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Pierson, Peer Review, and Patent Law

Lisa Larrimore Ouellette*

When has a researcher done enough to merit a patent? Should the patent belong to the researcher who first suggests an invention or the one who brings it to fruition? The canonical dispute over a fox in Pierson v. Post is used to illustrate the competing policy considerations in deciding when to award a new property right, including providing efficient incentives, setting forth clear rules to guide future behavior, and respecting natural rights. In patent law, all of these considerations suggest that in practice, many patents are awarded too early, before an applicant has demonstrated that the invention is likely to work. The main problem seems to be not with the substantive standards but with the Patent Office's institutional competence to enforce these standards. A patent is supposed to teach a researcher of "ordinary skill" in the field how to make the invention without "undue experimentation." Yet it often takes extraordinary skill to recognize when this standard is not met based merely on reading a patent application—expertise that the typical patent examiner lacks. To address this information asymmetry, it is worth experimenting with bringing those of extraordinary skill into the patent examination process through a robust peer review system. So far, opportunities for outside input such as the Peer To Patent pilot project have focused on providing examiners with additional prior art, but peer review would be far more valuable for evaluating patent disclosures to assess whether applicants have in fact done enough work to merit a patent or whether it remains too early in the chase.

INTRODUCTION	1826
I. THE PROBLEM OF PROPHETIC PATENT DISCLOSURES	1829
II. THE NEED FOR EXPERT REVIEW OF PATENT DISCLOSURES, AND WHY PRIOR-ART-FOCUSED PEER REVIEW CHANNELS ARE INSUFFICIENT	1836
III. BRINGING THE PERSON OF EXTRAORDINARY SKILL INTO THE PATENT EXAMINATION PROCESS.....	1842
CONCLUSION.....	1847

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INTRODUCTION

A researcher may patent her novel invention once she “possesses” it.¹ Yet the question of what constitutes possession has bedeviled property theorists for centuries, as demonstrated by the enduring resonance of the 1805 property case *Pierson v. Post*.² Should the fox belong to the hunter who begins the chase or the one who makes the kill? Should an invention belong to the researcher who begins work on it or the one who brings it to fruition? Patent law at times provides some reward to both researchers—after all, ideas are more easily divisible than foxes.³ But neither the majority nor the dissent in *Pierson v. Post* thought the fox should be awarded to a casual observer who spots the fox but who has little chance of completing the chase.⁴ And yet in patent law, the current balance seems tipped too far toward such casual early chasers, whether one’s lodestar is efficiency or natural rights. As numerous patent scholars have observed, too many patents seem to be awarded too early to patentees who haven’t done enough to show that the invention works.⁵

Part of the problem is the legal standard for patent disclosures. To the surprise of many scientists, one can receive a patent without doing experiments or building models to confirm that the invention works as expected.⁶ But a patent must at least enable the “person having ordinary skill in the art” to make and use the invention without

1. *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (“[T]he test for sufficiency is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date.”); see also Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 HARV. J.L. & TECH. 545, 550–53 (2012) (summarizing the other disclosure requirements).

2. 3 Cai. 175 (N.Y. Sup. Ct. 1805). For readers with rusty memories of property law, the majority concluded that the fox belonged to Pierson, who killed it, rather than Post, who began the pursuit with his hounds. *Id.* The case has come to stand as a simple illustration of the maxim that “possession is the root of title,” Carol M. Rose, *Possession as the Origin of Property*, 52 U. CHI. L. REV. 73, 75–77 (1985), though the historical context was more complicated than the court’s recitation of facts suggests, see Bethany R. Berger, *It’s Not About the Fox: The Untold History of Pierson v. Post*, 55 DUKE L.J. 1089, 1090 (2006).

3. See generally Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, J. ECON. PERSP., Winter 1991, at 29 (discussing the challenge of rewarding both early- and late-stage innovators).

4. The dissent favored Post, the initial huntsman, over Pierson, the “saucy intruder, who had not shared in the honours or labours of the chase.” *Pierson*, 3 Cai. at 181 (Livingston, J., dissenting).

5. See, e.g., Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65 (2009); Mark A. Lemley, *Ready for Patenting*, 96 B.U. L. REV. 1171 (2016); Sean Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621 (2010).

6. See Ouellette, *supra* note 1, at 553. This rule is “well settled.” *Pfaff v. Wells Elecs., Inc.*, 525 U.S. 55, 61 (1998).

“undue experimentation,”⁷ which would seem sufficient to weed out many armchair inventors. To better align the patent reward with the inventor’s contribution, examiners and courts should do more to enforce this requirement—to make patentees show their work.

Patent disclosures serve two functions, which Professor Dan Burk refers to as the *teaching function* and the *limitation function*.⁸ First, they teach others about the invention—an underappreciated benefit, though incidental to the primary incentive-based justification for granting patents.⁹ Second, and more importantly, making patentees *show* their work ensures that they actually *did* enough work to deserve a patent. Of course, determining what constitutes *enough* is the hard part, and patent rights cannot be limited to only the exact configurations tested by the inventor.¹⁰ But patenting practices seem divorced from the standards for judging technical contributions in many fields, with patents looking more like research proposals than completed scientific papers.¹¹

Both functions are important, but failures in the limitation function likely lead to larger welfare losses. When an applicant presents data showing that an invention works but obfuscates key steps of the method, the public loses out on the teaching function that a clearer protocol would have provided, but the patent is still probably going to the right person.¹² In contrast, when an applicant receives a patent on an uncertain research plan, it not only means that the patent is not serving a useful teaching function—it also limits the patent incentive

7. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988). An invention is defined by a “claim”—a one-sentence summary at the end of the patent that sets the legal limits of the patentee’s right to exclude. One patent often has many claims. The rest of the patent, variously called the “specification,” “written description,” or “disclosure,” must show that the patentee possessed the claimed invention and must teach others how to make and use it. See 35 U.S.C. § 112 (2012).

