Patent Disclosure

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ABSTRACT: Patent law is premised on the onward march of science and technology. Patent law encourages cumulative innovation, both by dangling the patent before the inventor as an incentive to invent in the first instance and by requiring him to disclose to the public his invention so that science can progress by building on the divulged knowledge. Patent disclosure is essential. It indirectly stimulates others' future innovation by revealing to them the invention so that they can use it fruitfully when the patent term expires and so that they can design around, improve upon, or be inspired by the invention both during and after the patent term. Judicial decisions and nearly all legal scholarship on patent law have therefore not surprisingly consistently cited disclosure's critical role in the patent system, but they do so without much theoretical or institutional analysis. The rare handful of articles addressing the issue of patent disclosure suggests that disclosure is and ought to be of almost no importance in designing the patent system. This Article disagrees and argues in favor of its centrality in the patent system. Given this deserved centrality, this Article maintains that patent disclosures should be, well, patent, so that inventors can use these disclosures to culminate scientific and technological progress more effectively, thereby fulfilling the underlying premise of the patent system—stimulating innovation. The Article contends that the disclosure function is underperforming due to four systemic reasons—the inadequacies of the writer, the index, the reader, and enforcement—and suggests how to improve them. Surely, invigoration of the patent system's disclosure function

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carries with it costs, which this Article explores, suggesting they might not be too significant in relation to the benefits that patent disclosure offers in terms of growth of innovation. The Article then posits how invigoration of the patent system's disclosure function bridges what has seemed to be an impassable gap between those who believe in strong patent rights and those who think instead that inventions and information about them should be freely available.

I. INTRODUCTION

Patent law is premised on the onward march of science and technology. The Wright Brothers, for example, observed birds in flight, which they then sought to replicate by building gliders with wings that warped in flight to turn and maneuver.[1] Standing on the shoulders of the Wright Brothers,[2] inventors innovated further by creating the jet plane, the seaplane, and surveillance aircraft. Patent law encourages this cumulative innovation, both by dangling the patent right before the inventor as an incentive to invent in the first instance and by requiring him to disclose his invention to the public so that science can progress by building on the divulged knowledge. This stimulation lies at the heart of the patent laws that Congress enacted based on its constitutional power "[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."[3]

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.

The danger of undisclosed scientific and technological knowledge slowing scientific progress is substantial. Judicial decisions and nearly all legal scholarship on patent law have therefore, not surprisingly, consistently cited disclosure's critical role in the patent system, but they do so without much theoretical or institutional analysis.[4] The literature that does address

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1. *Cf.* Herbert A. Johnson, *The Wright Patent Wars and Early American Aviation*, 69 J. AIR L. & COM. 21, 23–38, 56–61 (2004) (discussing the patents obtained by the Wright Brothers on their "flying machine," the ensuing patent litigation, and the resulting patent pools). *See generally* T.A. HEPPENHEIMER, FIRST FLIGHT: THE WRIGHT BROTHERS AND THE INVENTION OF THE AIRPLANE (2003).

2. *See* Letter from Sir Isaac Newton to Robert Hooke (Feb. 5, 1675) ("If I have seen further [than you and Descartes] it is by standing on the shoulders of Giants."), *reprinted in* ROBERT K. MERTON, ON THE SHOULDERS OF GIANTS: A SHANDEAN POSTSCRIPT, at ii (1965).

3. U.S. CONST. art. I, § 8, cl. 8.

4. For some recent examples, see J.E.M. Ag Supply, Inc. v. Pioneer Hi-Bred Int'l, Inc., 534 U.S. 124, 142 (2001) (noting that disclosure is important because it is the quid pro quo for

patent disclosure tends to focus on the doctrinal rules.[5] Though some scholarship occasionally contains mention of patent disclosure's purpose of promoting innovation[6] and that the promotion may not be adequate,[7] there has been very little theorizing on the place of disclosure in the patent system. Nor has there been substantial analysis of the structure and content of invention disclosure. This means there has been surprisingly little investigation into whether the patent system serves its purported purpose of disclosing new inventions adequately to the public, and in particular, to the experts who can build on this information for further innovation. Similarly, while there is debate in the economic literature about how to strike the right balance in the patent system between stimulating innovation and minimizing deadweight loss, both sides of the debate tend to assume the gold standard of disclosure is effectuated.[8]

The rare scholarship addressing the issue of patent disclosure suggests that disclosure is, and ought to be, of almost no importance in designing the patent system.[9] In this Article, I disagree with this scholarship and devote Part II to explaining patent disclosure and arguing in favor of its centrality in the patent system. Given this deserved centrality, I maintain that patent disclosures should be, well, patent, so that inventors can use them to culminate scientific and technological progress more effectively, thereby fulfilling the underlying premise of the patent system—stimulating innovation. I agree with the conclusion of previous works that disclosure is

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the right to exclude); Alan L. Durham, *Patent Symmetry*, 87 B.U. L. REV. 969, 983 (2007) (noting the role disclosure plays); Jennifer E. Rothman, *The Questionable Use of Custom in Intellectual Property*, 93 VA. L. REV. 1899, 1966 (2007) (stating that property rights are granted in exchange for disclosure).

5. *E.g.*, Alison E. Cantor, *Using the Written Description and Enablement Requirements to Limit Biotechnology Patents*, 14 HARV. J.L. & TECH. 267, 280–310 (2000) (discussing the enablement and written-description requirements of 35 U.S.C. § 112); Matthew H. Solomson, *Patently Confusing: The Federal Circuit's Inconsistent Treatment of Claim Scope as a Limit on the Best Mode Disclosure Requirement*, 45 IDEA 383, 384–423 (2005) (discussing section 112's best-mode requirement).

6. *E.g.*, W. Michael Schuster, Comment, *Subjective Intent in the Determination of Antitrust Violations by Patent Holders*, 49 S. TEX. L. REV. 507, 517 (2007) ("Disclosures of new technology . . . can serve as the basis for new innovation . . . .").

7. *E.g.*, Brenner v. Manson, 383 U.S. 519, 533–34 (1966) (explaining the purposes of disclosure and the pressure not to disclose); Douglas Lichtman, *How the Law Responds to Self-Help*, 1 J.L. ECON. & POL'Y 215, 255 (2005) (noting that disclosure is "rarely revealing"); Peter K. Yu, *The International Enclosure Movement*, 82 IND. L.J. 827, 847 (2007) (suggesting that patent disclosures are frequently too cryptic).

8. *See infra* note 69 and accompanying text (discussing the resulting consensus on disclosure).

9. Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 133–35 (2006); Note, *The Disclosure Function of the Patent System (or Lack Thereof)*, 118 HARV. L. REV. 2007, 2014–17 (2005) [hereinafter Note, *Disclosure Function*]; *cf.* Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 105, 111, 119 (advocating that disclosure is irrelevant for self-disclosing inventions).

underperforming in this regard.[10] However, those works have not focused on a number of critical, systemic factors that contribute to disclosure's current inadequacy in the patent system. Nor, given their conclusions on the minor significance of patent disclosure, have those works addressed how to invigorate patent disclosure.

I contend in Part III that there are four systemic reasons why the disclosure function has underperformed, and I suggest improvements to strengthen patent disclosure. First, there is what I call an inadequacy of "the writer," in that interested readers of the patent document are not able to glean truly useful information from it. Though the patent document is often the only source of information about an invention, it is not currently structured to serve disclosure by forcing writers to include useful information. Fundamentally, the patent system intends the disclosure to have two types of audiences—legal and technical. The legal audience is looking to understand the scope of the right to exclude, while the technical audience is looking to understand the invention for purposes of further innovation. Despite the dual audiences, technical and legal information are confusingly intertwined in the document and must be teased apart for each layer to speak most fruitfully to its audience. I suggest making the technical layer separate from the legal layer and then constructing the technical layer to contain useful technical information. I suggest doing this by injecting useful redundancies into the technical layer and by more conscientiously, and specifically, mandating the structure of the technical layer.

Even if the technical layer is well constructed by the writer, there is a second point of inadequacy in disclosure called the inadequacy of "the index"—the difficulty of finding relevant patent documents in the repository of patent documents. One simple way to ameliorate this problem is to immerse the patent documents for a particular technological field in that field's principal databases or libraries. This inclusion would lead researchers to browse or search through the relevant patent literature. Such incorporation of the patent literature is already done in the field of chemistry, which logically explains why chemical research relies on information in patent documents significantly more than in any other technical field.[11] Moreover, the process of searching patents might be vastly improved by rethinking the classification scheme for patents to group similar patents together for easier retrieval.

Supposing the first two inadequacies were repaired, there nonetheless remains a third systemic problem—the inadequacy of "the reader." As legal scholars have already observed, the patent system offers a strong legal disincentive to read others' patents in the first instance. The disincentive comes from the rule of willful infringement, which when found, can lead to

10. *See* sources cited *supra* note 9.

11. *Infra* text accompanying notes 220–21.

treble damages in patent infringement cases.[12] Therefore, to avoid the possibility of increased damages, researchers are routinely advised not to read others' patents. This disincentive needs to be removed and perhaps even replaced with incentives to read patents in the first instance to stimulate innovation.

Finally, a fourth systemic inadequacy is enforcement. Due to limited resources, skewed incentives, and too-abstract guidelines, the Patent and Trademark Office ("PTO") regularly grants patents that do not meet current standards of disclosure. The only way to challenge inadequate disclosure post-patent issuance is during litigation by asserting a defense to patent infringement based on invalidity of the patent.[13] Because disclosure of a patented invention has value to innovators independent of their desire to use—that is, infringe the patent of—the invention, because so few patents are litigated for infringement, and because many non-litigated patents might be informationally valuable, litigation is an inadequate and disjointed place to enforce adequate disclosure systemically. To enforce the adequacy of disclosure, it should be possible—through the PTO during and after the application process or through the courts post-patent issuance—to challenge and enforce the adequacy of disclosure independently.

Surely, invigoration of the patent system's disclosure function carries with it costs. I explore the costs in Part IV and suggest they might not be too significant in relation to the benefits that patent disclosure offers in terms of growth of innovation. I conclude by suggesting future direction for research on patent disclosure and positing how invigoration of the patent system's disclosure function bridges an impassable gap between those who believe in strong patent rights and those who think that inventions and information about them should be freely available.

II. PATENT DISCLOSURE

After explaining in Section A how the disclosure function is implemented in the patent system, this Part explores the theory of patent disclosure as well as its limitations. Contrary to recent scholarship, Section B puts forth that disclosure in the patent system is critical for the advancement of science and technology, be it the Wright Brothers' airplane or a better mousetrap. In theory, disclosure can occur in many different ways, but in reality, as Section C shows, the patent document is the primary situs of technical information about a patented invention. Yet Section D makes the case that the patent document is effectively irrelevant in practice for informing scientific and technological research.

12. 35 U.S.C. § 284 (2000).

13. *See id.* § 282 (including "invalidity of the patent . . . for failure to comply with [a] requirement [of patentability]" as a defense to patent infringement).

A. IMPLEMENTATION

To stimulate innovation, Congress bestows a reward—patent protection—on inventors of certain inventions (or their assignees). Congress has marked out for utility patent protection a class of inventions deemed beneficial to society—those that are useful, novel, and nonobvious.[14] Patents are granted after successfully undergoing examination by the PTO to ascertain that an invention meets patentability conditions and its description in the patent application satisfies the disclosure requirements set out below.[15]

The patent right is not an exclusive right to market or practice a particular invention. Rather, the U.S. government grants to the patentee the right to exclude others from practicing his invention for a term of approximately twenty years.[16] That means that a patentee need not practice his invention or allow others to practice it during the patent term,[17] which would directly hinder subsequent innovation if not for the mandated disclosure of the patented invention in exchange for the patent right.[18]

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14. *Id.* §§ 101–103.

15. *Id.* § 131.

16. *Id.* § 154(a).

17. *But cf.* Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 285–86 (1977) (theorizing that patent rights lead to efficient control by the patentee through manufacturing and licensing).

18. In the late fifteenth century, the Republic of Venice implemented the first administrative patent system to reward inventors. BRUCE W. BUGBEE, GENESIS OF AMERICAN PATENT AND COPYRIGHT LAW 21 (1967). Before granting a patent, the Venetian government required a successful demonstration of the invention before the patent administrators, *id.*, necessitating some disclosure. More directly influential on the American patent system was the development of a patent system in Great Britain almost one century after the Venetian system. *See generally* ROBERT P. MERGES, PETER S. MENELL & MARK A. LEMLEY, INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 124–25 (2d ed. 2000). In 1778, the British judiciary grafted onto their patent laws the additional requirement that patent applicants clearly and fully describe their inventions in a specification. Liardet v. Johnson, (1778) 481 N.B. 173 (K.B.). Nonetheless, before the creation of this judicial requirement, it was not unheard of for an inventor in Great Britain to disclose his invention in a patent application. BUGBEE, *supra*, at 42; Adam Mossoff, *Rethinking the Development of Patents: An Intellectual History, 1550-1800*, 52 HASTINGS L.J. 1255, 1289–91 (2001). The motivations for an inventor's voluntary disclosure were typically proof of inventorship, delineation of the invention's metes and bounds to prevent infringement, and preemption of a requirement of a working model. Mossoff, *supra*, at 1289–90. In *Liardet*, Judge Mansfield expressly noted as disclosure's purpose the public use of the information when the patent term expires. *See* E. Wyndham Hulme, *On the History of the Patent Law in the Seventeenth and Eighteenth Centuries*, 18 LAW Q. REV. 280, 285 (1902) (describing how the patent seeker "'must specify upon record [the] invention in such a way as shall teach an artist,'" at the expiration of the patent "'to make it—and to make it as well as [the inventor]; for then at the end of the term, the public have the benefit of it.'" (quoting Liardet v. Johnson, (1778) 481 N.B. 173 (K.B.))). This requirement marks the accepted origin of the patent monopoly grant in exchange for disclosure of the invention. Mossoff, *supra*, at 1288. In fact, a study of nineteenth-century English innovation shows that industries that tended to patent (and thus disclose) had wider geographic diffusion of innovations than industries that used alternate protection mechanisms. Petra Moser, *Do Patents Weaken the Localization of Innovations? Evidence from World's*

Congress has mandated disclosure of an invention, which typically occurs eighteen months after the patent application is filed and at the latest by the time the patent issues.[19]

The statute mandates four disclosure requirements and PTO regulation imposes additional requirements. The first statutory requirement structures the content a patentee must present: a patent application—which is later published, perhaps in modified form, as the patent—must contain a specification describing the invention in writing and concluding with one or more claims "particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention,"[20] and one or more drawings, if necessary, to elucidate the invention.[21] For illustration of a patent's content, the Appendix contains a relatively comprehensible patent for a shark protector suit. The other three statutory requirements—written description, enablement, and best mode[22]—are best understood as obliging disclosure of certain content within the specification. The written-description requirement ensures that the inventor is in possession of the claimed invention.[23] Though the written description was originally required to prevent patent applicants from amending patent claims to include things or processes not within their initial application, the Federal Circuit has invoked it as a substantive test for adequate disclosure in recent years.[24] To enable the invention, the patent applicant must demonstrate in the specification to "any person skilled in the [relevant] art [how] . . . to make and use the [invention]"[25] without "undue experimentation."[26] Also, the

Fairs, 1851-1915, at 23–24 (Nat'l Bureau of Econ. Research, Working Paper No. 941571, 2008), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=941571.

19. 35 U.S.C. § 122(b) (2000). An applicant certifying that he will not seek patent protection in another country is one of the most prominent exceptions to the eighteen-month disclosure requirement. *Id.* § 122(b)(2)(B). In any event, pre-grant publication underscores the primacy of the disclosure function to the patent system, as disclosure is mandated even for those applications that are never granted. As another example of how patent policy emphasizes disclosure's importance, an "invention" can be patented even if someone else has already invented it but has maintained it in secrecy. Ormco Corp. v. Align Tech., Inc., 463 F.3d 1299, 1305 (Fed. Cir. 2006).

20. 35 U.S.C. § 112.

21. *Id.* § 113.

22. *Id.* § 112.

23. Guang Ming Whitley, Comment, *A Patent Doctrine Without Bounds: The "Extended" Written Description Requirement*, 71 U. CHI. L. REV. 617, 629 (2004).

24. *Id.*

25. 35 U.S.C. § 112. This, however, does not mean that a person skilled in the art must be enabled to make and use "a perfected, commercially viable embodiment absent a claim limitation to that effect." CFMT, Inc. v. Yieldup Int'l Corp., 349 F.3d 1333, 1338 (Fed. Cir. 2003).

26. Monsanto Co. v. Syngenta Seeds, Inc., 503 F.3d 1352, 1360 (Fed. Cir. 2007) (citing 35 U.S.C. § 112).

patent applicant must set out "the best mode contemplated by the inventor of carrying out his invention."[27]

The PTO has further regimented the patent's structure. Through regulations and guidelines, it requires the patent applicant to include in the specification a title and an abstract,[28] as illustrated in the Appendix. The PTO then assigns classification numbers to each patent application to narrow patent examiners' search for relevant prior art (certain knowledge available on the date of invention to a person of ordinary skill in the art) to evaluate patentability.[29] The PTO also mandates that patent applicants reveal material information known to them about prior art and patentability by imposing "a duty of candor and good faith in dealing with the [PTO]."[30]

Having outlined the nuts and bolts of the implementation of patent disclosure, I now turn to the theory animating these rules and to the disclosure function generally.

B. THEORY

It is well-accepted that the principal goal of the American patent system is to stimulate innovation.[31] This goal is manifested in the U.S.

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27. 35 U.S.C. § 112. The best-mode requirement is met so long as the patent document objectively discloses the best mode that the inventor subjectively conceived by the time the inventor files the patent application. Eli Lilly & Co. v. Barr Labs., Inc., 251 F.3d 955, 963 (Fed. Cir. 2001). The three statutory content requirements are understood to be independent of one another. For example, an invention can be described without it being enabled, such as when a patent contains a description of a chemical compound for which there is no known production method. U.S. PATENT & TRADEMARK OFFICE, U.S. DEP'T OF COMMERCE, MANUAL OF PATENT EXAMINING PROCEDURE § 2161 (8th ed., rev. 7 2008) [hereinafter MPEP].

28. 37 C.F.R. § 1.77 (2008); MPEP, *supra* note 27, § 601(I).

29. HARRY KURSH, INSIDE THE U.S. PATENT OFFICE 114 (1959). Significant criticism has been lobbed at the patent system regarding its failings in uncovering relevant prior art, resulting in issued patents for inventions that are obvious or not novel. *See, e.g.*, Beth Simone Noveck, *"Peer to Patent": Collective Intelligence, Open Review, and Patent Reform*, 20 HARV. J.L. & TECH. 123, 130–38 (2006) (arguing that the PTO search capabilities for prior art are inadequate because they do not allow examiners to find the prior art they need). There have been different proposed solutions to this problem: a greater burden should be placed on the patent applicant to produce this prior art, Jay P. Kesan & Marc Banik, *Patents as Incomplete Contracts: Aligning Incentives for R&D Investment with Incentives to Disclose Prior Art*, 2 WASH. U. J.L. & POL'Y 23, 26–27 (2000); PTO examiners should be better trained to locate relevant prior art, which should be made more easily available, AM. INTELL. PROP. LAW ASS'N, PATENTING BUSINESS METHODS 1 (2000), *available at* http://cyber.law.harvard.edu/ilaw/BMP/aipla_white_paper.pdf; or the public should be allowed to participate in patent examination or attack issued patents on the basis of prior art, Noveck, *supra*, at 143–61. *See also* Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1496–97 (2001) (rejecting some solutions as disproportionate to the problem when most issued patents are worthless and the novelty or nonobviousness of valuable patents can be challenged in litigation).

30. 37 C.F.R. § 1.56(a).

31. Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1597–99 (2003); Donald F. Turner, *The Patent System and Competitive Policy*, 44 N.Y.U. L. REV. 450, 450–51 (1969). That said, not enough is known empirically about how patents promote innovation.

Constitution's articulation of Congress's power "[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."[32] The theory is that this stimulation occurs by rewarding inventors for taking two steps they likely would not otherwise take: to invent in the first instance[33] and to reveal information to the public about these inventions.[34]

The reasons to spur invention need little elaboration, as it tends to benefit society economically and otherwise.[35] By giving inventors the incentive of a limited monopoly, the reasoning goes, those who would otherwise refrain from inventing—out of fear that they would not recover the costs of research and development, let alone make a profit, due to competing imitators—are motivated otherwise.[36]

Disclosure of information about inventions stimulates productivity[37] in at least two ways. First, it permits society at large to apply the information by freely making or using the patented invention after the expiration of the patent.[38] Second, the disclosure can stimulate others to design around the invention[39] or conceive of new inventions—either by improving upon the

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Mark A. Lemley, *Reconceiving Patents in the Age of Venture Capital*, 4 J. SMALL & EMERGING BUS. L. 137, 139 (2000); Lior J. Strahilevitz, *Wealth Without Markets?*, 116 YALE L.J. 1472, 1483 (2007). Other theories occasionally proffered to justify a patent system are grounded in notions of reward or moral rights. *See, e.g.*, Lawrence C. Becker, *Deserving To Own Intellectual Property*, 68 CHI.-KENT L. REV. 609, 619–29 (1993) (exploring how desert-for-labor arguments are attractive explanations of patent theory but do not justify the scope of patents, for example, to preclude others who have independently invented a patented invention from using it).

32. U.S. CONST. art. I, § 8, cl. 8. For explications of this clause, see I. BERNARD COHEN, SCIENCE AND THE FOUNDING FATHERS 308 (1995) and Dotan Oliar, *Making Sense of the Intellectual Property Clause*, 94 GEO. L.J. 1771, 1772–77 (2006).

33. This is particularly true of industries in which the inventive process is typically long, expensive, and uncertain, such as the pharmaceutical and semiconductor industries. Burk & Lemley, *supra* note 31, at 1581–82.

34. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 481 (1974).

35. COMM. ON NEW TECH. & INNOVATION IN BLDG., NAT'L RESEARCH COUNCIL, THE ROLE OF PUBLIC AGENCIES IN FOSTERING NEW TECHNOLOGY AND INNOVATION IN BUILDING 70 (David R. Dibner & Andrew C. Lerner eds., 1992); Jim Chen, *There's No Such Thing as Biopiracy . . . and It's a Good Thing Too*, 37 MCGEORGE L. REV. 1, 24 (2006).

36. Vincenzo Denicolò & Luigi Alberto Franzoni, *The Contract Theory of Patents*, 23 INT'L REV. L. & ECON. 365, 365–66 (2003). A comparative study of nineteenth-century innovation shows that countries with patent laws generated more diverse forms of invention than those without. *See generally* Petra Moser, *How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fairs*, 95 AM. ECON. REV. 1214 (2005).

37. Sudipto Bhattacharya & Jay R. Ritter, *Innovation and Communication: Signalling with Partial Disclosure*, 50 REV. ECON. STUD. 331, 332 (1983); Denicolò & Franzoni, *supra* note 36, at 366; Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257, 268–69 (2007); *cf.* Mossoff, *supra* note 18, at 1288 (viewing the patentee's eventual dedication of the invention to the public as a form of Lockean social contract).

