald Sobel, *Patent Scope and Competition: Is the Federal Circuit's Approach Correct?*, 7 VA. J.L. & TECH. 3, ¶ 50, at 25 (2002), http://www.vjolt.net/vol7/issue1/v7i1_a03-Sobel.PDF.

8. Much innovation takes place on a cumulative basis, as inventors build upon prior knowledge to achieve advances in their field. *See* Clarisa Long, *Patents and Cumulative Innovation*, 2 WASH. U. J.L. & POL'Y 229, 229–30 (2000); Katherine J. Strandburg, *Evolving Innovation Paradigms and the Global Intellectual Property Regime*, 41 CONN. L. REV. 861, 865 (2009). Full access to contemporary know-how is an essential prerequisite of such follow-on innovation. *See* Brian Kahin, *Patents and Diversity in Innovation*, 13 MICH. TELECOMM. & TECH. L. REV. 389, 397 (2007). If people mask their discoveries from others,

supposed benefits, the characterization of the patent system as a regime that imparts knowledge is woefully incomplete. This Article explains that the contemporary embrace of disclosure by proponents of the patent system is misconceived. As a primary function of that system, disclosure is both ineffective and potentially poisonous to larger social goals.

First, the extent to which patent documents successfully teach the inner workings of cutting-edge technologies is quite limited.[9] The information conveyed by many specifications is inadequate and, in practice, fails to reflect the legislative requirements of § 112.[10] Indeed, a minority of patents do not convey meaningful information of any kind. Patents in the information technology ("IT") industry are perhaps the worst offenders, being notorious for their vague language.[11]

Second, to the extent patents are drafted in a manner that is actually capable of conveying accurate information, third parties' disinter-

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they will compromise the efficacy of the innovative process. By requiring all patentees to divulge their valuable discoveries, the law facilitates a more dynamic process of research and development than would otherwise be possible. In addition, the demarcation of the boundaries of a patentee's proprietary interest serves a vital function in creating legal certainty and facilitating efficient bargaining. Only when property rights are clearly established can third parties comport themselves so as not to infringe patentees' exclusive rights. *See* Randall Ackee, *Checkerboards and Coase: The Effect of Property Institutions on Efficiency in Housing Markets*, 52 J.L. & ECON. 395, 397 (2009). Viewed in this light, the enablement, written description, and best mode requirements — collectively "the § 112 requirements" — of patentability are eminently valuable.

9. *See* Michael Abramowicz, *The Uneasy Case for Patent Races over Auctions*, 60 STAN. L. REV. 803, 839 n.140 (2007).

10. *See* Teresa M. Summers, Note, *The Scope of Utility in the Twenty-First Century: New Guidance for Gene-Related Patents*, 91 GEO. L.J. 475, 489 (2003) (noting critics' assertions that "what little information is known and disclosed at the time the patent issues fails to convey enough information to be of practical use to the public"). Such an outcome is partially a result of the substantive limitations of language. *See* William R. Hubbard, *Efficient Definition and Communication of Patent Rights: The Importance of Ex Post Delineation*, 25 SANTA CLARA COMPUTER & HIGH TECH. L.J. 327, 371–372 (2009). It also reflects a patentee's incentive to be as parsimonious as possible in meeting the requirements of disclosure. *See* Fromer, *supra* note 1, at 589. It further results from the U.S. Patent and Trademark Office ("USPTO") and Federal Circuit's refusal to enforce appropriately a prospective patentee's obligation to reveal pertinent technology. Indeed, the Federal Circuit has essentially relieved inventors in certain industries of the need to satisfy the literal requirements of § 112. *See* Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1161–62 (2002) [hereinafter Burk & Lemley, *Technology-Specific*]; Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1688 (2003) [hereinafter Burk & Lemley, *Policy Levers*].

11. *See* Jerome H. Reichman, *Intellectual Property in the Twenty-First Century: Will the Developing Countries Lead or Follow?*, 46 HOUS. L. REV. 1115, 1135–36 (2009); *see also* Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 EMORY L.J. 181, 202 (2008) (noting that the IT field is most often associated with the "bad-patent" problem, but finding that the PTO grant rate in that particular field is surprisingly low); Robert A. Migliorini, *The Narrowed Experimental Use Exception to Patent Infringement and Its Application to Patented Computer Software*, 10 COMPUTER L. REV. & TECH. J. 135, 154 (2006); Arti K. Rai, John R. Allison & Bhaven N. Sampat, *University Software Ownership and Litigation: A First Examination*, 87 N.C. L. REV. 1519, 1531 (2009).

est stymies the disclosure function.[12] To a surprising degree, inventors simply ignore patents.[13] The sheer volume of outstanding patents, coupled with the lack of specificity in many claims and complications arising from the doctrine of equivalents,[14] makes an exhaustive search of the prior art expensive.[15] For some entities, the price of such an inquiry may be prohibitive, in that the search costs likely will outweigh the potential gains. In addition, the ever-looming danger of treble damages resulting from a finding of willful infringement creates perverse incentives to remain ignorant of patented technology.[16]

Combined, these two observations cast serious doubt on the patent system's efficacy, if one justifies that system on the basis of disclosure.[17] However, the system should not be justified on this basis. Instead, the patent regime should primarily be construed as a tool for incentivizing the invention and commercialization of easily appropriated technology. This Article argues that disclosure should be treated merely as an ancillary feature of the patent system. Moreover, disclosure is a benefit that regularly conflicts with incentives to invent and commercialize. Treating disclosure and the incentive to invent as goals of unequal importance to the patent regime is therefore crucial.

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12. *See* Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19. "Disinterest" here refers not merely to subjective indifference, but to deliberate ignorance of the prior art.

13. *See* Fromer, *supra* note 1, at 560–62; Lemley, *supra* note 12, at 21. The magnitude of this phenomenon is industry-specific; it is especially bad in the IT and software sectors where innumerable patents, many of dubious quality, abound. *But see* John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth*, 18 BERKELEY TECH. L.J. 987, 1003–04 (2003) (finding Internet business method patents to be of higher quality than the average patent). But ignorance of the patents in one's field is a ubiquitous problem that transcends industries and varies only in severity.

14. *See* Warner-Jenkinson Co. v. Hilton Davis Chem. Co., 520 U.S. 17, 39–40 (1996); John R. Allison & Mark A. Lemley, *The (Unnoticed) Demise of the Doctrine of Equivalents*, 59 STAN. L. REV. 955, 977–78 (2007).

15. *See* Patricia E. Campbell, *Representative Patent Claims: Their Use in Appeals to the Board and in Infringement Litigation*, 23 SANTA CLARA COMPUTER & HIGH TECH. L.J. 55, 86 (2006) (noting the expense of prior art searches); Anthony H. Azure, Note, Festo*'s Effect on After-Arising Technology and the Doctrine of Equivalents*, 76 WASH. L. REV. 1153, 1174 (2001) (noting same).

16. By maintaining conscious ignorance of the prior art, an innovator shields herself from such claims. *See* Lorelei Ritchie de Larena, *What Copyright Teaches Patent Law About "Fair Use" and Why Universities Are Ignoring the Lesson*, 84 OR. L. REV. 779, 785 (2005); Marc Morgan, Comment, *Stop Looking Under the Bridge for Imaginary Creatures: A Comment Examining Who Really Deserves the Title* Patent Troll, 17 FED. CIR. B.J. 165, 169 (2007). Although the Federal Circuit ameliorated the situation in *In re Seagate Technologies, LLC*, 497 F.3d 1360 (Fed. Cir. 2007), it is not yet clear what effect, if any, the decision will have on researchers' attention to patented technologies. *See Seagate*, 497 F.3d at 1371 (overturning the prior standard of willful infringement and replacing it with a requirement that a patentee demonstrate by clear and convincing evidence that the infringer acted despite an objectively high likelihood that its actions constituted infringement of a valid patent). It remains true that an inventor who purposefully avoids reading patents that implicate his industry will be able to avoid treble damages.

17. *See* Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421, 1465 (2009).

Disclosure can and must bow in the presence of a conflict with patent law's larger needs.

Thus, equating disclosure with the patent system's normative foundation is wrong. Even though specifications often fail to communicate information in any great detail and many inventors decline to read those specifications, the patent system as a whole does not completely constrain information. On the contrary, the system incentivizes the creation and commercialization of valuable technology, the disclosure of which often takes place as a byproduct of the technology's creation. Patents are distinct from the underlying technologies themselves. While the patent document alone may fail to teach the workings of an invention with sufficient clarity, the invention itself is often self-revealing.[18] Put differently, the kind of innovation for which inventors seek patent protection is often vulnerable to reverse engineering.[19] Once these inventions come into being and are brought to market, disclosure is inevitable. For this reason, disclosure is subsumed within patent law's larger purpose, which is to create a property regime that solves the public goods dilemma.[20] Viewed in this light, one can appreciate why disclosure should be viewed as a secondary benefit of the patent system, rather than a primary concern.

This is not to suggest, however, that the disclosure benefits obtained from successful reverse engineering are comparable in value to those that result from effective disclosure from a specification, even if those gains are comparable in kind. Reverse engineering, if fruitful, may give rise to proprietary information that will only be shared indirectly with the public. By contrast, a properly constructed patent specification makes information available to all. Moreover, deconstruction of a patent-protected technology tends to be prolonged and costly.[21] When reverse engineering is necessary due only to a lack of effective patent disclosure, capital expended on such engineering is socially wasteful, even if the end result is otherwise desirable.[22] If the best mode and enablement requirements are given full force, specifications can provide much of the same information instantly.

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18. *See* Frank H. Easterbrook, *Intellectual Property Is Still Property*, 13 HARV. J.L. & PUB. POL'Y 108, 109–10 (1990); Kevin Iles, *A Comparative Analysis of the Impact of Experimental Use Exemptions in Patent Law on Incentives to Innovate*, 4 NW. J. TECH. & INTELL. PROP. 61, 64–65 (2005).

19. *See* Mark A. Lemley, *The Surprising Virtues of Treating Trade Secrets as IP Rights*, 61 STAN. L. REV. 311, 313 (2008).

20. For my larger discussion of this point, see generally Alan Devlin, *Restricting Experimental Use*, 32 HARV. J.L. & PUB. POL'Y 599 (2009).

21. *See* Frederick M. Abbott & Jerome H. Reichman, *The Doha Round's Public Health Legacy: Strategies for the Production and Diffusion of Patented Medicines Under the Amended TRIPS Provisions*, 10 J. INT'L ECON. L. 921, 979 (2007); Keith E. Maskus, *Using the International Trading System to Foster Technology Transfer for Economic Development*, 2005 MICH. ST. L. REV. 219, 234; Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575, 1579 (2002).

22. *See* Thomas F. Cotter, *Misuse*, 44 HOUS. L. REV. 901, 955–56 (2007).

Despite this, one can safely conclude that society is better off with a patent system that incentivizes invention and commercialization without requiring disclosure than with a system that dilutes ex ante incentives and reduces the incidence of invention by demanding as much disclosure as possible. Although policymakers are not currently presented with such a stark choice of extreme alternatives, the tension between these two positions lies at the very heart of contemporary patent policy.

This discussion leads back to an earlier point: disclosure as a goal is secondary to invention and commercialization. This observation might be without consequence but for the crucial fact that these goals often come into conflict. As a result, society should deviate from maximizing disclosure in certain situations in order to promote aggregate welfare. One important example involves the law governing experimental use.[23] The optimal scope of patentable subject matter, appropriate remedies for infringement, and inventors' right to keep secret their pending applications at the U.S. Patent and Trademark Office ("USPTO") all implicate the tension between effective disclosure and incentivizing prospective inventors in optimal ways.

This Article is organized into a series of parts. Part II explains the current disclosure requirements of modern U.S. patent law and explores the purported role of those requirements as an independent incentive within patent policy. Part III questions the patent system's role in imparting knowledge and explains that disclosure cannot enjoy a status commensurate with the incentives to invent and commercialize. In doing so, Part III envisions a system without requirements to divulge information of any kind. This inquiry, though indicating the many benefits of disclosure, reveals that utilitarian incentives should enjoy hegemonic status. Part IV pursues a broader question, which focuses on how the contemporary misunderstanding of disclosure's role within patent law may have led policymakers astray. The Article identifies a variety of substantive rules and doctrines that should perhaps be revisited. It also investigates why inventors would ever patent non-self-revealing inventions, for which the disclosure function is of particular social importance. A brief conclusion follows.

23. *See infra* Part IV.B.

II. EXPLORING THE PATENT BARGAIN THROUGH THE LENS OF DISCLOSURE

A. Disclosure and the Patent Bargain

The "patent bargain" is an easily understood concept.[24] Awarding an inventor twenty years exclusivity naturally entails considerable social cost — a cost that rises in direct proportion to the value of the covered invention. In certain instances — those where the patented technology is so useful that no substitutes exist — the award of a patent creates a complete economic monopoly.[25] Deadweight loss, allocative inefficiency, and wealth transfer from consumers to the patpatentee all ensue.[26] In exchange for this considerable price, society demands something in return.[27] Most observers contend the something exchanged is disclosure.[28]

This concept is hardly revolutionary. Were the government to award a monopoly for the fact of invention alone but not insist that the inventor reveal the workings of his discovery, society would presumably be deprived of valuable information it would otherwise enjoy.[29] That information may still be put to good use while the underlying patent is in force. It can be used to guide improvements

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24. *See* AK Steel Corp. v. Sollac, 344 F.3d 1234, 1244 (Fed. Cir. 2003); Natasha N. Aljalian, *The Role of Patent Scope in Biopharmaceutical Patents*, 11 B.U. J. SCI. & TECH. L. 1, 27 (2005); Dianne Nicol, *On the Legality of Gene Patents*, 29 MELB. U. L. REV. 809, 810 (2005); David C. Hoffman, Note, *A Modest Proposal: Toward Improved Access to Biotechnology Research Tools by Implementing a Broad Experimental Use Exception*, 89 CORNELL L. REV. 993, 996 (2004).

25. *See* U.S. DEP'T OF JUSTICE & FED. TRADE COMM'N, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY § 2.2, at 4 (1995); Richard A. Posner, *Transaction Costs and Antitrust Concerns in the Licensing of Intellectual Property*, 41 J. MARSHALL REV. INTELL. PROP. L. 325, 329 (2005); Kelly Hershey, Note, Scheiber v. Dolby Laboratories, Inc., 18 BERKELEY TECH. L.J. 159, 164 (2003).