8. Dan Burk, *Patent Silences*, 69 VAND. L. REV. 1603 (2016).

9. For defenses of the disclosure theory of patents (coupled with skepticism about how well patents serve this function), see Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 539 (2009); and Seymore, *supra* note 5. I have argued that patent disclosures cannot justify the patent system but that they are more useful to scientists than prior scholars have recognized and that the benefit of improving disclosures likely outweighs the cost. Ouellette, *supra* note 1.

10. See Tun-Jen Chiang, *The Levels of Abstraction Problem in Patent Law*, 105 NW. U. L. REV. 1097, 1114 (2011); Jeffrey A. Lefstin, *The Formal Structure of Patent Law and the Limits of Enablement*, 23 BERKELEY TECH. L.J. 1141, 1168 (2008).

11. Cf. Ouellette, *supra* note 1, at 601 (noting this problem and arguing for “[b]ringing patents more in line with scientific norms”).

12. Professor Sean Seymore might disagree. See Sean B. Seymore, *Reinvention*, NOTRE DAME L. REV. (forthcoming), <http://ssrn.com/abstract=2741038> [<https://perma.cc/6MFS-SVXF>]. But I have argued that patent disclosures, while an important benefit, are not a compelling *justification* for patents. Ouellette, *supra* note 1, at 554–61.

for others to solve the problems necessary to obtain the completed invention.¹³

The difficulty in weeding out such patents is that patent examiners are ill equipped to determine when an application really is just a research plan for which “undue experimentation” is still required. Patent examiners rarely have much experience in the fields they examine: fewer than four percent have a Ph.D.,¹⁴ and high attrition rates mean that most examiners have been working at the U.S. Patent & Trademark Office (“USPTO”) for less than four years.¹⁵ And even when examiners have *ordinary* skill in the art, this may not be enough. Patents must enable the hypothetical person of ordinary skill to recreate the invention, but it often takes *extraordinary* skill to recognize when a disclosure is insufficient based merely on reading it.

In this Article, I argue that to address this problem, it is necessary to bring insights from persons of extraordinary skill into the USPTO. Part I describes how policing the problem of early patents requires such expertise. I argue that all of the competing considerations in deciding *when* to award a property right—familiar to first-year law students from discussions of *Pierson v. Post*—point toward awarding patents later than is often done in practice through more stringent enforcement of the disclosure requirements. But such enforcement is difficult without greater technical expertise.

Part II discusses the potential value of bringing outside expertise into the patent examination process and explains why mechanisms focused on identifying relevant prior art are likely insufficient.¹⁶ The USPTO has experimented with a small-scale “Peer To Patent” program to allow crowdsourcing of prior art,¹⁷ and third parties are also allowed to submit relevant prior art through the

13. To be sure, others may still work on the project if they think the early patent can be invalidated or if they think their improvement patent (their portion of the fox pelt) will have sufficient value. For example, the University of Rochester’s later-invalidated patents on cox-2 inhibitors did not deter pharmaceutical companies from developing and commercializing drugs in this class. See *Univ. of Rochester v. G.D. Searle & Co.*, 358 F.3d 916, 919 (Fed. Cir. 2004). But unnecessary early patents still reduce the potential reward for follow-on innovators.

14. See Ronald J. Mann, *The Idiosyncrasy of Patent Examiners: Effects of Experience and Attrition*, 92 TEX. L. REV. 2149, 2163 fig.2 (2014).

15. See Mark A. Lemley & Bhaven Sampat, *Examiner Characteristics and Patent Office Outcomes*, 94 REV. ECON. & STAT. 817, 820 (2012) (reporting that of the 2,797 examiners who worked on patents filed in January 2001, thirty-five percent had one year or less of experience and twenty-eight percent had two to four years of experience).

16. Prior art includes all information, including printed documents and actual uses, that is considered “prior” to the application and that is therefore relevant to assessing whether the claimed invention is novel and nonobvious. See 35 U.S.C. §§ 102–103 (2012).

17. See *infra* notes 72–82 and accompanying text.

preissuance submissions process.¹⁸ But these mechanisms do not allow experts to discuss enablement problems. As I have argued previously, peer review would be far more useful for evaluating disclosure than for locating prior art.¹⁹

Finally, Part III discusses the feasibility of experimenting with a more robust patent peer review system that allows experts to opine on whether undue experimentation is still required to practice an invention. Persons of extraordinary skill likely would be helpful not only for identifying failures in the limitation function of patent disclosures but also for spotting other problems with disclosures and with other criteria for patentability.²⁰ But the most compelling case for attempting to bring this technical expertise into the patent examination process is to make it easier to assess whether applicants have in fact done enough work to merit a patent or whether it remains too early in the chase.

I. THE PROBLEM OF PROPHEPIC PATENT DISCLOSURES

To help make the problems with patent disclosures more concrete, consider the tunable carbon nanotube resonator. (The scientific details are unimportant for this story, but this device is like a tiny guitar string that is hooked up to an electrical circuit that can change the string's vibration frequency.)²¹ When I was in physics graduate school at Cornell, one of my labmates, Vera Sazonova, created the first tunable carbon nanotube resonator with some others in our lab, and they published the result in *Nature* (one of the most prestigious scientific journals) in 2004.²² They did not seek a patent. But others did, including a Caltech group that filed an application claiming a tunable nanotube resonator three years earlier, in 2001—after Sazonova had begun work on her Ph.D. project.²³ The Caltech patent shows no data from a nanotube resonator, and its examples are described in the

18. See 35 U.S.C. § 122(e) (2012); *infra* notes 83–87 and accompanying text.

19. Ouellette, *supra* note 1, at 591.

20. See 35 U.S.C. §§ 101–103, 112 (2012).

21. For an overview, see H.B. Meerwaldt et al., *Carbon Nanotubes: Nonlinear High-Q Resonators with Strong Coupling to Single-Electron Tunneling*, in *FLUCTUATING NONLINEAR OSCILLATORS: FROM NANOMECHANICS TO QUANTUM SUPERCONDUCTING CIRCUITS* 312, 314–17 (Mark Dykman ed., 2012).