38. Universal Oil Prods. Co. v. Globe Oil & Ref. Co., 322 U.S. 471, 484 (1944); Gill v. Wells, 89 U.S. 1, 25–26 (1874).

39. WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 295 (2003).

invention or by being inspired by it[40]—even during the patent term.[41] Otherwise, the patent system would not require disclosure earlier than the expiration of the patent term, as it does here by requiring disclosure at the time of the patent grant, at the latest, and typically much sooner.[42]

It is these uses of disclosure—for inventing around, improving upon, and inspiring both during and after the patent term, and for copying after the patent term—with which this Article is concerned. As long as there has been innovation, technologists have built upon extant research,[43] whether reinventing—and thereby reimagining—the cart wheel,[44] the bicycle wheel,[45] or the roulette wheel.[46] Disclosure of an invention sets out what others have already accomplished, thereby both revealing information about

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40. *See* DAVID A. HOUNSHELL & JOHN KENLY SMITH, JR., SCIENCE AND CORPORATE STRATEGY: DU PONT R&D, 1902–1980, at 249 (1988) (describing how the invention of nylon created the possibility of other synthetic polymers); R. Polk Wagner, *Information Wants To Be Free: Intellectual Property and the Mythologies of Control*, 103 COLUM. L. REV. 995, 1034 (2003) (arguing that the availability of information is "crucial to the advancement of our culture and our economy").

41. Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 481 (1974); Oren Bar-Gill & Gideon Parchomovsky, *The Value of Giving Away Secrets*, 89 VA. L. REV. 1857, 1861 (2003); Wesley M. Cohen & Richard C. Levin, *Empirical Studies of Innovation and Market Structure*, *in* 2 HANDBOOK OF INDUSTRIAL ORGANIZATION 1059, 1086–89 (R. Schmalensee & R.D. Willig eds., 1989); Carolyn C. Cooper, *Nineteenth-Century American Patent Management as an Invisible College of Technology*, *in* LEARNING AND TECHNOLOGICAL CHANGE 40, 40 (Russ Thompson ed., 1993); Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177, 1183 (2000); Suzanne Scotchmer & Jerry Green, *Novelty and Disclosure in Patent Law*, 21 RAND J. ECON. 131, 134–35 (1990). Empirical evidence suggests that technologists "find it very valuable to know what technical problem a competitor is trying to solve, what technical approach has been adopted, or what approach has succeeded." Cohen & Levin, *supra*, at 1094 n.47. There is nonetheless a concern that the existence of numerous patents in an area can cause "patent thickets," wherein "[v]arious parties may be able to lay claim to the same technologies or to aspects of the same technology," Burk & Lemley, *supra* note 31, at 1614, which deters research due to the decreased probability of inventing that which is more than marginally better or different. Turner, *supra* note 31, at 455.

42. *Cf.* Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 219 (1987) ("The requirement of early disclosure suggests that certain uses of patented inventions during the patent term do not constitute patent infringement.").

43. *E.g.*, 6 THE WRITINGS OF THOMAS JEFFERSON 180 (H.A. Washington ed., Washington, D.C., Taylor & Maury 1854). Thomas Jefferson elaborates:

> He who receives an idea from me, receives instructions himself without lessening mine; as he who lights his taper at mine, receives light without darkening me. That ideas should freely spread from one to another over the globe, for the moral and mutual instruction of man, and improvement of his condition, seems to have been peculiarly and benevolently designed by nature . . . .

Id.

44. *See* U.S. Patent No. 7,011,317 (filed May 19, 2003) (Cart Wheel with Bearing Components).

45. *See* U.S. Patent No. 7,114,785 (filed Oct. 3, 2003) (Aerodynamic Surfaced Bicycle Wheel).

46. *See* U.S. Patent No. 6,047,965 (filed Oct. 21, 1998) (Randomized Roulette Wheel).

those discoveries—enabling the avoidance of "wasteful duplication of the original inventor's research"[47]—and noting, usually implicitly by omission, what has yet to be done.[48] Patent disclosures act, as one commentator labels it, as an "invisible college of technology."[49] Use of these disclosures, in turn, speeds the rate of innovation in society, which is central to economic growth.[50]

Certainly, there are other beneficial uses for patent disclosure. For one thing, the disclosure requirements *in toto* help patent examiners determine whether an invention merits a patent and indicate that the patentee possesses enough information about the invention to indicate that he actually discovered it.[51] And of course, it helps competitors comprehend the metes and bounds of the patent so they can avoid liability for patent infringement.[52] The patent disclosure also may serve a signaling function, such as attracting funding for the patentee based on the information contained therein.[53] Of essential importance to this discussion, though, is that the disclosed information additionally can be useful for other technologists, either by helping them understand enough about the invention to prompt designing around it—thereby avoiding infringement liability[54]—or as academic inspiration to develop further related inventions.[55]

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47. Note, *Disclosure Function*, *supra* note 9, at 2010; *accord* Denicolò & Franzoni, *supra* note 36, at 367–68; *cf.* Holbrook, *supra* note 9, at 126 (highlighting that disclosure demonstrates the patent applicant's possession of the patented invention).

48. *See* JOEL MOKYR, THE LEVER OF RICHES: TECHNOLOGICAL CREATIVITY AND ECONOMIC PROGRESS 6–11, 186–90 (1990) (highlighting the historical importance of sharing information about inventions in driving technological and, thus, economic progress); Paul M. Romer, *Endogenous Technological Change*, 98 J. POL. ECON. S71, S84–S85, S89 (1990) (examining how inventors use previous patents to improve on designs for similar inventions).

49. Cooper, *supra* note 41, at 40.

50. Romer, *supra* note 48, at S72.

51. Lockwood v. Am. Airlines, Inc., 107 F.3d 1565, 1572 (Fed. Cir. 1997).

52. R. Polk Wagner, *Reconsidering Estoppel: Patent Administration and the Failure of* Festo, 151 U. PA. L. REV. 159, 164–65 (2002).

53. *See* Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 636–37, 648 (2002) (noting that patent disclosures "can indicate what lines of research the firm is undertaking and what the firm . . . consider[s] valuable, outline a research trajectory that adumbrates fields the firm may be branching into next, [and] disclose how fast the firm is proceeding within a particular area of research"). Recent work highlights how some patent documents contain public advocacy, such as those for inventions regulating access to abortion, John R. Thomas, *Liberty and Property in the Patent Law*, 39 HOUS. L. REV. 569, 580–84 (2002), and describing tax shelters, Rachel Emma Silverman, *The Patented Tax Shelter—Lawyers, Financial Advisers Are Getting Exclusive Rights to Estate-Planning Strategies*, WALL ST. J., June 24, 2004, at D1. *Cf.* Timothy R. Holbrook, *The Expressive Impact of Patents: An Emerging Political Geography of Intellectual Property in Biotechnology*, 84 WASH. U. L. REV. 573, 575–81 (2006) (arguing that some patents convey negative messages about homosexuality); Jonathan Kahn, *Race-ing Patents/Patenting Race*, 92 IOWA L. REV. 353, 355–60 (2007) (contending that patents can send signals about race).

54. *See* Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1583 (Fed. Cir. 1996) ("[C]ompetitors are entitled to review the public record, apply the established rules of claim

Though recognizing that disclosure theoretically advances innovation economically, the legal literature does not readily appreciate the associated consequence of democratization of innovation: effective disclosure in a patent system should tend to equalize the positions of the initial innovator and potential competitors by granting the latter the information needed to innovate subsequently in the field. Without successful disclosure, the same inventor will be more likely to continue building up on his original invention because he will be the one with the best information to do so. In fact, inventors appear to innovate based only on the information they already have when other information is difficult to acquire.[56] Ineffective disclosure, by extension, can also prolong the patent right beyond its stated expiration because more of the useful information about an invention remains only in the patentee's hands. Innovative rivalry, despite creating some inefficiencies,[57] is more beneficial to society—both economically speaking and as a matter of distributive justice—than a prospecting system that fully concentrates the investment in a technological area in the hands of the initial innovator. History has shown that "most technological change . . . comes through the small contributions of ordinary, anonymous workers and tinkerers."[58] That is, more minds are able to effect that much more technological progress—both in quantitative terms and in terms of the breadth of creativity—which benefits both society and a broader set of innovators, including newcomers and those in the developing world.[59]

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construction, ascertain the scope of the patentee's claimed invention and, thus, design around the claimed invention.").

55. *See* Denicolò & Franzoni, *supra* note 36, at 367 (assuming innovation is the result of "serendipity").

56. ERIC VON HIPPEL, DEMOCRATIZING INNOVATION 70 (2005).

57. Examples include "reduced levels of competition" and "wasteful design-around efforts by competitors." Kesan & Banik, *supra* note 29, at 23–24.

58. ROBERT FRIEDEL, A CULTURE OF IMPROVEMENT: TECHNOLOGY AND THE WESTERN MILLENNIUM 3 (2007).

59. YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM 301–55 (2006); *see also* Shubha Ghosh, *The Merits of Ownership; Or, How I Learned To Stop Worrying and Love Intellectual Property: Review Essay of Lawrence Lessig,* The Future of Ideas*, and Siva Vaidhyanathan,* Copyrights and Copywrongs, 15 HARV. J.L. & TECH. 453, 495 (2002) ("Patent law is an instrument for reaching certain distributive justice goals that balance the interests of creators, entrepreneurs, and users."); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 908 (1990) ("Such a structure does tend to generate rapid technical progress."); Tim Wu, *Intellectual Property, Innovation, and Decentralized Decisions*, 92 VA. L. REV. 123, 141–42 (2006) ("Decentralized industry structures seem to have the strongest track record for inculcating innovation and economic growth."); Paul M. Romer, The Concise Encyclopedia of Economics: Economic Growth, http://www.econlib.org/library/Enc/EconomicGrowth.html (last visited Feb. 20, 2009) ("[I]t is ideas, not objects, that poor countries lack."); *cf.* B. ZORINA KHAN, THE DEMOCRATIZATION OF INVENTION: PATENTS AND COPYRIGHTS IN AMERICAN ECONOMIC DEVELOPMENT, 1790–1920, at 3 (2005) (suggesting that in early American thought on patent law, "[g]enius was redefined as the province of the many, not the rare gift of the few"). In fact, Zorina Khan argues that a carefully designed patent system made available to schoolteachers as much as machinists is what set the

In the face of the societal importance of disclosure, some scholars doubt whether inventors will disclose those inventions that might be guarded secretly.[60] Yet there are rational reasons to disclose these inventions, such as when there are risks of "leakage and duplication" of an invention,[61] especially once it becomes known by the public—typically, because it is commercially available;[62]when there is high mobility of skilled laborers; or when technical information can be transferred easily.[63] The patent system replaces these risks with "certain but temporary protection."[64]

At the same time, patentees rationally have little to no incentive to offer more information than the patent laws require and have an incentive to obfuscate information they provide whenever possible.[65] Inventors can seek

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early United States apart from other countries offering patent protection at the time. *See id.* at 6–19, 28–65.

60. FREDERIC M. SCHERER, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 381 (1970). An inventor might rationally choose to forego a patent on his invention and instead keep the invention secret (either under the relevant trade secret regimes or as actual secrets). David D. Friedman, William M. Landes & Richard A. Posner, *Some Economics of Trade Secret Law*, 5 J. ECON. PERSP. 61, 64 (1991). David Friedman, William Landes, and Richard Posner reason:

> Inventors choose trade secret protection when they believe that patent protection is too costly relative to the value of their invention, or that it will give them a reward substantially less than the benefit of their invention (as reflected, in part, in the length of time before any else will invent it), . . . because the length (or other conditions) of patent protection is insufficient.

Id. Such an inventor would either not market the invention or market it without fully disclosing how the invention was made or its underlying theory. It is sometimes possible to keep a marketed product or process secret, convincing inventors not to disclose—and therefore not to patent—their invention. Burk & Lemley, *supra* note 31, at 1584; Note, *Disclosure Function*, *supra* note 9, at 2015–16. Though many products can be reverse-engineered, there are significant practical and legal barriers to reverse-engineering patented inventions that underscore the patent document's primacy in disclosing an invention. *Infra* text accompanying notes 85–99. An inventor's choice to patent an invention that is easily reverse-engineered requires him to divulge more information in the patent than the object itself does. It is therefore wrong to maintain that patentees should not be concerned when divulging inordinate amounts of information in the patent document for such inventions. *See* Note, *Disclosure Function*, *supra* note 9, at 2015 (asserting that this is not a concern).

61. Denicolò & Franzoni, *supra* note 36, at 367.

62. Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1028–30 (1989).

63. In fact, recent work has theorized that inventors are more likely to choose patent protection over secrecy for these reasons. Rajshree Agarwal & Michael Gort, *First-Mover Advantage and the Speed of Competitive Entry, 1887–1986*, 44 J.L. & ECON. 161, 174 (2001).

64. Denicolò & Franzoni, *supra* note 36, at 367.

65. *Cf.* Brenner v. Manson, 383 U.S. 519, 534 (1966) (noting "the highly developed art of drafting patent claims so that they disclose as little useful information as possible"). There are exceptions, such as patentees wanting to secure capital in reliance on their patents. Long, *supra* note 53, at 637. But this does not mean they will reveal as much as the patent system requires or ought to require, only that they will reveal as much as is necessary to reach those goals, which do not necessarily coincide with those of patent law. *Id.* at 626. Most pointedly, there is every reason to think that disclosure of an invention's function—quite the minimal disclosure—is

to maximize their own competitive advantage by curtailing competitors' use of information about the invention.[66] In this way, they can make it harder for competitors to capitalize on the invention or related technologies, especially when the invention is groundbreaking. Minimal disclosure makes it harder for third parties to learn how to use the invention itself after the patent term expires and to understand the innovation in order to build on it. When this effect transpires, it is that much more likely that the original inventors can be the sole patentees on follow-up innovation. These effects serve to prolong the inventors' exclusive use, thereby enriching the original inventors.

The accepted understanding in patent policy and doctrine is that disclosure of a patented invention to the public—and its dedication to the public after the expiration of the patent term—is part of a quid pro quo the patentee must provide to gain the broad patent right.[67] Until now, much of the academic literature on patent law has addressed the ideal quid—the scope of the patent right in light of economic concerns generally and with regard to particular technologies[68]—but not the ideal quo—the structure and content of invention disclosure and its place in the patent system. That is, does the patent system serve its purported purpose of disclosing new inventions adequately to the public and, in particular, to the experts who can build on this information for further innovation? Similarly, the economic literature on the patent system—engaged in a debate over the right balance to strike between stimulating innovation and minimizing deadweight loss—tends to assume that disclosure is enlightening.[69] This Article seeks to narrow this gap in the patent literature with a systems analysis, concluding that the rules and operation of patent law negatively affect the quality of the disclosure and proposing how the patent system might be overhauled to strengthen the disclosure function with which it is justifiably charged. Before analyzing the systemic implementation of the

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sufficient to attract attention from capital providers, who can then personally and confidentially inquire into the invention's operation more deeply.

66. There are other incentives not to disclose information, primarily that the more information disclosed, the greater the chance that the scope of the patent right will be constricted. *Infra* text accompanying notes 122–24; *see also infra* Part III.A.2 (suggesting that marking the layers of patent documents could reduce the possibility of constricting the scope of the patent right).

67. Bonito Boats, Inc. v. Thunder Craft Boats, Inc., 489 U.S. 141, 150–51 (1989); Merges & Nelson, *supra* note 59, at 844–45.

68. *E.g.*, Mark A. Lemley, *An Empirical Study of the Twenty-Year Patent Term*, 22 AIPLA Q.J. 369, 422 (1994) (concluding that "overall, patentees will benefit from the new twenty-year term").

69. *E.g.*, Denicolò & Franzoni, *supra* note 36, at 368 (finding that "early 'disclosure' through the patent specification is socially valuable"); Ronald E. Myrick, William P. Skladony & Ram Nath, *The Technological Innovation Process: Patent Documentation as a Source of Technological Information*, 9 SANTA CLARA COMPUTER & HIGH TECH. L.J. 355, 356 (1993) (recognizing the value of learning from others).

disclosure function, it is useful first to explore the primary role the patent document serves in effectuating disclosure and its current irrelevance as a technical disclosure to most scientists and engineers.

C. THE PRIMACY OF THE PATENT DOCUMENT

The importance of disclosure in the patent document, underscored in the previous Sections, hinges on the document's primacy. To the extent that the information is not widely available in other forms, the divulgement of the invention in the patent itself becomes ever important. Two recent articles suggest that invention disclosure—whether or not theoretically important—ought not to be an important goal of the patent system because the information is or should be available in other forms. Katherine Strandburg proposes that patent disclosure is not so helpful for the many inventions that are self-disclosing, as they are best divulged by the commercialization of the invention.[70] Instead, she suggests that energy should be focused on permitting experimental use on patented inventions to effectuate the disclosure function for non-self-disclosing inventions.[71] Timothy Holbrook builds on Strandburg's analysis, advocating that the set of non-self-disclosing inventions is relatively small compared with the much larger class of self-disclosing inventions and concluding therefore that the patent system ought not to center on disclosure but rather on the incentive to innovate.[72] In this Section, I take issue with these conclusions on the bases that patent disclosure is imperative both for non-self-disclosing and theoretically self-disclosing inventions and that—whether or not experimental use on inventions is broadened—the patent document is typically the primary situs of information about patented inventions. Even when the information is sometimes available elsewhere, it is normally not available widely, which undercuts any notion of the democratization of innovation that is central to the American patent system.

Much of the information contained in—or that ought to be in—patents is not published elsewhere.[73] For one thing, an inventor will generally not

70. Strandburg, *supra* note 9, at 105, 111 (arguing further that these inventions came about because of the patent incentive). A recent student note makes a similar argument. Note, *Disclosure Function*, *supra* note 9, at 2014–17.

71. Strandburg, *supra* note 9, at 119.

72. Holbrook, *supra* note 9, at 133–35.

73. ESTEBAN BURRONE & GURIQBAL SINGH JAIYA, INTELLECTUAL PROPERTY (IP) RIGHTS AND INNOVATION IN SMALL AND MEDIUM-SIZED ENTERPRISES 3 (2004), *available at* http://www.wipo.int/sme/en/documents/pdf/iprs_innovation.pdf ("It has been estimated that patent documents contain 70% of the world's accumulated technical knowledge and that most of the information contained in patent documents is either never published elsewhere or is first disclosed through the publication of the patent application."); Long, *supra* note 53, at 647; Myrick, Skladony & Nath, *supra* note 69, at 360 & n.17; Fiona Murray & Scott Stern, *Do Formal Intellectual Property Rights Hinder the Free Flow of Scientific Knowledge?* 7 n.3 (Nat'l Bureau of Econ. Research, Working Paper No. 11465, 2005), *available at* http://www.nber.org/papers/w11465.

publish information about his invention until the associated patent application becomes public. Until the inventor is closer to knowing whether the invention will receive patent protection, the inventor will typically not want to jeopardize the secrecy—and thus competitive profitability—of the invention.[74] And because for the same reasons it is thought that an inventor will not reveal more information about his invention than he must,[75] no other source will contain as much disclosure as the patent document. Therefore, inventors cannot typically read about patented inventions other than in the patent document. The impact of this observation is magnified by noting that more and more academic scientific discourse, traditionally published in technical, non-patent literature because the underlying work

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That said, some recent economic work demonstrates that inventors sometimes publish a scientific article and secure a patent on the same invention, typically in the academy when the subject matter both contributes to scientific knowledge and constitutes technological development. Fiona Murray, *Innovation as Co-Evolution of Scientific and Technological Networks: Exploring Tissue Engineering*, 31 RES. POL'Y 1389, 1389–90 (2002); Murray & Stern, *supra*, at 20. And recent theoretical work concludes that technologists might rationally change the state of the prior art by preemptively publishing their findings in non-patent research publications to prevent competitors from earning patents on the basis that their competitors' innovations are either not novel or are obvious. Gideon Parchomovsky, *Publish or Perish*, 98 MICH. L. REV. 926, 926–30 (2000); *cf.* Douglas Lichtman, Scott Baker & Kate Kraus, *Strategic Disclosure in the Patent System*, 53 VAND. L. REV. 2175, 2179–89 (2000) (positing that leading innovators might choose to publish preemptively to drive competitors out of an innovation or patent race, but with the risk that they might preempt themselves from ultimately obtaining patent protection). Thus, patent applicants might preemptively publish and then file for a patent within one year of the date of publication under the applicable patent laws. Parchomovsky, *supra*, at 940–41, 950. If inventors are publishing their findings in this manner, there will be disclosure outside of the patent system. Nonetheless, there is reason to doubt that this form of strategic disclosure occurs often. For one thing, innovators employing strategic disclosure might harm themselves by giving their competitors information about an invention and how close they are to realizing the invention. Lichtman, Baker & Kraus, *supra*, at 2216. Moreover, the notion of strategic publication relies on questionable assumptions. *See* Rebecca S. Eisenberg, *The Promise and Perils of Strategic Publication To Create Prior Art*, 98 MICH. L. REV. 2358, 2360–61 (2000) (emphasizing that current patent laws "prevent[] a lagging firm from defeating the patent claims of a leading firm by publishing interim research results that merely duplicate what the leading firm has already done," that "[p]ublication of inadequate research results by a lagging rival might actually help the patent applicant to establish that the invention was nonobvious," and "often the publishing rival would be better off turning the same disclosure into a patent application of its own"). Internal critique aside, even if inventors are publishing preemptively, there is no reason to think they will relinquish any competitive advantage and disclose more information than they must to prevent a competitor from obtaining or retaining a patent. Preemptive publication, assuming the information therein is kept to the minimum necessary, should approach but not exceed the quantum and quality of disclosure necessary to secure a patent. Amgen Inc. v. Hoechst Marion Roussel, Inc., 457 F.3d 1293, 1306 (Fed. Cir. 2006); Perricone v. Medicis Pharm. Corp., 432 F.3d 1368, 1375 (Fed. Cir. 2005). Nonetheless, this Article argues that such typical patent disclosure is likely not to be sufficiently useful to other technologists to stimulate further innovation. The same would thus hold true of strategic disclosures.

74. Eisenberg, *supra* note 42, at 216–17. Moreover, an inventor will not want to invoke the statutory bar to patentability by publishing about an invention more than one year before the filing of a patent application for that invention. 35 U.S.C. § 102(b) (2000).

75. *Supra* text accompanying notes 65–66.

was not being patented, is being published in patent form because patents are now being sought on such work.[76] This has fostered an atmosphere of academic secrecy.[77]

That said, certain information-sharing mechanisms or norms have arisen in particular industries leading to spillovers of privately held information about patented inventions from one entity to another. For instance, the chemical-process industry tends to license and cross-license patented processes.[78] Through acquiring a license for a patented process, the licensee will often gain information about the invention not contained in the patent disclosure.[79] As another example, participants in the high-technology industry in Silicon Valley commonly share tacit knowledge with one another, whether through informal conversations between employees of different firms or the frequent movement of workers between firms.[80]

When such mechanisms share information about patented inventions, the informational primacy of the patent document—and concomitantly, the need for good disclosure there—is undermined. That said, these mechanisms typically involve sharing of information only among the in-crowd of established players: a chemical-process firm is more likely to license its inventions to other established firms with inventions it can cross-license,[81] and a Silicon Valley software engineer is more likely to pass on valuable information to his neighboring friend than an unknown entity in a

76. *See* Bayh-Dole Act, Pub. L. No. 96-517, 94 Stat. 3015 (1980) (codified as amended at 35 U.S.C. §§ 200–212, 301–307) (allowing patents to be sought on federally funded research).