26. *See* DENNIS W. CARLTON & JEFFREY M. PERLOFF, MODERN INDUSTRIAL ORGANIZATION 95–99 (4th ed. 2005) (describing the costs of monopoly); RICHARD A. POSNER, ANTITRUST LAW 9–32 (2d ed. 2001).

27. *See* Kristen Osenga, *Information May Want To Be Free, But Information Products Do Not: Protecting and Facilitating Transactions in Information Products*, 30 CARDOZO L. REV. 2099, 2106–07 (2009) (suggesting that the patenting of information products may be inappropriate because "the patent bargain is one-sided," as "the patentee gets the exclusionary right but the public does not get additional disclosure").

28. *See* Eldred v. Ashcroft, 537 U.S. 186, 224 (2003) (Stevens, J., dissenting) ("Complete disclosure as a precondition to the issuance of a patent is part of the *quid pro quo* that justifies the limited monopoly for the inventor as consideration for full and immediate access by the public when the limited time expires."); Enzo Biochem, Inc. v. Gen-Probe Inc., 323 F.3d 956, 981–82 (Fed. Cir. 2002) (Rader, J., dissenting); Anu R. Sawkar, Note, *Are Storylines Patentable? Testing the Boundaries of Patentable Subject Matter*, 76 FORDHAM L. REV. 3001, 3006 (2008).

29. *See* Sean C. Pippen, *Dollars and Lives: Finding Balance in the Patent "Gene Utility" Doctrine*, 12 B.U. J. SCI. & TECH. L. 193, 208 (2006).

upon the patented technology, which can themselves be patented.[30] The knowledge revealed by the patent document also facilitates invent-around,[31] which can enable rival companies to market substitute, non-infringing products to consumers and thus erode the patentee's monopoly.[32]

The value of disclosure is largely axiomatic. The first benefit lies in facilitating cumulative invention. Follow-on innovation accounts for the vast majority of technological breakthroughs, which suggests the importance of inventors being compelled to explain their discoveries.[33] However, this does not necessarily mean that the information used for cumulative innovation resides exclusively or even predominantly within the confines of patent specifications.[34] But surely the patent system serves to bring more knowledge to society than would otherwise be the case.[35] This is why commentators ubiquitously speak of "an incentive to disclose" rationale of the patent system — a rationale that would likely strike most onlookers as unremarkable.[36]

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30. *See* Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 496 n.60 (2006); R. Polk Wagner, *Information Wants To Be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995, 1007 n.46 (2003).

31. *See* Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 95 n.126 (2004).

32. Some question exists as to whether invent-around activities are socially desirable on the whole. Although successful efforts to invent around an identified patent reduce the monopoly rents associated with that IP right, thus enhancing static efficiency and probably promoting consumer welfare, the capital expended in inventing around a patent is socially wasteful insofar as it is unlikely to yield a meaningful contribution to social knowledge. The possibility exists, though it is unlikely in most circumstances, that successful invent-around can deny a patentee the monopoly reward she required ex ante to induce the innovation. If invent-around became sufficiently widespread and successful, patents would become less valuable, and prospective inventors would have less incentive to devote capital to the risky and expensive process of innovation.

33. *See* FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY 25 (2003), http://www.ftc.gov/os/2003/10/innovationrpt.pdf; John Dubiansky, *The Role of Patents in Fostering Open Innovation*, 11 VA. J.L. & TECH. 7, ¶ 108, at 28 (2006), http://www.vjolt.net/vol11/issue4/v11i4_a7-Dubiansky.pdf.

34. Indeed, quite the opposite would appear to be true. This observation is highly important and is explored in more detail below. *See infra* Part III.B.

35. *See* Rebecca S. Eisenberg & Arti K. Rai, *Harnessing and Sharing the Benefits of State-Sponsored Research: Intellectual Property Rights and Data Sharing in California's Stem Cell Initiative*, 21 BERKELEY TECH. L.J. 1187, 1194–95 (2006); Anthony J. Mahajan, Note, *Intellectual Property, Contracts, and Reverse Engineering After* ProCD*: A Proposed Compromise for Computer Software*, 67 FORDHAM L. REV. 3297, 3317 (1999).

36. *See* DONALD S. CHISUM ET AL., PRINCIPLES OF PATENT LAW: CASES AND MATERIALS 67–68 (3d ed. 2004); Kitch, *supra* note 2, at 278; Peter Lee, *Contracting To Preserve Open Science: Consideration-Based Regulation in Patent Law*, 58 EMORY L.J. 889, 901 n.48 (2009); Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 105–06; Richard Li-Dar Wang, *Biomedical Upstream Patenting and Scientific Research: The Case for Compulsory Licenses Bearing Reach-Through Royalties*, 10 YALE J.L. & TECH. 251, 265 (2008); Hon. Howard T. Markey, Chief Judge, U.S. Court of Customs & Patent Appeals, Special Problems in Patent Cases (Oct. 16, 1974), *in* 66 F.R.D. 529, 531 (1975).

The second benefit lies in clarifying the boundaries of an invention.[37] This is because the information conveyed by patents also serves an important role in demarcating the contours of a patentee's property interests.[38] To avoid accidentally "trespassing" on another's intellectual property, one must be able to find all potentially blocking patents and derive from them sufficient information to determine the zone of exclusion created by each one. Notice of property boundaries is especially important in the patent context because, unlike with copyright, no independent inventor defense exists.[39] Potential infringers and patentees can bargain efficiently ex ante to ensure that resources are devoted to their highest value uses only if property rights are clear.[40] Patents attempt to convey this information primarily through the claims incorporated within them.[41]

Patent law's disclosure function is carried into effect in numerous ways. An inventor must provide not only a sufficiently concise explanation of his invention as to enable others to recreate it (the "enablement" requirement) but also the optimal method known to him of practicing it (the "best mode" requirement).[42] A patentee must satisfy the written description requirement, which compels him to describe his invention in such a way "that one skilled in the art can clearly conclude that '[she] invented the claimed invention.'"[43] She must provide a drawing of his discovery where necessary to enable one skilled in the art to understand it.[44] The claims themselves, which demarcate the boundaries of the relevant invention and promote further

37. A related gain is the role of disclosure in preventing overclaiming. I would like to thank Professor Mark Lemley for bringing this issue to my attention.

38. *See* Kenneth D. Bassinger, *Unsettled Expectations in Patent Law:* Festo *and the Moving Target of Claim Equivalence*, 48 HOW. L.J. 685, 690 (2005); Jean O. Lanjouw & Mark Schankerman, *Protecting Intellectual Property Rights: Are Small Firms Handicapped?*, 47 J.L. & ECON. 45, 51 (2004).

39. *See* Hubbard, *supra* note 10, at 328–30; Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475 *passim* (2006).

40. *See* Randall Ackee, *Checkerboards and Coase: The Effect of Property Institutions on Efficiency in Housing Markets*, 52 J.L. & ECON. 395, 397 (2009); R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

41. *See* Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1000–01 (1997). But it would be a mistake to think that the claims are the sole source of knowledge about a particular patent's reach. The specification of a patent also grants considerable information about how the protected technology operates, which has particular relevance for the doctrine of equivalents. *See supra* note 14 and accompanying text.

42. *See* 35 U.S.C. § 112 (2006); Eli Lilly & Co. v. Barr Labs., Inc., 251 F.3d 955, 963 (Fed. Cir. 2001).

43. Regents of the Univ. of Cal. v. Eli Lilly & Co., 119 F.3d 1559, 1566 (Fed. Cir. 1997) (quoting Lockwood v. Am. Airlines, Inc., 107 F.3d 1565, 1572 (Fed. Cir. 1997)); *see also In re* Hayes Microcomputer Prods., Inc. Patent Litig., 982 F.2d 1527, 1533 (Fed. Cir. 1992). Although this started off as a substantive limitation on patentees' ability to amend their claims subsequent to filing, the Federal Circuit has made clear that an inadequate written description renders the underlying patent invalid. *See* Cordis Corp. v. Medtronic Ave, Inc., 339 F.3d 1352, 1364–65 (Fed. Cir. 2003).

44. 35 U.S.C. § 113 (2006).

disclosure, are even more important.[45] Should courts or the USPTO subsequently find that the inventor has violated these conditions, the patent may be invalidated.[46] Combined, the preceding requirements would seem to promote the disclosure function admirably. By revealing the invention to all, the patent system allows information to percolate through society and makes it available for a range of valuable uses. This is the conventional and commonly understood function of disclosure.

B. Questioning the Bargain

But is disclosure actually society's primary benefit from the patent bargain? Counterintuitively, the information-revealing function of the patent system is largely illusory.[47] Although the enablement condition of patentability would appear to educate third parties on the nature of a patented invention,[48] in practice it lacks bite.[49] Many patents fail to disclose properly the inner workings of the protected technology. Numerous studies and anecdotal reports reveal that the patent system's performance in disseminating information is disappointing at best.[50] A 2009 study by Professors Christopher Cotropia and Mark Lemley makes clear that "defendants in patent infringement lawsuits . . . were not knowingly using already-patented technology."[51] The IT industry, in particular, is infamous for producing patents that convey little, if any, information about the underlying nature of the discovery.[52] Indeed, even IT patents' claims are notoriously vague, creating an indeterminate zone of potential, though not certain, infringement for third parties to traverse.

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45. *See* 35 U.S.C. § 112; Alan L. Durham, *Patent Symmetry*, 87 B.U. L. REV. 969, 995–96 (2007).

46. *See* Great N. Corp. v. Henry Molded Prods., 94 F.3d 1569, 1574 (Fed. Cir. 1996).

47. *See* Dan L. Burk, *The Role of Patent Law in Knowledge Codification*, 23 BERKELEY TECH. L.J. 1009, 1010 (2008).

48. At least one commentator has questioned the stand-alone purpose of the written description, as separate from the enablement and best mode requirements. *See* Robin Feldman, *Plain Language Patents*, 17 TEX. INTELL. PROP. L.J. 289, 301–02 (2009).

49. *See* Guang Ming Whitley, Comment, *A Patent Doctrine Without Bounds: The "Extended" Written Description Requirement*, 71 U. CHI. L. REV. 617, 618–19 (2004).

50. *See* Cotropia & Lemley, *supra* note 17, at 1465; Fromer, *supra* note 1, at 560–62; Dan Callaway, Note, *Patent Incentives in the Semiconductor Industry*, 4 HASTINGS BUS. L.J. 135, 143–44 (2008).

51. Cotropia & Lemley, *supra* note 17, at 1465; *see also* Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007 (2005) (reaching comparable conclusions).

52. *See* Burk & Lemley, *Technology-Specific*, *supra* note 10, at 1163–64; Ben Klemens, *The Rise of the Information Processing Patent*, 14 B.U. J. SCI. & TECH. L. 1, 35 (2008) (concluding that "patents on software and other information-processing technologies [are] virtually useless for disclosure purposes"); Henry E. Smith, *Institutions and Indirectness in Intellectual Property*, 157 U. PA. L. REV. 2083, 2127–28 (2009).

To be fair, the conventional view of disclosure does hold true with respect to a minority of industries, with the pharmaceutical sector being the prime example.[53] But the patent system's larger failure to bestow information with even minimally effective specificity is significant. When specifications fail to teach how protected technologies operate, they subvert the disclosure function of patent law.[54]

Disclosure thus appears to be a lofty goal that the patent system fails to achieve. The normative repercussions of this fact are not obvious. While some scholars argue that "without sufficient enablement the social bargain fails, and the inventor gets a windfall in monopoly profits,"[55] this is not necessarily the case.

First, simply because a patent specification fails to convey sufficient information does not mean that the invention itself will not be disclosed to the public. One must distinguish the nature of the underlying invention from the patent document itself. As the following Part explains, because patented inventions are typically self-revealing, their vulnerability to reverse engineering ensures that society will reap the benefit of their creation.[56] The patent document's failure to disclose the invention on a more immediate basis may be imperfect, but this failure does not thereby eviscerate the patent's raison d'être.

To the contrary, the larger social purpose of intellectual property is to promote the invention and commercialization of easily appropriated technology.[57] If the patent system performs this function satisfactorily, then we should not be overly concerned about effective disclosure.[58] Other scholars have pointed out that the patent bargain metaphor is incomplete, as considerably more factors are at play than disclosure as a quid pro quo of monopoly.[59] But it is not yet com-

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53. *See* Ronald J. T. Corbett, *Protecting and Enforcing Intellectual Property Rights in Developing Countries*, 35 INT'L LAW. 1083, 1085 (2001); C. Scott Hemphill, *Paying for Delay: Pharmaceutical Patent Settlement as a Regulatory Design Problem*, 81 N.Y.U. L. REV. 1553, 1611 (2006); Natalie J. Tanner, Note, *Understanding the Disparity in Availability of Prescription Drugs in the United States: Compromise May Be the Answer*, 2 IND. HEALTH L. REV. 267, 268 (2005).

54. *See* Alan L. Durham, *Natural Laws and Inevitable Infringement*, 93 MINN. L. REV. 933, 990–91 (2009).

55. Elisa Rives, Comment, *Mother Nature and the Courts: Are Sexually Reproducing Plants and Their Progeny Patentable Under the Utility Patent Act of 1952?*, 32 CUMB. L. REV. 187, 226 (2002); *see also* Lucy Gamon, Note, *Patent Law in the Context of Corporate Research*, 8 J. CORP. L. 497, 499 (1983); Matthew D. Kellam, Note, *Making Sense out of Antisense: The Enablement Requirement in Biotechnology After* Enzo Biochem v. Calgene, 76 IND. L.J. 221, 232 (2001).

56. *See* Easterbrook, *supra* note 18, at 109–10.

57. *See* U.S. CONST. art. I, § 8, cl. 8 (granting Congress the power to create an IP system "[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries"). I will refer to this as the "utilitarian incentive" goal of the patent system.

58. At the very least, we should not be concerned insofar as disclosure comes into tension with incentivizing invention and commercialization.

59. *See* Shubha Ghosh, *Patents and the Regulatory State: Rethinking the Patent Bargain Metaphor After* Eldred, 19 BERKELEY TECH. L.J. 1315 (2004).

monly understood that disclosure is an ancillary benefit — indeed, merely an advantageous by-product — of the patent system. Crucially, the goals of disclosure and utilitarian incentives can and do come into tension. Given that the former goal is for most purposes illusory and disclosure follows from the fact of invention itself — independent of the patent document — disclosure must yield to utilitarian incentives when these goals conflict.