22. Vera Sazonova et al., *A Tunable Carbon Nanotube Electromechanical Oscillator*, 431 *NATURE* 284, 284 (2004); see also Vera A. Sazonova, *A Tunable Carbon Nanotube Resonator* (Aug. 2006) (unpublished Ph.D. dissertation, Cornell University), http://ecommons.cornell.edu/bitstream/handle/1813/3205/PhDThesis_Sazonova.pdf [<https://perma.cc/6TH3-T2W2>].

23. See U.S. Patent No. 6,803,840 (filed Apr. 1, 2002) (claiming priority to provisional applications filed on Mar. 30, 2001).

present tense—an indication that they are what is known as “prophetic examples” written to support a “constructive reduction to practice” rather than actual results from a working device.²⁴

For an earlier project on patent disclosures, I gave this Caltech patent to Sazonova for review.²⁵ She said it described devices “very similar” to her own and would have been “a good place to start” for understanding the problem and useful “to know that we were not alone [in] thinking of building a [nanotube] resonator that way.”²⁶ But she quickly concluded that the patent “is not giving any solutions to any problems we have encountered along the way.”²⁷ In other words, it was no different from what she or others in the field could have written then—it did not solve the hard problems that had to be overcome for the device to actually work, so it seemed more like a grant application than a technical contribution. She was quite surprised to learn that one can patent “something that *CAN* be envisioned, given all the technologies of the day (kind of a Gedankenexperiment)” rather than only “a particular invention that has been implemented and shown to work.”²⁸

This anecdote helps illustrate two related problems with the patent system: (1) the lack of clarity on when one can patent a given invention; and (2) the frequent award of patents earlier than is socially optimal. The remainder of this Part discusses these problems in turn.

First, in the progression from a nascent research plan for creating an invention to something that actually works, when can one receive a patent?²⁹ Researchers such as Sazonova who are supposed to

24. See *id.* As noted above, a constructive reduction to practice is legally sufficient if the patent enables one of skill in the art to make and use the invention without undue experimentation. See *supra* note 9 and accompanying text. And prophetic examples are allowed, though they must be drafted in the present tense; writing a prophetic example in the past tense can lead to a patent being held unenforceable for inequitable conduct. See *Novo Nordisk Pharm., Inc. v. Bio-Tech. Gen. Corp.*, 424 F.3d 1347, 1361 (Fed. Cir. 2005).

25. Ouellette, *supra* note 1, at 581.

26. *Id.*

27. *Id.* at 581 n.158:

In particular, she said that the patent proposes “to use charge injection to modulate the length,” but “that effect will be much smaller than the electrostatic attraction that would be present anyway, something that [the patentees] didn't anticipate.” The patent also does not consider: (1) how to prevent “capacitive coupling between electrodes 18 and 28,” (2) how to separate “tension induced with the charge injection” from “tension due to the attractive force between the resonating member and the electrode 28,” (3) how “the RF signal [will] be read out of a high-impedance resonating member[] without [an] integrated amplifier,” or (4) “[w]hat kind of contact resistances are produced with this fabrication method . . . and how will they affect the charge injection.”

28. *Id.* at 581.

29. This transition is of course not the only timing issue in patent law. An invention that works in a research laboratory may be quite far from a commercial product, or its commercial applications may be as-yet unknown.

be one of the audiences for patent laws do not understand what the rules are, in large part because the rules themselves are unclear. As a formal matter, of course, the rules on the timing of patentability are simple enough to state. Under the enablement and written description requirements of § 112 of the Patent Act, you cannot get a patent if the person of ordinary skill still must undertake “undue experimentation”³⁰ or if you cannot demonstrate “possession of the claimed subject matter as of the filing date.”³¹ These requirements are “closely related” to the utility requirement of § 101, which prevents the patenting of “mere ideas” or “a mere research proposal.”³² Relatedly, the patentable-subject-matter requirement of § 101 prevents patents on an “abstract idea” rather than a more specific “application.”³³

But trying to apply these doctrines to a specific question—such as when a tunable carbon nanotube resonator may be patented—is challenging. Professor Dmitry Karshedt has called application of the various patent timing doctrines “tentative and unsystematic” and has argued for a more unified statutory “completeness” requirement.³⁴ In a number of cases, the Court of Appeals for the Federal Circuit has held research plans and proposals to be sufficiently enabled to be patentable on their own or to anticipate a patent on later results.³⁵ Yet there are many other cases that have disallowed such claims.³⁶

Determining whether a disclosure requires an “undue” level of experimentation “is not a single, simple factual determination but

30. *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988).

31. *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc). For an empirical study of how these requirements have been adjudicated in cases involving different technologies from 1982–2012, see John R. Allison & Lisa Larrimore Ouellette, *How Courts Adjudicate Patent Definiteness and Disclosure*, 65 DUKE L.J. 609 (2016).

32. *Janssen Pharmaceutica N.V. v. Teva Pharm. USA, Inc.* (*In re* '318 Patent Infringement Litig.), 583 F.3d 1317, 1323–24 (Fed. Cir. 2009). A patentee must identify some “specific and substantial utility” for a claimed invention. *In re Fisher*, 421 F.3d 1365, 1372 (Fed. Cir. 2005). For a discussion of how utility doctrine could act as a stronger timing policy lever, see Michael Risch, *Reinventing Usefulness*, 2010 BYU L. REV. 1195, 1211–16.