77. Margo A. Bagley, *Academic Discourse and Proprietary Rights: Putting Patents in Their Proper Place*, 47 B.C. L. REV. 217, 218–21 (2006). There is an intense drive within the scientific and engineering research communities to publish results, whether in patent documents or elsewhere. Robert Merton emphasizes the centrality of scientific publication—encompassing both professional recognition of scientists' original work and the ability for other scientists to test, learn about, and build upon such work—to the reward structure of the scientific community. *See generally* ROBERT K. MERTON, THE SOCIOLOGY OF SCIENCE (1973). On this reasoning, scientists have the incentive to publish their new discoveries or inventions promptly. Patent law falls somewhat in line with this structure by requiring disclosure to be reviewable by other scientists and the PTO. Eisenberg, *supra* note 42, at 207–08. Yet it delays disclosure about the invention, because the patent document is published after some hold-up. *Id.* at 216–17.

78. Merges & Nelson, *supra* note 59, at 898–900 (attributing this norm to the cumulative nature of chemical-process innovation).

79. Joshua S. Gans & Scott Stern, *Incumbency and R&D Incentives: Licensing the Gale of Creative Destruction*, 9 J. ECON. & MGMT. STRATEGY 485, 485 (2000) (positing that firms consider licensing transactions as "a strategic substitute for in-house research"); Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CAL. L. REV. 803, 868–69 (1988).

80. ALAN HYDE, WORKING IN SILICON VALLEY: ECONOMIC AND LEGAL ANALYSIS OF A HIGH-VELOCITY LABOR MARKET 27–90 (2003); Ronald J. Gilson, *The Legal Infrastructure of High Technology Industrial Districts: Silicon Valley, Route 128, and Covenants Not To Compete*, 74 N.Y.U. L. REV. 575, 585–86, 593 (1999).

81. *See* ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT 60–64 (2004) (discussing this trend with regard to cross-licensing generally).

developing country.[82] These information-sharing mechanisms therefore do not serve an essential purpose of disclosure—giving informational opportunities to potential inventors on the periphery or outside of the establishment—which would minimize barriers to entry, a founding premise of the American patent system.[83]

Moreover, the existence of these mechanisms affects, in not insignificant ways, who bears the costs of (uncovering or sharing) this information: a company in possession of a patent can be required to divulge information to the public through the patent system or, alternatively, it can use its leverage to extract favorable terms when it comes to licensing, cross-licensing, or even informal trading of information in exchange for the information it possesses. The patent system's disclosure function asserts that the patentee should bear this cost—an assertion I agree with and explore in greater detail in Part IV[84]—which runs counter to these industry-specific mechanisms that expect third parties to pay heavily for information. Therefore, although information about patented inventions sometimes flows outside of the patent document, it is to a limited set of potential innovators and with imposed costs in contravention of the disclosure function.

Despite the assertions of Strandburg and Holbrook,[85] technologists cannot generally expect to learn about a patented invention by reverse-engineering a commercially available implementation of the invention—that is, by disassembling the object to determine how it works.[86] Pointedly, inventions that are theoretically self-disclosing are often not self-disclosing in practice. For one thing, there is no obligation that a patented invention be commercially available, as a patent grant confers the right to exclude others from making the invention but does not mandate that the patentee make the invention. In fact, it is estimated that between forty and ninety percent

82. *See* ALFONSO GAMBARDELLA, SCIENCE AND INNOVATION: THE US PHARMACEUTICAL INDUSTRY DURING THE 1980S, at 47 (1995) ("[A]cademic scientists will be more inclined to exchange ideas with people that they deem to be part of the same 'club.'" (citation omitted)); ERIC VON HIPPEL, THE SOURCES OF INNOVATION 6, 76–91 (1988) (discussing the common phenomenon of informal sharing of technological know-how information among economic rivals).

83. *See supra* note 59 (suggesting that the American patent system, from its start, aimed to be available to outsiders as much as already-advantaged insiders).

84. *Infra* text accompanying notes 268–70.

85. Holbrook, *supra* note 9, at 133–35; Strandburg, *supra* note 9, at 105, 111; *accord* Carmen Matutes, Pierre Regibeau & Katharine Rockett, *Optimal Patent Design and the Diffusion of Innovations*, 27 RAND J. ECON. 60, 63 (1996) (listing reverse engineering and patent disclosure as equivalent ways to learn about an invention); Note, *Disclosure Function*, *supra* note 9, at 2015 (suggesting that reverse-engineering can frequently serve as a cheaper substitute to patent disclosure for information acquisition).

86. In the abstract, it would seem to be a much easier decision for an inventor to patent, rather than conceal, an invention, which when distributed, will not be easily reproduced or understood via reverse-engineering. Lee Kovarsky, *A Technological Theory of the Arms Race*, 81 IND. L.J. 917, 960 (2006); Note, *Disclosure Function*, *supra* note 9, at 2015.

of issued patents are neither used nor licensed.[87] Even when a patented invention is commercialized, it typically takes a long time after patent publication before the invention becomes available for theoretical reverse-engineering.[88] Inventors also will not necessarily learn about the most useful innovations from the mere existence and reverse-engineering of commercially available products because commercial success is not that well-correlated with the quality or usefulness of an inventive leap.[89] That is, commercially available inventions are not necessarily the set of inventions most useful for dissection to stimulate follow-up innovation. Moreover, patentees regularly make commercially available inventions difficult to take apart and understand, increasing the cost and decreasing the effectiveness of reverse-engineering as a way to understand an invention.[90]

Even if these formidable barriers did not exist to reverse-engineer a patented invention, a technologist reverse-engineering an invention can incur a severe risk of liability for patent infringement (whether or not justifiably).[91] Generally, a patented object cannot be made, used, or sold without the patentee's permission.[92] The exception to the prohibition on using or making a patented invention for experimental use—such as that involved in trying to understand the invention for follow-up innovation—is so limited that it can be invoked only when done "'for amusement, to satisfy idle curiosity, or for strictly philosophical inquiry,'" but not when there is the "slightest commercial implication" or is "in keeping with the legitimate business of the alleged infringer."[93] The doctrine of patent exhaustion or

87. Kurt M. Saunders, *Patent Nonuse and the Role of Public Interest as a Deterrent to Technology Suppression*, 15 HARV. J.L. & TECH. 389, 391 (2002). This nonuse in no way means that information about such inventions is not valuable. *Infra* text accompanying notes 237–41. There are various reasons why a patentee would choose to suppress an informationally valuable patent, such as when a patent is obtained defensively "whereby competing firms use patents as bargaining chips to negotiate with competitors and to secure certain niches in the marketplace," Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 26–27 (2005); *accord* Saunders, *supra*, at 392–96 (describing examples of firms suppressing their patents for inventions as varied as synthetic caviar, photocopier technology, and less carcinogenic cigarettes, to deter competitors from advancing in the relevant technological field and to prevent cannibalizing their own profits), or the patent lacks commercial value, Saunders, *supra*, at 391.

88. Note, *Disclosure Function*, *supra* note 9, at 2016.

89. *See* Robert P. Merges, *Commercial Success and Patent Standards: Economic Perspectives on Innovation*, 76 CAL. L. REV. 803, 805–06 (1988) (criticizing the Federal Circuit rule that considers an invention's commercial success as supportive of its nonobviousness because success is often attributable to other factors, such as marketing).

90. JAMES POOLEY, TRADE SECRETS § 5.02[5] (1997). Relatedly, reverse-engineering inherently may be prohibitively expensive. Note, *Disclosure Function*, *supra* note 9, at 2017.

91. Robert A. Migliorini, *The Narrowed Experimental Use Exception to Patent Infringement and Its Application to Patented Computer Software*, 88 J. PAT. & TRADEMARK OFF. SOC'Y 523, 537 (2006).

92. 35 U.S.C. § 154(a)(1) (2000).

93. Madey v. Duke Univ., 307 F.3d 1351, 1361–62 (Fed. Cir. 2002) (quoting Embrex, Inc. v. Serv. Eng'g Corp., 216 F.3d 1343, 1353 (Fed. Cir. 2000)). *See generally* Ted Hagelin, *The*

first sale allows a purchaser of a patented invention to use the invention thereafter without any limitation,[94] presumably even to reverse-engineer it. However, the doctrine is subject to two qualifications. First, a patentee can lawfully condition a purchaser's subsequent use of the invention on specified and lawful terms.[95] This limitation allows the patentee to prohibit reverse-engineering as a condition of sale[96] and is not infrequently used by patentees.[97] The second limitation applies specifically to the software industry, where reverse-engineering typically requires a computer to make an intermediate copy of software. This copying might extend beyond the unlimited implied use allowed to a purchaser of patented software, which means that making an additional copy could constitute patent

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Experimental Use Exemption to Patent Infringement: Information on Ice, Competition on Hold, 58 FLA. L. REV. 483, 489–504 (2006) (describing the exception's evolution). Many criticize the limited scope of the exception for retarding innovation. Rochelle Dreyfuss, *Protecting the Public Domain of Science: Has the Time for an Experimental Use Defense Arrived?*, 46 ARIZ. L. REV. 457, 457–61 (2004); Hagelin, *supra*, at 503; Strandburg, *supra* note 9, at 102. There is a disconnect in patent doctrine between physical and informational uses of a patented invention. The former is allowed in the most limited forms, if at all, but the latter can be used without restraint. Judge Pauline Newman has criticized this gulf: in her view, the narrow experimental-use exception is inconsistent with the patent policy of providing useful technological information, as the patent disclosure is thus practically unusable until the end of the patent term. Integra Lifesciences I, Ltd. v. Merck KGaA, 331 F.3d 860, 873–76 (Fed. Cir. 2003) (Newman, J., concurring in part and dissenting in part), *vacated on other grounds*, 545 U.S. 193 (2005); *cf.* Hagelin, *supra*, at 513–15 (elaborating on Judge Newman's point). Reasonable minds might disagree whether this formalistic distinction between the physical and informational reflects the fine line patent law must straddle between promoting further innovation and giving teeth to the patent right. Without diminishing the need—especially in certain fields—for physical use of a patented invention, those who would broaden the experimental-use exception might be appeased in part by more useful information disclosures empowering technologists to experiment with informational approximations of a patented invention.

94. Quanta Computers, Inc. v. LG Elecs., Inc., 128 S. Ct. 2109, 2115 (2008).

95. *Id.* at 2115–16; *cf.* Daniel Laster, *The Secret Is Out: Patent Law Preempts Mass Market License Terms Barring Reverse Engineering for Interoperability Purposes*, 58 BAYLOR L. REV. 621, 624–25 (2006) (suggesting that state contract law cannot be invoked to prevent reverse-engineering of unpatented software because patent law, and the bargain it contains, preempts it).

96. Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1, 33–35 (2001). Of course, such restrictions must comply with antitrust laws and the doctrine of patent misuse. Mallinckrodt, Inc. v. Medipart, Inc., 976 F.2d 700, 708 (Fed. Cir. 1992). But because a restriction on reverse-engineering does not expand the scope of the patent, it is thought to be legal. Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575, 1584 n.39 (2002). *But cf. id.* at 1626–30 (noting that such restrictions are dubitable as to mass-market licenses, typically for computer software). There have been hardly any cases challenging the legality of reverse-engineering restrictions. Thomas F. Cotter, *The Procompetitive Interest in Intellectual Property Law*, 48 WM. & MARY L. REV. 483, 541 n.225 (2006).

97. Mark I. Koffsky, Note, *Patent Preemption of Computer Software Contracts Restricting Reverse Engineering: The Last Stand?*, 95 COLUM. L. REV. 1160, 1166 (1995). *But see* Lichtman, *supra* note 7, at 255 ("Where an inventor is interested in profiting from his invention, a patent removes the worry that the idea will be stolen and thus frees the inventor to scream his idea from the mountaintops.").

infringement.[98] For these theoretical, practical, and legal reasons, reverse-engineering a patented invention cannot be assumed to be equivalent to disclosure.[99]

By process of elimination, the patent document is the principal way for an interested technologist to locate useful information about a patented invention. To the extent that the patent system aims to divulge such information, it should take place in the publicly available patent document, whose structure and contents can be conscientiously set to achieve disclosure. In designing the patent document's ideal structure and content with regard to disclosure, a distinct aim should be to inform and stimulate those who are interested to learn about, improve upon, develop non-infringing variations on, and spark research related to a patented invention, an issue I pick up again in Part III.

D. THE CURRENT INSIGNIFICANCE OF THE PATENT DOCUMENT

Notwithstanding the primacy of the patent document as a publicly available repository of information about a patented invention, a good deal of evidence suggests that technologists do not find that it contains pertinent information for their research.[100] First, there is evidence that most inventors spend little to no time reading others' patents to inform their research and development.[101] Qualitative evidence suggests that technologists, trained in the relevant art, frequently find the legalized jargon in the patent document incomprehensible.[102] Quantitative data confirm that inventors are averse to

98. Cohen & Lemley, *supra* note 96, at 17–21; Samuelson & Scotchmer, *supra* note 96, at 1611 & n.174.

99. This analysis would seem to sit in some tension with the accepted notion that inventors will not patent their creations when they cannot easily be reverse-engineered for the asserted reason that one would not disclose an invention that can be kept secret for an indefinite period past the patent term. Note, *Disclosure Function*, *supra* note 9, at 2016. These points are reconcilable because even when there are no theoretical or practical difficulties to reverse-engineer an invention, the legal constraints on reverse-engineering are put in place by the patent system. Without the patent system, there would not be legal protection from reverse-engineering.

100. *Accord* Doug Lichtman, *Substitutes for the Doctrine of Equivalents*, 93 GEO. L.J. 2013, 2022–23 (2005) (stating that researchers do not read patents because they do not want to be accused of willful or contributory infringement).

101. By contrast, there is evidence that inventors rely on other technical literature to learn about developments in their field and as a basis for further innovation. Anthony F. Breitzman, *An Objective Analysis of the Effect of IEEE Publications on Subsequent Patented Technology*, CHI RESEARCH, July 29, 2003, http://www.ieee.org/portal/cms_docs/products/citations/Report.pdf; Wesley M. Cohen et al., *R&D Spillovers, Patents and the Incentive to Innovate in Japan and the United States*, 31 RES. POL'Y 1349, 1362–64 (2002).

102. Burrone & Singh Jaiya, *supra* note 73, at 9–10; Kitch, *supra* note 17, at 287 (describing the patent document as a "balky mechanism" for disclosure); FED. TRADE COMM'N, DEP'T OF JUSTICE ANTITRUST DIV., ROUNDTABLE: COMPETITION, ECONOMIC, AND BUSINESS PERSPECTIVES ON SUBSTANTIVE PATENT LAW ISSUES: NON-OBVIOUSNESS AND OTHER PATENTABILITY CRITERIA,

reading patents.[103] One recent survey of intellectual-property owners found that 65% of them do not always read patents before embarking on research, development, or product development.[104] Furthermore, economists studying the significance of a patent's citations to other patents have learned that most inventors do not learn of other, related patents at least until they have completed their invention.[105] Pointedly, when surveyed about their familiarity with other patents cited in their own patents, inventors have a good degree of familiarity less than one-third of the time with the cited patents; they have a low level of familiarity with the cited patents just under half of the time.[106] Yet another indicator of the patent literature's irrelevance to further technological research is the extremely limited citation of patents in the non-patent scientific literature: only 1.5% of U.S. patents have been cited in the scientific literature—of which only 1.7% are

79–80 (2002) (comments of Robert Barr) (transcript available at http://www.ftc.gov/opp/intellect/021030trans.pdf).

103. This evidence, while suggestive of poor disclosure, does not definitively pinpoint it as the reason for the disinclination to read patents. Nonetheless, the qualitative evidence and intuition suggest that improved disclosure ought to lead to a non-negligible increase in inventors' reliance on patents to inform their research.

104. IAIN M. COCKBURN & REBECCA HENDERSON, SURVEY RESULTS FROM THE 2003 INTELLECTUAL PROPERTY OWNERS ASSOCIATION SURVEY ON STRATEGIC MANAGEMENT OF INTELLECTUAL PROPERTY (2003), *available at* http://www.ipo.org/AM/Template.cfm?Section=Home&Template=/CM/ContentDisplay.cfm&ContentFileID=55152. This statistic likely overstates how many actually conduct patent searches to inspire their research in the first place, as the survey question lumps together research with the later stages of development, which are more likely to involve patent searches. It also probably overstates how many normally conduct patent searches by addressing only how many always do them.

105. Adam B. Jaffe, Manuel Trajtenberg & Michael S. Fogarty, *The Meaning of Patent Citations*, *in* ADAM B. JAFFE & MANUEL TRAJTENBERG, PATENTS, CITATIONS, AND INNOVATIONS: A WINDOW ON THE KNOWLEDGE ECONOMY 379, 390 & fig.5 (2002) [hereinafter *Meaning of Patent Citations*] (reporting that, in a survey of just under 400 inventors with patents, about 38% of the inventors learned about the invention described in certain patent citations before or during the development of their patented inventions). In fact, many of a patent's citations to other patents are included not by the inventor but by the inventor's patent lawyers or by the PTO examiner during patent prosecution (examination by the PTO of the patent application to determine patentability). *Id.* at 390; Ricardo J. Caballero & Adam B. Jaffe, *How High Are the Giants' Shoulders: An Empirical Assessment of Knowledge Spillovers and Creative Destruction in a Model of Economic Growth*, *in* PATENTS, CITATIONS, AND INNOVATIONS, *supra*, at 89, 106 & n.22; Adam B. Jaffe, Michael S. Fogarty & Bruce A. Banks, *Evidence from Patents and Patent Citations on the Impact of NASA and Other Federal Labs on Commercial Innovation*, *in* PATENTS, CITATIONS, AND INNOVATIONS, *supra*, at 261, 278. That said, if an inventor learns about a patent post-invention, he will have retained the knowledge gleaned therefrom in advance of and possibly in inspiration of his next inventions.

106. *Meaning of Patent Citations*, *supra* note 105, at 389. When asked how related a patent citation was to their patented invention, inventors ranked a near-majority of the citations as barely related. *See id.* at 385 ("44% of the citations did not rank above 2 [out of 5] on either relatedness dimension. . . . At the other extreme, only 14% of the citations were rated at 4 or greater on either relatedness dimension.").

citing U.S. patents—and 73% of these patents are cited merely once.[107] And when asked about their sources of inspiration for their inventions, inventors ranked others' patents as less influential than all of the other proposed sources: awareness of a commercial or technological opportunity, word of mouth, personal interactions, viewing a presentation or demonstration, joint work with others, and technical literature.[108]

In summary, despite mainstream academic assumptions and policy expectations to the contrary,[109] the evidence tends to show that potential inventors are not turning to patent disclosures to inspire their research.[110] That, combined with the primacy of the patent document, means that potential inventors are not learning about a rich collection of innovation: those inventions that others have thought to be valuable enough to patent and that the PTO has deemed to be useful, novel, and nonobvious. That other technologists' research is likely not to be informed by published patents strikes at the heart of the patent system's disclosure function. The question is why inventors are not informing their research by reviewing relevant patent documents.

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107. Wolfgang Glänzel & Martin Meyer, *Patents Cited in the Scientific Literature: An Exploratory Study of 'Reverse' Citation Relations*, 58 SCIENTOMETRICS 415, 415–22 (2003) (analyzing all citations to utility patents issued between 1980 and 2000 in publications between 1996 and 2000 in the Institution for Scientific Information's *Science Citation Index*). The citation data might, however, understate the links between the technological world of patents and the scientific world. *See* Murray, *supra* note 73, at 1395–96 (noting links between the two in the forms of "consulting, Scientific Advisory Board membership, licensing, sponsored research and firm founding").

108. *Meaning of Patent Citations*, *supra* note 105, at 387–89, 388 fig.3; *cf.* Cohen et al., *supra* note 101, at 1362–64 (describing similar results for the American respondents in a comparative study of the Japanese and American patent systems, though the Japanese respondents ranked patent literature to be the most important source of information for research and development). Though technical literature was not a significant influence on the surveyed inventors, the study found it was approximately two-and-a-half times more significant than patent literature. *Meaning of Patent Citations*, *supra* note 105, at 388 fig.3.

109. *See, e.g.*, Matutes, Regibeau & Rockett, *supra* note 85, at 63 ("We assume that imitation [of a patented invention] can occur with no lag [because] the . . . knowledge can be inferred from the patent file.").

110. *Accord* James Bessen, *Patents and the Diffusion of Technical Information*, 86 ECON. LETTERS 121, 122 (2005); Ashish Arora, Marco Ceccagnoli & Wesley M. Cohen, *R&D and the Patent Premium* 17 (Nat'l Bureau of Econ. Research, Working Paper No. 9431, 2003), *available at* http://www.nber.org/papers/w9431 (finding that patent disclosures appear to have no measurable impact on information flows). The evidence presented in this Section is for the most part consistent with the alternative hypothesis that a small number of individuals are reading patent documents and elsewhere disseminating to a wider audience the information contained therein, thereby keeping the patent relevant. The closest this maps onto reality, however, is with regard to a handful of companies marketing patent databases that rewrite some of the information in the patent document to make it more accessible. *Infra* note 111. However, this rewriting happens without the inventors' input, making its reliability suspect because the patent document is often difficult to comprehend accurately. *Infra* Part III.A.

III. THE SYSTEMIC INADEQUACY OF DISCLOSURE

Because patent disclosure is so important to the patent system's key purpose—to advance innovation—this Part undertakes a systemic analysis of the design and operation of the patent laws. The Part identifies four points of inadequacy in fulfilling the disclosure function, three of which have until now gone unexplored in patent literature. Each of the following four Sections addresses a particular point of inadequacy negatively affecting patent disclosure and also proposes how to repair it so as to invigorate disclosure. Until now, these constructive steps have not been addressed in the literature because the little recent work on disclosure has not sought to invigorate it in the patent document, if at all. Section A analyzes how the patent system fails to encourage the writer to include the most useful information in the patent disclosure. Section B discusses how the patent laws generate the insufficiency of the index or the difficulty in locating relevant patent disclosures in the library of patents. Section C focuses on the inadequacy of the reader, in that the patent system is structured so that interested members of the public will not read patent disclosures to inform their research. And Section D demonstrates the patent system's severe under-enforcement of the adequacy of patent disclosure. If these repairs are made, it is much more likely that technologists will turn to patent disclosure to inform their own research.

A. THE WRITER

I argue herein that the patent document—the mechanism of disclosure demonstrated in the previous Part to be primary—does not do nearly enough to convey information useful to stimulate inventive activity because, due to the legal rules of the patent system, the document is poorly structured and does not contain some of the most pertinent technical information. These problems allow, if not encourage, the writer to under-divulge. This Section then suggests how the patent document can be restructured to vitalize its relevance in stimulating further innovation, thereby forcing the writer to provide more useful information.[111]

111. The ensuing discussion is principally agnostic with regard to whether the government should restructure itself or allow the private sector to do so. Because the patentee tends to possess the relevant information in a way that others do not, the government might prefer to exercise direct control over the patentee to regulate disclosure. At the same time, the private sector, with its eye more carefully on the market, has begun to recognize—more insightfully than the government—informational deficiencies in the patent document and library and has attempted to repair them, notwithstanding lack of input from the secretive patentee. *See* Delphion, Delphion Citation Link Analytical Tool for Patent Research, http://www.delphion.com/products/research/products-citelink (last visited Sept. 30, 2008) (visualizing patent networks connected by their citations to one another); Thomson Delphion, Text Clustering Linguistic Analysis for Patent Data, http://www.delphion.com/products/research/products-cluster (last visited Sept. 30, 2008) (creating links between patents based on user-specified textual similarities); Thomson Reuters, Derwent World Patents Index, http://scientific.