The second major insight is that, despite purporting to promote disclosure as the primary goal of the patent system, doctrine has not given full effect to this aspiration. At first blush, this might appear to be nothing more than an incongruity. But on closer inspection, patent law seems to have been formulated with subtle reference to the fact that an unqualified promotion of disclosure might diminish, rather than enhance, social welfare. For example, patent applicants are not required to reveal their applications until eighteen months after they file at the USPTO.[60] A regime that insisted on maximizing disclosure would presumably spurn such a rule. This Article seeks to expand on this subtle acknowledgment and, in doing so, to point out that contemporary doctrine has not gone far enough to promote social welfare.

III. DISCLOSURE'S PROPER ROLE: SUBORDINATING THE DISSEMINATION OF INFORMATION TO THE PATENT SYSTEM'S LARGER PURPOSE

A. Intellectual Property as a Solution to the Public Goods Dilemma

Disclosure, far from being the unqualified goal of the patent system, serves no more than an ancillary role within the larger purpose of the patent regime. This conclusion should not be surprising in light of the preceding Part's exploration of how patent documents fail to effectively convey valuable information. This Part expands on that conclusion and argues that disclosure as an objective of patent policy should be discarded in certain circumstances.[61]

The patent system is designed to induce innovation that would otherwise take place at suboptimal rates, if at all.[62] It does so by providing monetary incentives that would otherwise be lacking. The need for an intellectual property system stems from the nature of information goods. All technological innovation, no matter how abstruse, is

60. 35 U.S.C. § 122(b)(1)(A)–(B) (2006).

61. This is not to deny the many benefits of disclosure or suggest that disclosure should not be maximized subject to the constraint of not reducing innovation. The fact remains that vibrant disclosure is eminently desirable in many circumstances. This Article merely seeks to counter the view inherent in most relevant scholarship that maximizing disclosure necessarily promotes the purpose of the patent system. As explained below, such a position becomes untenable in certain circumstances.

62. *See* Lee, *supra* note 36, at 900–01.

nothing more than knowledge. Information has unique attributes when compared to physical goods and services.

In the jargon of economics, tangible goods are both excludable and rivalrous.[63] The former attribute means that an owner of traditional property, be it land or any physical object, can prevent third parties from appropriating it for their use. Land can be fenced off, cars can be locked, and personal possessions can be kept hidden from others' view. Ultimately, government support is necessary to enforce property rights, by prosecuting those who flout the law, ejecting trespassers, and recovering stolen goods. But some form of property rights, albeit less advanced and secure, would persist in the absence of governmental support. Such is the nature of excludability. Physical goods are also rivalrous, which simply means that one person's consumption of an article reduces the amount available for further consumption by others.[64] If one person drinks half of another person's Coke, that amount is forever lost.

Information goods, by contrast, are neither excludable nor rivalrous.[65] They are nonrivalrous because the supply of an information good is limitless.[66] Once revealed, a method for solving a renowned problem, a formula for a new drug, the source code underlying valuable software, and an infinite variety of other examples are available for all to utilize. Such information goods are also nonexcludable, which means that preventing third parties from learning of one's discovery and employing it for their own gain is inordinately difficult.[67] Unless one does not attempt to market information goods, others will be exposed to an embodiment of the underlying innovation. Digital versions of movies and songs can be readily copied; computer software can be disassembled into object code and, often from there, to source code;[68] and pioneer drugs' formulation parameters can be reverse engineered. Once third parties understand how a technology operates, the original inventor has little recourse to prevent them from

63. *See* Yonatan Even, *Appropriability and Property*, 58 AM. U. L. REV. 1417, 1426–27 (2009); Winslow B. Taub, Comment, *Blunt Instrument: The Inevitable Inaccuracy of an All-or-Nothing On-Sale Bar*, 92 CAL. L. REV. 1479, 1491 (2004).

64. *See* Benjamin G. Damstedt, Note, *Limiting Locke: A Natural Law Justification for the Fair Use Doctrine*, 112 YALE L.J. 1179, 1188 (2003).

65. *See* Michael A. Carrier, *Unraveling the Patent-Antitrust Paradox*, 150 U. PA. L. REV. 761, 767 (2002).

66. *See* Jim Chen, *Conduit-Based Regulation of Speech*, 54 DUKE L.J. 1359, 1412–13 (2005). More precisely, only limited constraints in distribution, such as bandwidth and the availability of other communication fora, restrict the supply of an information good.

67. *See* Neeraj Arora, *Disabling Patentability for Skill-Based Inventions: Aligning Patent Law with Competition Policy*, 22 SANTA CLARA COMPUTER & HIGH TECH. L.J. 1, 6 (2005).

68. *See* Allan M. Soobert, *Antitrust Implications of Bundling Software and Support Services: Unfit To Be Tied?*, 21 U. DAYTON L. REV. 63, 65 (1995).

using it. Products bearing the characteristics of nonexcludability and nonrivalry are known as public goods.[69]

It should be clear from these traits that private markets will fail to produce these goods at socially optimal levels. Prospective innovators know all too well that the process of researching and developing novel technologies can be expensive. It is also risky. The pharmaceutical industry provides an apt example. The average cost of bringing a drug to market has been estimated to be over $800 million.[70] But even this gargantuan cost masks the improbability of any given compound bearing fruit. Estimates suggest that only one out of every 10,000 compounds originally marked for development will receive FDA approval and be made available to the public.[71]

Such enormous up-front costs are sunk. We normally trust free market forces to ensure allocative efficiency, as competitive conditions force companies to drop prices toward marginal cost.[72] While marginal cost pricing creates socially desirable static efficiency,[73] it creates insolvency in the presence of fixed costs.[74] Given information goods' nonexcludable nature, many innovators will have difficulty maintaining a monopoly over their commercialized inventions.[75] As competitors reverse engineer those products and begin to market their alternatives, competitive market forces will require the original innovator to reduce prices below the monopoly level.[76] If an inventor is subject to sufficient competition due to others copying her invention, she will be unable to command a sufficient price to cover her sunk research and development costs. Knowing this possibility ex ante, prospective inventors of public goods will be hesitant to devote their scarce capital to the risky process of innovation. In a free market,

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69. *See* William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325, 326 (1989).

70. *See* Christopher P. Adams & Van V. Brantner, *Estimating the Cost of New Drug Development: Is It Really $802 Million?*, 25 HEALTH AFF. 420, 427 (2006); Joseph A. DiMasi et al., *The Price of Innovation: New Estimates of Drug Development Costs*, 22 J. HEALTH ECON. 151, 166, 181 (2003).

71. *See* U.S. GOV'T ACCOUNTABILITY OFFICE, NEW DRUG DEVELOPMENT: SCIENCE, BUSINESS, REGULATORY, AND INTELLECTUAL PROPERTY ISSUES CITED AS HAMPERING DRUG DEVELOPMENT EFFORTS 7 (2006).

72. *See* CARLTON & PERLOFF, *supra* note 26, at 57–73; James Boyle, *Cruel, Mean, or Lavish? Economic Analysis, Price Discrimination and Digital Intellectual Property*, 53 VAND. L. REV. 2007, 2018 (2000); Dan L. Burk, *Muddy Rules for Cyberspace*, 21 CARDOZO L. REV. 121, 134 (1999).

73. *See* Tomas J. Philipson & Richard A. Posner, *Antitrust in the Not-for-Profit Sector*, 52 J.L. & ECON. 1, 5 (2009).

74. *See* William J. Baumol & Daniel G. Swanson, *The New Economy and Ubiquitous Competitive Price Discrimination: Identifying Defensible Criteria of Market Power*, 70 ANTITRUST L.J. 661, 668 (2003); Daniel F. Spulber & Christopher S. Yoo, *Toward a Unified Theory of Access to Local Telephone Networks*, 61 FED. COMM. L.J. 43, 67–68 (2008).

75. *See* Christopher Sprigman, *Copyright and the Rule of Reason*, 7 J. ON TELECOMM. & HIGH TECH. L. 317, 318 (2009).

76. *See* Shubha Ghosh, *Intellectual Property Rights: The View from Competition Policy*, 103 NW. U. L. REV. COLLOQUY 344, 347 (2009).

then, inventors will devote suboptimal capital to innovation.[77] This suboptimal allocation deprives consumers of valuable information goods that never come into being or emerge considerably later than they otherwise would.

One conceivable solution, albeit a profoundly poor one, would be to render reverse engineering illegal. The Supreme Court has quite properly put any such possibility to rest, describing the process of reverse engineering in laudatory terms.[78] The better answer is to grant inventors a sufficient pecuniary return to compensate them for the risk and capital that they devoted ex ante.

One possibility, often praised because it does not result in direct deadweight loss, is a prize mechanism.[79] If the government pays deserving innovators an amount that represents just enough return to have been regarded as a satisfactory reward ex ante, then the invention can be brought to market and used by consumers without the constrictions of monopoly. Reward systems also carry the attractive virtue of preventing entities that amass patents from stifling follow-on innovation through monopoly.[80]

Yet reward systems carry their own limitations.[81] For one thing, it is not true that prizes eliminate distortions completely. While such an approach forecloses monopoly in the marketing of technology, the government must raise the capital to fund rewards through taxation, which also carries a distortionary effect, albeit one distributed more broadly. Indeed, this broad distribution creates cross-subsidization problems, as those taxpayers who have no interest in certain technologies end up paying for those who do. The more fundamental problem, however, relates to the incentive to commercialize. Many technologies require significant post-discovery investment in order to commercialize them. Prize systems may do a good job at incentivizing initial innovation, but their ability to spur inventors to expend the

77. *See* Derek Bambauer, *Legal Responses to the Challenges of Sports Patents*, 18 HARV. J.L. & TECH. 401, 413 (2005); Colleen Chien, *Cheap Drugs at What Price to Innovation: Does the Compulsory Licensing of Pharmaceuticals Hurt Innovation?*, 18 BERKELEY TECH. L.J. 853, 872 (2003); Andrew W. Torrance & Bill Tomlinson, *Patents and the Regress of Useful Arts*, 10 COLUM. SCI. & TECH. L. REV. 130, 132 (2009) (summarizing this conventional view).

78. *See* Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 160 (1989) (observing that "the competitive reality of reverse engineering may act as a spur to the inventor, creating an incentive to develop inventions that meet the rigorous requirements of patentability"); *see also* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 476 (1974).

79. *See* Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 128–32 (2003).

80. *See* Steve P. Calandrillo, *An Economic Analysis of Property Rights in Information: Justifications and Problems of Exclusive Rights, Incentives To Generate Information, and the Alternative of a Government-Run Reward System*, 9 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 301, 332–33 (1998).

81. *See* Abramowicz, *supra* note 79, at 170–81.

capital required for commercialization is questionable.[82] In addition, confirming that inventions are worthy of pecuniary return due to their utility, nonobviousness, and novelty through the formal prosecution process at the USPTO may be easier.[83]

Given these limitations, strong support exists for the basic idea underlying the current patent regime. This system operates to ensure that innovators escape the public goods dilemma by maintaining exclusivity over their inventions and thus reap a sufficient ex post return to have induced their research efforts ex ante.

Of course, the award of a patent does not guarantee commercial success. Indeed, the majority of patents sit collecting dust on shelves and will never derive value for their owners.[84] Even in the pharmaceutical industry, where patents are unusually valuable, only a minority of patents prove to be profitable.[85] Thus, the patent system may provide an imperfect platform for inducing innovation. Significant commentary exists suggesting that patents may be hindering innovation in some markets more than incentivizing it.[86] But it remains clear that eliminating the patent system would stymie dynamic efficiency and choke innovation. Particularly in capital-intensive research industries, such as pharmaceuticals, the effect would be catastrophic. For this reason, promoting the incentive to invent and commercialize principles of the patent system is of utmost importance.

B. Disclosure's Proper Role Within the Patent System

The principle that patent laws exist to remedy a public goods problem is easily overlooked. If one embraces the notion that conveying technical know-how is a primary function of the patent system such that the lack of substantive disclosure requirements risks stifling innovation, one encounters an incongruity: if patented technologies are public goods, then they are readily appropriable.[87] Thus, the inevitability of disclosure is what drives the inventors of these goods to seek patent protection. Even if the § 112 requirements were eliminated, technical information would still be conveyed through mere

82. *See* F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 707–12 (2001).

83. *See id.* at 712–17.

84. *See* Mark A. Lemley & Carl Shapiro, *Probabilistic Patents*, 19 J. ECON. PERSP. 75, 80–81 (2005).

85. *See* Adam R. Young, Note, *Generic Pharmaceutical Regulation in the United States with Comparison to Europe: Innovation and Competition*, 8 WASH. U. GLOBAL STUD. L. REV. 165, 175 (2009).

86. *See* F. Scott Kieff & Troy A. Paredes, *Engineering a Deal: Toward a Private Ordering Solution to the Anticommons Problem*, 48 B.C. L. REV. 111, 112–14 (2007) (exploring this commentary).

87. After all, the nonexcludable nature of information goods is what warrants patentability.

visual inspection or more formal reverse engineering, depending on the complexity of the given invention. In such cases, § 112 serves only to hasten the inevitable.[88] Characterizing disclosure as being necessarily dependent on the formal conditions of patentability embodied in § 112 is therefore a mistake.

Some commentators have fallen prey to the allure of disclosure, while understating the public goods nature of much patentable subject matter. The following discussion is representative:

> Patent disclosure is essential. Imagine a world without it, in which the Wright Brothers invented the airplane, successfully tested it in remote Kitty Hawk, North Carolina, without being observed, and secured a patent on their undisclosed invention. They then hired scientists and developers to the newly formed Wright Brothers Airlines to commercialize their invention. Under the rubric of their patent, they do not allow anyone else to make, use, or sell aircrafts; they, and only they, operate airline flights. No one outside of Wright Brothers Airlines has an opportunity to understand the workings of the airplane, which are hidden by its casing, and develop it any further. In this world of undisclosed knowledge, science stalls, or at the very best, marches on slowly. By contrast, patent disclosure indirectly stimulates future innovation by revealing the invention's design so that others can use it fruitfully when the patent term expires and design around, improve upon, or be inspired by the invention, even during the patent term.[89]

This characterization of a world without patent disclosure requirements is melancholy, but also inaccurate. Crucially, Professor Jeanne Fromer fails to explain why the Wright Brothers would choose to patent their airplane invention at all if they otherwise were able to keep their valuable findings secret. If no one observed them in Kitty Hawk, and if they could commercialize their invention in a non-self-revealing way, why would they give away an invention of potentially perpetual value for mere twenty years exclusivity? Of course, they never would, nor would any rational inventor.[90] The simple fact is that patent laws likely were not designed to appeal to the inventors of concealable technology, for whom trade secret is the avenue of greatest

88. While this hastening is desirable, it is clearly an ancillary benefit.
89. Fromer, *supra* note 1, at 541.
90. *See* Easterbrook, *supra* note 18, at 109–10.

allure.[91] In Fromer's hypothetical, the contemporary patent system with its many disclosure conditions would remain unused. Society would be deprived of an understanding of the Wright Brothers' invention regardless of the patent system's existence.