33. *Alice Corp. Pty. v. CLS Bank Int'l*, 134 S. Ct. 2347, 2355 (2014).

34. Dmitry Karshedt, *The Completeness Requirement in Patent Law*, 56 B.C. L. REV. 949, 991–92 (2015). Professor Karshedt was focused primarily, however, on the transition from foundational building-block inventions to specific downstream applications, rather than on the transition from research plan to working examples. *Cf. supra* note 29 (noting this distinction).

35. See, e.g., *Allergan, Inc. v. Sandoz Inc.*, 796 F.3d 1293, 1310 (Fed. Cir. 2015); *In re Montgomery*, 677 F.3d 1375, 1382 (Fed. Cir. 2012); *Eli Lilly & Co. v. Actavis Elizabeth LLC*, 435 F. App'x 917, 923–26 (Fed. Cir. 2011).

36. See, e.g., *AbbVie Deutschland GmbH & Co. v. Janssen Biotech, Inc.*, 759 F.3d 1285, 1301 (Fed. Cir. 2014); *Novozymes A/S v. DuPont Nutrition Biosciences APS*, 723 F.3d 1336, 1350 (Fed. Cir. 2013); *Billups-Rothenberg, Inc. v. Associated Reg'l & Univ. Pathologists, Inc.*, 642 F.3d 1031, 1037 (Fed. Cir. 2011); *Univ. of Rochester v. G.D. Searle & Co.*, 358 F.3d 916, 929 (Fed. Cir. 2004); *Fiers v. Revel*, 984 F.2d 1164, 1171 (Fed. Cir. 1993).

rather is a conclusion reached by weighing many factual considerations,” including the eight *Wands* factors—such as “the quantity of experimentation necessary” and “the nature of the invention”—though even these are merely “illustrative, not mandatory.”³⁷ The leading patent treatise, *Chisum on Patents*, does not attempt to provide any guidelines for applying these factors; it merely notes that cases “finding that the amount of experimentation required by a given specification was reasonable or not undue . . . are legion” and that “cases finding that the amount of experimentation required by a given specification was unreasonable in terms of either quantity or quality are also numerous,” with long lists of both.³⁸ The USPTO’s guidelines for patent examiners are no more helpful.³⁹

The level of experimentation needed to go from the Caltech disclosure of a carbon nanotube resonator to the device disclosed in Sazonova’s *Nature* paper certainly seems undue: it required over three years of laboratory work by a group in one of the top carbon nanotube laboratories in the world—that is, a group with far more than an ordinary level of skill in the art. But there is no statute or case law under which this becomes a straightforward conclusion, which is a problem for a system that is intended to provide efficient incentives and guide investment decisions.

The second problem illustrated by the carbon nanotube resonator story is that in practice, patents often are awarded too early. I am far from the first patent scholar to note this problem. Professor Chris Cotropia and Professor Sean Seymore have argued that actual reduction to practice should be required, at least for complex inventions.⁴⁰ Professor Martin Adelman has also criticized the allowance of patents based on “speculative disclosures.”⁴¹ Professor Mark Lemley recently argued that “requiring actual reduction to

37. *Streck, Inc. v. Research & Diagnostic Sys., Inc.*, 665 F.3d 1269, 1288 (Fed. Cir. 2012) (quoting *ALZA Corp. v. Andrx Pharm., LLC*, 603 F.3d 935, 940 (Fed. Cir. 2010); *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988); *Amgen, Inc. v. Chugai Pharm. Co.*, 927 F.2d 1200, 1213 (Fed. Cir. 1991)).

38. 3 DONALD S. CHISUM, *CHISUM ON PATENTS* § 7.03(4)(a)–(b) (2016).

39. See U.S. PATENT & TRADEMARK OFFICE, *MANUAL OF PATENT EXAMINING PROCEDURE* § 2164 (rev. 9th ed. 2015), <http://www.uspto.gov/web/offices/pac/mpep/s2164.html> [<https://perma.cc/SN34-EXUE>] [hereinafter MPEP]. The only examiner training materials on enablement focus on the separate issue of functional claiming. See *Examination Guidance and Training Materials*, U.S. PAT. & TRADEMARK OFF., <http://www.uspto.gov/patent/laws-and-regulations/examination-policy/examination-guidance-and-training-materials> [<https://perma.cc/N28E-TPJT>].

40. Cotropia, *supra* note 5, at 119–28; Seymore, *supra* note 5, at 641.

41. Martin J. Adelman, *Credible Utility in Patent Law*, in CHITEKI ZAISANHÔ NO ATARASHII NAGARE: KATAYAMA EIJI SENSEI KANREKI KINEN RONBUNSHU [NEW TRENDS IN INTELLECTUAL PROPERTY: CELEBRATORY VOLUME IN HONOR OF PROF. EIJI KATAYAMA] 633 (Seirin Shoin 2010), <http://ssrn.com/abstract=2245615> [<https://perma.cc/66WY-3WEB>].

practice probably goes too far,” but he thinks it is problematic that patent law currently “reward[s] those who run to the patent office before they are fully done with the invention and giv[es] them precedence over those who take the time to make sure their invention works by building and testing it.”⁴² Perhaps one doctrinal tool to accomplish this goal of limiting (without completely eliminating) patents based on constructive reduction to practice is, as John Duffy suggests, revival of the “paper patent doctrine,” which declined in the late twentieth century.⁴³ But even without formal doctrinal change, simply enforcing the current enablement requirement would go a long way toward limiting the problems of prophetic patents.