This Section first posits that a principal structural flaw of the patent document in serving the disclosure function is a failure to recognize the distinct layers in the patent document. The patent document speaks, in theory, both to legal and technical audiences, each of whom seeks different information. The entangling of these layers confuses each audience, especially the technical audience, as the legal audience's needs tend to be met at the expense of the technical audience. Therefore, the layers meaningfully must be unscrambled. One can then construct the technical layer to contain useful information. A restructuring would inject useful redundancies into the technical layer to ensure that technologists reading it could glean the most important information and would have a more mandated structure to ensure that patent applicants comply with disclosure requirements. In this way, the inadequacy of the writer can be repaired.

1. The Layering of the Patent Document

Information in a document can be directed at more than one audience.[112] To take an everyday example, suppose a household has a whiteboard on which members list telephone messages taken for others, household items that need to be purchased, and reminders. Each telephone message has as its audience the household member to whom the corresponding telephone call was directed. The shopping list might have as its audience a designated household member responsible for grocery shopping or whoever accomplishes the task first. And the reminders are directed at the writer or some other household member. To generalize, to the extent that there are multiple audiences for the information in a document (as with the whiteboard), each audience will find varying subsets

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thomson.com/media/gmscorppdfs/dwpi.pdf (last visited Sept. 30, 2008) (classifying patents, standardizing their presentation of certain information, and rewriting titles and abstracts for clarity). The allocation of responsibilities between the government and the private sector is beyond the scope of this discussion.

Relatedly, the discussion also does not solidify which governmental branch is best equipped to structure informational rules for the patent document and library. Congress and the PTO are better placed than courts to consider broadly the disclosure needs of different industries, while courts—participating in case-by-case adjudication—will generally be better at divining the shape of ideal disclosure in any particular case. *See* Jeffrey J. Rachlinski, *Bottom-Up Versus Top-Down Lawmaking*, 73 U. CHI. L. REV. 933, 933–37 (2006) (positing such differences between legislative and judicial bodies). And the PTO, with its technically trained staff, would seem to be better placed than Congress and the courts to appreciate the type of information needed for useful disclosure.

112. The same can be true of legal rules. *See* Meir Dan-Cohen, *Decision Rules and Conduct Rules: On Acoustic Separation in Criminal Law*, 97 HARV. L. REV. 625, 630–34 (1984) (suggesting that, in criminal law, conduct rules are transmitted to the general public and rules to make decisions about individuals' conduct are channeled to officials applying conduct rules). For another thing, the text of a scholarly legal article might be directed at legal academics generally, while the footnotes might contain supplemental information for those working in the specific field of the writing. *See generally* J.M. Balkin, *The Footnote*, 83 NW. U. L. REV. 275 (1988–1989) (deconstructing the legal footnote).

of the document to be relevant (of course, with potential overlapping interests). The part of the document relevant to each audience is a "layer" of the document.[113] Well-designed layered documents communicate clearly to each layer's audience first, by marking the layer clearly for that audience so it is not distracted by other irrelevant layers, and second, by thoughtfully structuring the layer and infusing it with useful information. As Henry Smith points out in analyzing the communication of property rights, "[b]ecause audiences of different types have different abilities to process messages, the nature of the audience has implications for the amount and form of the information communicated."[114] In Smith's view, the goal of designing documents with an audience in mind is "to maximize the net benefits of communication, that is, the excess of the benefits of communication over the costs of production and processing."[115]

Previous thinking on the patent system has not in any significant way recognized that the patent document is layered in the sense that it has both a legal layer describing the metes and bounds of the patent right and a technical layer communicating the invention's details.[116] The legal layer is of

113. The notion of a "layered" document is borrowed from research on digital libraries in the field of computer science: an electronic document can be composed of various layers with related content (each with its own associated behaviors), such as the "align[ment of] a video clip with [its] script and language translations so that . . . the playing video can be presented simultaneously in multiple languages [and] the video can be searched with text-based techniques." Thomas A. Phelps & Robert Wilensky, *Multivalent Documents: Inducing Structure and Behaviors in Online Digital Documents*, *in* PROCEEDINGS OF THE 29TH ANNUAL HAWAII INTERNATIONAL CONFERENCE ON SYSTEMS SCIENCE 144 (1996), *available at* http://ieeexplore.ieee.org/ie12/3511/10449/00495332.pdf; *cf.* Lawrence Lessig, *Creative Economies*, 2006 MICH. ST. L. REV. 33, 40 (describing a Creative Commons license as having three layers: an education layer to convey the license to the public, a lawyer-readable layer written in "legalese," and a machine-readable layer for search engines).

114. Henry E. Smith, *The Language of Property: Form, Context, and Audience*, 55 STAN. L. REV. 1105, 1108 (2003).

115. *Id.* In the context of intellectual-property theory, Clarisa Long sees three categories of audiences: infringement avoiders, "who merely wish to avoid infringing the property owners' rights and have little interest in comprehending the good beyond those boundaries"; transactors, "who wish to transact with owners of goods, either to consume the good or to enter into some other contractual negotiation[s]"; and builders, "who, in addition to fulfilling their legal duties of avoidance, do wish to comprehend the good in greater detail because they are interested in building on it or inventing around it." Clarisa Long, *Information Costs in Patent and Copyright*, 90 VA. L. REV. 465, 491–92 (2004) (emphasis omitted). After establishing these categories, Long observes that the different legal observers will invest varying amounts of energy into understanding the information contained in a patent document based on their respective varying concerns with regard to infringing the relevant patent. *Id.* at 481–82, 492–94. Though not expressed as such, Long's categories are a variant on my distinction between the legal and technical; her work focuses instead on avoiders requiring *less* information than builders rather than on the need for separate layers on the basis that avoiders (and the governmental and legal actors engaging with avoiders) and builders need *different* information.

116. That these layers have different audiences is occasionally hinted at in other contexts, but it is not explicitly stated. *See, e.g.*, STACY V. JONES, THE PATENT OFFICE 150 (1971) (noting in the course of describing how the patent document is publicly available that "[t]he Patent Office

interest to numerous constituencies: competitors seeking to avoid patent infringement; the PTO attempting to assess an invention's novelty, utility, and nonobviousness; courts attempting to construe the scope of the patent right; and lawyers, usually patent specialists, advising clients with regard to the preceding concerns. The technical layer is of consequence both to technologists interested in understanding how an invention works and the PTO and courts attempting to assess whether this disclosure is adequate.[117] In other words, the technical layer of the patent document, if structured and completed properly, fulfills the patent system's disclosure function. Most thinking about the patent document, however, has been concerned with the legal layer—though not expressly identified as such—virtually ignoring the technical layer.[118]

The legal scope of the patent right is not the same as a technical understanding of the patented invention. For one thing, understanding the legal scope of the patent right is principally about knowing that manufacturing a widget with two steel handles will infringe a particular

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has several publics: the lawyers and inventors with whom it does business directly, the corporation executives and technologists who use it as a research center, and the vast general citizenry").

117. There is also an economic (meta-)layer to the patent document in the sense that a good deal of information that is or could be in the document is useful for studying the operation and efficacy of the patent system. Useful information of this sort includes: the ability to match patents to their firms, as the firm assigned the patent often changes over time (to study patenting behavior of firms); whether a citation to the prior art was included by the patent applicant or by the examiner, and if included by the applicant, whether the citation came to light during research and development or during investigation into the patentability of the invention (to study spillovers of knowledge); and fields of future research, a norm in many sciences (to study knowledge spillovers or for the legal purpose of assessing obviousness of future inventions).

118. For example, there has been a heavy focus on drafting and construing patent claims. *See generally* ROBERT C. FABER, LANDIS ON MECHANICS OF PATENT CLAIM DRAFTING (5th ed. 2003) (discussing claim drafting); Christopher A. Cotropia, *Patent Claim Interpretation and Information Costs*, 9 LEWIS & CLARK L. REV. 57 (2005) (discussing the information costs associated with the difficulty in identifying inventions); Joseph Scott Miller, *Enhancing Patent Disclosure for Faithful Claim Construction*, 9 LEWIS & CLARK L. REV. 177 (2005) (arguing that the PTO can improve claim construction by enhancing disclosure); Lee Petherbridge, *Positive Examination*, 46 IDEA 173 (2006) (arguing that the patent examiner should articulate what property rights the applicant has in the patent); *cf.* SMALL & MEDIUM-SIZED ENTER. DIV. OF THE WORLD INTELLECTUAL PROP. ORG., RESEARCH AND INNOVATION ISSUES IN UNIVERSITY-INDUSTRY RELATIONS 6 (2002), *available at* http://www.wipo.int/sme/en/documents/pdf/fp6.pdf ("'[T]he patent jargon' in which patent applications are written differs significantly from the language of technical journals."); F. Scott Kieff, *The Case for Registering Patents and the Law and Economics of Present Patent-Obtaining Rules*, 45 B.C. L. REV. 55, 112 (2003) ("Th[e] approach to [patent] claiming and drafting . . . is the job of a good patent lawyer and one reason why patents are legal documents drafted by lawyers for interpretation by judges and lawyers, not technical documents evaluated by peer review."). Another example of scholarly focus on the legal layer of the patent document has been with regard to disclosure of prior art by the patent applicant to assess an invention's novelty and nonobviousness. *E.g.*, Kesan & Banik, *supra* note 29, at 36.

patent, but manufacturing a widget with two plastic handles, one steel handle, or two steel knobs will not. By contrast, this sort of legal information can be irrelevant to a technical understanding of the invention. A technical understanding of the same invention will principally be concerned with the invention's essence—that the widget performs its function faster, that it does so because of the combined presence of a doodad and a thingamajig, that certain specified features of the doodad and the thingamajig are what enhance the speed of the widget, that the inspiration for this unique combination came from another field of engineering, that the invention was motivated by the importance of creating faster widgets to speed production of the in-demand doohickey, and so forth. Judge Giles Rich, a noted expert in patent law,[119] underscores the difference between the legal and technical layers when he describes how useless patent claims are to comprehending the technical nature of a patented invention:

> What the inventor regards as his invention has very little, if anything, to do with most claims. Claims are drafted by attorneys and agents. Their wording ultimately must satisfy patent office examiners that they distinguish, distinctly and with particularity, from all prior art known to them. When litigated, they have to satisfy the judiciary to the same effect and probably with respect to prior art the examiner did not know about, which has been found by the defendant's attorneys. And when all is said and done and the court has spoken, what is it that the claims point out? What the inventors invented? Or the scope of the invention? Not likely! It is the claims that have determined what infringes the patentee's right to exclude, construed in the light of the specification . . . . [T]he claims are the measure of the patentee's right to exclude rather than the measure of what was invented.[120]

Though it is has been stated that the patent specification encompasses the technical and the patent claims cover the legal,[121] all parts of the patent document—especially the specification—are written with legal goals in mind, whether or not accompanied also by distinct technical goals. Primarily because courts readily call upon the specification to infuse meaning in sparsely worded claims,[122] the specification that might otherwise be written technically in reliance on the inventor's considerable technical input will be

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119. Judge Rich helped draft the 1952 Patent Act, the first codification of the federal patent laws, which is still substantially intact, and served as a judge on the Court of Customs and Patent Appeals and later on the U.S. Court of Appeals for the Federal Circuit. John F. Duffy, *The* Festo *Decision and the Return of the Supreme Court to the Bar of Patents*, 2002 SUP. CT. REV. 273, 296 n.82.

120. Giles S. Rich, *Foreword* to DONALD S. CHISUM, CRAIG A. NARD, HERBERT F. SCHWARTZ, PAULINE NEWMAN & F. SCOTT KIEFF, PRINCIPLES OF PATENT LAW, at iii, v–vi (2d ed. 2001).

121. Merges & Nelson, *supra* note 59, at 844–45.

122. Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

sanitized, modulated, or otherwise transformed by the legal pencil.[123] In fact, the courts often use the disclosure in the specification to limit the scope of the patent right delimited by the claims.[124] Therefore, the patent document has become a mostly undifferentiated—and therefore confusing—jumble of legal and technical assertions, making it excessively hard for the technical expert to comprehend the invention's technical aspects through the patent.[125] Because the patentee's legal goal is to maximize patent protection, the specification—much like the claims—will often contain broad or ambiguous phrasings to maximize the probability of extensive patent protection in the face of ever-changing technological conditions, further confusing the technical expert eager to understand the invention.[126] As just one example, a specification for computer software can properly refer to "known algorithms" to compute a result without "disclos[ing] exactly what mathematical algorithm will be used to compute" it.[127]

At bottom, disentangling these two layers emphasizes the different goals of each in terms of both the audience to whom it communicates and the type and content of information most useful to achieve those layers' respective goals. For example, one might argue that it is imperative to structure the legal layer of the patent document with clarity as the primary goal, so it is easy to ascertain the metes and bounds of the patent right and avoid infringement.[128] Clarity of boundaries, however, is not so important in

123. NAT'L RESEARCH COUNCIL OF THE NAT'L ACADS., A PATENT SYSTEM FOR THE 21ST CENTURY 63 (Stephen A. Merrill et al. eds., 2004), *available at* http://books.nap.edu/html/patentsystem/39-80.pdf; *cf.* Michael Risch, *The Failure of Public Notice in Patent Prosecution*, 21 HARV. J.L. & TECH. 179, 224–25 (2007) ("Improving a patent's specification . . . is an important way to clarify the patent's claims.").

124. *See* Timothy R. Holbrook, *Substantive Versus Process-Based Formalism in Claim Construction*, 9 LEWIS & CLARK L. REV. 123, 139–44 (2005) (describing the far-reaching application of the dedication rule).

125. *Cf.* Elliot Soloway, Beth Adelson & Kate Ehrich, *Knowledge and Processes in the Comprehension of Computer Programs*, *in* THE NATURE OF EXPERTISE 129, 137–43 (Michelene T.H. Chi, Robert Glaser & M.J. Farr eds., 1988) (observing that the comprehension of computer source code by advanced computer programmers is reduced to that of beginners when they are presented with source code that violates the discourse rules of programming). Joseph Miller highlights the flipside of this concern: that the technical complexity of patents is getting in the way of understanding the legal aspects of the patent document, principally "predictable patent claim boundaries." Miller, *supra* note 118, at 180.

126. Risch, *supra* note 123, at 227.

127. *In re* Dossel, 115 F.3d 942, 946 (Fed. Cir. 1997); *cf.* Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127, 130–31 (2008) (asserting that an absence of "supporting data or examples" for inventions in certain unpredictable fields like chemistry make it hard for those in the field to comprehend these inventions' full implications).

128. *E.g.*, Markman v. Westview Instruments, Inc., 517 U.S. 370, 373 (1996) (discussing the rights of investors to secure their invention with patents); Jeanne C. Fromer, *Claiming Intellectual*

the technical layer. Often, it is enough to understand generally those manifestations of the invention that fall within the category's heartland.

2. Marking the Layers

As a first step to providing useful legal and technical layers in the same patent document, they must be marked—or indicated in some way—to differentiate them. Marking avoids distracting the legal audience with the technical layer and the technical audience with the legal layer. Marking provides another related advantage: minimizing the use of information in the technical layer for patent interpretation and answering other legal questions. This separation permits each respective layer's goals to be maximized. The technical layer, the focus here, can then contain information and modalities that might otherwise undermine the task of legal interpretation of the patent right. For example, and as discussed in the next Section, it is generally useful to comprehend an object, an idea, or a category by describing it in multiple modalities (such as pictures, texts, and graphs). Law cannot naturally tolerate a multimodal description because it becomes difficult to pin a clear interpretation on a legal object when its description in one modality conflicts or provides different information than does another modality.[129] The legal layer, by contrast, can then be used (without the technical layer) to give legal meaning to the patent claims. Marking the legal layer apart from the technical layer satisfies each audience's goals by incorporating multimodal redundancies into the technical layer, making it useful for technologists to understand the technical aspects of the invention without having an impact on the legal interpretation of the patent right.[130]

It is easy to mark some existing parts of the document as part of one layer or the other, such as marking the patent claims as purely legal. Differentiation is not easy, however, because of the overlapping nature of the two layers. The title, the specification, the abstract, the drawings, and most other parts of the patent document are arguably both part of the legal layer and the technical layer. For example, the specification is part of the legal layer in that it infuses the sparsely worded patent claims with meaning

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Property, 76 U. CHI. L. REV. (forthcoming 2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1273449.

129. One can get around such difficulties by prioritizing the different modes, wherein a more highly prioritized mode will be used for interpretive purposes before a lower one. Note, *Looking to Statutory Intertext: Toward the Use of the Rabbinic Biblical Interpretive Stance in American Statutory Interpretation*, 115 HARV. L. REV. 1456, 1479 n.164 (2002); *see In re* Johnston, 435 F.3d 1381, 1384 (Fed. Cir. 2006) ("[D]ictionary definitions must give way to the meaning imparted by the specification . . . .").

130. To the extent that the technical layer is not fully separated from the legal layer, a rethinking of patent-interpretation rules would have to accompany any discussion of redesigning the patent document because of the link between document structure and interpretation. Such exploration, while important, is beyond this work's scope.

and, therefore, courts and others turn to it to understand the scope of the claims.[131] The specification is also part of the technical layer as the situs of fulfillment of the statutory disclosure requirements of written description, enablement, and best mode, and more generally as the prosaic description of the invention. Therefore, it is not possible to take the existing structure of the patent document and mark up two distinct subsets to constitute the legal and technical layers.

The cleanest solution to the problem of marking the different layers in this context (though one not without potential costs, as discussed in Part IV) is to make them distinct, even though it involves some duplication. Separating the legal from the technical layer gives the lawyer an outlet to establish patentability and broad patent protection and the inventor a space to share technical details of his invention, patentability issues aside. It would therefore be reasonable to have a technical specification to disclose the invention in a useful fashion for a technical audience as well as a legal specification to infuse the sparsely written claims with meaning for legal purposes. Similarly, the technical title of the patent might be different from the legal title. The technical title would encapsulate the invention for a technical audience and would typically be based on the improvement the invention offers, while the legal title would be most useful in encapsulating the essential elements of the patented invention. The form the technical layer ought to take is the subject of the following Section.

Before turning to the technical layer's content and structure, a note on the practicalities of separation is required. A clean division between the technical and legal layers will sometimes be difficult to maintain. Perhaps the trickiest part about marking or separating the layers is that the technical layer addresses enablement, as to which it is long settled that the scope of the claims—and thus the patent right—cannot exceed that which the specification has enabled a person having ordinary skill in the art to make or use.[132] This doctrine preserves a link between the technical layer and the legal layer by ensuring that the patent right cannot extend beyond that which the technical layer enables. However, that does not mean that one must use the technical layer to interpret the legal layer. Instead, the doctrine's use of the technical layer ensures that a person having ordinary skill in the art can, in reliance on the technical layer and his background knowledge, make and use—without undue experimentation—the full breadth of the patent claim, which a court will interpret using the legal layer.[133]

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131. Phillips v. AWH Corp., 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc).

132. *See* Consol. Elec. Light Co. v. McKeesport Light Co., 159 U.S. 465, 472–77 (1895) (applying this principle in the context of the light bulb).

133. *See* Monsanto Co. v. Syngenta Seeds, Inc., 503 F.3d 1352, 1360 (Fed. Cir. 2007) ("[T]o be enabling, the specification of the patent must teach those skilled in the art how to make and use the full scope of the claimed invention without undue experimentation.").

Another area where patent law seems to blend the technical and the legal is in interpreting means-plus-function patent claims by reference to the specification. Means-plus-function claims are, according to the law, claims written in the form of "a means or step for performing a specified function without the recital of structure, material, or acts in support thereof."[134] The statute defines the scope of means-plus-function claims by reference to the "corresponding structure, material, or acts described in the specification and equivalents thereof."[135] Courts can address this blending in the context of marking or separating the layers either by interpreting these types of claims based on the structure described in the legal layer or by leaving means-plus-function claims an exception to the demarcation of the technical and legal, just as they already are an exception under the current patent system.

There are also a number of scenarios in which a person would want to consult both the legal and technical layers. The technical expert retained in patent infringement litigation will likely read both layers to inform his views. The litigator concerned with the legal breadth of the patent right will similarly rely on the information in the technical layer for purposes of understanding the invention, even if the technical layer is given little to no priority in this construction. A patentee's competitor looking to design around the patent will not only turn to the technical layer but will need to comprehend the scope of the right to exclude—set out in the legal layer—before ultimately deciding how to design around the invention without infringing.

Despite these complexities, as an initial investigation into the design of the patent document, it is conceptually useful to separate the technical layer from the legal layer. At the very least, it is beneficial to have both the inventor write about the invention in technical terms for the technical audience and the lawyer write about the invention in legal terminology for the legal audience.

3. Constructing the Technical Layer

Once the legal layer is marked separately it can essentially be ignored and the inventor can construct the technical layer to disclose the invention usefully to other technologists. Most legal scholars assume without question that the patent document is theoretically structured in such a way as to disclose patented inventions.[136] This assumption, however, is far from solid

134. 35 U.S.C. § 112 (2000).

135. *Id.*

136. *E.g.*, Long, *supra* note 115, at 499 ("Observers who read patent documents carefully can often discover . . . what the patentee thinks of the competition or competing products."); Myrick, Skladony & Nath, *supra* note 69, at 356 (discussing how patent documents are a good source of technical information on a given "technological art"); Smith, *supra* note 114, at 1174 (discussing how invention users can process the information disclosed in patent documents).

and must be probed, particularly because, as demonstrated in Section II.D, potential inventors generally do not read patents to take advantage of their disclosures. There are numerous reasons for this problem, including the three other inadequacies explored later in this Part, but fundamental among them is the absence of some of the most useful technical information about an invention in the technical layer.[137]

In the field of psychology, it is well-accepted that the presentation of information on a topic influences the ability to use that information and to master the topic.[138] Patent documents—containers of information, both legal and technical—are not exempt from this tenet. Therefore, the structure and content of information in the patent document has a direct effect on the ability of interested technical experts to comprehend the patented invention.[139] Though the specification's textual discussion of the invention and its related drawings contain a fair share of useful technical information,[140] the technical layer of the patent, even when it is separated from the legal layer to ease processing of the technical information, is flawed.[141] The easiest way to demonstrate that the technical layer is lacking is to demonstrate and justify what would be useful for it to contain. This discussion cannot by its nature be exhaustive, for other improvements can be suggested.[142] Nonetheless, the goal is to get at the most important defects in the technical layer. The following two Subsections address mending different structural defects with the information in the patent document's technical layer: first, the general idea of incorporating useful redundancies into the technical layer along with the specific idea of including a dynamic model of the invention in the patent document; and second, giving teeth to the structure of the technical layer.

But cf. Holbrook, *supra* note 9, at 131–46 (elaborating some legal reasons why the patent document does not serve the disclosure function).

137. *Cf.* Note, *Disclosure Function*, *supra* note 9, at 2024–25 (alluding to disclosure's inadequacy in the sense that one needs more information than the patent document currently contains to practice the patented invention).

138. *E.g.*, Micheline T.H. Chi, Paul Feltovich & Robert Glaser, *Categorization and Representation of Physics Problems by Experts and Novices*, 5 COGNITIVE SCI. 121, 122 (1981) (discussing differences in novice-expert understanding of problems based on how the problems are represented); Richard J. Koubek & Timothy P. Clarkston, *The Training of Knowledge Structures for Manufacturing Tasks*, 37 ERGONOMICS 765, 778 (1994).