This leads to a crucial insight. To a significant degree, inventions of the kind that are appropriate for patent protection are self-revealing. Disclosure comes hand-in-hand with many patent grants. Of course, the extent to which different inventions are self-revealing surely occupies a spectrum.[92] But the truth remains that, other things being equal, innovators patent inventions that they believe are vulnerable to reverse engineering. This is true even for some inventions that are not readily self-revealing. If the expected return from trade secret protection exceeds that available through the patent system, a rational inventor will adopt the former course. Thus, the concerns of many commentators that a patent system without disclosure would cause information to remain hidden indefinitely are misplaced.[93]

Courts, academics, and practitioners have ubiquitously embraced the notion that disclosure is the quid pro quo of patentability — the price that innovators must pay to reap the fruits of a twenty-year monopoly.[94] Commentators therefore speak of an "incentive to disclose" rationale of the patent system[95] as a normative justification that can be equal to, or even greater than, other goals of intellectual property law.[96]

The meaning that these commentators wish to attribute to this phrase is readily apparent. Obviously, significant social benefits accompany the concise and accessible revelation of novel technology.[97] And a patent's specification and claims can provide at least some such

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91. *See* Lemley, *supra* note 19, at 313.

92. *See* Burk & Lemley, *Policy Levers*, *supra* note 10, at 1584; Peter J. Courture, *Independent Derivation and Reverse Engineering*, *in* TRADE SECRET PROTECTION AND LITIGATION: PROTECTING CONFIDENTIAL BUSINESS AND TECHNICAL INFORMATION 615, 623–24 (PLI Patents, Copyrights, Trademarks, and Literary Prop., Course Handbook Series No. 340, 1992).

93. Nevertheless, it is true that a minority of patented products or processes may not be self-revealing at all. The issue of whether the inventors of such technologies are simply irrational or whether another explanation for this phenomenon exists is explored in detail below. *See infra* Part IV.A.

94. *See* Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co., 535 U.S. 722, 736 (2002) ("[P]atent rights are given in exchange for disclosing the invention to the public."); Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 150–51 (1989); Eli Lilly & Co. v. Barr Labs., Inc., 251 F.3d 955, 963 (Fed. Cir. 2001).

95. *See* Kevin Emerson Collins, *The Reach of Literal Claim Scope into After-Arising Technology: On Thing Construction and the Meaning of Meaning*, 41 CONN. L. REV. 493, 506 (2008); Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1029–30 (1989); Lee, *supra* note 36, at 901 n.48.

96. *See* Strandburg, *supra* note 36, at 104–07.

97. *See supra* Part II.A.

information to the public at large, though perhaps less than is commonly realized.[98]

However, it is inaccurate to characterize the patent system's disclosure function as tantamount to an incentive to patent. Incentives induce entities to adopt a course of action that they might otherwise shun. Conversely, the enablement and best mode requirements create a *disincentive* to seek patent protection by requiring inventors to reveal the inner workings of their discoveries, thus reducing the cost to their rivals of recreating those inventions. Disclosure is in fact a cost that inventors pay only because they need patent protection to derive a sufficient financial return from their discoveries. By framing the disclosure requirements of patentability in terms of incentives, commentators misleadingly imply that the revelation of one's invention falls within the same utilitarian framework as the incentives to invent and commercialize that are considered below.[99] Quite to the contrary, these requirements lie in some tension with patent law's incentive regime.

How great a disincentive do the disclosure conditions of patentability create? One can express the general result as follows: The disclosure requirements of § 112 disincentivize patentability in inverse proportion to the self-revealing quality of the relevant invention. Because patent law requires an inventor to reveal how her invention works and because the monopoly associated with a patent grant is ephemeral, not every eligible innovator will wish to avail herself of the patent system.[100] If rivals can easily discern the operation of a given invention embodied in a product, the inventor will have little choice but to pursue patent protection. Should she attempt to rely on trade secret, her exclusivity will be short-lived. For her, the disclosure requirements of § 112 represent a cost, for they will allow her competitors to recreate her technological discovery more cheaply and swiftly than would otherwise have been the case. But the prospect of a twenty-year monopoly over an invention that others could otherwise readily appropriate will greatly exceed that cost. As a result, she will seek patent protection, and society will benefit from that patent's disclosure.

In this setting, the disclosure disincentive does not create a social cost. But in other situations, it might. Consider an inventor who is on the fence about choosing trade secret or patent protection. She believes that her commercialized invention will be difficult, though not impossible, to reverse engineer. She concludes that there is a small but

98. *See supra* Part II.B.; *cf.* Burk & Lemley, *Policy Levers*, *supra* note 10, at 1584 (discussing the extent to which some inventions are self-disclosing).

99. *See infra* Part IV.

100. *See* Andrew Beckerman-Rodau, *The Choice Between Patent Protection and Trade Secret Protection: A Legal and Business Decision*, 84 J. PAT. & TRADEMARK OFF. SOC'Y 371 (2002).

significant chance that rivals could, with perhaps a half-decade's effort, uncover her novel technology and then begin marketing it themselves. Yet she also considers the possibility that her competitors will not deem the protracted cost involved in reverse engineering her technology worthwhile. Given the importance of her invention to her ongoing enterprise, she would prefer a right to exclude rather than a right to keep her discovery secret. Although the patent option would likely grant her more security in her invention than trade secret would,[101] this path would reveal her technology to her rivals in a manner that will enable them to duplicate it with reasonable experimentation. Here, the disclosure conditions of patentability may induce her to forego the otherwise favorable route of patent protection. Were patenting her discovery without meeting the requirements of § 112 possible, she would do so.[102] This is the "disincentive to disclose" in action.

A fundamental question arises from this example: would a social cost accrue to an inventor choosing trade secret protection if the patent regime did not require disclosure? None is immediately apparent, as the invention conveys no useful information to the public either way. The commercialized technology will be equally vulnerable or resistant to reverse engineering under both regimes.[103] Thus, one might conclude that society should be indifferent. However, more considered thought reveals that an obscure, but potent, cost might exist. If an inventor would prefer patent protection but chooses trade secrecy instead due to the cost associated with the § 112 requirements, then we know something important: the inventor would gain more utility from patent protection with no disclosure requirements than she would from trade secret. Greater utility translates into a larger ex post reward. Such enhanced ex post value means greater ex ante incentives to innovate. The "incentive to disclose" may therefore at times be in tension with the utilitarian "incentive to invent" foundation of the patent system.[104]

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101. It is important to note that patent rights are far from secure, given their probabilistic propensity for being found both valid and infringed in any particular case. *See* Lemley & Shapiro, *supra* note 84, at 79–80.

102. Even if the § 112 requirements were absent, however, some disclosure would still exist, which would emanate from the claims of the patent. Nevertheless, a patentee who is under no obligation to satisfy a best mode or enablement condition would reveal less information than under the current system. Since patent protection would grant a twenty-year monopoly at a lower cost in terms of revealing valuable know-how to rivals, some entities that would otherwise choose trade secret protection may instead follow this patent-with-less-disclosure path.

103. Of course, under patent protection, competitors will not be able to engage in reverse engineering if it involves practicing the patented claims.

104. *Cf.* Sean M. O'Connor, *Using Stock and Stock Options To Minimize Patent Royalty Payment Risks After* Medimmune v. Genentech, 3 N.Y.U. J.L. & BUS. 381, 418 (2007) (suggesting that if the costs of disclosure outweigh the incentives of a patent, an inventor may choose not to patent his or her inventions and instead keep them secret).

We thus arrive at a tentative conclusion. Although myriad benefits accompany disclosure as a general matter, a myopic focus on achieving this goal can perversely deflect inventors from electing patent protection. Such deflection may foreclose valuable knowledge from the public domain.[105] The repercussions of this important conclusion are explored in detail in Part IV.

Thus, apart from the incentive of the patent itself, which is withheld absent adequate disclosure, the § 112 factors do not create an incentive to disclose anything. These factors amount to a cost that some — but not all — inventors are willing to pay. The release of valuable information may be a social benefit that flows from patentability, but that benefit surely results in fewer inventors seeking patent protection than would otherwise be the case. Whether one believes the current patent system strikes the appropriate balance depends on how one weighs the competing theories underlying that system.

If we construe the patent system's purpose as extending no further than disclosure, then we should be indifferent as to whether the § 112 requirements reduce the number of patents sought by inventors and issued by the USPTO. A twenty-year monopoly absent disclosure amounts to a cost without a concomitant benefit, at least according to the conventional view. Yet, for the reasons discussed above, regarding the patent regime's creation of incentives as superior to any disclosure function is the better view. Very large benefits indeed may exist to awarding patents, even where an inventor's decision to patent her discovery results in no useful information being revealed.

But if disclosure is truly ancillary and often comes into tension with the more important goal of incentivizing innovation, could social welfare conceivably be improved by jettisoning the requirements of § 112? The answer is no. To understand why, one must first note that the self-revealing nature of a particular invention is not fixed but rather may depend on the inventor's subsequent actions. In a world without disclosure requirements, inventors may begin to inject artificial complexity into their products. Just as Da Vinci employed a variety of codes to obscure his inventions, inventors could conceivably package their discoveries in a manner that forecloses third parties from understanding them.[106] Were this phenomenon likely to occur, it would constitute a strong ground for maintaining, and perhaps expanding, contemporary disclosure requirements.

This point should not be overstated, however. If all innovators could commercialize their inventions in a manner that would reliably

105. *See* Limin Zheng, Note, Purdue Pharma L.P. v. Faulding Inc., 17 BERKELEY TECH. L.J. 95, 103 (2002).

106. *See* Shubha Ghosh, *Exclusivity — The Roadblock to Democracy?*, 50 ST. LOUIS U. L.J. 799, 806 (2006).

impede their rivals' abilities to discern their technologies, almost all entities would choose trade secret protection. That many inventors instead seek patent protection indicates that these inventors lack an unqualified ability to render their discoveries insusceptible to reverse engineering.

This observation should not be surprising. Indeed, many industries exist where efforts to manufacture non-self-revealing products would be in vain.[107] For instance, pharmaceutical products, which are likely the most deserving candidates for patent protection, are easy to reverse engineer[108] and would remain vulnerable to reverse engineering regardless of the efforts undertaken by the brand-name drug producers that developed them.

Inventors currently look to the patent system for protection in droves.[109] If they were capable of deriving a greater monopoly return by manufacturing their products in such a way as to prevent reverse engineering, we would not see almost half a million patent applications in 2008.[110] Of course, many reasons other than the prospect of a twenty-year monopoly exist that may explain this large number of patent applications. Such reasons, explored in detail below, include prestige, risk aversion, strengthening one's bargaining position, and defending oneself against independent invention.[111] But these reasons, even taken together, cannot explain the deluge of applications to which the USPTO is subject every year. Such factors would seem to have relevance at the margin, but they would be most unlikely to induce inventors of especially valuable and non-self-revealing technologies to jettison trade secret protection. It seems that inventors primarily apply for patents to obtain exclusivity that is largely free from the dangers of reverse engineering.[112]

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107. *See* Sheila R. Arriola, *Biotechnology Patents After* Festo*: Rethinking the Heightened Enablement and Written Description Requirements*, 11 FED. CIR. B.J. 919, 947 (2002) (stating that biotechnology products are easily reverse engineered); Duncan M. Davidson, *Common Law, Uncommon Software*, 47 U. PITT. L. REV. 1037, 1105 (1986) (noting that semiconductors can be readily reverse engineered); Alfred C. Yen, *What Federal Gun Control Can Teach Us About the DMCA's Anti-Trafficking Provisions*, 2003 WIS. L. REV. 649, 689 (observing that computer software is easy to reverse engineer).

108. *See* Uché Ewelukwa, *Patent Wars in the Valley of the Shadow of Death: The Pharmaceutical Industry, Ethics, and Global Trade*, 59 U. MIAMI L. REV. 203, 208 (2005).

109. *See* Matthew Sag, Sean Seymore & Chris Singer, *Panel on* Tafas v. Dudas*, Patent Rules Changes and Patent Reform*, 7 NW. J. TECH. & INTELL. PROP. 280, ¶¶ 111–13, at 291 (2009) (statement of Professor Matthew Sag).

110. *See* U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE AND ACCOUNTABILITY REPORT 54 (2008), http://www.uspto.gov/web/offices/com/annual/2008/2008annualreport.pdf.

111. *See infra* Part IV.A.

112. Of course, a patent does not ensure protection against all forms of reverse engineering. If a patented technology proves commercially valuable, competitors will likely attempt to decipher the workings of the invention and try to invent around it.

IV. REEXAMINING PATENT DOCTRINE IN LIGHT OF CONTEMPORARY DISCLOSURE

Unquestionable social value exists in rapid and effective disclosure. But the weight one attaches to that value must be qualified. Requiring innovators to reveal their secrets to their competitors imposes a cost of patenting that rises in tandem with the difficulty of reverse engineering the commercialized technology. Such disclosure comes at considerable benefit to innovators' rivals and for that reason, disclosure is a source of disutility for the original inventors themselves. This disutility, though desirable from a social viewpoint in most circumstances, can lead to problematic outcomes. Specifically, the § 112 requirements of patentability can reduce the incentive to innovate in the first place.

This Part explores the relationship between utilitarian incentives and disclosure within the patent laws and identifies certain aspects of patent doctrine that are implicated by the ensuing tension. Specifically, this Part discusses the inclusion of "self-realizing" inventions within the reach of patentable subject matter; justifies the Federal Circuit's restricted reading of the experimental use doctrine; explores optimal remedies in the event of infringement from the perspective of disclosure; and addresses the apparent conflict between the patent system's delay in patent publication and its disclosure-facilitating function.

A. Disclosure and the Question of Patentable Subject Matter

1. Disclosure Does Not Justify the Patentability of "Self-Realizing" Inventions

The breadth of patentable subject matter provides significant insight into the patent system's focus on imparting technical knowledge. Although the law excluded broad swathes of innovative activity from patent protection at one time or another, the law has evolved to incorporate "anything under the sun that is made by man."[113] Perhaps most controversially, business methods and computer software have fallen within the sphere of patentability.[114] The tendency of patent law to

113. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting S. REP. NO. 82-1979, at 5 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2399; H.R. REP. NO. 82-1923, at 6 (1952)) (internal quotation mark omitted).