Why are early patents so problematic? As noted above, this question of when to award a patent is at root the same problem that first-year law students struggle with when discussing the famous dispute over the fox in *Pierson v. Post*.⁴⁴ Both foxes and inventions raise the same basic quandary: If the reward goes only to the hunter who begins the chase, there is less incentive for someone else who is better positioned to make the kill. But if the reward goes only to the one who makes the kill, then others might not begin the chase. If the idea can be divided in two, it may be possible to give them both some reward, but that will mean that in some cases the reward is too small to efficiently incentivize one of them,⁴⁵ and it will increase the transaction costs of developing a product that requires rights from both innovators.⁴⁶ It also may not legally be possible to reward both inventors; for example, had

42. Lemley, *supra* note 5, at 1172, 1186–87.

43. John F. Duffy, *Reviving the Paper Patent Doctrine*, 98 CORNELL L. REV. 1359 (2013). Alternatively, Professor Dmitry Karshtedt thinks “the enablement requirement of patent law can become more closely aligned with the norms of the research community” by requiring narrower claims for certain prophetic patents. Dmitry Karshtedt, *Limits on Hard-to-Reproduce Inventions: Process Elements and Biotechnology’s Compliance with the Enablement Requirement*, 3 HASTINGS SCI. & TECH. L.J. 109, 114–15 (2011). But I am most concerned about patentees who have not enabled *anything* related to their claims and who thus do not seem to deserve a patent at all.

44. Professor Tim Holbrook has discussed this analogy in the context of patent law’s written description requirement. See Timothy R. Holbrook, *Equivalency and Patent Law’s Possession Paradox*, 23 HARV. J.L. & TECH. 1, 2, 15 (2009); Timothy R. Holbrook, *Patent Anticipation and Obviousness as Possession*, 65 EMORY L.J. 987, 997 (2016).

45. Professor Suzanne Scotchmer wrote that for “fully efficient incentives,” each innovator “must earn the entire social surplus of his innovation.” Scotchmer, *supra* note 3, at 34. While this is not true in general, see Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents—Prizes Debate*, 92 TEX. L. REV. 303, 359 n.252 (2013), her broader point still stands: providing sufficient incentives to both early- and late-stage innovators may be challenging.

46. See Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698, 700 (1998) (suggesting that too many patents on early-stage inventions may hinder later-stage developments due to these transaction costs). *But see* Jonathan Barnett, *The Anti-Commons Revisited*, 29 HARV. J.L. & TECH. 127, 141 (2015) (arguing that there is little evidence of such anti-commons effects in practice).

Sazonova attempted to file a patent version of her *Nature* paper, it likely would have been rejected in light of the Caltech patent, which—as a granted patent—is presumed to be enabled.⁴⁷

In first-year property law classes, *Pierson v. Post* is generally used to illustrate the competing policy considerations in deciding when to award a property right. These considerations include: (1) providing efficient economic *incentives* to encourage socially valuable behaviors (such as killing foxes); (2) providing a reward for those who seem to *deserve* it based on the effort expended in the hunt; and (3) increasing efficiency by providing a *clear rule* that fox hunters can understand.⁴⁸ In the patent context, all three of these considerations point toward awarding patents later that is often done in practice now—once people are closer to having an invention that actually works.

The tunable nanotube resonator again helps to illustrate this point. Consider the inventive process as broken into only two steps, where step one is coming up with a new idea (as represented by the Caltech patent) and step two is figuring out how to make the idea work (as represented by Sazonova's *Nature* paper).⁴⁹ If coming up with the initial idea is easy, and making it work is hard, then the reward should clearly go to the innovator who does the work at step two. If coming up with the initial idea at step one is hard, and making it work is easy, then it should not be too onerous to require the idea person to explain the details of making it work—but even if they are awarded the patent directly, there is little risk of insufficiently rewarding step two. If both steps are easy, of course, then no patent is needed at all.

The difficult cases are thus those where both steps are hard. And to be clear, by “hard” I am not necessarily referring to *laborious* work—I am referring to steps that will not get taken but for the inducement of a patent (or equivalent reward).⁵⁰ If both the step-one and the step-two researchers must do significant work that they will not undertake

47. See *Amgen Inc. v. Hoechst Marion Roussel, Inc.*, 314 F.3d 1313, 1355 (Fed. Cir. 2003); see also Seymore, *supra* note 12 (explaining why this presumption is problematic).

48. See, e.g., THOMAS W. MERRILL & HENRY E. SMITH, *PROPERTY: PRINCIPLES AND POLICIES* 87–90 (2d ed. 2012); BARTON H. THOMPSON, JR. & PAUL GOLDSTEIN, *PROPERTY LAW: OWNERSHIP, USE AND CONSERVATION* 208–09 (2d ed. 2014).

49. Note that the trajectory I am focusing on is *not* the one from basic research to commercial application; Sazonova's working resonator was still basic research that was far from a commercial product. Rather, this discussion applies to the trajectory from an idea (which could be basic or applied) to something that actually works.

50. Cf. Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 *YALE L.J.* 1590, 1595 (2011) (arguing that the patentability standard should focus on identifying “those inventions which would not be disclosed or devised but for the inducement of a patent” (quoting *Graham v. John Deer Co.*, 383 U.S. 1, 11 (1966))); Tun-Jen Chiang, *A Cost-Benefit Approach to Patent Obviousness*, 82 *ST. JOHN'S L. REV.* 39, 104–05 (2008) (advocating a similar approach to nonobviousness).

without a reward, which should receive the patent on the resulting completed invention (here, the nanotube resonator)? They both need some incentive, and they both seem to deserve a reward from a moral rights perspective.⁵¹

Granting the patent to the step-two innovator has some plain advantages. Most obviously, the patent system is best tailored as a reward for steps that are closer to a marketable product, because the patent system's rewards are tied to the market success of a product.⁵² Thus, the patent provides a less uncertain reward with a smaller time lag for the later innovator. And perhaps just as importantly, rewarding the person who actually reduces an idea to practice tends to be a *clearer* rule than figuring out whether a given description of a nanotube resonator is actually sufficient before anyone has ever made one.⁵³ This rule may also map better to the way researchers like Sazonova think the patent system actually works.⁵⁴

But what about the researcher in step one, who by assumption *also* has to do some hard work and will not do it without some reward? In such cases, it is important to remember that the patent system is not the only mechanism for transferring rewards to innovators. As I have emphasized in prior work with Professor Daniel Hemel, the United States already spends over \$100 billion per year in direct federal spending on R&D and over \$10 billion more on general R&D-specific tax incentives.⁵⁵ Policymakers thus have many options for rewarding early-stage research in cases when the patent system is insufficient.