139. Helen M. Berman & Rochelle C. Dreyfuss, *Reflections on the Science and Law of Structural Biology, Genomics, and Drug Development*, 53 UCLA L. REV. 871, 898 (2006).

140. *See* Long, *supra* note 115, at 499 (describing the requirements of a patent application).

141. Some of the useful information that can appear in the patent document—such as experimental results and the patentee's views on competing products, *id.* at 499 & n.70—is not specifically mandated (at least across the board) and appears idiosyncratically.

142. At the same time, it is useful to develop an external measure of whether disclosure is useful. This measure can come from psychology (by studying how experts understand the disclosure) or empirical work (by studying different technology industries to ascertain the information they need to innovate).

Before turning to the structural defects in information, it must be emphasized that those potential inventors to whom disclosure of a patented invention is useful are experts in their relevant fields. As such, the technical layer should disclose information about the patented invention geared toward them.[143] At the broadest level, because of their similar background knowledge, smaller size, and relative homogeneity, persons skilled in an art can process nuanced information in a patent about the invention[144] that general audiences—to whom, say, property rights about real property are intended—cannot easily comprehend.[145] Even so, restructuring the patent document should focus on improving the quality of information, rather than increasing the quantity of information, which could lead to an overload of information that undermines the disclosure function.[146]

a. Useful Redundancy

Redundancy is one useful technique in information theory: it is the repetition of information in a message so that it can be reconstructed even if its subsets cannot be retrieved or comprehended.[147] Redundancy, if implemented properly, can thus counteract the noise in a message, particularly a complex one.[148] Martin Shapiro, for one, reasons that the practice of string citations in legal communication, surely informational redundancy, serves to ease the processing of legal data and also harmonizes various courts' judicial rulings over time.[149]

Psychological research has shown that readers absorb technical information better when structurally and functionally important information is repeated.[150] Thoughtful redundancy would thus be useful in the patent document by presenting the most useful pieces of technical information

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143. *See supra* text accompanying notes 114–15 (emphasizing the importance of audience design in constructing legal documents).

144. Smith, *supra* note 114, at 1111, 1122.

145. *Id.* at 1107–08. Nevertheless, the information contained in a patent document cannot be idiosyncratic because the information is being broadcast to a group of experts without a necessary relationship amongst one another, however small the group's size. Compare these circumstances to the situation of two contracting parties with an ongoing relationship, in which it makes some sense to defer to their possibly idiosyncratic contractual commitments because they worked them out together. *Id.* at 1108.

146. *Cf.* Steven L. Schwarcz, *Rethinking the Disclosure Paradigm in a World of Complexity*, 2004 U. ILL. L. REV. 1, 5–6 (arguing that the complexity of some structured transactions means that information provided under current securities disclosure rules either oversimplifies the transactions or provides so much detail that most experts are overwhelmed).

147. *See generally* CLAUDE E. SHANNON & WARREN WEAVER, THE MATHEMATICAL THEORY OF COMMUNICATION (1963) (originating the mathematical study of information by focusing on the redundancy and entropy of information).

148. Smith, *supra* note 114, at 1161.

149. Martin Shapiro, *Toward a Theory of Stare Decisis*, 1 J. LEGAL STUD. 125, 127–34 (1972).

150. Bruce K. Bromage & Richard E. Mayer, *Quantitative and Qualitative Effects of Repetition on Learning from Technical Text*, 78 J. EDUC. PSYCHOL. 271, 276–77 (1986).

about an invention for technologists in multiple modalities.[151] In this Section, I provide two examples of such useful redundancies—a dynamic model and the categorical exemplar of the invention—though others can be imagined.

i. Dynamic Models

The form of the patent document has been frozen in time since it was last structured over a century ago.[152] As such, the document consists of nothing more than prose and formal drawings. These modes of information are important to disclosing the details of an invention. Text can describe the workings of an invention in detail, and pictures can refer to the most salient aspects of the textual description, highlighting their importance.[153]

Starting in 1836, Congress required another type of information by obliging a patent applicant to submit to the Patent Office a physical model of his invention when necessary to determine patentability; these models would then be displayed in a public gallery.[154] In 1870, Congress amended

151. Intuitively, repetition is needed less for experts than for novices, but this is less true for more complex technical topics, and depends on whether repetition occurs through literal repetition or through subtle redundancies. *Id.* at 277. Because the technical information in patent documents is often complex, carefully designed repetition should be useful to experts looking to understand the described invention.

152. *See* Miller, *supra* note 118, at 180–82 (comparing three patent documents issued in 1904, 1954, and 2004, respectively, and concluding that they look structurally similar with claims and drawings). One historical analysis suggests that, though the patent system is currently seen—at least in its ideal form—as a public benefit of stimulating invention and disclosure, "the idea that the patent system was intended primarily for the benefit of inventors as opposed to that of the general public remained in place well into the nineteenth century." Edward C. Walterscheid, *Patents and Manufacturing in the Early Republic*, 80 J. PAT. & TRADEMARK OFF. SOC'Y 855, 856 (1998). This stance might explain why there was little early emphasis on the structure of the patent document. Furthermore, inventions early in the history of the American patent system tended to be available commercially and also to be simple and mechanical in nature, meaning they were frequently self-disclosing, Cooper, *supra* note 41, at 40, suggesting that patent disclosures were less important historically than today. And the relatively new enterprise of thinking about the effects of legal rules on the flows of information—whether between members of the public or between the public and the government—might explain why the subject has remained dormant.

153. Yuichiro Anzai, *Learning and Use of Representations for Physics Expertise*, *in* TOWARD A GENERAL THEORY OF EXPERTISE: PROSPECTS AND LIMITS 64, 87 (K. Anders Ericsson & Jacqui Smith eds., 1991); Richard E. Mayer, *Illustrations That Instruct*, *in* 4 ADVANCES IN INSTRUCTIONAL PSYCHOLOGY 253, 263–67 (Robert Glaser ed., 1993).

154. Patent Act of July 4, 1836, ch. 357, §§ 6, 20, 5 Stat. 117, 119, 125 (repealed 1870). *See generally* Kendall J. Dood, *Patent Models and the Patent Law: 1790–1880 (Part I)*, 65 J. PAT. & TRADEMARK OFF. SOC'Y 187 (1983) [hereinafter Dood, *Patent Models I*] (discussing the use of models in early American patent law); Kendall J. Dood, *Patent Models and the Patent Law: 1790–1880 (Part II—Conclusion)*, 65 J. PAT. & TRADEMARK OFF. SOC'Y 234 (1983) (same). Nonetheless, it had been tradition since the earliest federal patent laws to submit a model. Dood, *Patent Models I*, *supra*, at 190–208.

the law to its current form,[155] under which the patent examiner has the authority to require a patent applicant to provide a model that demonstrates the parts of a claimed invention.[156] In effect, the Patent Office had become convinced that models were almost always unnecessary on the basis that a patent application sufficed to describe the relevant invention.[157] In practice, the PTO currently will not demand a model to demonstrate that the invention works as claimed unless the claimed invention involves perpetual motion.[158] The physical models' purpose has principally been to assure the PTO that a patented invention works or was in the possession of the inventor. Because the currently requested models are not generally accessible to the public, they have played no role in effectuating the disclosure function. In any event, it would undoubtedly be impracticable to store a physical model of each patented invention and to make them generally and easily available to divulge the invention.

Nevertheless, the nearly discarded idea of a physical model can be recast to suit disclosure and be practical in the form of a dynamic digital model. A dynamic model of an invention would most usefully be a three-dimensional representation of the invention that could be viewed and manipulated on a computer. It could be rotated to be viewed from any vantage point, dissected to understand how the invention's various parts (or steps for a process) fit and work together, and its use in action could be simulated for better comprehension.[159] The PTO could easily store dynamic

155. In 1925, Congress decided to sell the previously required models. KURSH, *supra* note 29, at 28; Donald W. Hogan, *Unwanted Treasures of the Patent Office*, 9 AM. HERITAGE 16, 16–19 (1958), *available at* http://www.americanheritage.com/articles/magazine/ah/1958/2/1958_2_16.shtml. The Smithsonian Institution selected the most important models for retention, and over 50,000 other models were sold at public auction. KURSH, *supra* note 29, at 28.

156. 35 U.S.C. § 114 (2000); 37 C.F.R. § 1.91(a)(2), (b) (2006). Similarly, the PTO can require an applicant to provide specimens or ingredients for inspection or experimentation with regard to claimed inventions of compositions of matter. 35 U.S.C. § 114. It would thus seem that requiring a dynamic digital model would fall within the statutory authority of the PTO.

157. U.S. PATENT OFFICE, THE STORY OF THE AMERICAN PATENT SYSTEM 1790–1940, at 14, 28 (1940).

158. MPEP, *supra* note 27, § 608.03. The PTO not long ago requested a working model of a warp drive described in a patent application as creating a curvature of the space-time continuum. Mark T. Kopec, U.S. Patent & Trademark Office, Office Action re: Application No. 10/182,373, at 6 (Dec. 22, 2005), *available at* http://patentlaw.typepad.com/10182373.pdf. Even when not required, a patent applicant can submit a model. 37 C.F.R. §§ 1.91(a), 1.93.

159. *See generally* FREDERICK KUHL, RICHARD WEATHERLY & JUDITH DAHMANN, CREATING COMPUTER SIMULATION SYSTEMS: AN INTRODUCTION TO THE HIGH LEVEL ARCHITECTURE (1999) (detailing how to create computerized simulations). Under current law, simulation of a patented invention probably does not constitute patent infringement. *See* Harris Corp. v. Ericsson Inc., 417 F.3d 1241, 1256 (Fed. Cir. 2005) (refusing to find infringement when there was evidence only of computerized simulation, rather than an "actua[l] carr[ying] out" of a claimed method). Nonetheless, requiring disclosure and allowing public use of dynamic models eliminates the possibility that a patent would be infringed by their use.

models compactly on computers. And technologists could easily access and manipulate digital models from remote locations via networked computers.[160]

Dynamic models of inventions would prove to be useful, even though somewhat redundant, in aiding the comprehension of a patented invention by technologists. Models would make it easier to understand how an invention—normally statically described in words and pictures—works by making the invention more tangible.[161] More generally, the availability of a dynamic model for an invention approximates the ability to use and experiment with the invention itself, which is not usually possible.[162] Cognitive research indicates the utility of such models, as they seamlessly combine both diagrammatic organizational information—the structural relations among the parts of the invention—and explanative information about the different possible states of each of the invention's parts by way of simulation.[163] Organizational information is effective at "help[ing a reader] build internal connections among [an invention's] elements."[164] And explanative illustration is considered uniquely effective at teaching how an invention works by "help[ing] readers envision a runnable mental model of

160. Similarly, for software patents or other inventions written in computer source code, it would be relatively straightforward for the PTO to collect and publish the source code. *Cf.* FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY ch.3, at 49 (2003), *available at* http://www.ftc.gov/os/2003/10/innovationrpt.pdf (noting that some experts advocate the disclosure of source code). One court recently recognized that source code (or its descriptive equivalent) should have been included in the patent document to provide structure for means-plus-function claims, and that the patent disclosure was thus inadequate. Touchcom, Inc. v. Dresser, Inc., 427 F. Supp. 2d 730, 735–36 (E.D. Tex. 2005).

161. *Cf.* Cotropia, *supra* note 118, at 58 ("[I]nventions are difficult to define—the difficulty stemming in part from the intangible nature of inventions. Inventions are ideas, information, and concepts. While an invention has physical manifestations, these are merely examples of the invention."); Long, *supra* note 115, at 537 ("[A]n object's tangibility lowers information costs for observers. The tangible embodiment of the invention serves as a referent for its protected attributes. When objects are tangible, the general idea of the object-as-a-thing can be more readily conveyed."); Strandburg, *supra* note 9, at 103 ("[F]or scientists and engineers, understanding is often, if not virtually always, a hands-on experience."). The dynamic model is not dissimilar to the relatively common practice of patent attorneys' placement of sample biological strains in depositories in the course of securing a patent for an invention encompassing unique biological materials, which cannot be replicated solely based on a written description. Eisenberg, *supra* note 42, at 208; *see* 37 C.F.R. § 1.802 (permitting reference to deposited biological material in a patent disclosure). Upon patenting, these biological strains become available to the public for disclosure purposes. Eisenberg, *supra* note 42, at 208. Their availability makes tangible that which was both intangible and irreproducible based on the written, prosaic elements of the patent document. MPEP, *supra* note 27, § 2402.

162. *Supra* text accompanying notes 89 and 93.

163. *See generally* Mayer, *supra* note 153 (categorizing scientific text and illustrations); *accord* Jill H. Larkin & Herbert A. Simon, *Why a Diagram Is (Sometimes) Worth Ten Thousand Words*, 11 COGNITIVE SCI. 65, 99 (1987) (same).

164. Mayer, *supra* note 153, at 267.

the system that is consistent with their existing knowledge."[165] It is thought that this information helps readers acquire knowledge, generate inferences, and solve problems.[166] Additionally, the great detail offered by a dynamic model is useful to experts.[167]

Of course, it is theoretically possible to provide this information in static illustrations and text. For complex (and possibly even simple) inventions, however, the number of illustrations and length of text needed to convey systematic cause and effect would grow unwieldy and would obfuscate disclosure of these inventions. Moreover, providing this information in the static format of text and drawings makes it more likely that the patentee will (inadvertently or not) omit useful information, as each aspect of the invention's parts and its states must be recalled and included.[168] By contrast, a dynamic model is less likely to omit information useful to other inventors because the model's designer must include all states and parts for the model to be an accurate representation, and one can readily observe the degree of accuracy. It is precisely the current danger of obfuscation and omissions that, in part, causes a structural inadequacy of information useful to technical disclosure. In essence, a dynamic model would force the writer to include more complete, useful information. Lawyers already often use dynamic models in patent litigation to explain to a judge or jury how an invention works, indicating that they also think these models are a useful way to communicate information about an invention, albeit to a different audience.[169] Illustrations and text, of course, remain useful for focusing attention on key states or parts of an invention in a way that a dynamic

165. *Id.* at 268.

166. *Id.* at 268–69, 271. These predictions are borne out by studies. *Id.* at 272–73. Though Mayer thinks that explanative illustrations are probably more useful for novices in a particular domain than experts, *id.* at 275; *see also* Richard E. Mayer, *Using Illustrations To Promote Constructivist Learning from Science Text*, *in* THE PSYCHOLOGY OF SCIENCE TEXT COMPREHENSION 333, 348–49, 354 (José Otero, José A. León & Arthur C. Graesser eds., 2002), Mayer's findings are grounded in far less complex systems than typical patented inventions.

167. Mayer, *supra* note 153, at 269.

168. *See id.* at 270–71 (outlining several potential problems with the static format).

169. For examples of animations made for patent litigation showing an invention at work, see Animators at Law, Courtroom Animation, Trial Exhibits and Litigation Technology, http://www.animators.com/aal/samples/samplesanimation.html (last visited Sept. 30, 2008) and Interact Mediaworks, Demonstrative Evidence That Persuades, http://www.interactmediaworks.com (last visited Sept. 30, 2008).

model will not.[170] Nonetheless, the unique edification possibilities a dynamic model provides would render it a useful addition to the patent document.[171]

In addition to the educational value a dynamic model would add to the patent document, a simulation would easily permit technologists to review—and thus comprehend—inventions at varying levels of generality depending on the degree and type of information each one seeks. The dynamic model, moreover, would allow technologists effectively to circumvent the practical and legal restrictions on reverse-engineering or replicating a physical manifestation of the patented invention by providing nearly all, if not sometimes more, of the information that reverse-engineering or replication would provide.[172]

ii. Best Exemplar

Beyond requiring best mode, another useful redundancy would be the requirement of describing the categorical exemplar of the invention, that is, the manifestation of the invention that best represents the invention's

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170. *Cf.* Mayer, *supra* note 153, at 278. Mayer states:

> [L]ine drawings are often more effective than actual photographs in explaining how a system such as the human circulatory system works. Photos contain a great deal of specific information, much of which is irrelevant to understanding how the system works. . . . Simplified line drawings, by contrast, focus attention on relevant components and state changes.

Id.

171. Some psychologists have concluded that "it is the content and structure of instructional materials, and not the media and modalities in which they are presented that is important for comprehension of complex devices." Mary Hegarty, N. Hari Naraynan & Pam Freitas, *Understanding Machines from Multimedia and Hypermedia Presentations*, *in* THE PSYCHOLOGY OF SCIENCE TEXT COMPREHENSION, *supra* note 166, at 357, 372. Assuming the conclusion's validity in the context of the controlled studies from which it is derived, its application to the patent document is undermined by the observation that the inventions described in patents are typically far more complex than those in the studies (such as simple toilet-tank systems). *See id.* at 380. Because of the increased complexity, one modality might be more useful than another in the patent document for two related reasons: first, the probability of successfully teaching a complex invention is higher when important aspects of it are conveyed in multiple modalities (such as text with pictures and animations), and second, certain modalities (here, dynamic models) are more likely than others (here, text and pictures) to teach particular aspects of a complex invention succinctly, and thus clearly. *Cf.* Richard E. Mayer, *Comprehension as Affected by Structure of Problem Representation*, 4 MEMORY & COGNITION 249, 253 (1976) ("[D]iagrams produce better performance if they replace particularly complicated verbal representation presumably due to faster accessing of information, and . . . diagrams result in poor performance if they are substituted for well-structured verbal representation, presumably due to distraction."). Furthermore, the studies' conclusion is in no way based on how much observers prefer multiple modalities to a single modality. A principal problem with the disclosure function is that inventors are not turning to the patent document to inform their research. If they liked doing so, they might do it more often, regardless of the precise comparative cognitive efficacy of multimodal and unimodal documents.

172. *See supra* notes 86–99 and accompanying text (discussing the difficulties of reverse-engineering a patented invention).

category. This categorical exemplar need not be the same as the best mode of implementing the invention, but would be the best mode of explaining the invention—something clearly helpful to disclose the invention to technical experts.[173] For example, the best way to implement an automated toilet might involve complex wiring—either analog or digital—but the best way of explaining the invention might be to abstract away the complexities and present it in a simpler form.

Of course, there is a downside to implementation of redundancy in the patent document: a decrease in efficiency of coding a message,[174] namely, that it would cost more for patent applicants to provide the same information in multiple modes. In Part IV, I explore the cost of redundancy alongside other costs of invigorated disclosure. But before turning there, I discuss the utility of further mandating the structure of the technical layer.

b. Mandating the Structure

There is every reason to believe that the PTO does not sufficiently detect inadequate disclosure. To wade through the sea of over 450,000 patent applications filed annually,[175] PTO examiners spend an average of only eighteen hours over a two- to three-year period on a patent application, during which time they must review the application and any amendments, search for and read pertinent prior art, explain in writing to the patent applicant why patent claims have been rejected, and possibly be interviewed by the patent applicant's lawyer.[176] Because the PTO examiner must complete so many complicated tasks, there is little time to spend reviewing the adequacy of disclosure. The little time the examiner has is unlikely to be spent spotting inadequate disclosure for three additional reasons. First, there is significant turnover in PTO examiners, insufficient training for junior examiners, and bonuses awarded for closing patent applications.[177] Thus, examiners both do not have the necessary experience to spot inadequate disclosure and receive incentives to issue patents.[178] Second, the statutory disclosure requirements are abstractly and amorphously written

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173. *See* Marianne Elshout-Mohr & Maartje van Daalen-Kateijns, *Situated Regulation of Scientific Text Processing*, *in* THE PSYCHOLOGY OF SCIENCE TEXT COMPREHENSION, *supra* note 166, at 223, 233 (discussing how such exemplars are helpful to communicating scientific information).

174. Smith, *supra* note 114, at 1161–62.

175. PATENT TECH. MONITORING TEAM, U.S. PATENT & TRADEMARK OFFICE, U.S. PATENT STATISTICS CHART, CALENDAR YEARS 1963–2007, http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm (last visited Sept. 30, 2008).

176. Lemley, *supra* note 29, at 1499–1500.

177. Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 606–09 (1999).

178. A pro-patent bias also arises because the PTO is wholly funded by patent-applicant fees. Stuart Minor Benjamin & Arti K. Rai, *Who's Afraid of the APA?: What the Patent System Can Learn from Administrative Law*, 95 GEO. L.J. 269, 314 (2007).

(even if they are lofty goals),[179] so it is easy for someone, despite the facts, to conclude with a straight face that the application has met the requirements for disclosure,[180] especially because examiners and applicants looking to reach an agreement tend to agree on less rather than more disclosure.[181] As written, then, the disclosure requirements can easily lead to condoning inadequately disclosed patent applications. Third, the PTO is not well-situated to evaluate the adequacy of disclosure under current standards. The PTO has no inclination to build a described invention (or upon or around it), making it hard to determine whether an invention is enabled. Even in this regard, PTO examiners try to determine patentability by assaying a disclosure from the point of view of a hypothetical person skilled in the art,[182] which merely approximates the quantum and quality of information an actual person skilled in the art needs to find a disclosure useful. Further supporting the conclusion that too many underdisclosed patent applications slip through the PTO's nets is that over one-third of Federal Circuit decisions addressing patent invalidity for inadequate disclosure declare the patent invalid.[183]

This problem might be minimized by making the amorphous statutory disclosure requirements more concrete, thus improving the PTO's detection of inadequate technical disclosure.[184] If the layer's structure mandates technical disclosure, it will become easier for the PTO to police and harder for patent applicants to evade.[185]

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179. *Supra* Part II.A.

180. *Cf.* Mark D. Janis, *On Courts Herding Cats: Contending with the "Written Description" Requirement (and Other Unruly Patent Disclosure Doctrines)*, 2 WASH. U. J.L. & POL'Y 55, 61 (2000) ("[B]y devising an essentially standardless disclosure doctrine that can be deployed arbitrarily, the Federal Circuit has effectively arrogated to itself unbridled authority to strike down claims for inadequate disclosure.").

181. Long, *supra* note 115, at 506.

182. Falko-Gunter Falkner v. Inglis, 448 F.3d 1357, 1365 (Fed. Cir. 2006).

183. *See* John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 208–10, 209 tbl.2 (1998) (analyzing Federal Circuit decisions from 1989 to 1996).

184. Congress, the PTO, the courts, or industry norms might fashion these rules. The PTO and courts might more easily work out rules for a particular patent situated in a particular industry. There is a concern, though, with courts having the primary responsibility to fashion these rules. As discussed below in Section D, only a very limited set of patent disclosures can and will be challenged in court. Industry norms would be useful as they would fully comprehend the practical benefits and demerits of particular disclosures, but even were such norms to develop, they might not be able to sanction inadequate disclosures as the government might. *Cf.* Eric Talley, *Disclosure Norms*, 149 U. PA. L. REV. 1955, 1955–64 (2001) (positing that norms of corporate disclosure can work together with judicial rules). For an analysis suggesting that it might make sense for each industry to structure its own disclosure rules, see *infra* note 205.

185. Another option is to perform patent audits—a more detailed round of patent examination—either randomly or based on certain red flags of patentability. If audits carried sufficient risks to patentees, patentees might feel forced to reveal more information initially.