114. *See* State St. Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368, 1375 (Fed. Cir. 1998) (upholding a business method patent); Russell Moy, *A Case Against Software Patents*, 17 SANTA CLARA COMPUTER & HIGH TECH. L.J. 67, 70–74 (2000). *But see In re* Bilski, 545 F.3d 943 (Fed. Cir. 2008) (en banc), *cert. granted*, 129 S. Ct. 2735 (2009) (invalidating the "useful, concrete, and tangible result" test from *State Street*). The patentability of computer software is particularly interesting, both because it is also protectable

expand to reach new discoveries in areas not contemplated by the original patent system indicates, among other things, that the law values disclosure.

Presumably, inventions that are not eligible for patent protection can only be guarded as trade secrets.[115] Thus, the narrower the band of innovation that patent laws can protect, the greater the proportion of inventions that inventors will withhold from public view.[116] Certain discoveries protected by trade secret, namely those that are not self-revealing, will remain hidden from the public domain for some time.[117] If disclosure is the primary function of the patent system, then one should advocate an expansive interpretation of eligible subject matter. And indeed we find such a broad interpretation: patent doctrine has evolved to the point where it embraces a near-all-encompassing approach to the kind of innovation that is subject to potential patent protection.[118] In this fundamental respect, patent policy appears truly dedicated to maximizing the dissemination of technological information.[119]

As explained above, there is no question that the rapid percolation of knowledge through society carries myriad benefits. Indeed, such gains represent a significant positive externality or "spillover" from the fact of invention itself.[120] From this perspective, a strong normative basis exists for expanding patentable subject matter to all instances of valuable innovation. Any increment in technological knowledge that bears potential for useful application should be entitled to patent protection, ensuring that society is apprised of all new, useful, and nonobvious advancements in knowledge. But do the disclosure and utilitarian justifications for patentability operate in unison?

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under copyright and because one would think the printed matter doctrine might apply to preclude patentability, though the courts have held this not to be the case. *See In re* Lowry, 32 F.3d 1579, 1583 (Fed. Cir. 1994). On the printed matter doctrine, see *In re* Gulack, 703 F.2d 1381, 1385 (Fed. Cir. 1983).

115. *See* Dan L. Burk, *Protection of Trade Secrets in Outer Space Activity: A Study in Federal Preemption*, 23 SETON HALL L. REV. 560, 580 (1993).

116. *See* David Manspeizer, Note, *The Cheshire Cat, the March Hare, and the Harvard Mouse: Animal Patents Open Up a New, Genetically-Engineered Wonderland*, 43 RUTGERS L. REV. 417, 423 (1991) (opining that patents are preferable to trade secrets because the latter "are concealed from the public and do not increase public knowledge").

117. *See* Dan L. Burk, *Misappropriation of Trade Secrets in Biotechnology Licensing*, 4 ALB. L.J. SCI. & TECH. 121, 130 (1994) (observing that patent and trade secret regimes are incompatible for inventors).

118. *See* Fed. Trade Comm'n, *To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy, Executive Summary*, 19 BERKELEY TECH. L.J. 861, 878 (2004); Hoffman, *supra* note 24, at 1011–12.

119. *Cf.* Thomas F. Cotter, *A Burkean Perspective on Patent Eligibility*, 22 BERKELEY TECH. L.J. 855, 878 n.129 (2007) (noting the possibility that expanded subject matter might enhance disclosure, but opining that the greater monopoly, transaction, and identification costs could actually have a negative effect on revealing information).

120. *See* Eisenberg & Rai, *supra* note 35, at 1194–95.

I have written elsewhere that the current reach of patent law is difficult to justify from a utilitarian viewpoint.[121] More specifically, given the patent system's ultimate goal of incentivizing the creation and commercialization of valuable technology, scant normative justification exists for allowing inventors of "self-realizing" discoveries to appeal to patent law for protection.[122] Internally consumed business methods provide the paradigmatic example of such discoveries. Since free-market competition creates adequate incentives for a company to research and employ novel internal processes for reducing its operating costs or increasing the quality of its products, the introduction of a patent monopoly on such business methods merely creates a windfall. Moreover, internally consumed processes are good candidates for trade secret protection because they are difficult to observe and appropriate.[123] Other areas of innovative activity are potentially suspect, including the products of research conducted by faculty for the esteem of their host institutions and fellow academics.[124] Tenure requirements may spur innovation in a manner that is quite indifferent to external rewards in the form of a patent monopoly. Accidental discoveries that require a modicum of commercialization costs similarly have an attenuated claim to patent protection from a utilitarian standpoint.

Here, we encounter an important tension between the disclosure and incentive goals of the patent system, which are typically (though incorrectly) portrayed as harmonious. If inventors would develop internally consumed business methods independent of the patent system, then utilitarian incentives form a poor justification for patentability. Disclosure may provide a better justification. If business methods and other forms of potentially self-realizing innovation are valuable to their creators, these inventions are presumably of some worth to third parties as well, be they competitors, scientists, or consumers. By denying such innovators patent protection, we potentially force them to go underground — benefiting from their discoveries in clandestine fashion, while denying society the potentially rich benefits of their technological contributions. As a result, the normative implications of disclosure and incentive-to-invent principles point in opposing directions. The former suggests that patentability should be broader than what is minimally required to spur innovation. The latter

121. *See* Alan Devlin & Neel Sukhatme, *Self-Realizing Inventions and the Utilitarian Foundation of Patent Law*, 51 WM. & MARY L. REV. 897 (2009).

122. "Self-realizing" inventions are those that come into being for reasons unrelated to the patent system. They may be thought of as inventions that would continue to arise even in the absence of patent protection.

123. *See* Burk & Lemley, *Policy Levers*, *supra* note 10, at 1584; Kitch, *supra* note 2, at 279.

124. For a recent discussion related to this point in the field of copyright, see Steven Shavell, *Should Copyright of Academic Works Be Abolished?*, J. LEGAL ANALYSIS (forthcoming 2010), *available at* http://ssrn.com/abstract=1525667.

cuts against such broad reach. The incentive-to-invent rationale, however, should carry the day.

The preceding Part explored the dearth of information that the current patent system in fact conveys. Inventors, whether through deliberate ignorance or practical inability, seldom rely on patent specifications in conducting their research.[125] Few companies sued for infringement are aware of the patent that the patentee accuses them of violating.[126] Some patents, particularly in the IT industry, do not lend themselves to instructive reading even if innovators do happen upon them. Thus, the true value of the patent system lies not in disclosure but in enabling inventors of public goods to appropriate value by enjoining others' use.[127] This process of extracting wealth, though costly in the sense of static efficiency, promises disproportionate long-run gains in the form of dynamic efficiency.[128]

While few would argue that the patent system would be much improved if it could be constructed in a manner that would better serve the congressional mandate found in § 112 without disproportionately diluting ex ante incentives, one must embrace the reality of the present situation in formulating doctrine. Even if patents succeeded in conveying information to anyone who was interested, this fact alone would not justify an expansive definition of patentable subject matter.[129] Rather, in delineating the optimal contours of patentable subject matter, the focus should be on providing sufficient rewards to induce innovation. Where adequate incentives exist independent of the patent system, the allure of disclosure should not tempt policymakers to expand that system's reach. Similarly, patent law should be conceived in a parsimonious manner, providing just enough reward to induce creation and commercialization but no more.[130]

An advocate of disclosure might counter that reducing the sphere of patent eligibility would choke the release of information. Excluded inventors may turn to trade secret for protection, deliberately crafting their products in a manner that would render them insusceptible to reverse engineering. As noted above, this fear is probably overstated.[131] If current patentees could convert self-revealing inventions

125. *See* Cotropia & Lemley, *supra* note 17, at 1465.

126. *See id.*

127. *Cf.* David S. Almeling, *Four Reasons To Enact a Federal Trade Secrets Act*, 19 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 769, 783–84 (2009) (discussing the reliance of companies on IP to protect competitive advantages).

128. *See* Thomas O. Barnett, *Maximizing Welfare Through Technological Innovation*, 15 GEO. MASON L. REV. 1191, 1199 (2008).

129. *See* Cotter, *supra* note 119, at 878 n.129.

130. *See* Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257, 292 (2007); Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1057 (2005). For my view on this point, see Alan Devlin, *Patent Law's Parsimony Principle*, 25 BERKELEY TECH. L.J. (forthcoming 2010), *available at* http://ssrn.com/abstract=1534886.

131. *See supra* Part III.B.

into non-self-revealing ones, few would elect to obtain patents in lieu of trade secret protection. Generally, inventors would only choose the patent system if the cost of preventing reverse engineering exceeded the expected gains of trade secret protection over patent protection.[132] Given the rather limited disclosure actually carried into effect by the contemporary patent system, and the fact that relatively few inventors forego patent protection in favor of trade secret protection, it follows that the inventors of self-realizing technologies should be denied access to the USPTO. Although inventors of self-realizing technologies will do their best to mask their discoveries when reducing them to practice, their ability to do so will presumptively be limited. Were the situation otherwise, they would likely have eschewed patent protection even if it had been available to them. Thus, concerns of disclosure do not warrant extending the sphere of patentability beyond what utilitarian goals of invention and commercialization justify.

2. The Patent System Does Not Spur the Patenting of Non-Self-Revealing Inventions

The final argument that a proponent of disclosure might air would relate to the phenomenon of inventors patenting non-self-revealing inventions.[133] Such discoveries appear eminently suited for trade secret protection.[134] To the extent the patent system succeeds in enticing such innovators, it would appear to be a good thing. Even the imperfect disclosure associated with modern patents is better from a societal standpoint than the dearth of information associated with the trade secret regime. This implies that patentable subject matter should be expanded to the extent that it would entice inventors of non-self-revealing technologies to forgo trade secret protection.

This conundrum raises two important issues. First, what explains the apparent paradox of inventors patenting non-self-revealing innovation? Second, is this phenomenon necessarily desirable?

It might be tempting to dismiss inventors' use of the patent system for non-self-revealing inventions as irrational.[135] This would not be an entirely unreasonable explanation. After all, the fact that a commercial decision may be foolish does not prevent one from making such a decision. The market works by punishing the inane and

132. An inventor may also choose patent protection if he fears that others would independently discover his invention and patent it. This issue is discussed in Part IV.A.2, *infra*.

133. One should find this phenomenon surprising, given that we should not expect inventors of non-self-revealing technologies to seek patent protection. *See* Burk, *supra* note 47, at 1010.

134. *See* Easterbrook, *supra* note 18, at 109–10.

135. *See id.*

rewarding the smart.[136] But it would be a mistake to discard such a fundamental question so easily. In fact, more insightful analysis reveals that several independent explanations exist for this ostensibly paradoxical phenomenon.

First, certain entities — particularly large companies involved in patent-heavy industries such as IT — have strong incentives to accumulate vast patent portfolios.[137] By acquiring a large volume of patents, such companies enjoy enhanced bargaining power when negotiating with rivals and third parties for attractive cross-licensing arrangements.[138] The ensuing patent "arms race" reaps considerable awards for companies that successfully acquire IP rights on a large scale.[139] The resulting armament may be effective for both defensive and offensive purposes in litigation.[140] Given the significant private incentives for hoarding patents, a large-scale commercial developer of a technology that might otherwise be suited for trade secret protection may instead add the invention to its arsenal of patents.[141] In some situations, patenting an invention may conceivably create more value for its owner than protecting it as a trade secret,[142] even if trade secret protection would prove more durable.

Second, most determinations as to whether a particular invention is vulnerable to reverse engineering are probabilistic. At either end of the spectrum, it will be clear to inventors whether their technological discoveries are best protected through the patent or trade secret laws. But in the fuzzy middle, some close calls may exist.[143] Certain inventions, when reduced to practice, may be difficult to reverse engineer. Perhaps the process of inspection will only reveal a limited number of the necessary constituents of the invention, such that engineers will

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136. *See* Dynamics Corp. of Am. v. CTS Corp., 794 F.2d 250, 256 (7th Cir. 1986), *rev'd on other grounds*, 481 U.S. 69 (1987).

137. The innumerable patents that contribute to the current "thicket" create an incentive for companies to hoard as many patents as possible, which can be used prophylactically to ward off the threat of lawsuits, to resolve possible conflicts through portfolio cross-licensing agreements, and to use in larger mutually beneficial arrangements such as patent pools. *See* Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, 1 INNOVATION POL'Y & ECON. 119 (2001).

138. *See* Stuart J.H. Graham & Ted Sichelman, *Why Do Start-Ups Patent?*, 23 BERKELEY TECH. L.J. 1063, 1066 (2008).

139. *See* Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1504 (2001).

140. *See* F.M. Scherer, *The Political Economy of Patent Policy Reform in the United States*, 7 J. TELECOMM. & HIGH TECH. L. 167, 194–95 (2009).

141. *See* Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 26 (2005).

142. *Cf.* Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CAL. L. REV. 1889, 1949 n.249 (2002) (suggesting patents can be defensive in addition to royalty creating, which offers numerous advantages when participating in industries with an abundance of patents).

143. *See* John E. Mauk, Note, *The Slippery Slope of Secrecy: Why Patent Law Preempts Reverse-Engineering Clauses in Shrink-Wrap Licenses*, 43 WM. & MARY L. REV. 819, 843 n.143 (2001).

have to guess and repeatedly experiment to recreate the technology. In such situations, rivals' prospects of success may possess a stochastic quality. Risk-neutral inventors will analyze such situations using a form of rational choice theory, which will look to the expected outcome. Risk-averse innovators, however, may not be willing to sacrifice their exclusive rights by taking the chance that a competitor might successfully and promptly reverse engineer their technologies.[144] Although large scale research entities are likely to be risk-neutral given their ability to hedge risk across a number of innovative projects, small scale or individual inventors whose future financial success depends on the ongoing viability of the discovery at hand are most likely to be risk-averse.[145] Some such entities, despite believing that rivals are unlikely to be able to reverse engineer their inventions, may take the safe road and opt for patent protection.