51. Proponents of commercialization theory would likely argue that the patent should be awarded even *before* step one and that having the patent will then provide the incentive to conduct the research at steps one and two. See generally Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 341 (2010) (proposing “a new ‘commercialization’ patent, granted in exchange for the commitment to make and sell a substantially novel product”). Those concerned with the inefficiencies of patent racing might also prefer for patents to be awarded as early as possible. See generally Michael Abramowicz, *The Uneasy Case for Patent Races over Auctions*, 60 STAN. L. REV. 803 (2007) (reviewing the racing literature). I am assuming here, however, that the primary role of a patent is to provide an incentive for innovation. See Hemel & Ouellette, *supra* note 45, at 359–61 (examining the relationship between these different theories).

52. See generally Hemel & Ouellette, *supra* note 45, at 327 (describing how the patent reward is “market set”).

53. Cf. *Pierson v. Post*, 3 Cai. 175 (N.Y. Sup. Ct. 1805), finding for the man who killed the fox “for the sake of certainty”:

If the first seeing, starting, or pursuing such animals, without having so wounded, circumvented or ensnared them, so as to deprive them of their natural liberty, and subject them to the control of their pursuer, should afford the basis of actions against others for intercepting and killing them, it would prove a fertile source of quarrels and litigation.

54. See *supra* note 28 and accompanying text.

55. Hemel & Ouellette, *supra* note 45, at 321–25.

In sum, patenting practices often seem divorced from the standards for judging technical contributions in many fields, with many patents looking more like research proposals than completed scientific papers. The fundamental problem seems to be the information asymmetry at the USPTO: patent examiners do not have the expertise necessary to spot problems with patent disclosures. Part II explores this concern.

II. THE NEED FOR EXPERT REVIEW OF PATENT DISCLOSURES, AND WHY PRIOR-ART-FOCUSED PEER REVIEW CHANNELS ARE INSUFFICIENT

As discussed in Part I, speculative patents such as the Caltech nanotube resonator patent seem both problematic from a policy perspective and dubious from a legal perspective. This leads to a third general problem with patent disclosures: patent examiners often do not have the scientific expertise necessary to spot these kinds of disclosure problems. And while patents are supposed to enable researchers of ordinary skill in the art to recreate the invention without undue experimentation, it typically takes extraordinary skill in the art to spot enablement problems based merely on reading a patent document.

As one of the leading experts on nanotube resonators who had struggled with making one actually work, Sazonova could quickly point to the gaps in the disclosure of the Caltech patent. These problems were not obvious to me, even though I earned a Ph.D. for related experimental work with carbon nanotubes and would thus almost certainly represent the perspective of a person of at least ordinary skill in the art. Unless one has extraordinary skill in the art, it is far easier to figure out whether the claim elements are present in prior art references than to figure out whether undue experimentation is still required. And as noted above, most examiners lack extraordinary skill: fewer than four percent of patent examiners even have a Ph.D., and most leave the USPTO before acquiring even four years of examination experience.⁵⁶

For readers without laboratory experience, a hypothetical from the kitchen might help. Suppose you are given a recipe for a cronut—the famed croissant/donut hybrid that continues to create multi-hour lines at Dominique Ansel’s NYC bakery, which has sparked numerous copycats and debates over IP in recipes.⁵⁷ (Ansel’s website emphasizes

56. See *supra* notes 14–15 and accompanying text.

57. See Megan McArdle, *Go Ahead, Make Your Own Cronut*, BLOOMBERGVIEW (Apr. 22, 2016), <https://www.bloomberg.com/view/articles/2016-04-22/go-ahead-make-your-own-cronut> [<https://perma.cc/2H5Q-UNTU>].

its registered trademark, “Cronut®,”⁵⁸ though there is a good argument that the term is generic.⁵⁹) Ansel has in fact published an “at home” cronut recipe,⁶⁰ which takes three days but contains no great surprises for experienced chefs.⁶¹ Ansel’s recipe likely enables someone of ordinary pastry skills to create a cronut, provided they have sufficient patience (and butter). But suppose the recipe you are given omits the directions to refrigerate the dough between rolling and folding it to create another butter layer. If you are a chef of ordinary skill—one who has never gone through the effort of making homemade croissants or puff pastry dough—the problem would not be revealed unless you actually try to reproduce the invention. But if you are a pastry chef of extraordinary skill, even if you have never made a cronut, it would be immediately apparent that the recipe would fail: allowing the butter to soften will cause it to run into the dough rather than producing flaky croissant layers, and without refrigeration the dough will be too elastic to roll.⁶²

In sum, it typically takes more expertise to understand, simply by *reading* a recipe, whether the recipe will work than to follow a recipe in the first place. Thus, even if a patent examiner is a person of ordinary skill for some of the patents they examine, they will still lack the extraordinary skill needed to know whether the person of ordinary skill would be able to make and use the invention without undue experimentation.

It is difficult to determine how pervasive the problem of inadequate disclosures is, but there is no reason to believe that the Caltech patent is a unique example.⁶³ When I surveyed nanotechnology

58. *Cronut® 101*, DOMINIQUE ANSEL BAKERY, <http://dominiqueansel.com/cronut-101> [<https://perma.cc/TP2F-U7DU>].