Setting more concrete disclosure requirements is not just about directly calling for certain content but also about mandating structure that—as with useful redundancies such as the dynamic model—will tend to force the patent applicant to reveal useful content[186] in the face of the incentive to reveal minimal information about his invention. To take one example, the PTO currently regulates the patent application's title. The title can be useful in helping technologists locate relevant patents in the vast database of issued patents. However, current PTO regulations of the title are too vague to effect useful disclosure. The PTO requires a patent application's title to be shorter than 501 characters.[187] It imposes vague qualitative requirements as well—the title generally must be "as short and specific as possible,"[188] as well as "technically accurate and descriptive."[189] If the title proffered by the patent applicant is not descriptive of the invention, the assigned PTO examiner will require a more appropriate title in its place.[190] But these

186. Experts process information differently than ordinary people. Paul J. Feltovich, Kenneth M. Ford & Robert R. Hoffman, *A Preliminary Tour of Human and Machine Expertise*, *in* EXPERTISE IN CONTEXT: HUMAN AND MACHINE, at xiii, xiii (Paul J. Feltovich, Kenneth M. Ford & Robert R. Hoffman eds., 1997). To take but one strand of relevant psychological research, experts are more abstract than novices in two ways: first, they reason at a more abstract level, and second, their expertise is represented with more (moderately) abstract concepts. Colleen M. Zeitz, *Some Concrete Advantages of Abstraction: How Experts' Representations Facilitate Reasoning*, *in* EXPERTISE IN CONTEXT: HUMAN AND MACHINE, *supra*, at 43, 43–44. For example, a physicist will tend to characterize a mechanics problem by the abstract concepts of forces, relationships between forces, and the relevant principles. *Id.* at 43. Abstract representations are helpful to obtain and maintain expertise in a particular domain because abstractions are more stable in the face of the acquisition of new information; are more easily triggered, as they are cued by a wider range of problems; and make an expert less susceptible to processing irrelevant concrete details. *Id.* at 45. To obtain and maintain expertise in an area, an individual must therefore become proficient at processing information at the appropriate level of abstraction. *Id.* at 44. In light of these findings, one cognitive scientist suggests that the most useful type of instruction is that which occurs at the moderately abstract conceptual level to "provid[e] learners with a framework to which they can attach more detailed levels of new information . . . to form a coherent, fleshed-out structure [enhancing] both knowledge organization and proceduralization." *Id.* at 60. This finding, among others, should be incorporated into a rethinking of the structure and content of the patent document to provide information at the most useful degree of abstraction. The current structure of the patent document does contain some abstractions, but the wrong ones. In theory, the patent document goes into ever-increasing amounts of detail, depending on how much a reader wants to know. Namely, there are steadily increasing amounts of information in the title, the abstract, the brief summary of invention, and the detailed description. Nevertheless, the increasing level of detail is prosaic rather than conceptual in the sense that each increasingly concrete structural unit contains more detailed language about the invention rather than more concrete detail. To aid disclosure, there should be a hierarchical description that explains an invention and how it solves a problem from an abstract level to a more concrete level. *Id.*

187. 37 C.F.R. § 1.72 (2006).

188. *Id.*

189. MPEP, *supra* note 27, § 606. The title also cannot contain variations on the word "improvement." *Id.*

190. The examiner will request a better title from the applicant; if the applicant fails to supply a satisfactory title, the examiner will re-title the patent. *Id.* § 606.01.

regulations do not systematically generate good titles. For example, there are numerous patents simply and non-informatively titled "Hammer,"[191] "Printer,"[192] or "Mattress."[193] A more useful mandate for a technical title might require the most specific technical description of the function that covers all variations on the invention described in the patent document, probably highlighting the invention's improvement.[194] For example, for a patent covering robotic vacuum cleaners that (1) work by autonomously detecting and cleaning only those areas that are dirty, (2) work by autonomously cleaning every square inch of a room, and (3) work less autonomously by requiring a user to specify in advance the dirty areas to be cleaned, a reasonable specific title covering all variations would be "A Robotic Vacuum Cleaner That Moves Autonomously To Clean Dirt."[195] Another reasonable regulation might implement technical subtitles to encapsulate the inventive variations, such as the three presented here, to capture in easily digested form the variations conceived by the inventor. Regulation probably should not be much more rigid than that, either for titles or for other parts of the technical layer because that would allow inventors to avoid disclosure by complying literally with narrow requirements but avoiding the spirit of disclosure. In other words, to the extent that there is still some ambiguity in the regulations and there is some fear that violations of the spirit of the disclosure rules will be caught, patent applicants have greater incentive to comply with both the rules and the spirit of disclosure. Other aspects of the patent document—including the order of presentation of information in the patent document,[196] the coherence of

191. *E.g.*, U.S. Patent No. 4,683,784 (filed Feb. 11, 1986); U.S. Patent No. 4,363,344 (filed May 9, 1979).

192. *E.g.*, U.S. Patent No. 5,268,993 (filed June 4, 1991); U.S. Patent No. 4,031,519 (filed Nov. 11, 1974).

193. *E.g.*, U.S. Patent No. 4,275,473 (filed July 25, 1979); U.S. Patent No. 3,778,851 (filed Feb. 24, 1972).

194. An apt title is useful to later recall: psychologists have shown that "providing a thematic title to participants prior to reading an ambiguous passage has dramatic effects on later recall. . . . [and more specifically,] those who read the titles recalled approximately twice as much as those who read the ambiguous passage without the benefit of its title." Suzanne Mannes & Marie St. George, *Effects of Prior Knowledge on Text Comprehension: A Simple Modeling Approach*, *in* MODELS OF UNDERSTANDING TEXT 115, 115 (Bruce K. Britton & Arthur C. Graesser eds., 1996).

195. Another approach to getting more useful titles might involve less-direct methods. For example, the government might award stronger or broader patent protection to a patentee whose patent has been cited fifty times by other entities in a non-collusive fashion. This rule gives the patentee the incentive to write a clear title to help other entities locate its patent for citation.

196. *See* Guy J. Groen & Vimla L. Patel, *The Relationship Between Comprehension and Reasoning in Medical Expertise*, *in* THE NATURE OF EXPERTISE, *supra* note 125, at 287, 295–96 (concluding that medical experts are better able to make medical inferences when clinical medical information is presented in a proper order); Mannes & St. George, *supra* note 194, at 115, 117 (discussing the use of outlines appearing before the text).

the text,[197] and the presentation of examples of the invention[198]—also require reassessment in the face of psychological evidence.

Beyond generally directing a more specific structure for the patent document, I suggest mandating differing structures in the patent document based on the technology at hand—be it a computer system, a business method,[199] a mechanical object, a chemical process, or something else. The patent statute generally does not differentiate between different technologies.[200] Nonetheless, the qualities of inventions differ depending on

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197. *Compare* Elshout-Mohr & van Daalen-Kateijns, *supra* note 173, at 225 ("[S]tudies showed that recall was always better for text with high coherence than with low coherence, for students with both low and high knowledge about the [scientific] subject matter . . . ."), *with id.* at 225–26 (describing paradoxical findings). The authors found:

> The paradoxical result was that high-knowledge participants performed better on texts with low rather than high coherence in tests that tap deep comprehension and reasoning . . . . When coherence gaps occur, students are challenged to use available prior knowledge to establish local coherence relations, to figure out the macrostructure of the text, and to elaborate the textual material with what they already know . . . . The combination of a high-coherence text and high background knowledge may induce a 'feeling of knowing' or an 'illusion of comprehension,' which prevents readers from deep processing of the text.

Id.

198. *See* GEORGE LAKOFF, WOMEN, FIRE, AND DANGEROUS THINGS: WHAT CATEGORIES REVEAL ABOUT THE MIND 56 (1987) (discussing notions of exemplars of categories and degrees of membership within a category); George F. Wheeler, *Creative Claim Drafting: Claim Drafting Strategies, Specification Preparation, and Prosecution Tactics*, 3 J. MARSHALL REV. INTELL. PROP. L. 34, 43 (2003) ("[C]onvey in your specification that there are many ways to carry out the invention. Challenge the inventors to conceive several different embodiments of the invention, with many different features. Describe more than one embodiment when you can do so.").

199. An abundance of commentary suggests that business-method patents are frequently granted to inventions that are not novel, are obvious, or are not patentable subject matter. *E.g.*, John R. Thomas, *The Patenting of the Liberal Professions*, 40 B.C. L. REV. 1139, 1143–63 (1999) (patentable subject matter); Andrew Kopelman, Note, *Addressing Questionable Business Method Patents Prior to Issuance: A Two-Part Proposal*, 27 CARDOZO L. REV. 2391, 2393–94 (2006) (novelty and obviousness). *But see* John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth*, 18 BERKELEY TECH. L.J. 987, 989–1006 (2003) (positing, after conducting an empirical analysis, that business-method patents are not inferior to other patents). The current disclosure requirements, rather than providing too little useful information, might simply provide too much information for business methods, thereby obfuscating their frequent simplicity. An oft-criticized patent is Amazon.com's patent on its "one-click" method for ordering merchandise on the Internet. U.S. Patent No. 5,960,411 (filed Sept. 12, 1997); Allison & Tiller, *supra*, at 993; Jeanne C. Fromer, *The Layers of Obviousness in Patent Law*, 22 HARV. J.L. & TECH. 75, 86–87 (2008). To the extent that the one-click method should not have been patentable, provision of a model, which would appear simple, or the software code, which would be succinct, might highlight patentability concerns.

200. Burk & Lemley, *supra* note 31, at 1576. That said, in interpreting the type of information required for enablement, the relevant industry matters to setting the standard of a person skilled in the relevant art. *See* Craig Allen Nard, *A Theory of Claim Interpretation*, 14 HARV. J.L. & TECH. 1, 43–81 (2000) (dissecting the person having skill in the art). And it is thought that "[i]n contrast to the applied sciences, the judiciary has required a more detailed disclosure in chemistry, and the experimental sciences" because "'results are often uncertain,

the technological field, whether due to industry differences or the substance of the technological area.[201] Until now, the existence of varying models of innovation has been principally cited as support for arguments that the scope of the patent right should vary from model to model[202] (or that courts should fine-tune patent law based on the relevant technology[203]). One might wish to do the same in structuring disclosure rules.[204] For instance, patents for computer systems might require providing the software code or the informational equivalent of a flow chart to show the system's organization. And biotechnology patents addressed to structural proteomic and genomic information might require conforming to certain data-bank specification formats.[205] Or some industries might require more detailed disclosure for an invention and its relevant facets to be understood because of the industry's complexity. Conversely, in some industries disclosure might be relatively

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unpredictable, and unexpected.'" Seymore, *supra* note 127, at 137 (quoting Schering Corp. v. Gilbert, 153 F.2d 428, 433 (2d Cir. 1946)).

201. Dan Burk and Mark Lemley describe industry differences:

> Industries vary in the speed and cost of research and development . . . , in the ease with which inventions can be imitated by others, in the need for cumulative or interoperative innovation rather than stand-alone development, and in the extent to which patents cover entire products or merely components of products.

Burk & Lemley, *supra* note 31, at 1577; *accord* Merges & Nelson, *supra* note 59, at 880–84 (discussing four models of inventive advances: discrete inventions, cumulative technologies, chemical technologies, and science-based technologies).

202. *E.g.*, Merges & Nelson, *supra* note 59, at 882 (positing, for instance, that the scope of the patent right is more significant with cumulative technologies than with discrete inventions because granting broad patents to pioneers for the former type of invention might prevent industry growth and development).

203. *See* Burk & Lemley, *supra* note 31, at 1577 (demonstrating how patent law, though facially uniform, is applied differently depending on the industry to develop differing legal standards of obviousness, enablement, and written description).

204. *Cf. id.* at 1652–54 (suggesting some ways in which the written-description requirement varies by technology).

205. Berman & Dreyfuss, *supra* note 139, at 898–99. Though there are many different ways to decide on industry- or technology-specific disclosure rules, one promising avenue might be to grant the industry a significant role in delineating the sorts of information useful to patent disclosure. As those working in a particular industry both disclose their inventions in patent applications and consume the patent disclosures of others in the industry, *infra* text accompanying notes 264–66, they are uniquely situated to balance out the information they would like to provide as patentees and the information they would like to read as consumers of the information in others' patents. Of course, any such solution would have to avoid being captured by coordinated industry efforts to minimize overall disclosure when more or different disclosure is optimal. *Cf.* Burk & Lemley, *supra* note 31, at 1637 ("[B]oth public choice theory and practical experience warn that each new amendment to the patent statute represents an opportunity for counterproductive special interest lobbying. Technology-specific patent legislation will encourage rent-seeking by those who stand to benefit from favorable legislation." (footnotes omitted)).

unimportant because one can only rarely improve upon or learn from those industries' inventions.[206]

Beyond forcing the writer to divulge more useful information, instituting more concrete disclosure goals by structuring the information to be presented in the patent document has two additional benefits. First, it eases the PTO's detection of inadequate disclosure during examination. It is more straightforward to detect a failure to comply with more specific goals rather than more amorphous ones. Concomitantly, concrete goals steady patentees' expectation of their patent's validity by more readily guaranteeing that future decisionmakers will find that they complied with disclosure requirements.

With this exploration of the inadequacy of the writer in the patent system and suggestions of how to improve patent disclosure in this regard—by marking the technical layer and by constructing it via injections of useful redundancies and a better mandated structure of disclosure—I now turn to the second inadequacy, that of the index.

B. THE INDEX

Supposing that the technical layer is carefully and usefully structured to divulge the invention to inventors and competitors, this audience still has to be able to find relevant patents in the vast database of issued patents. Patent documents are publicly available on the PTO website[207] and in numerous commercial databases.[208] Patents, however, are currently hard to find due to the vast number of issued patents[209] combined with insufficient attention to indexing the patents. That said, significant difficulties with searching the patent library stem from poor information in the searchable fields, such as title and abstract, which is something that should be radically improved by better mandating the structure of the technical layer.[210] These improvements do not, though, make the patent library fully navigable.

Current indexing of patents is seriously flawed. Patent applicants generally include a preliminary classification of their invention in the

206. *Cf.* Merges & Nelson, *supra* note 59, at 880 (emphasizing that discrete inventions "do[] not point the way to wide ranging subsequent technical advances").

207. U.S. Patent & Trademark Office, Patent Full-Text and Full-Page Image Databases, http://www.uspto.gov/patft/index.html (last visited Sept. 30, 2008). For a recounting of the successful fight to make patent information publicly available in the 1820s, see Cooper, *supra* note 41, at 45–47.

208. *E.g.*, Delphion Research Intellectual Property Network—International and U.S. Patent Search Database, http://www.delphion.com (last visited Sept. 30, 2008).

209. Brian Kahin, *Through the Lens of Intangibles: What Patents on Software and Services Reveal About the System*, *in* PATENTS, INNOVATION AND ECONOMIC PERFORMANCE 209, 211 (2004) (attributing to a Cisco employee the quote that "there are too many patents to be able to even locate which ones are problematic").

210. *See supra* Part III.A.3.b (noting the ambiguous nature of patent titles).

application.[211] The PTO then assigns classification numbers to each patent—seen on the first page of a patent, as in the Appendix—to ease patent examiners' searches for prior art by narrowing their queries.[212] Classification is determined based only on the content of a patent's claims, rather than the contents of the entire patent document.[213] Thus, it is no surprise that classification, as currently implemented, is unreliable in that there are "numerous instances of what seem to be wrong or arbitrary classification decisions."[214]

There are many ways to improve classification by usefully grouping like with like. Some scholars find it useful to classify patents by industry[215] or analogous arts,[216] enabling experts to access developments in their industry easily. Or instead of being written in stone, classifications might emerge. For instance, families of patents might be constructed together because they contain overlapping references to prior art and each other,[217] similar titles, and the like. Or the public's use of the patent library might dictate classifications in the sense that sets of patent documents repeatedly viewed together by a user might be designated as similar.[218] Another option would permit users of the patent library to develop classifications accessible to others;[219] if they are useful to one expert user, chances are they would be useful to others.

These improvements will make patent documents easier to locate in the patent library but will not, in and of themselves, bring experts to search the patent library. The simplest way to bring experts to the patent library is to immerse it in the principal libraries of technical non-patent literature to which experts already regularly turn. Wolfgang Glänzel and Martin Meyer

211. MPEP, *supra* note 27, § 601(III).

212. KURSH, *supra* note 29, at 114. For a list of the current classification classes, see United States Patent and Trademark Office, http://www.uspto.gov/web/offices/opc/documents/caa.pdf (last visited Sept. 30, 2008).

213. U.S. PATENT & TRADEMARK OFFICE, U.S. DEPARTMENT OF COMMERCE HANDBOOK OF CLASSIFICATION 9, *available at* http://www.uspto.gov/web/offices/opc/documents/handbook.pdf.

214. John R. Allison & Mark A. Lemley, *The Growing Complexity of the United States Patent System*, 82 B.U. L. REV. 77, 92 (2002).

215. *Id.*

216. "Analogous arts" are the fields a technical expert in a particular field would think of consulting when working in that field, which the Federal Circuit addresses in ruling on obviousness in light of prior art. *In re* Kahn, 441 F.3d 977, 986–87 (Fed. Cir. 2006).

217. *But cf.* Katherine J. Strandburg et al., *Law and the Science of Networks: An Overview and an Application to the "Patent Explosion,"* 21 BERKELEY TECH. L.J. 1293, 1298–99 (2006) (finding increasing disparity between the most-cited and the least-cited patents).

218. This emergent classification is similar to Amazon.com's recommendation that a certain percentage of people who bought one book also bought another one.

219. *Cf.* Noveck, *supra* note 29, at 146 (labeling self-tagging a "folksonomy") (citing Clay Shirky, Ontology Is Overrated: Categories, Links, and Tags, http://www.shirky.com/writings/ontology_overrated.html (last visited Sept. 30, 2008)).

observe that the chemistry industry relies significantly more heavily on patent literature to inform research than any other field.[220] They proffer the intuitive explanation that this reliance is attributable in large part to chemistry's status as the only field in which patent documents are indexed along with non-patent scientific literature in a traditional bibliographic database.[221] The federal government (or the private sector) could similarly ensure that patent literature be incorporated into existing technical libraries so that researchers' browsings and searches would reveal both relevant patent and non-patent literature, exposing experts to patent disclosures.

In sum, improving the index of patent documents by better structuring information, improving classification, and situating the index within general technical databases or indices would help improve patent disclosure by ensuring that experts can find relevant patents.

C. THE READER

Even assuming the inadequacies of the writer and the index are repaired, a third key insufficiency of the disclosure function lies in the reader. The patent system's legal incentive not to read patents stemming principally from the rule of willful infringement is a systemic concern that other scholars stress.[222] According to this rule, though patent infringement is akin to a strict-liability offense,[223] a court has the authority to award up to treble damages to a patentee when it finds an infringer to have acted willfully.[224] Though the Federal Circuit has not precisely defined the contours of willful infringement, the court has elaborated that it requires at least objectively reckless infringement,[225] as to which "the primary consideration is whether the infringer, acting in good faith and upon due inquiry, had sound reason to believe that it had the right to act in the

220. Glänzel & Meyer, *supra* note 107, at 426.

221. *Id.*

222. Holbrook, *supra* note 9, at 142–43; Mark A. Lemley & Ragesh K. Tangri, *Ending Patent Law's Willfulness Game*, 18 BERKELEY TECH. L.J. 1085, 1100–02 (2003); Edwin H. Taylor & Glenn E. Von Tersch, *A Proposal To Shore Up the Foundations of Patent Law That the* Underwater *Line Eroded*, 20 HASTINGS COMM. & ENT. L.J. 721, 724 (1998); Note, *Disclosure Function*, *supra* note 9, at 2017–23.

223. Jurgens v. CBK, Ltd., 80 F.3d 1566, 1570 n.2 (Fed. Cir. 1996).

224. 35 U.S.C. § 284 (2000); Read Corp. v. Portec, Inc., 970 F.2d 816, 826 (Fed. Cir. 1992). The Federal Circuit has justified this standard as both deterring "intentional disregard of legal rights," Knorr-Bremse Systeme Fuer Nutzfahrzeuge GmbH v. Dana Corp., 383 F.3d 1337, 1342 (Fed. Cir. 2004) (en banc), and "quantifying the equities as between patentee and infringer," SRI Int'l, Inc. v. Advanced Tech. Labs., Inc., 127 F.3d 1462, 1468 (Fed. Cir. 1997). Upon finding willful infringement, a court might also choose to award attorney's fees. 35 U.S.C. § 285; *Knorr-Bremse*, 383 F.3d at 1347.

225. *In re* Seagate Tech., LLC, 497 F.3d 1360, 1371 (Fed. Cir. 2007) (en banc). Willfulness is determined by evaluating the totality of circumstances based on factors like deliberate copying of another's ideas, duration of infringement, and the infringer's motivation. *Read Corp.*, 970 F.2d at 826–28.

manner that was found to be infringing."[226] Because infringers would rather not pay treble damages, firms aware of the willful-infringement rule—that is, most companies—routinely advise their employees not to read outside patents, thereby avoiding the risk of any knowledge of relevant patents and thus any willful infringement.[227]

That said, individuals and firms are still acting unreasonably if they make or market new products in ignorance of existing patents, possibly infringing them willy-nilly. The patent system theoretically encourages inventors to read patents by imposing as conditions of patentability the novelty and nonobviousness of the invention in light of others' patents (or other prior art);[228] an inventor would rationally want to be aware of others' patents to know whether his invention is patentable. Review of patents to determine whether an already-developed product infringes any of them, however, has not resulted in scientists and technologists reading patents to inform their own research in innovating in the first place, a principal purpose of the disclosure function.[229] Therefore, the rule of willful infringement hinders the patent system's disclosure function.

The concept of willful infringement is, as with much of patent law, about drawing a fine line between the public interest of allowing society some form of access to patented inventions and protecting the exclusive patent right. That is, the rule severely discourages certain egregious instances of infringement. However, the rule also has the side effect of limiting the utility of disclosure. Excising this disincentive to read patents—at the very least by creating a safe harbor for inventors reading a patent while involved in their technical research so long as there is no intentional infringement—is thus imperative to improving the disclosure function.

To invigorate disclosure, not only might the legal disincentive to read patents be removed, but affirmative incentives to read patents might be constructed, a solution not previously offered. One might, for instance, reward a scientist's proven review of patent documents at the research stage with accelerated patent examination should that research result in a patent application.

In sum, to improve the incentive to read patent documents, which is a critical aspect of operational disclosure, it is vital to remove—if not reverse—the penalty of willful infringement as applied to reviewing patents to inform follow-up innovation.

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226. *SRI Int'l*, 127 F.3d at 1464–65.

227. *See* Kahin, *supra* note 209, at 211–12 (identifying willful infringement as a principal reason why engineers at Cisco Systems, Inc. avoid information in patents); Lemley, *supra* note 29, at 1516 ("[M]ost sophisticated companies strenuously avoid reading other companies' patents because they don't want to be charged with knowledge of the patent's existence.").

228. 35 U.S.C. §§ 102–103 (2000).

229. Note, *Disclosure Function*, *supra* note 9, at 2022.

D. ENFORCEMENT

Suppose that the patent document is now structured to be chock-full of information useful to scientists and technologists, and that they are locating and mining this information to advance their research and development. Even so, there will nonetheless be instances in which the patent fails to convey the information needed to inspire further innovation. This can happen because patent applicants have little incentive to reveal any more information about their inventions than they practically must to secure a patent.[230] This information can be less than is required under the patent laws and becomes problematic when the PTO does not root it out. As the PTO does not systemically uncover disclosure problems for the many reasons discussed in Section A,[231] there is good cause to believe that patents containing insufficient disclosure will sometimes issue.