Third, if an inventor believes her rivals are likely to develop or implement a method that will arguably infringe her newly discovered process, she may have powerful incentives to obtain a patent. If more than a year passes after a person publishes or begins practicing his invention, the patent laws bar her from patenting it.[146] After that year, the inventor's only option is to protect the invention as a trade secret by maintaining its secrecy; however, by doing this, her innovation will not count as prior art against rivals.[147] A later inventor who independently discovers the same technology may be able to obtain a patent and enjoin the original innovator.[148] Thus, one reason to prefer patents over trade secret protection is that patents allow inventors to exclude others, while trade secret does not.[149] Of course, a significant danger of subsequent independent invention will only be present if the relevant discovery is in some way obvious.[150] But if a problem is

144. In other words, even if a risk-averse inventor could probably succeed in rendering his products non-self-revealing, the threat of a rival's success, unlikely as it may be, may be sufficient reason to play it safe and elect patent protection. *Cf.* Mark D. Janis, *Rethinking Reexamination: Toward a Viable Administrative Revocation System for U.S. Patent Law*, 11 HARV. J.L. & TECH. 1, 113 n.488 (1997) (explaining that a pre-grant publication system may cause risk-averse inventors to rely solely on trade secret protections)

145. Srikant Datar, Richard Frankel & Mark Wolfson, *Earnouts: The Effects of Adverse Selection and Agency Costs on Acquisition Techniques*, 17 J.L. ECON. & ORG. 201, 213 (2001); *see* Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713, 743 (1996).

146. 35 U.S.C. § 102(a)–(b) (2006); Jeffrey A. Lefstin, *The Formal Structure of Patent Law and the Limits of Enablement*, 23 BERKELEY TECH. L.J. 1141, 1161 n.69 (2008).

147. *See* 35 U.S.C. § 102(a)–(b); Jason Mazzone & Matthew Moore, *The Secret Life of Patents*, 48 WASHBURN L.J. 33, 60 n.128 (2008).

148. *See* 35 U.S.C. § 102(g); *see also* Mazzone & Moore, *supra* note 147, at 60 n.128.

149. *See* Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 490 (1974).

150. Judge Posner has explained that "[t]he functional meaning of obviousness is discoverable at low cost." RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 38 (6th ed. 2003).

well-known and its solution is potentially lucrative, there is every chance that subsequent efforts will prove fruitful.[151]

In general, if an invention is of sufficient expected value as to warrant the prosecution costs and subsequent maintenance fees, an inventor may wish to obtain a patent as a defense against independent invention.[152] The incentive to pursue this course of action may be especially strong in highly innovative industries, where new technology rapidly renders older technology obsolete. Not only are such conditions ripe for independent invention, but these conditions will surely strip the patented technology of any ongoing commercial value well before the patent expires. In such circumstances, trade secret protection may be singularly unattractive, as it would be a brave inventor indeed who considered her technological accomplishment to be so extraordinary that no one else is likely to repeat it.

Finally, patents may possess some independent value for marketing and other prestige purposes.[153] Thus, there are a variety of reasons why an inventor of a trade-secret-eligible invention might rationally prefer patent protection, though in practice this only occurs at the margin. Such factors would hardly spur Coca-Cola to forego trade secret protection. But whether any of these reasons have normative

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151. This possibility is perhaps most likely with respect to business methods, where free market forces will induce competitors to improve internal processes and, in so doing, produce better products at lower cost. Particularly if a company's discovery of a new method is only marginally superior to the prior art, the company may have a strong incentive to apply for a patent. If it successfully convinces a USPTO examiner that the claimed process is not obvious or otherwise invalid, it may then obtain a right to exclude others. This right can then be exercised to raise rivals' costs by enjoining their methods of conducting business. The "one-click" method that Amazon patented for making online purchases, which Amazon enforced against Barnes & Noble, is perhaps the most notorious example. *See* Amazon.com, Inc., v. BarnesandNoble.com, Inc., 239 F.3d 1343 (Fed. Cir. 2001); *see also* Carl Shapiro, *Patent System Reform: Economic Analysis and Critique*, 19 BERKELEY TECH. L.J. 1017, 1019 n.3 (2004) (noting that Amazon's one-click patent may be the most criticized software patent).

152. *See* 35 U.S.C. § 271(a); Stephen A. Stack, Jr., *Recent and Impending Developments in Copyright and Antitrust*, 61 ANTITRUST L.J. 331, 334 (1993).

153. *See* Benjamin K. Sovacool, *Placing a Glove on the Invisible Hand: How Intellectual Property Rights May Impede Innovation in Energy Research & Development (R&D)*, 18 ALB. L.J. SCI. & TECH. 381, 437 (2008). While these considerations demonstrate why an inventor may favor the patent system over trade secret protection for non-self-revealing discoveries, at least some circumstances in which trade secret may be more attractive exist. First, inventors of unremarkable technologies may be unwilling to go to the expense of obtaining and enforcing patent rights. *See* F. Andrew Ubel, *Who's on First? — The Trade Secret Prior User or a Subsequent Patentee*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 401, 441–42 (1994). Trade secret thus may be the vehicle of choice for some mundane discoveries. Second, inventors may also find trade secret attractive in fields that are particularly "crowded" with prior art. *See* Michelle L. Gross, Recent Development, In re Omeprazole Patent Litigation*: Misapplication of Inherent Anticipation Opens the Door to Future Speculation in Patent Protection*, 48 JURIMETRICS 409, 417 (2008). In these situations, exhaustive prior art searches may not be cost-justified given the expected value of the invention. When countless patents populate the prior art, one also runs a significant risk that an examiner or, worse, a court will unearth an obscure anticipatory reference and invalidate the patent. *See* Lemley & Shapiro, *supra* note 84, at 79–83.

value regarding the optimal reach of patentable subject matter is an entirely different story. In fact, there is good reason to conclude that none of these factors justifies extending the reach of patent laws beyond what is required to incentivize the creation and commercialization of easily appropriable technology.

If we deny self-realizing inventions patent protection, how much of the excluded innovation would have been (a) non-self-revealing, but (b) patented by the inventor? This band of innovation is apt to be narrow, given that inventions will be self-realizing primarily by the fact that they are non-self-revealing. What social value can we attribute to the disclosure of the inventions in this subset? To answer this, we must determine what kind of technological advancements could reliably be deemed self-realizing and hence unworthy of patent protection. For the reasons explained above and expanded on in greater detail elsewhere,[154] such advancements would primarily entail internally consumed business methods. Allowing patents on these methods would result in costly exclusion that would outweigh the benefit of disclosure.

The only convincing explanation for why the inventor of a novel internally consumed business method would patent that method is that she can use that patent to raise rivals' costs. Given that internally consumed business methods do not lend themselves to reverse engineering of an end product, an innovator has little to fear on that ground.[155] To the extent an inventor wishes to obtain property rights in business methods in order to hoard patents, it is far from clear that such activity is desirable. The fear of rivals inventing the same process should inspire little consternation if those competitors are similarly incapable of obtaining patent protection. Although good reason may exist to allow an inventor to obtain a patent and enjoin the use of subsequently and independently developed technology in many situations, this is not the case where the original inventor has sufficient independent incentives to invent. Many inventors will only derive a sufficient ex post return to have induced their innovation by being able to exclude others and thereby set a monopoly price and/or negotiate favorable licensing fees.[156] However, a certain subset of innovators, such as those who develop internal business methods, may extract sufficient value from consuming the invention themselves. If a new and useful business method reduces costs or results in a superior product, which

154. *See* Devlin & Sukhatme, *supra* note 121.

155. *See* Robert G. Bone, *From Property to Contract: The Eleventh Amendment and University-Private Sector Intellectual Property Relationships*, 33 LOY. L.A. L. REV. 1467, 1506 (2000); David W. Melville, *Liability Rules, Property Rules, and Incentives Not To Bargain: The Effect of Competitive Rivalry on the Protection of Legal Entitlements*, 29 SETON HALL L. REV. 1277, 1291 (1999); *cf.* Strandburg, *supra* note 36, at 106 (explaining that industrial processes are non-self-disclosing inventions).

156. *See* Cotropia & Lemley, *supra* note 17, at 1465.

itself may be patented, the prospect of that result may be enough to induce the relevant innovation. This result is even stronger when one looks to the role of free market competition in incentivizing inventors to reduce cost and improve product quality.

Because we should limit the self-realizing innovation to be excluded from patentable subject matter to internally consumed business methods and because the benefits of disclosing such processes through the patent system are apt to be outweighed by the social costs of exclusion, disclosure does not warrant the current reach of the patent regime. Given the primacy of utilitarian considerations of imparting optimal incentives, the patent system's concern with conveying information must take second place. Nevertheless, the phenomenon of inventors patenting non-self-revealing technologies demonstrates that patent law's disclosure function continues to have value in many instances.

B. Disclosure and the Experimental-Use Doctrine

Nowhere is the role of disclosure more explicitly implicated than it is with respect to the concept of experimental use. Unlike the question of patentable subject matter, where the law's interest in disclosure would seem to explain recent expansion, courts have severely limited the experimental-use doctrine's reach.[157] An explicit statutory right to experiment only exists with respect to certain sectors, most notably the pharmaceutical industry.[158] The courts have also recognized a limited right for third parties to practice a patented technology in order to learn more about its operation.[159] Apart from these narrow exceptions, however, a patent-holding company's competitors have essentially no right to reverse engineer and hence fully understand the patented invention. Instead, they will either have to bargain for permission, which understandably might not be forthcoming, or infringe the patent and hope that they are not caught. This aspect of the law might strike the reader as profoundly odd. If indeed the law adopts a disclosure rationale for patent law, what possible justification could exist for

157. *See* Madey v. Duke Univ., 307 F.3d 1351, 1362 (Fed. Cir. 2002).

158. *See* Merck KGaA v. Integra Lifesciences I, Ltd., 545 U.S. 193, 202 (2005); Embrex, Inc. v. Serv. Eng'g Corp., 216 F.3d 1343, 1353 (Fed. Cir. 2000) (Rader, J., concurring); *see also* 7 U.S.C. § 2544 (2006); 17 U.S.C. § 906(a)(1) (2006).

159. *See Madey*, 307 F.3d at 1362 (noting that the experimental use doctrine is "very narrow and limited to actions performed 'for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry'" (quoting *Embrex*, 216 F.3d at 1349)); Roche Prods., Inc. v. Bolar Pharm. Co., 733 F.2d 858, 862 (Fed. Cir. 1984); Poppenhusen v. Falke, 19 F. Cas. 1048, 1049 (C.C.S.D.N.Y. 1861) (No. 11,279); Whittemore v. Cutter, 29 F. Cas. 1120, 1121 (C.C.D. Mass. 1813) (No. 17,600).

such a parsimonious interpretation of the experimental-use doctrine?[160]

In fact, an examination of the law governing experimental use reveals that patent doctrine does not place an unqualified focus on disclosure. The Federal Circuit has proven decidedly reluctant to embrace a more expansive interpretation of the doctrine, a fact that has riled many academics.[161] Nevertheless, a proper construction of the relationship between incentives and disclosure reveals that the Federal Circuit's position is correct. Many academics' efforts to expand experimental use reveal a fundamental misunderstanding of the role of disclosure. Expanding the doctrine in the manner they advocate would operate to dilute incentives and create an unwarranted threat to ex ante innovation.[162]

Some posit that introducing a meaningful experimental-use exception would not carry an appreciable negative effect on ex ante incentives to innovate.[163] They assert further that bargaining failure of the kind that justifies fair use in copyright necessitates a meaningful experimental-use exemption in patent law.[164] Finally, they contend that free experimentation is integral to effective follow-on innovation.[165] These contentions, though strongly intuitive, are misplaced.

The concept of bargaining failure lies at the heart of these scholars' arguments to expand experimental use. No rational company, the thinking goes, would ever license any of its rivals to experiment on its patented technology, given that such experimentation might allow a

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160. Some scholars have reacted to this apparent incongruity in the law with incredulity. *See, e.g.*, Strandburg, *supra* note 36, at 104–05 (opining that the current law on experimental use cannot be reconciled with the incentive-to-disclose rationale of the patent system, and urging a significant expansion in the reach of the exemption).

161. *See* Ted Hagelin, *The Experimental Use Exemption to Patent Infringement: Information on Ice, Competition on Hold*, 58 FLA. L. REV. 483, 512–13 (2006); Janice M. Mueller, *The Evanescent Experimental Use Exemption from United States Patent Infringement Liability: Implications for University and Nonprofit Research and Development*, 56 BAYLOR L. REV. 917, 919 (2004); Elizabeth A. Rowe, *The Experimental Use Exception to Patent Infringement: Do Universities Deserve Special Treatment?*, 57 HASTINGS L.J. 921, 922–23 (2006) (noting academics' outcry to the Federal Circuit's jurisprudence); Strandburg, *supra* note 36, at 83–84; Hoffman, *supra* note 24, at 1037.

162. I have expounded my views on this particular subject elsewhere, though I take the opportunity now to expand upon them in light of this Article's exploration of the relationship between incentives and disclosure. *See* Devlin, *supra* note 20.

163. *See* Strandburg, *supra* note 36, at 119.

164. *See* Eisenberg, *supra* note 95, at 1072–73 ("The risk that the parties will be unable to agree on terms for a license is greatest when subsequent researchers want to use prior inventions to make further progress in the same field in competition with the patent holder, especially if the research threatens to render the patented invention technologically obsolete."); *see also* Michael J. Meurer, *Too Many Markets or Too Few? Copyright Policy Toward Shared Works*, 77 S. CAL. L. REV. 903, 940 n.154 (2004) (justifying copyright's fair use doctrine on artists' understandable unwillingness to license rights to their works for parody or criticism, which is a form of bargaining failure).

165. *See* Andrew S. Baluch, Note, *Relating the Two Experimental Uses in Patent Law: Inventor's Negation and Infringer's Defense*, 87 B.U. L. REV. 213, 243–44 (2007).

rival to develop a superior product or, worse, invent around the patent.[166] Moreover, the sheer number of patents that potentially implicate certain technologies creates significant search and transaction costs.[167] Advocates for expanding the experimental-use doctrine might characterize inventors' refusal to license as economically inefficient, thus justifying judicial intervention in the form of a liability rule.

Such arguments are ill-conceived. As explained in detail above, the patent regime is first and foremost a system for incentivizing innovation and commercialization, not economic efficiency. It operates by granting patentees the right to exclude, which enables them potentially to earn monopoly returns.[168] But it is a profound mistake to think that the only form of return that matters to inventors is pecuniary.[169] A patentee's right to prevent her rivals from experimenting fully on her invention may be a significant source of utility. In certain circumstances, the patentee may prefer such exclusion to licensing at a monopoly price. To the extent a patentee declines a proffered license fee, the economic insight is simple: the proposed fee undercompensates the patentee. Far from being irrational, a patentee's refusal to license others to experiment on her invention simply increases her ex post return, resulting in heightened ex ante incentives to innovate.