59. *Cf.* Chris Morran, *Bakery that Never Used the Word “Cronut” Told To Stop Using the Word “Cronut.”* CONSUMERIST (Oct. 24, 2014), <https://consumerist.com/2014/10/24/bakery-that-never-used-the-word-cronut-told-to-stop-using-the-word-cronut> [<https://perma.cc/JK4J-US6Q>] (quoting a bakery owner who received a cease-and-desist letter from Donique Ansel as saying that “everybody refers to them as cronuts and we can’t be responsible for what customers choose to call it”).

60. *Dominique Ansel’s At-Home Cronut: The Pastry That Changed the World*, ABC NEWS (Oct. 6, 2014), <http://abcnews.go.com/GMA/recipe/home-cronut-recipe-dominique-ansel-25948902> [<https://perma.cc/8Q4N-GG7E>].

61. *See* Katy Salter, *Revealed: The Official Cronut Recipe (and Why You Will Never Make One)*, GUARDIAN (Oct. 7, 2014), <http://www.theguardian.com/lifeandstyle/shortcuts/2014/oct/07/official-cronut-recipe-dominique-ansel-three-days> [<https://perma.cc/EK63-B6L9>] (“[T]he most surprising thing about Ansel’s ‘secret’ recipe is that it contains no great secrets.”).

62. *See* JACQUES PÉPIN, JACQUES PÉPIN’S COMPLETE TECHNIQUES 570, 711 (2001) (discussing the effects of heat and humidity on puff pastry).

63. Janet Freilich is working on an empirical study to algorithmically quantify prophetic examples in patents. Janet Freilich, *Prophetic Patents* (unpublished manuscript) (on file with author).

researchers about their experience reading patents, only thirty-eight percent of patent-reading respondents thought the patents they read were reproducible.⁶⁴ For example, an industrial chemist thought that “it was not clear if the inventors ever actually made the invention and saw that it worked as claimed,” and an academic studying nanomechanics complained about “lazy people [who] sit in their office and say ‘we should do this’” and then patent it without “complet[ing] these projects.”⁶⁵ In a more recent survey of researchers across a broader range of sectors and fields, when I asked patent readers if they thought they could recreate the most recent patent they had read in their field, forty-one percent said definitely or probably yes, thirty-four percent said maybe, and twenty-five percent said definitely or probably not.⁶⁶ The more skeptical readers had complaints about patents on “just ideas [that were] not experimentally proven,” a “level of detail, or lack thereof, [that] would not be acceptable in any reputable peer-reviewed publication in the same field,” or even a patent that “was claiming something was possible that is not technically possible.”⁶⁷

It is possible that patent disclosures could be improved from a social welfare perspective by finding ways to bring these expert voices—those who do have extraordinary skill in the art—into the patent examination process. One promising way to do this is through some form of external peer review.⁶⁸ Patent scholars such as Professor Jeanne Fromer and I have previously advocated for peer review by outside experts during patent examination.⁶⁹ These proposals are modeled on the ubiquitous use of expert peer review for evaluation of scientific journal articles and applications for grants from federal science

64. Ouellette, *supra* note 1, at 576.

65. *Id.* at 578.

66. The survey methodology is described in detail in a separate manuscript, which will be published along with the full dataset. Lisa Larrimore Ouellette, *Who Reads Patents?* (Sept. 8, 2016) (unpublished manuscript) (on file with author).

67. For additional comments, see *id.*

68. Alternatively, one could try to increase expertise *within* the USPTO, such as by increasing salaries and training to attract and retain top scientific talent. Such a dramatic restructuring of personnel management seems less feasible, however, than the more mild intervention proposed here. See generally Daniel E. Ho, *Does Peer Review Work? An Experiment of Experimentalism*, 69 STAN. L. REV. (forthcoming 2017) (manuscript at section VII.C), <http://ssrn.com/abstract=2785927> [<https://perma.cc/3YVC-C9RF>] (reviewing these more conventional internal means of improving quality within the administrative state and suggesting that “while it may not be the most direct way to promote accurate decision making, peer review might, as a political economy matter, be the most feasible”).

69. Fromer, *supra* note 9, at 591–92; Ouellette, *supra* note 1, at 591–92; see also Lisa Larrimore Ouellette, *Patent Experimentalism*, 101 VA. L. REV. 65, 108–09 (2015) [hereinafter Ouellette, *Patent Experimentalism*] (proposing peer review of examiners *by each other*, which is different from peer review focused on gathering outside knowledge).

agencies,⁷⁰ and a number of scholars have suggested that broader use of peer review could have benefits throughout the administrative state.⁷¹

But this does not mean that there have been no opportunities for third-party experts to provide input on pending patent applications. The USPTO has experimented with a version of crowdsourced prior art gathering through the Peer To Patent pilot program orchestrated by Professor Beth Noveck,⁷² and third parties may also submit relevant prior art through the preissuance submissions procedure.⁷³ This Part briefly reviews these programs and explains why they are insufficient for improving patent disclosures.

The Peer To Patent pilot was an opt-in program in which patent applicants could volunteer to have their applications listed on the Peer To Patent website for crowdsourcing of the most relevant prior art references, up to ten of which would be forwarded to the examiner for review.⁷⁴ The initial pilot program, which ran from July 2007 to June 2009, attracted 226 applications and an average of 2.66 prior art references per application.⁷⁵ For thirty-eight of the 226 applications, examiners cited prior art identified through Peer To Patent as a basis for rejection in some office action.⁷⁶ A second pilot began in October 2010 and accepted applications until September 2011,⁷⁷ but no results have been reported from this period.