Inadequately disclosed patents cannot easily be remedied. There is no mechanism for a third party to repair an inadequate disclosure by infusing sufficient information into the issued patent.[232] The two ways to invalidate a patent for insufficient disclosure—reexamination and litigation—underperform in policing inadequate disclosure. Congress allows the PTO to reexamine issued patents on its own initiative or when requested by the patentee or a third party, but only upon the basis of prior art, not the validity of the patent disclosure.[233] Even if the PTO were to permit reexamination based on disclosure concerns, the problems plaguing initial examination would no doubt also affect reexamination.

Patent litigation as an avenue to enforce disclosure requirements in issued patents fares no better than reexamination. Among the defenses

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230. *Supra* notes 65–66 and accompanying text.

231. *Supra* text accompanying notes 175–83.

232. The patent laws provide for the PTO's reissuance of a patent "for the invention disclosed in the original patent" when "through error without any deceptive intention, deemed wholly or partly inoperative or invalid, by reason of a defective specification or drawing." 35 U.S.C. § 251. But only the patentee—not a third party—can seek reissue. *See id.* In any case, disclosure defects cannot be cured in a reissue application. *In re* Hay, 534 F.2d 917, 920 (C.C.P.A. 1976).

233. 35 U.S.C. §§ 301–307, 311–318. Outside parties have limited participation rights in reexamination, *see id.* §§ 302, 311, 314(b)(2), which occurs according to the same procedures and standards as patent examination, *id.* § 305. This procedure is useful for patents whose novelty or nonobviousness is in doubt and has the express purpose of strengthening "investor confidence in the certainty of patent rights." H.R. REP. NO. 96-1307, at 3 (1980); *In re* Recreative Techs. Corp., 83 F.3d 1394, 1396–97 (Fed. Cir. 1996). Congress limited the scope of reexamination to prior art to avoid abusive practices to "harass the patentee and waste the patent life." *Id.* Reexamination as structured has been opposed for not allowing challengers to participate. Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 965 (2004). It also has been opposed for being limited to correcting only patentability issues related to prior art. Mark D. Janis, *Rethinking Reexamination: Toward a Viable Administrative Revocation System for U.S. Patent Law*, 11 HARV. J.L. & TECH. 1, 53–54 (1997).

available to a defendant in a patent-infringement suit is patent invalidity for inadequate disclosure.[234] This defense provides the grounds for a third party to initiate an action for declaratory judgment for patent invalidity so long as there is an actual controversy between the parties.[235] The Federal Circuit finds an actual controversy so long as "the plaintiff [can] actually produce or be prepared to produce an allegedly infringing product," and "the patentee's conduct must have created an objectively reasonable apprehension on the part of the plaintiff that the patentee will initiate suit if the activity in question continues."[236] While there is an avenue to sue a patentee for inadequate disclosure, it is systemically unhelpful in enforcing disclosure failures. This is because there is no cause of action that can be brought against a patentee simply for inadequate disclosure absent the threat or accusation of patent infringement. Conceptually, however, there is no reason that infringement and inadequate disclosure should be tightly coupled because inadequate disclosure is an independent harm to the patent system. As discussed in Part II, technologists want to use the information that should be disclosed in a patent to design around a patented invention, learn from it for future research, or improve on the invention, but do so without infringing the patent itself. Because these technologists ostensibly suffer harm from inadequate disclosure in and of itself—an underlying assumption of the patent bargain—they should not be forced to infringe a patent to correct a disclosure failure.

Additionally, only approximately 0.2% of issued patents are litigated to judgment in infringement actions.[237] Even if inadequate disclosure were litigated in each case, the infinitesimal numbers of patents litigated mean insufficient systemic enforcement of the disclosure function.[238] Though some think it preferable to have detailed and costly patent-validity determinations made in litigation rather than in PTO examination because only the limited class of valuable patents will typically be litigated,[239] this analysis overlooks validity determinations turning on adequacy of disclosure. Fundamentally, a patent need not be commercially valuable by a measure of infringement purposes for it to be informationally valuable as a mechanism of useful disclosure to technologists. Pointedly, while there are a rising

234. 35 U.S.C. §§ 281–282.

235. MedImmune, Inc. v. Genentech, Inc., 549 U.S. 118, 126–27 (2007).

236. EMC Corp. v. Norand Corp., 89 F.3d 807, 811 (Fed. Cir. 1996). This recitation generally continues to be accurate after the Supreme Court's recent ruling on the case-or-controversy requirement in declaratory-judgment actions in which a patent licensee sues the patentee without first repudiating the license agreement. *MedImmune*, 549 U.S. at 126–37.

237. Lemley, *supra* note 29, at 1501.

238. That said, the PTO devotes more hours to examining patents that are less likely to be litigated, John L. King, *Patent Examination Procedures and Patent Quality*, *in* PATENTS IN THE KNOWLEDGE-BASED ECONOMY 54, 66–67 (Wesley M. Cohen & Stephen A. Merrill eds., 2003), making it somewhat more likely that it will detect inadequate disclosure.

239. Kieff, *supra* note 118, at 73; Lemley, *supra* note 29, at 1497, 1510–11.

number of patents for incremental technical advances,[240] which individually might not be commercially or informationally valuable, the collectivity of incremental advances provides essential information for further innovation in many areas, including biomedicine.[241] Therefore, worthless patents for purposes of infringement will never be properly tested for adequacy of disclosure even if they could, if properly divulged, be of great use to the public for disclosure's purposes of future research and development.

To strengthen the disclosure function, it is imperative to fix the patent system's inadequacy of enforcement. Beyond making disclosure goals less abstract to detect inadequate disclosure before a patent is issued, the insufficiency of enforcement can be repaired in two ways, perhaps working together. First, just as there is a legal review by the PTO during examination to ensure patentability,[242] there ought to be a disclosure review by the PTO, experts in the field, or both. Beyond that, for those patents that issue despite inadequate disclosure, it should be possible to challenge the adequacy of the disclosure post-issuance.

Disclosure review would best be accomplished by those with technical expertise in the relevant art, as they are the intended readers of the technical layer. This can be done by PTO examiners with sufficient technical experience. Another possibility is to implement a form of peer review by having the patent applicant's peers advise on the adequacy of disclosure.[243] That is, a set of experts in the relevant field would assess the disclosure by suggesting which absent technical information about the invention would be useful to them in inspiring further innovation, such as the applicant's experimentation techniques, an image to clarify the invention's description, a more apt technical title for the patent, and so forth. The applicant's peers are well-placed to assess the adequacy of disclosure due to their regular creative work in the field (in contrast to the evaluative work of the PTO examiner). The PTO examiner would determine the validity of peer suggestions and pass along a subset of them to the patent applicant.[244] Peer review would bring some cost to the PTO: the PTO would have to identify a

240. *See supra* note 41 (discussing patent thickets).

241. VERNON M. RUTTAN, TECHNOLOGY, GROWTH, AND DEVELOPMENT: AN INDUCED INNOVATION PERSPECTIVE 67 (2001); Arti K. Rai & Rebecca S. Eisenberg, *Bayh-Dole Reform and the Progress of Biomedicine*, 66 LAW & CONTEMP. PROBS. 289, 297–98 (2003).

242. *But see* Jay P. Kesan & Andres A. Gallo, *Why "Bad" Patents Survive in the Market and How Should We Change?—The Private and Social Costs of Patents*, 55 EMORY L.J. 61, 76 (2006) (criticizing the quality of the patent-examination process).

243. Peer review could be implemented on a case-by-case basis when the examiner is uncertain about the adequacy of disclosure, in certain fields in which disclosure is often inadequate, or across the board.

244. *Cf.* Nature.com, Getting Published in *Nature*: For Authors and Referees, http://www.nature.com/nature/authors/get_published/index.html (last visited Sept. 30, 2008) (describing *Nature*'s peer-review process).

set of experts for peer review, and the PTO and the patent applicant would have to process the extra communications.[245]

The peer-review process need not end at patent issuance. The PTO can allow experts—either self-selected from the general public or a pre-approved set—to annotate the patent document[246] by adding useful information or search keywords, explaining key terms, asking questions of the expert community, and the like.[247] The publicly available annotated patent document would provide a richer set of information to technologists facilitating disclosure. Facilitating annotations externalizes the cost of disclosure by imposing it in part on the interested public, which makes sense when inventors will not realize that omitted information is useful. Of course, when there is a great gulf between annotations and the patent disclosure, there might be good reason to think the patent is invalid due to inadequate disclosure.[248]

The systemic under-enforcement of inadequate disclosure should also be repaired through the provision of administrative[249] or judicial proceedings to challenge inadequate disclosure in issued patents.[250]

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245. Another option might be to adopt a variation of Beth Noveck's project of community patent review (being implemented in trial version by the PTO), Noveck, *supra* note 29, at 127–29 (proposing review by the public of the adequacy of prior art—and thus the novelty and nonobviousness—in patent applications), and allow anyone to provide comments on the adequacy of technical disclosure. A problem with (closed or open) peer review of disclosure is that feedback might be misleading or wrong: first, competitors have self-interest to deter issuance of patents to their rivals, maximize disclosure, impose greater communication costs on their rivals, and learn more about their rivals' works; second, allowing anyone to contribute feedback increases the chance that reviewers provide irrelevant feedback. Noveck addresses the second problem by allowing the public to rank feedback already provided, but that alone does not minimize the first problem of self-interest, a problem that afflicts a PTO-selected "blue ribbon" panel as well as self-selected public reviewers. To minimize this problem, feedback should be advisory by having the examiner act as a critical gatekeeper, *cf.* Noveck, *supra* note 29, at 156–57 (providing that reviewers' information is provided to the examiner for ultimate review), and allowing the patent applicant to defend against suggestions.

246. Annotation also might be privatized. For examples, see *supra* note 111.

247. Allowing annotations should not turn the patent into a document editable by the anonymous public, as with Wikipedia entries. In such a system, those with biased or contorted views of the patent laws, might rapidly capture the system, which could lead to the replacement of accurate information. *Cf.* Stacy Schiff, *Know It All: Can Wikipedia Conquer Expertise?*, NEW YORKER, July 31, 2006 (discussing similar concerns with Wikipedia). A more successful system would allow only the addition of commentary, possibly with attribution. *See generally* BABYLONIAN TALMUD, *translated in* THE TALMUD: THE STEINSALTZ EDITION (Adin Steinsaltz trans. & ed., 1999) (interposing attributed rabbinic commentary with the Talmudic text).

248. That said, the unforeseen path of subsequent innovation might render patent disclosures inadequate, which might yield a great deal of annotation.

249. *See* Benjamin & Rai, *supra* note 178, at 320–28 (discussing the combination of patent law with administrative-law principles).

250. To varying degrees, the PTO and the federal courts are composed of lay individuals who would need to decide whether disclosure in the technical layer is adequate. Lay decisionmakers can rely on expert testimony, as they often do in areas beyond their ken. Scott Brewer, *Scientific Expert Testimony and Intellectual Due Process*, 107 YALE L.J. 1535, 1678 (1998)

Recognition of an independent action for inadequate disclosure would be essential to enforcing good disclosure. A disclosure action brought by an interested member of the public[251] would be akin to a class action brought on behalf of all interested members of the public.[252]

Provision of actions for inadequate disclosure must guard against providing members of the public—or, more specifically, a patentee's competitors—either too much incentive to tie up patentees in disclosure challenges or too little incentive to bear the non-negligible cost of bringing such challenges in the first instance. If the substantial reward of patent invalidation automatically lies at the end of each successful disclosure challenge, competitors plausibly would always challenge the adequacy of disclosure in their rivals' patents. Invalidation through this route weighs down the patentee with both the direct cost of defending against the challenge and the increased risk of patent invalidation. Both costs substantially devalue any particular patent to the point that inventors might not invent or might seek alternative and more secretive protection of their inventions. Therefore, it might be preferable to reduce the incentive to challenge the adequacy of disclosure by reducing the prize for a successful challenge, perhaps by forcing adequate disclosure and providing for a somewhat decreased patent term.[253] In order to provide adequate incentive for plausible challenges to be brought by someone bearing the cost on behalf of the public, the law could reward successful challengers with, say, a compulsory license (to a valid patent with a decreased term) on favorable conditions.

In light of the documentation of four critical points in the patent system leading to inadequacy of disclosure and suggestions of how to repair them to

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(discussing but criticizing the prevalence of this practice). Nonetheless, lay decisionmaking introduces more room for error than would unbiased expert decisionmaking, and the need to rely on experts increases the costs of bringing or defending a disclosure challenge, which decreases patent value.

251. Those bringing such actions should have sufficient interest in adequate disclosure of that patent as a proxy for avoiding actions brought to harass patentees.

252. *Cf.* Christopher R. Leslie, *The Anticompetitive Effects of Unenforced Invalid Patents*, 91 MINN. L. REV. 101, 104–05 (2006) (arguing that private parties be able to challenge mere possession of an invalid patent as an antitrust violation); Jason Mazzone, *Copyfraud*, 81 N.Y.U. L. REV. 1026, 1078–83 (2006) (proposing broad standing for the public in civil litigation to rein in false copyright notices).

253. Provision of an action for inadequate disclosure must guard against collusive settlement of meritorious suits brought by a competitor against a patentee to the detriment of the public. *Cf.* C. Scott Hemphill, *Paying for Delay: Pharmaceutical Patent Settlement as a Regulatory Design Problem*, 81 N.Y.U. L. REV. 1553, 1557–62 (2006) (discussing a similar concern with regard to settlement of patent-infringement actions brought by a drug patentee against an intended manufacturer of a generic version of the drug for the purpose of delaying entry of generic drugs into the marketplace). One solution to this problem is to make these actions *qui tam*, in the sense that they cannot be terminated without government approval as they are not only actions brought on behalf of the public but also the government, which granted the patent.

invigorate disclosure, I now turn to analyzing the costs of invigorated disclosure.

IV. THE COSTS OF INVIGORATED PATENT DISCLOSURE

Invigorating patent disclosure in the forms suggested by the previous Part, like any legal choice, carries with it benefits as well as costs. Though these costs are sometimes expressed below in terms of cost to the patentee (as the quid pro quo rhetoric of patent law often suggests), that is merely for ease of discussion. The costs of invigorating disclosure with which I am most concerned are the costs to innovation borne by society: how much do stronger disclosure requirements undermine the incentive to invent or to opt into the patent system?

As discussed repeatedly above, an inventor currently has little incentive to disclose any more than that required by law (or, more likely, that which will be enforced).[254] Rational inventors will not seek a patent in the first place when the expected costs of disclosing information in a patent exceed the expected gains from the patent right.[255] They will instead choose to protect their inventions in other ways, principally by keeping them secret—under a trade-secret regime or as an actual secret—if they invent at all.[256]

It is already costly to obtain patent protection: it costs between $10,000 and $30,000 to prosecute a patent.[257] Heightened disclosure would increase the patent applicant's cost by requiring increased expenditure on disclosure compliance: more disclosure consumes more of the resources of those involved in patent prosecution, and patent applicants must both be more meticulous due to the increased chance of detection of inadequate disclosure and willing to bear the costs of disclosure challenges.[258] The inventor also bears the increased risk that the disclosure will help

254. *See supra* notes 65–66 and accompanying text.

255. Long, *supra* note 53, at 626.

256. *Id.*

257. Lemley, *supra* note 29, at 1498–99 (including in this cost PTO filing fees and the attorney's fees for meeting with the inventor, writing the patent application, and responding to PTO office actions).

258. Increasing the cost of disclosure might affect individual inventors more severely than those employed by large firms, who can more readily shoulder the burden of increased costs. The typical patentee long ago moved away from the basement inventor to the firm inventor. Allison & Lemley, *supra* note 214, at 96. However, new business models funding individuals, *e.g.*, Intellectual Ventures, http://www.intellectualventures.com (last visited Jan. 19, 2009) (providing an example of a new business model), might diminish the trend as well as support increased costs of patent disclosure. Even were that not the case, disclosure requirements might be structured to require less of the more easily burdened basement inventor. *Cf.* 17 C.F.R. § 240.13e-3 (2008) (eliminating various securities disclosure obligations for companies with less than 300 shareholders that do not trade their securities on an exchange); Stephen J. Choi, *Behavioral Economics and the Regulation of Public Offerings*, 10 LEWIS & CLARK L. REV. 85, 121 (2006) (observing how the Securities and Exchange Commission has not required as much disclosure from smaller businesses as it has from larger ones).

competitors at his expense. For example, disclosure might give a competitor a leg up on creating an improvement or by revealing enough information that the applicant has disclaimed possible future patents.[259] That said, some of the suggested changes might decrease costs to the patent applicant in other ways. First, mandating the structure of the patent document in more detail might make it easier to determine from the get-go the information to include.[260] Second, improved PTO detection of inadequate disclosures accords a better chance of fending off attacks on disclosure. Third, providing a more informative patent and patent library will make it easier for applicants to find relevant prior art to cite in their applications.

Invigorated disclosure also might place an increased burden on the PTO. So long as invigorated disclosure adds to the complexities of examination, examiners can spend more time examining patents, and the PTO must spend more time and money hiring and training qualified examiners.[261] (The added burden might not be too severe, as a more mandated structure might make it easier to determine whether there is adequate disclosure[262] and public assistance from experts might relieve some burdens examiners currently shoulder alone.[263]) Increased costs would likely be passed on to the patent applicant in the form of increased filing fees and possibly a longer period before a patent is granted.

These extra costs to the patentee are offset in part by the benefit he derives from improved disclosure when he reads others' better-disclosed patents.[264] Patentees wearing the hat of patent reader glean more useful

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259. Patent law has a dedication rule pursuant to which subject matter disclosed in the patent document but not claimed therein is dedicated to the public. Johnson & Johnston Assocs. Inc. v. R.E. Serv. Co., 285 F.3d 1046, 1054 (Fed. Cir. 2002). This rule would seem to discourage revelation in the patent of anything more than that which is claimed—something more likely to happen under a system of invigorated disclosure (unless the rule is applied only to the legal layer, not the technical layer). Concomitantly, the rule will encourage inventors to claim all that must be disclosed in an invigorated system. Broader claims—and broader patent scope—might therefore accompany broader disclosure and might negate the increased cost the dedication rule would seem to impose.

260. *Cf.* Risch, *supra* note 123, at 227 ("The marginal costs of accurately describing and enabling an invention are likely to be low because the applicant can be expected to have a full grasp of what he believes was invented.").

261. Lemley, *supra* note 29, at 1508.

262. *Supra* Part III.A.3.b.

263. *Supra* Part III.D.

264. *Cf.* Merges & Nelson, *supra* note 59, at 916. The authors state:

> [I]t is important to bear in mind that every potential inventor is also a potential infringer. Thus a 'strengthening' of property rights will not always increase incentives to invent; it may do so for some pioneers, but it will also greatly increase an improver's chances of becoming enmeshed in litigation.

Id. Henry Smith relatedly notes:

> [S]peakers have as much interest in being understood as hearers have in understanding. But the question remains why speakers do not unilaterally place

information under a system of invigorated disclosure to design around and improve upon their competitors' inventions. This is a multi-person instantiation of the classic prisoner's dilemma,[265] where if all patentees coordinated to effectuate better disclosure, everyone would be better off, but individual defection cannot be prevented absent enforced disclosure norms.[266] Most fundamentally, invigorated disclosure would increasingly stimulate competitors and other inventors to build on and learn from the patent disclosure. This purpose is, for good reason, an integral aspect of patent theory and, as such, it has been duly noted that the patent right is granted in exchange for disclosure. Viewing this notion from the flipside also explains why inventors might collectively be happy to disclose more than they must do currently, even when they currently have every individual incentive to underdisclose. When disclosure norms and rules are lax—as I argue they currently are—inventors rationally have no reason to ramp up disclosure, thereby retaining as much competitive advantage as possible.[267] By contrast, when inventors are gaining competitive advantage pursuant to invigorated disclosure, they are less likely to fear disclosure because of invigorated disclosure's offsetting benefits.

There is good reason to place the costs of adequate informational disclosure on the patent applicant rather than on the public (or the government), to which a greater portion of it is now relegated. Patent applicants are better placed than any other actor in the patent sphere to know about the inventions they seek to patent[268] and are therefore in the position to disclose the invention to the public at the lowest cost. Even if

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> more of the cost of communication on hearers. Part of the explanation resides in the fact that most people are speakers *and* hearers, and a speaker who consistently imposes costs on hearers will find himself without conversational partners.

Smith, *supra* note 114, at 1137.

265. ROBERT AXELROD, THE EVOLUTION OF COOPERATION 7–10 (1984).

266. *Cf.* Cohen & Levin, *supra* note 41, at 1094 (noting "the simple 'disincentive effect' of spillovers" alongside the "offsetting incentive to invest in 'absorptive capacity' to make use of [spillovers]"); Arijit Mukherjee & Scott Stern, Disclosure or Secrecy?: The Economics of Open Science 16–17 (July 5, 2007), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=998548 (exploring how a scientist's choice between keeping secret and publishing his work depends on other scientists' choices, and concluding that systemic openness leads to greater public welfare). A private scheme of sharing of useful information might be difficult to attain, as ABC Widget Company might be interested in learning only about the patented inventions of XYZ Widget Company, XYZ Widget Company might be interested in learning only about those of QED Widget Company, and QED Widget Company might be interested in learning only about those of ABC Widget Company.

267. *Supra* text accompanying notes 65–66.

268. *See* Long, *supra* note 115, at 496 (arguing that "owners know more about their property" and therefore, it is "eas[ier] for owners to convey information about an intellectual good to others"). That said, the inventor also has a greater interest than any other entity in minimizing this disclosure, which weakens the argument that the inventor is best placed to disclose.

useful disclosure increases costs to patentees, such disclosure should increase overall social welfare because inventors provide the information they already possess and outsiders need not try to learn about the invention on their own.[269] Put another way, if disclosure is deemed to be valuable and the democratization of innovation is important, as I suggest it is in Part II, society should not bear the cost of gathering useful information about patented inventions when patentees are in the best position to provide it.[270]

There is the colorable concern that restructuring patentees' informational obligations and increasing the chances that other technologists will be able to make use of this information will prove too costly to the potential patent applicant, both in terms of filing for a patent and in terms of the ability to extract as much rent as possible from the potential patent. In turn, this concern can deter potential applicants from seeking patent protection in the first place and thus from ever disclosing information about their inventions, which would be useful to society at large.[271] This danger is greatest in industries in which disclosure is already poor, either because information can be retained secretly or because the patent system accepts minimal disclosure.[272] Society might accept this possibility on the ground that there is nothing wrong with deterring some potential patent applicants from seeking patent protection in the name of realigning the implementation of the patent system with its underlying theory of quid pro quo.[273] On this view, applicants who do not want to disclose their invention in any truly useful sense should not be given the valuable broad patent right.[274]

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269. *Id.* at 496, 504–05.

270. Wagner, *supra* note 52, at 218.

271. Similarly, with regard to modifying the willful-infringement rule, patenting might be deterred on the margins because damage awards in patent-infringement suits will be lower if willful infringement is less likely to be found.

272. As an example, the Federal Circuit set a high standard for skill in the art for software patents, under which a patented software invention is sufficiently enabled to a software engineer so long as the mere function of the software is revealed. Dan L. Burk, *Biotechnology in the Federal Circuit: A Clockwork Lemon*, 46 ARIZ. L. REV. 441, 450 (2004) (citing N. Telecom, Inc. v. Datapoint Corp., 908 F.2d 931, 941 (Fed. Cir. 1990)).