Furthermore, while the propriety of liability rules is widely debated, especially with respect to defining optimal access prices, there is no question that a price of zero is improper.[170] Yet by allowing free experimentation, an expansion of the experimental-use doctrine would set just such a price, ensuring patentees are undercompensated.

For the preceding reasons, an expanded experimental-use exemption would necessarily reduce inventors' incentive to invent and cannot be justified by general appeal to the idea of bargaining failure.

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166. Most improvements on an invention will rely on the original inventor's patent right, which can act as a blocking patent. The original patentee can thus profit from others' advancements in their original technology. Only if a subsequent researcher's discovery represents an overwhelming technological leap will the original patentee be denied blocking rights. However, this phenomenon, which operates under the mantle of the reverse doctrine of equivalents, rarely occurs. If the original patentee's rival invents around the original patent instead, the original patentee is left without the benefits of blocking rights.

167. This contention is particularly misplaced. In most cases, a company wishing to reverse engineer a product will only need or want to experiment on a subset of patents covering the product. For these patents, the patent and its owner have been specifically identified. As negotiations will only take place between a small number of identified parties, transaction costs are limited.

168. *See* 35 U.S.C. § 154(a)(1) (2006).

169. *See* POSNER, *supra* note 150, at 11 (explaining that "utility in the sense used by philosophers of utilitarianism" equates to happiness, which can differ dramatically from willingness to pay).

170. *See* Dana R. Wagner, *The Keepers of the Gates: Intellectual Property, Antitrust, and the Regulatory Implications of Systems Technology*, 51 HASTINGS L.J. 1073, 1115–16 (2000). An access price of zero may, however, be appropriate in the case of an antitrust violation. *See id.* at 1117.

Despite these observations, it is crucial to note that a restricted experimental-use doctrine will not result in a dearth of experimentation. Patentees will not always refuse to license others. Increasingly, patent owners enter into reciprocal cross-licensing arrangements with close rivals, pursuant to which each can lawfully employ and hence experiment on the other's patented technology.[171] Patent pools have the same effect, except on a larger scale.[172] In addition, sufficiently large licensing fees may entice patentees to license when the proffered reward exceeds the utility the patentees would derive from exclusivity. This situation is most likely to arise where the prospective experimenter is not a direct competitor, but an interested third party.

Perhaps most importantly, however, large-scale experimentation will take place, even in the absence of any experimental-use doctrine at all. A de facto fair-use aspect to current patent law exists, which emanates from the difficulty of detecting infringement and the immense cost of prosecuting it once discovered.[173] Given this reality, inventors of important technologies have limited practical means to police and prevent experimentation.

The most convincing objection to the current law on experimental use is that the system allows patentees, at least in some ways, to control the path of follow-on innovation.[174] But as the preceding discussion reveals, patentees' ability to restrict most experimentation is illusory, given the relevant identification and prosecution costs. In practice, the right to exclude will largely be relevant only with respect to large-scale use of a well-known technology by a close competitor. In this narrow subset of circumstances, concerns of disclosure should give way to promoting the goal of incentivizing invention.

Of course, promoting innovation requires more than ensuring the supply of adequate incentives ex ante. It requires the availability of information ex post. The crucial question is how much information patentees should be responsible for conveying. As noted, most patented technologies are self-revealing, in that they will give up their secrets upon either casual inspection or more formal reverse engineering. Thus ex ante incentives are imperative, given that they naturally give rise to both invention and disclosure. But the ex post dissemina-

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171. *See* Shapiro, *supra* note 137, at 122; Steven C. Carlson, Note, *Patent Pools and the Antitrust Dilemma*, 16 YALE J. ON REG. 359, 373–80 (1999).

172. *See* Carlson, *supra* note 171, at 373–80.

173. *See* Colleen V. Chien, *Of Trolls, Davids, Goliaths, and Kings: Narratives and Evidence in the Litigation of High-Tech Patents*, 87 N.C. L. REV. 1571, 1573 (2009) (referring to the well-known fact that patent litigation is the "sport of kings"); Michael S. Mireles, *Adoption of the Bayh-Dole Act in Developed Countries: Added Pressure for a Broad Research Exemption in the United States?*, 59 ME. L. REV. 259, 275 (2007) (noting that "infringement by researchers is very difficult to detect"); Brian C. Banner, Note, *Patenting Tax Strategies: The Case for Excluding Legal Methods from the Realm of Patentable Subject Matter*, 15 TEX. INTELL. PROP. L.J. 491, 504 (2007).

174. *See supra* note 165 and accompanying text.

tion of technical know-how is also significant because it hastens the release of information and reduces the cost of replication.

Fortunately, Congress and the courts have provided us with an answer. The law does not require patentees to divulge all possible information about their discoveries. Nor does it entitle their rivals to the full amount of knowledge that they would obtain from an unfettered right to experiment. Rather, inventors who elect patent protection must comply with the strictures of § 112.[175] More particularly, the specifications they provide must enable those skilled in the art to recreate the patented invention "without undue experimentation."[176]

Where patent documents reveal little meaningful information, it becomes difficult to reconcile a strong exclusive right with the social contract envisioned by Congress.[177] The failure of a patentee to abide by the conditions of § 112 distorts this legislative judgment, except where others can reverse engineer the invention without undue experimentation even if the patent lacks a specification.

To the extent that a specification fails to satisfy the enablement, best mode, and written description requirements as laid down by Congress, the USPTO is supposed to apprise the applicant of the shortcoming and, if necessary, issue a rejection.[178] But if the nature of the invention is such that written language is incapable of providing the minimum information required by § 112, it is hardly fair to blame the inventor. Nor is allowing the Federal Circuit to relieve those inventors of the obligation to convey the technical knowledge required of them necessarily desirable.[179] A better solution in these limited circumstances might be to demand as much specificity as can reasonably be required in the written claims and specification and then additionally grant third parties a limited right to reverse engineer the invention after the patent has been issued.[180]

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175. See *supra* note 42 and accompanying text for a description of the § 112 requirements.

176. *See In re* Wright, 999 F.2d 1557, 1561 (Fed. Cir. 1993).

177. *See* AK Steel Corp. v. Sollac, 344 F.3d 1234, 1244 (Fed. Cir. 2003) ("[A]s part of the *quid pro quo* of the patent bargain, the applicant's specification must enable one of ordinary skill in the art to practice the full scope of the claimed invention." (citing *In re Wright*, 999 F.2d at 1561)).

178. *See* Robert L. Harmon, *When a Patent Claim Is Broader than the Disclosure: The Federal Circuit's Game Has No Rules*, 1 J. MARSHALL REV. INTELL. PROP. L. 21, 29–30 (2001); Jeremy E. Noe, Comment, *Paradise Lost but Recaptured: Prosecution History Estoppel Weakened in* Warner-Jenkinson Co. v. Hilton Davis Chemical Co., 73 CHI.-KENT L. REV. 1393, 1402 n.69 (1998).

179. *See* Burk & Lemley, *Policy Levers*, *supra* note 10, at 1688 (explaining how the Federal Circuit has significantly relaxed the enablement requirements imposed on inventors of computer software).

180. *See* Julie Cohen & Mark Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1, 29 (2001) (suggesting a reverse engineering exception for software patents); Pamela Samuelson, *Are Patents on Interfaces Impeding Interoperability?*, 93 MINN. L. REV. 1943, 1981 (2009) ("[F]or already issued interface patents, some reverse engineering may be necessary to extract interface information. Such reverse engineering to

A right to reverse engineer a patented invention must be tied to a particular industry or context. Allowing third parties to experiment on another's patented technology whenever they believe that the § 112 conditions have not been met would be hopelessly unpredictable. The many virtues of property rights exist only if legal certainty prevails. Disputes over the adequacy of § 112 disclosures for the purpose of reverse engineering would do violence to larger social goals. Instead, this Article supports a reverse engineering right with regard to computer software, which is the sole sector in which patents routinely fail to meet the requirements laid down by § 112.[181]

Coupled with a right to experiment to determine patent validity,[182] an ability to reverse engineer a patented product whose specification fails to provide minimally adequate information would ensure that the balance between disclosure and incentives envisioned by Congress is honored. However, outside these narrow exceptions, patentees' right to exclude others — even from experimentation — should be respected.

C. The Role of Disclosure in Formulating Appropriate Relief for Infringement

Defining the proper contours of relief in cases of proven infringement is one of the most controversial aspects of modern patent policy.[183] At its core, the debate boils down to a choice between property and liability rules.[184] The former option grants patent holders an unqualified right to exclude, which translates into a right to injunctive relief in all cases of proven infringement. The latter grants anyone access to the relevant resource, subject only to paying a fee established by some third party, often the government. Under a liability regime, a property owner has no right to exclude others.

The respective primacy of liability and property rules has been the subject of much scholarly analysis. In general, property rules are widely accepted to be best in low transaction cost settings where the

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obtain information that should have been disclosed in the patent should not be deemed infringing."); *see also* Samuelson & Scotchmer, *supra* note 21, at 1590 (2002) (noting that reverse engineering is banned despite the fact that "a right to reverse-engineer has a salutary effect on price competition and on the dissemination of know-how that can lead to new and improved products").

181. *See supra* note 52 and accompanying text.

182. *See* Devlin, *supra* note 20, at 647–48.

183. *See* Vincenzo Denicolò et al., *Revisiting Injunctive Relief: Interpreting* eBay *in High-Tech Industries with Non-Practicing Patent Holders*, 4 J. COMPETITION L. & ECON. 571, 572–73 (2008).

184. *See* POSNER, *supra* note 150, at 67–71; Ian Ayres & J.M. Balkin, *Legal Entitlements as Auctions: Property Rules, Liability Rules, and Beyond*, 106 YALE L.J. 703, 704 (1996); Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement To Facilitate Coasean Trade*, 104 YALE L.J. 1027, 1037–38 (1995); Kaplow & Shavell, *supra* note 145, at 715.

number of parties is limited and all property holders are easily identifiable.[185] By creating a property rights regime, society encourages entities that wish to avail themselves of a privately owned resource to contract with the rights-holder. This results in legal certainty and efficient contractual exchange.[186] A great benefit of this system is that it assures owners of adequate compensation.[187]

Where property rights are ill-defined and stakeholders are numerous, however, transaction and search costs begin to outweigh the benefits of unfettered exclusive rights.[188] In such settings, liability rules allow entities to bypass bargaining failure and use resources as they please, being obliged only to pay the mandatory access fee established by a third party.[189] As applied to the patent setting, liability rules entail the payment of damages.

The choice between these respective rules is far from straightforward in patent law. Liability rules, while reducing the problem of holdout and transaction costs, threaten to undercompensate patentees by depriving them of the value that they would have appropriated through the threat of an injunction.[190] They further entail considerable cost in the form of ex post litigation over the reasonableness of fees and also encumber freedom of contract given the associated dilution in legal certainty. But in some industries, where the patents covering any given product may number in the thousands,[191] allowing a single patentee to enjoin the marketing of a product is problematic. Such holdout, enjoyed by every patent holder whose patent rights cover a product, creates great social cost in the form of "royalty stacking."[192] The desire to alleviate this phenomenon, which threatens cumulative innovation and commercialization, forces certain industries to rely on patent pools and standard-setting organizations to allow them securely to bring products to market.[193]

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185. *See* Stewart E. Sterk, *Property Rules, Liability Rules, and Uncertainty About Property Rights*, 106 MICH. L. REV. 1285, 1290 (2008).

186. *See* Coase, *supra* note 40.

187. *See* Heidi Wendel, Note, *Restoration as the Economically Efficient Remedy for Damage to Publicly Owned Natural Resources*, 91 COLUM. L. REV. 430, 434 (1991).

188. *See* Sterk, *supra* note 185.

189. *See id.* at 1292.

190. *See* Craig Allen Nard, *Certainty, Fence Building, and the Useful Arts*, 74 IND. L.J. 759, 768 (1999).

191. *See* Mark A. Lemley, *Ten Things To Do About Patent Holdup of Standards (And One* Not *To)*, 48 B.C. L. REV. 149, 150 (2007).

192. *See* Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991 (2007). "Royalty stacking" has been defined as "the phenomenon in which disparate owners of complementary technologies license their patents at their profit-maximizing monopoly price and cause a cumulative reduction in welfare." Sannu K. Shrestha, Note, *Trolls or Market-Makers? An Empirical Analysis of Nonpracticing Entities*, 110 COLUM. L. REV. 114, 124 (2010).

193. *See* Shapiro, *supra* note 137, at 126–29.

As can be seen from this compendious exploration, the decision of whether to grant a patentee injunctive relief after proof of infringement is a difficult and important one. One need merely recall the business world's shock when it appeared Research in Motion would have to shut down its BlackBerry service when it was sued for transgressing NTP's patent.[194] The parties subsequently settled the case for $612.5 million.[195]

Disclosure has a central role to play in the choice between property and liability rules. This choice is sometimes informed by analogy to the law of physical property, where an injunction will almost always issue in the event of trespass. But as I have explained elsewhere, important distinctions exist between the intellectual and tangible property regimes.[196] The latter are characterized by determinate boundaries, such that cases of inadvertent trespass are rare and, when they occur, easily reversible in most instances. Not so with patented technology. The boundaries established by a patent's claims are often nebulous and cannot be conclusively determined prior to a Markman hearing. More fundamentally still, due to the innumerable patents that remain in force, companies have limited means to identify all potential blocking patents.

It becomes difficult to justify the imposition of draconian injunctive relief when a defendant's infringement was clearly unknowing.[197] Many of the benefits of a property rights regime rely on the ready demarcation of parties' legal rights. In an environment where others cannot easily identify those rights, knowing whether a proposed course of action implicates another's property becomes difficult. Lacking such knowledge, companies that market technological products must either expend considerable resources scouring the patents in their field or deliberately keep their eyes shut and press forward. Neither option is particularly attractive. No guarantees exist that even an exhaustive patent search will reveal all blocking patents, though the direct pecuniary cost of that search is assured. Conscious ignorance obviously carries its own risks, most obviously that a company many blindly infringe a variety of patents that a reasonable search would have unearthed. From a social welfare perspective, deliberate disregard of patents is highly objectionable.

Where property rights are difficult to identify and construe, the end result is legal indeterminism. In such an environment, engaging in

194. *See* Gerard N. Magliocca, *Blackberries and Barnyards: Patent Trolls and the Perils of Innovation*, 82 NOTRE DAME L. REV. 1809, 1809–10 (2007); *see also* NTP, Inc. v. Research In Motion, Ltd., 418 F.3d 1282 (Fed. Cir. 2005), *cert. denied*, 546 U.S. 1157 (2006).

195. *See* Ian Austen, *BlackBerry Service To Continue*, N.Y. TIMES, Mar. 4, 2006, at C1.

196. *See* Alan Devlin, *Indeterminism and the Property-Patent Equation*, 28 YALE L. & POL'Y REV. 61 (2009).

197. A complicating factor is whether this conclusion holds in the event of conscious ignorance of the patents that potentially implicate one's product.

efficient contractual bargaining becomes difficult. Where the thicket becomes sufficiently dense, such bargaining becomes impractical, which carries serious consequences. If an innocent company accidentally infringes a patent, ex post holdup results. In an ex ante setting where property rights are both identifiable and clear, licensees will pay patentees no more than the intrinsic technological value of the patented invention.[198] The royalties demanded by patentees will often be constrained by the presence of alternatives that prospective licensees can turn to.[199] But in a context of legal uncertainty, companies may innocently market infringing products, thus depriving them of the ability to look to substitute technologies. In an ex post setting where a defendant has infringed a patent and has devoted considerable investment into commercializing his infringing product, the patentee will be able to extract considerably more than she could have ex ante.[200] Here, the threat of enjoining the putative infringer's operations allows the patent holder to demand payment far in excess of what her patented technology can alone justify. This problem has become endemic, and has been most vividly manifested by the phenomenon of patent trolls, which make a living not out of marketing products to the benefit of consumers but of amassing patents and suing practicing entities.[201]

In light of this Article's exploration of disclosure in patent law, it should not be surprising that many accused infringers are entirely oblivious of the patents others accuse them of infringing. Recent empirical evidence has confirmed this.[202] In 2009, Professors Cotropia and Lemley released a study of 200 representative patent infringement cases between 2000 and 2007.[203] They found that courts determined that a defendant's copying of a patented technology was conscious in a mere 1.76% of cases.[204] In some industries, such as computers and software, fewer than 3% of complaints alleged copying.[205] Such results — startling as they are — reflect the patent system's failure both to grant notice of ownership rights and to explain the scope of covered inventions.

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198. *See* CARL SHAPIRO & HAL R. VARIAN, INFORMATION RULES: A STRATEGIC GUIDE TO THE NETWORK ECONOMY 241 (1999) (defining a reasonable royalty rate as one "that the patent holder could obtain in open, up-front competition with other technologies, not the royalties that the patent holder can extract once other participants are effectively locked in to use technology covered by the patent").

199. *See id.*

200. *See* Lemley, *supra* note 191, at 153.

201. Another problem relates to strategic holdout, in which members of standard-setting bodies withhold notice of their patent rights until after an industry selects a standard and locks in. This phenomenon results in a similar extraction of wealth that is both artificial and undesirable.

202. *See* Cotropia & Lemley, *supra* note 17.

203. *Id.* at 1440.

204. *Id.* at 1424.

205. *Id.*

Such widespread ignorance of existing patents should be considered in determining the appropriate remedy in a given patent dispute. Injunctive relief may still be appropriate in some circumstances. Where a patented technology covers a central, rather than peripheral, part of a product, the case for a property rule is strong. Furthermore, if a company deliberately closed its eyes to relevant patents in its field, courts should be less than understanding of the company's subsequent infringement. On the other hand, if a company shows that it conducted a diligent search, which was reasonable in light of the cost and scale of industry technology, monetary damages would seem appropriate.

Courts should also consider the industrial context in which an infringement suit arises. Vast quantities of patents of dubious quality, which make it difficult for even conscientious companies to operate without arguably infringing others' patent rights, plague some industries, particularly the IT and software sectors.[206] In these settings, courts should be more hesitant to grant injunctions than in settings where such problems are less pervasive, such as the pharmaceutical industry.[207]

Finally, courts should look to the activities of the patentee. This Article has argued that a patent document itself often fails to grant notice to third parties. If a patentee practices her invention by commercializing it as a consumer product, such activity should constitute constructive notice.[208] In such cases, a patentee should be entitled to enjoin the third party's use of her invention, irrespective of the latter's subjective innocence.[209]

D. Prosecution and Disclosure

Patentable subject matter, experimental use, and optimal remedies for infringement are the most important areas in which incentives and disclosure collide. Nevertheless, it is fitting to end with a quick word on disclosure during patent prosecution before the USPTO.

Current prosecution procedures represent something of an anomaly given the patent system's focus on disclosure in other contexts.[210] Since innovation (especially cumulative innovation) is more likely to build upon more recent technology, strong policy arguments exist in

206. *See, e.g.*, Doug Harvey, Comment, *Reinventing the U.S. Patent System: A Discussion of Patent Reform Through an Analysis of the Proposed Patent Reform Act of 2005*, 38 TEX. TECH. L. REV. 1133, 1158–59 (2006).

207. *See supra* note 53 and accompanying text.

208. Of course, commercializing a technology will not always grant actual notice to rivals, but a rule that commercialization amounts to constructive notice would categorically exclude patent trolls, which would be attractive for the reasons discussed previously. *See supra* note 201 and accompanying text.

209. For a more in-depth exploration of this point, see Devlin, *supra* note 196, at 85–90.

210. *See* Michael Risch, *The Failure of Public Notice in Patent Prosecution*, 21 HARV. J.L. & TECH. 179 (2007).

favor of effecting disclosure as soon as is possible. One might imagine a system that requires applicants who seek patent protection to reveal the nature of their inventions at the moment of filing.

Instead, modern rules grant patent applicants eighteen months of secrecy before their applications are made publicly available.[211] During this time, third parties cannot learn about technologies for which inventors have filed patent applications and may innocently begin marketing goods that will later be subject to injunction should the USPTO grant the pending application. In rapidly innovating industries, this period of secrecy may facilitate wasteful duplication if numerous inventors independently make the same discoveries.[212] During the period of secrecy, society is denied knowledge of potentially valuable information. This problem has prompted some leading commentators to call for the current period of secrecy to be shortened.[213]

However, there is good reason to favor the status quo. Although a system predicated on maximum disclosure might favor the elimination of secrecy in the prosecution process, such a move would do violence to patent law's incentive-to-invent rationale. As many, indeed most, inventions within the patent system are self-revealing, trade secret is not a viable route for them. Requiring inventors to reveal crucial operative information before they know the fate of their patent applications might disincentivize some innovation that would otherwise take place. Although this effect might be modest in many cases, it may be far more powerful with regard to inventions that straddle the line between self-revealing and non-self-revealing. Interestingly, in this situation, maintaining the current period of secrecy serves both the incentive and disclosure functions of the patent system. Society gains when inventors patent inventions that are not readily self-revealing, due to the disclosure of information that inventors might constrain otherwise. And incentives to invent are maximized by granting inventors the secrecy they desire.

The abolition, or even temporal reduction, of the eighteen-month period of concealment may therefore come into tension with disclosure as a goal of the patent system, which is only initially a strange result. Such a system would direct some inventors, particularly those who have not conducted a search of the prior art for anticipatory references,[214] toward trade secret, because they could not run the risk of a rejection by the USPTO that would leave them without either property protection or exclusive knowledge of their innovations. Others,

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211. *See* 35 U.S.C. § 122 (2006).

212. *See* Kahin, *supra* note 8, at 397.

213. *See* Sivaramjani Thambisetty, *Patents as Credence Goods*, 27 OXFORD J. LEGAL STUD. 707, 737 (2007).

214. Interestingly, the law imposes no duty on patent applicants to conduct a search of the prior art. It merely imposes a duty to reveal prior art of which they are aware. *See* Lemley, *supra* note 139, at 1500–01.

whose inventions are probably, but not definitely, better suited for trade secret protection will be deflected toward that path by any requirement of instant disclosure of patent applications.

V. CONCLUSION

Nearly all would agree that inventors should be required to reveal their technological accomplishments in return for patent protection. The right to exclude inherent in a patent grant creates significant social costs. Depending on consumer demand and the availability of non-infringing substitutes, a patent may create an economic monopoly that results in powerful distortions. Society would hardly pay such a steep price without reason. By demanding that every patentee disclose the workings of her invention, the law facilitates the widespread dissemination of valuable information. Others can then use that know-how for follow-on innovation, or to invent around or help invalidate a patent. When the patent expires, the knowledge the specification contains becomes free for all to use. The disclosure function of patent law is therefore as valuable as it is obvious.

But this traditional account of the patent system is both simplistic and misleading. Effective disclosure confers great benefits, but these asserted gains mask something more fundamental. At its heart, the patent system is a solution to the problem posed by the public goods nature of innovation: that technical knowledge is both easily appropriated and distributed. Without patent protection, the inventors of such goods would be hesitant to devote precious resources to research and development. Disclosure ostensibly sits in a harmonious relationship with the incentive-to-invent rationale of the patent system, but in certain cases these goals come into conflict. Since disclosure is a bonus that follows, usually automatically, from the act of invention itself, incentivizing innovation must be the primary goal of the patent system.[215] The fact that the contemporary patent system evidently fails to apprise interested parties of pertinent technology bolsters this conclusion.

Commentators routinely speak of incentives to invent and to disclose in the same sentence, assuming that these goals are mutually

215. Yet the path of innovation is more complex than this story alone tells. Some inventions take less capital and risk to develop than others and hence require less ex post return to incentivize their development. Others may be internally consumed, such that separate rights to exclude may be unnecessary. Certain inventions may not be susceptible to reverse engineering. Other forms of discovery may yield paradigmatic public goods that are vulnerable to appropriation; yet if patented, the multitude of such inventions in an industry, coupled with the cumulative nature of innovation within it, may choke downstream innovation. When patent thickets emerge, they threaten to undo the exact benefit that patents are designed to provide. Such features of the patent system serve to complicate the relationship between disclosure and incentives.

consistent, harmonious, and reconcilable. In certain situations, these assumptions break down. When disclosure and incentives come into tension, a mistaken view of the patent system as a primary mechanism for conveying information creates significant dangers. Because policymakers often fail to appreciate this tension, guarding against such dangers is difficult.

This is not to say that the rapid diffusion of know-how is an unworthy goal of the patent system. Myriad benefits would indeed flow from a system that conveyed all relevant technical information to those who could benefit from it, if such knowledge could be disseminated without diluting incentives. But the modern patent regime is no such system. This leads to an important insight: the system should promote disclosure only to the extent that it does not dilute ex ante incentives. While undeniable benefits to disclosure exist, the current patent system does not effectively provide those benefits. Thus, if a patent regime requires disclosure at the expense of ex ante incentives, it might be chasing a false benefit. For this reason, expanding patentable subject matter beyond what is necessary to spur the creation and commercialization of technology cannot be supported on the ground of disclosure. This remains true despite the seemingly paradoxical phenomenon of inventors sometimes patenting non-self-revealing technology. Contemporary efforts to expand the currently limited scope of the experimental use doctrine should be similarly opposed. By allowing competitors freely to practice an inventor's patented technology, such an enlarged doctrine would reduce the incentive to invent that drove the underlying innovation in the first place. Bestowing patentees with strong property rights in such settings ensures that they receive a sufficient return.

The fact of inadequate disclosure also has significant repercussions for the optimal remedies that society should construct in cases of patent infringement. As readily observable and determinate property rights are a sine qua non for efficient contractual bargaining, the current patent system improperly casts disputes into an ex post setting. If commercialization has already taken place, patentees can obtain a greater return than their technologies would have allowed them ex ante. Since the act of infringement has occurred by the time of a lawsuit, the presence of substitute technologies will not constrain the royalties that patentees can demand ex post. Given the indeterminate nature of the modern patent regime, there is at least some basis for preferring liability rules in certain cases. This result is most compelling where the patentee is non-practicing and the defendant has conducted a reasonable pre-commercialization search of patents in its line of business.

One more question remains. In surveying the disappointing disclosure function that patent laws currently serve, one must ask

whether doctrine should be adjusted to more effectively promote the information-sharing goal of the system. Other than revisiting prosecution procedures or significantly elevating the hurdle to satisfy the § 112 conditions of patentability, the only mechanism that would facilitate more efficacious disclosure would be an expanded right to engage in experimental use. As noted previously, proposals for such an enhanced exception should be met with considerable skepticism. Given the zero compensation associated with experimental use, any expansion of the reach of the doctrine necessarily comes at cost to ex ante incentives. Crucially, a radically expanded experimental use exemption would not remedy the disclosure shortfall of the patent system. Most infringement defendants had no knowledge of the patents they are accused of violating, a result of the various incentives to remain ignorant of the patents in one's field. An enhanced right to experiment would merely increase the information associated with those patents that are specifically identified. While this benefit should not be understated, it would not solve the current dilemma of ineffective disclosure. Given this observation, coupled with the fact that a patent's claims and specification reveal at least some useful information, the patent system should generally regard a patentee's right to exclude as inviolable.

Nevertheless, one area of innovation may exist in which a limited third party right to engage in experimental use should perhaps be allowed. Patents issued in the IT sector routinely fail to meet the literal requirements of § 112, an outcome that the Federal Circuit has oddly facilitated. While this Article has gone to some length to explain that disclosure is an ancillary benefit to the larger utilitarian incentive to invent and commercialize — the foundation of the patent system — this is not to say that the former goal is without worth. In creating the enablement, best mode, and written description requirements of patentability, Congress imposed a cost on patentees that it presumably knew would deflect some inventors toward trade secret protection. But that cost carries genuine social value when inventors elect to pay it. Although the incentive to invent should enjoy primacy in formulating patent doctrine generally, courts must recognize that § 112 reflects the minimum disclosure required by Congress. This standard requires that an inventor reveal sufficient information that those skilled in the art can recreate the technology without undue experimentation. Once this standard is satisfied, disclosure should give way to the incentive to innovate, and the experimental use doctrine should not be expanded. Where linguistic limitations prevent inventors from meeting the § 112 requirements, however, a limited experimental use right should be available. In practice, this exception would be limited to the IT industry, where a constrained right to reverse engineer computer software would be consistent with the congressional mandate.

A nuanced appreciation for the relationship between incentives and disclosure can help cast light upon a number of difficult issues in contemporary patent law. Having such an appreciation will allow policymakers to resist the mistaken impulse of many modern commentators who advocate promoting disclosure at the expense of incentives to innovate.