273. This would also have the beneficial effect, in the eyes of many, of decreasing the ever-increasing numbers of patents filed and granted. *E.g.*, Shubha Ghosh & Jay Kesan, *What Do Patents Purchase? In Search of Optimal Ignorance in the Patent Office*, 40 HOUS. L. REV. 1219, 1246 (2004) (arguing that the PTO "grants too many patents").

274. One might nonetheless object on the basis that the more patents that are issued—even invalid ones—the better the disclosure function operates due to the increased amounts of revealed information available to stimulate further innovation. While that might hold true for, say, adequately disclosed patents that are unenforceable due to inequitable conduct, *see* Agfa Corp. v. Creo Prods. Inc., 451 F.3d 1366, 1377 (Fed. Cir. 2006) (emphasizing that inequitable conduct is almost always uncovered after a patent's issuance, in which case the public gets the benefit of disclosure even though the patent is unenforceable), patents containing inadequate disclosure will increase the noise-to-signal ratio in the already noisy patent library, making it yet harder to locate useful patents.

To avoid the full brunt of invigorated patent disclosure that may lead to some opting out of any disclosure by passing up either patent protection or invention, there is the more moderate alternative possibility of placing the decision of how much information to disclose, in part, in the hands of the patent applicant. Until now, the patent right has been a fixed one: once an applicant overcomes the patentability barrier, he gets a right to exclude for a specified time in a specified geographic range for a specified invention. Instead, the government might offer a sliding scale of patent rights calibrated in part to the quality of disclosure.[275] That is, to align the theory of quid pro quo with its implementation, the extent of the patent right—temporally, geographically, and so forth—can be linked to the scope of the disclosure offered by the patent applicant to the public.[276] The patent applicant, as he is well-placed to do, would evaluate the costs and benefits of differing degrees of disclosure. An applicant might prefer to disclose very little in exchange for a limited right or to make a substantial disclosure in exchange for maximal patent rights. In this sense, the sliding scale serves as a penalty default rule substantially disfavoring the applicant—the informed party—by inducing him to contract around a diminished patent right by providing the information he would have otherwise withheld.[277] Further, it eliminates the black-and-white choice between maximal disclosure plus patent right and no disclosure plus no patent right.

All in all, even if costs are increased under an invigorated scheme of disclosure, beefing up disclosure should tend to reduce deadweight loss in society by stimulating further and better innovation. Moreover, patentee costs should be reduced on the basis that more and speedier innovation should benefit the patentee: the patentee might license his patents more as a result of increased innovation building on his creation, and further

275. *Cf. In re* Fisher, 427 F.2d 833, 839 (C.C.P.A. 1970) ("[35 U.S.C. § 112] requires that the scope of the claims must bear a reasonable correlation to the scope of enablement provided by the specification to persons of ordinary skill in the art."). Other commentators have proposed doing away with a one-size-fits-all patent right in a different way by suggesting that the patent term should vary based instead on the technology at issue and the economic concerns of the relevant industry. *E.g.*, Jeff Bezos, *Bezos and O'Reilly Spearhead Call for Patent Reform: An Open Letter from Jeff Bezos on the Subject of Patents*, O'REILLY, Mar. 9, 2000, http://www.oreilly.com/news/amazon_patents.html (suggesting that patents for business methods and software, unlike those for pharmaceuticals where there is usually clinical testing, complex physical processes, and the like, should have limited terms).

276. Of course, there is another important reason other than disclosure that patents are granted—namely, to stimulate innovation in the first instance. *Supra* text accompanying notes 33–36. With that notable goal also in play, the extent of the patent right should depend only in part on disclosure.

277. *See* Ian Ayres & Robert Gertner, *Filling Gaps in Incomplete Contracts: An Economic Theory of Default Rules*, 99 YALE L.J. 87, 94–95, 97–100 (1989) (discussing penalty-default rules generally); *cf.* Kesan & Banik, *supra* note 29, at 26–27, 30 (arguing that patent applicants should, in exchange for disclosing relevant prior art, be given the incentive of a strong presumption of patent validity with regard to that art); Wagner, *supra* note 52, at 168–69 (applying the theory of penalty-default rules to the rules of prosecution-history estoppel).

innovation might bring more attention to his industry. Similarly, as each patentee is also a consumer of innovation literature, he benefits from others' better patent disclosures in his own research and development, leading to increased profits for him.

V. CONCLUSION

This Article explores the deserved centrality of the disclosure function in the patent system to promote the flow of information about inventions from patentees to potential future innovators, thereby stimulating increased and speedier follow-up innovation. It then analyzes four systemic aspects of the design and operation of patent law that have caused its assertedly central disclosure function to underperform—the inadequacies of the writer, the index, the reader, and enforcement. Finally, it proposes how to think about repairing these insufficiencies, thereby invigorating the disclosure function.

Beyond the intrinsic worth of invigorating the patent system's disclosure function, invigoration offers a bridge between two opposing camps in scholarship on patent law—those who believe in strong patent rights,[278] and those who instead think that inventions and information about them should be free, or at least more freely available.[279] Nothing precludes—and in fact the quid pro quo of patent law suggests—the coexistence of strong patent rights and the disclosure of innovation information that is useful to society. That is, invigorated disclosure makes information about patented inventions—and thus follow-up innovation—more accessible to the public, though a strong patent right might be in place concomitantly.

Although this Article focuses on disclosure, it is important that there be further work on the tradeoffs between the different variables of the patent system: patent terms, patent scope, patentability, and disclosure. Moreover, future work should assess how actual and optimal disclosure vary by industry and how best to communicate information about innovation to experts. It is my hope that this Article will stimulate debate about the extent to which disclosure ought to be invigorated—something I think should occur in a reasonable measure—instead of the prevailing assumptions about its effectuation. As the patent system is primarily concerned with encouraging the onward march of science and technology, a systemic analysis of all of the patent system's variables is necessary to maximize the stimulation of worthwhile innovation.

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278. *E.g.*, eBay Inc. v. MercExchange, L.L.C., 547 U.S. 388, 395 (2006) (Roberts, C.J., concurring) (noting the historic practice "of granting injunctive relief upon a finding of infringement in the vast majority of patent cases").

279. *E.g.*, Yochai Benkler, *Siren Songs and Amish Children: Autonomy, Information, and Law*, 76 N.Y.U. L. REV. 23, 112–13 (2001) (suggesting that "too complete a reliance on property rights . . . undermines personal autonomy").

APPENDIX

United States Patent [19]
Fox et al.

[11] **Patent Number: 4,833,729**
[45] **Date of Patent: May 30, 1989**

[54] **SHARK PROTECTOR SUIT**

[76] Inventors: **Nelson C. Fox; Rosetta H. V. G. Fox,** both of Ferry Reach, Anchorage View, St. Georges, Bermuda

[21] Appl. No.: **711,280**

[22] Filed: **Mar. 13, 1985**

[51] **Int. Cl.**[4] **A62B 17/00;** A41H 1/02; A41D 1/06

[52] **U.S. Cl.** ..... **2/2.1 R;** 2/2.5; 2/70; 2/79; 2/69

[58] **Field of Search** ..... 2/67, 70, 2.1 R, 2, 2/69, 160, 161, 16, 79, 46, 2.5, 22

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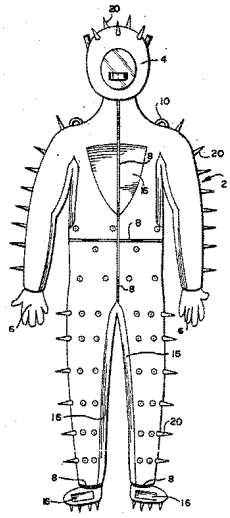
Attorney, Agent, or Firm—Berman, Aisenberg & Platt

[57] **ABSTRACT**

A shark protector suit of the invention is a combined rubber suit and helmet to completely cover the body of the wearer, including a face mask for facial protection, and preferably having at least a partial lining of flotation material, such as foam sheet. The suit and helmet have a plurality of spikes extending outward therefrom to prevent a shark from clamping its jaws over the wearer.

12 Claims, 4 Drawing Sheets



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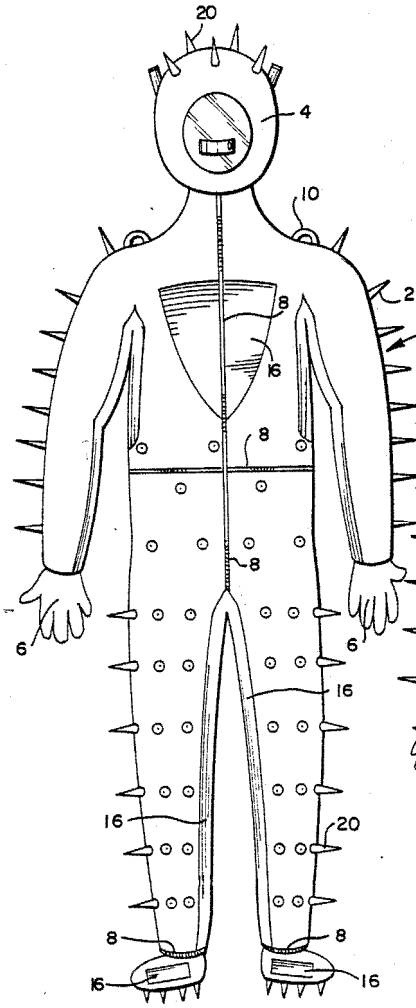
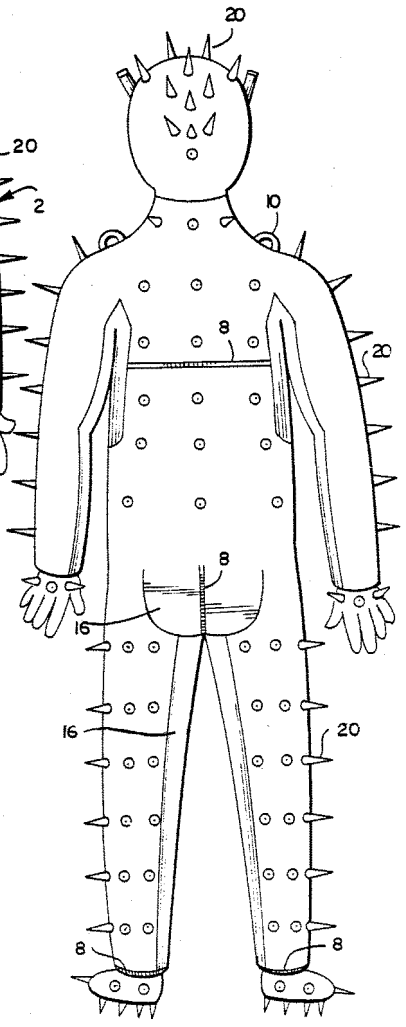


FIG. 1

FIG. 2



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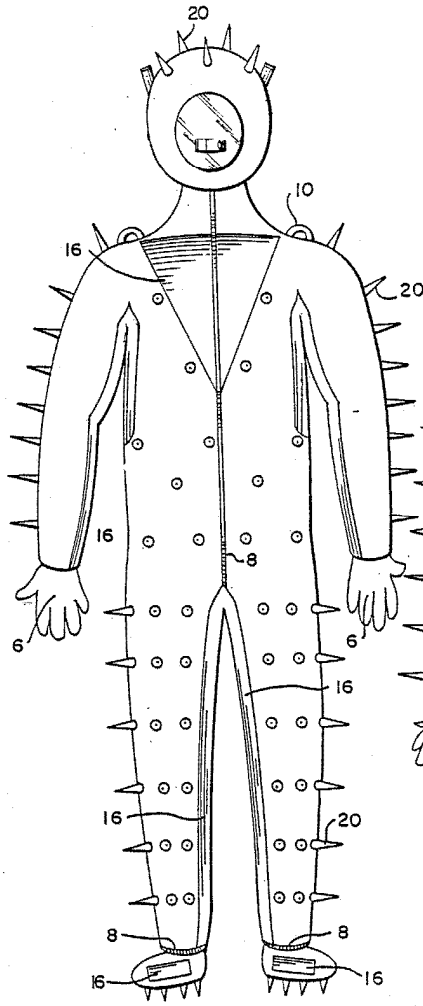
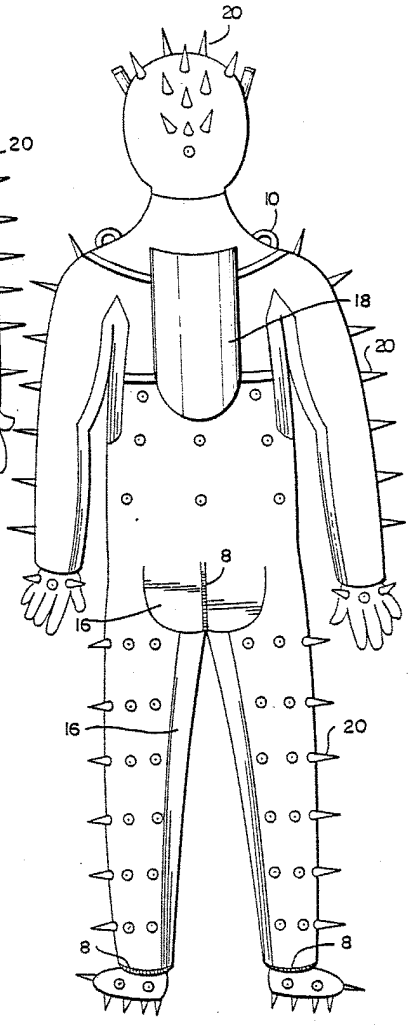


FIG. 3

FIG. 4



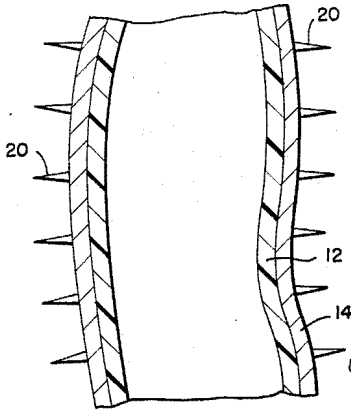


FIG. 5

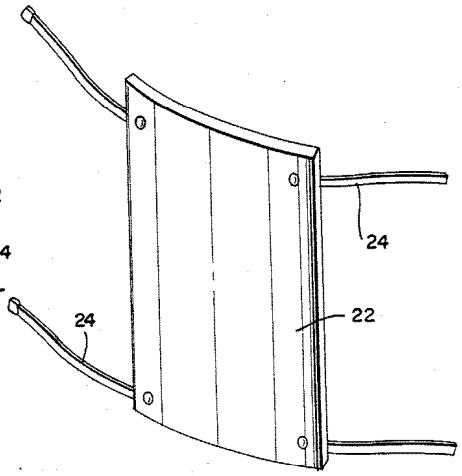


FIG. 6

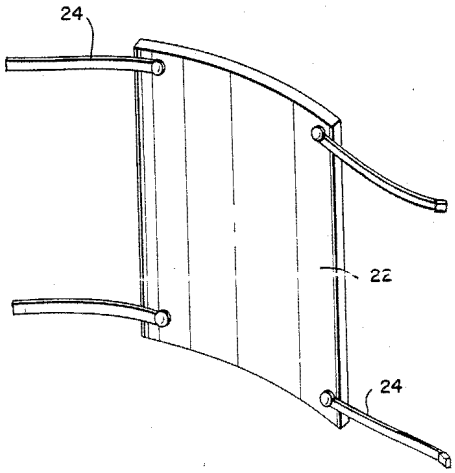


FIG. 7

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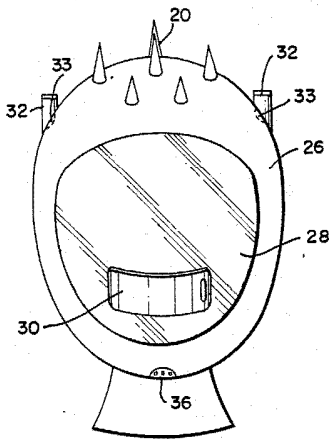

FIG. 8

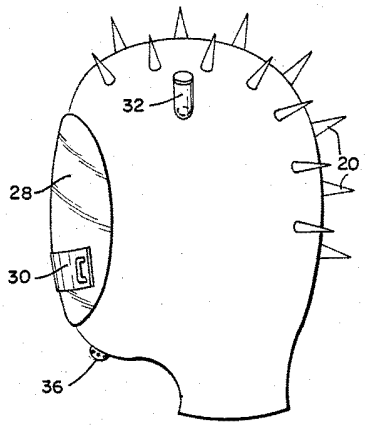

FIG. 9

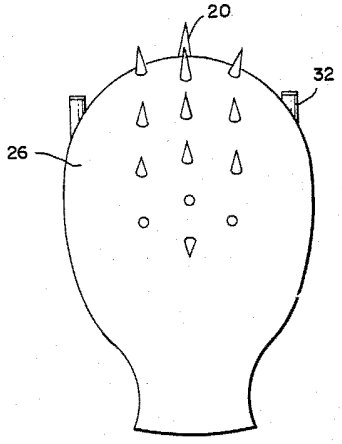

FIG. 11

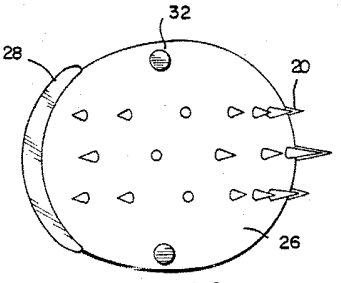

FIG. 10

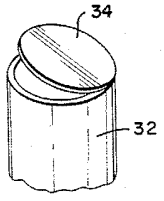

FIG. 12

SHARK PROTECTOR SUIT

FIELD OF THE INVENTION

This invention relates to body protection suits for wearing in shark-infested waters.

BACKGROUND OF THE INVENTION

Known shark protection and underwater suits have not provided sufficient deterrence to sharks, since sharks are able to clamp their mouths around the limb of a person in the water.

SUMMARY OF THE INVENTION

A shark protector suit of the invention is a combined rubber suit and helmet to completely cover the body of the wearer, including a face mask for facial protection, and preferably having at least a partial lining of flotation material, such as foam sheet. The suit and helmet have a plurality of spikes extending outward therefrom to prevent a shark from clamping its jaws over the wearer.

An object of the invention is to provide an effective shark protection suit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevational view of a shark protection suit of the invention.

FIG. **2** is a back elevational view of the suit of FIG. **1**.

FIG. **3** is a front elevational view of another suit of the invention.

FIG. **4** is a back elevational view of the suit of FIG. **3**.

FIG. **5** is a cross-sectional view of the body portion of a suit of FIG. **1** showing the flotation lining of the suit.

FIG. **6** is a schematic outside front view of a spike protection for covering the chest portion of the suit when not in use.

FIG. **7** is a schematic inside view of the spike protector of FIG. **6**.

FIG. **8** is a front elevational view of the helmet portion of the shark protector suit.

FIG. **9** is a side elevational view of the helmet portion of FIG. **8**.

FIG. **10** is a top view of the helmet portion of FIG. **8**.

FIG. **11** is a back elevational view of the helmet portion of FIG. **8**.

FIG. **12** is a perspective view of the top flap of the breathing devices shown in FIGS. **8** to **11**.

DETAILED DESCRIPTION OF THE INVENTION

The shark protection suit of the invention, which includes an attached helmet portion, has the unexpected advantage that a shark is unable to clamp its jaws around any part of the wearer since the multiplicity of spikes extending outwardly from the suit prevent the shark from closing its mouth, should it try to attack a wearer of the suit and helmet of the invention.

With reference to the Figures, in which like numerals represent like parts, FIGS. **1** and **2** show shark protector suit **2** having attached helmet **4**, gloves **6** and shoes **8**. Each of these parts of the suit is preferably made primarily of rubber or rubber-like material. The garment is put on and watertightly secured with zip fasteners **8** or other fasteners known in the art. FIGS. **1** and **2** show a plurality of zip fasteners **8** extending around the waist, at the ankles, from neck to waist, waist to crotch and through the seat of the suit. FIGS. **3** and **4** show an alternative arrangement of zip fasteners. Other means of watertight fastening and arrangement of fasteners will be apparent to one skilled in the art.

Suit **2** of the invention has loops **10** on the shoulders for attaching to a life raft, seaman's pillow (such as is shown in our patent, U.S. Pat. No. 4,666,414), or other flotation device. Optionally, suit **2** may include a layer of foam material **12** under at least a part of the outer layer **14** of the suit, as shown in FIG. **5**.

Metal plates **16** are attached to portions of the suit where additional protection may be needed. Plates **16**, which may alternatively be of other rigid protective material, are positioned, for example, on the front of the chest of the suit, on the inside of the arms, on the sides of the body, on the insides of the legs, in the seat area, and on the gloves and shoes.

Oxygen equipment **18** may be engaged on the back of suit **2** for underwater use.

Spikes **20** extend outward from substantially any portion of the suit, for example, from the helmet, front, back, arm, leg, glove and shoe portions, as shown in FIGS. **1** to **5** and **8** to **11**. FIGS. **6** and **7** show inside and outside views of spike protectors **22** which may be secured by tapes **24** over spikes on the suit, particularly when not in use, for protection.

Helmet portion **26**, shown in FIGS. **8** to **11**, which may include a thin layer of foam flotation material, has visor portion **28** transparently and watertightly covering the face. Portion **30**, covering the mouth, may be opened and closed watertightly, as necessary. Portion **30** is closed against a rubber seal. Tiny drain holes **36** in the chin portion vent excess moisture.

Breathing apparatus having tubular portion **32** has a ball swivel **33** at the base of the tubular portion, for facilitating watertight breathing, as shown schematically in FIG. **8**. FIG. **12** shows rubber flap **34** engaging upper end of breathing apparatus **32** to provide a watertight closure.

While the invention has been described above with respect to certain embodiments thereof, it willl be appreciated that variations and modifications may be made without department from the spirit and scope of the invention.

We claim:

1. A suit for protecting its wearer from attack by sharks comprising:

rubber suit means for substantially completely covering the wearer's body;

closed helmet means including a face mask attached to the suit means for substantially completely covering the wearer's head;

glove means attached to the suit means for substantially completely covering the wearer's hands;

shoe means attached to the suit means for substantially completely covering the wearer's feet;

elongated spike means for repelling sharks extending outwardly from the suit means and helmet means;

and rigid plate means attached to an outer surface of the suit for protecting the wearer.

2. A suit of claim **1** further comprising flotation means for facilitating floating.

3. A suit of claim **2** wherein the flotation means comprises a layer of foamed material lining at least part of the suit means.

4. A suit of claim **1** wherein the helmet means further comprises vent means for facilitating breathing.

5. A suit of claim 1 further comprising fastener means for facilitating putting on and taking off the suit.

6. A suit of claim 1 further comprising attachment means for attaching to auxiliary flotation devices.

7. A suit of claim 1 further comprising tank means for providing oxygen, engaged with the suit.

8. A suit of claim 1 wherein the plate means is attached to a front chest portion of the suit.

9. A suit of claim 1 wherein the plate means is attached to inner side leg portions of the suit.

10. A suit of claim 1 wherein the plate means is attached to outer side body portions of the suit between the underarm and hip of the wearer.

11. A suit of claim 1 wherein the plate means is attached to inner side portions the shoe means.

12. A suit of claim 1 wherein the spike means extends outward from a plurality of the chest, back, leg, glove, shoe and helmet portions of the suit.

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