The first Peer To Patent pilot did not hit its limit of four hundred participating applications, raising questions about the viability of an

70. For an overview of the peer review processes at *Nature* magazine, the National Science Foundation, and the National Institutes of Health, see *Getting Published in Nature: The Editorial Process*, NATURE, http://www.nature.com/nature/authors/get_published [<https://perma.cc/2UWH-CFE8>]; *Merit Review*, NAT'L SCI. FOUND., http://www.nsf.gov/bfa/dias/policy/merit_review [<https://perma.cc/9M6Q-3N95>]; and *Peer Review Process*, NAT'L INSTS. HEALTH, http://grants.nih.gov/grants/peer_review_process.htm [<https://perma.cc/KD4J-S3MT>].

71. See generally Ho, *supra* note 68 (reviewing the peer review literature and studying the feasibility of peer review among food safety inspectors).

72. See NAOMI ALLEN ET AL., PEER TO PATENT: FIRST PILOT FINAL RESULTS (2012), <http://www.peertopatent.org/wp-content/uploads/sites/2/2013/11/First-Pilot-Final-Results.pdf> [<https://perma.cc/V4N6-6BYP>]; Beth Simone Noveck, "Peer to Patent": *Collective Intelligence, Open Review, and Patent Reform*, 20 HARV. J.L. & TECH. 123, 143–51 (2006).

73. See 35 U.S.C. § 122(e) (2012).

74. ALLEN ET AL., *supra* note 72, at 4–5.

75. *Id.* at 2, 26.

76. *Id.* at 27.

77. Letter from Mark H. Webbink, Visiting Professor and Exec. Dir., Ctr. for Patent Innovations at N.Y. Law Sch., to Hiram Bernstein, Senior Legal Advisor, U.S. Patent & Trademark Office, 14 (Sept. 16, 2011), http://www.uspto.gov/sites/default/files/patents/law/comments/x_aia-c_nylawschool-ctr_webbink_20110916.pdf [<https://perma.cc/6FRV-EMAM>].

opt-in open-peer-review model.⁷⁸ (Interestingly, a 2006 trial with open peer review by *Nature* magazine was also less popular than initial enthusiasm suggested.⁷⁹) More significantly, the design of the pilots makes it very difficult to draw conclusions about their causal effect. The final report from the first pilot program was focused on only describing the extent to which the program was used and surveying examiners about the program.⁸⁰ As I have previously observed, the USPTO's willingness to experiment with pilot programs is laudable, but it would learn far more from these pilots by testing them on a randomized basis, such as by randomizing over the applicants who wanted to opt in to the program.⁸¹

The Peer To Patent pilot is no longer accepting applications, and it is unclear whether it will be renewed.⁸² But there is another way for outside experts to contribute to patent examination: the third-party preissuance submissions process of 37 C.F.R. § 1.290 that became effective on September 16, 2012.⁸³ Under this provision, after an application is published (typically eighteen months after filing), any third party has six months to submit relevant prior art along with “a concise description of the asserted relevance of each submitted

78. See ALLEN ET AL., *supra* note 72, at 34 (noting the number of participating applications in the Peer To Patent pilot).

79. *Overview: Nature's Peer Review Trial*, NATURE (Dec. 2006), <http://www.nature.com/nature/peerreview/debate/nature05535.html> [<https://perma.cc/3VGV-UE2U>].

80. See ALLEN ET AL., *supra* note 72. As far as I am aware, the only attempt at a more rigorous evaluation is Jin-Hyuk Kim & Benjamin Mitra-Kahn, *Peer Reviewed Patent Applications: Evidence from a Pilot Program* (2013) (unpublished manuscript) (https://kelley.iu.edu/BEPP/documents/kim_paperPeerReviewed.pdf) [<https://perma.cc/555X-YPJQ>]. But they make choices such as that “the number of community reviewers registered on the Peer To Patent website for each application in the treatment group can be used as a plausible instrument.” *Id.* at 20. This means they are assuming that the number of reviewers for each application is not correlated with their outcome measures—the probability of allowance and the number of forward citations—which seems dubious. They conclude that the probability of allowance is lowered by five percent for every piece of contributed prior art but that the second-order effect of examiners allowing more applications that enter the treatment group in the first place works in the opposite direction and typically outweighs this effect. See *id.* at 22.

81. Ouellette, *Patent Experimentalism*, *supra* note 69, at 98; see also Michael Abramowicz, Ian Ayres & Yair Listokin, *Randomizing Law*, 159 U. PA. L. REV. 929 (2011) (discussing randomization as a tool to estimate the efficacy of laws and regulations).

82. The most recent information on the Peer To Patent website is a report from 2012. See *Peer To Patent*, N.Y. LAW SCH., <http://www.peertopatent.org> [<https://perma.cc/2XA8-6GSM>].

83. See generally *Third-Party Preissuance Submissions*, U.S. PAT. & TRADEMARK OFF., <http://www.uspto.gov/patent/initiatives/third-party-preissuance-submissions> [<https://perma.cc/H6Q5-AJ23>] (providing an overview of the mechanism and a link for filing submissions).

document.”⁸⁴ Arguments against patentability are not allowed.⁸⁵ This provision has attracted few submissions⁸⁶ and even less scholarly attention.⁸⁷ It is thus not yet clear how much effect the third-party preissuance submissions process will have in practice.

There are of course many ways that third parties could be incentivized to participate in programs like Peer To Patent and the preissuance submissions process, including monetary rewards or faster patent processing times for parties who locate art that the examiner relies on. But even if these programs were more widely used (or implemented in a manner more susceptible to rigorous evaluation), neither could be an effective means for improving patent disclosures due to the same basic flaw: both mechanisms have focused only on identifying relevant prior art. Unless an expert can identify a prior art reference stating that a claimed invention is impossible, these mechanisms could not be used to explain why an application’s disclosure is inadequate. The sole opportunity for third parties to make *arguments* related to patentability is currently the “protest” procedure of 37 C.F.R. § 1.291 that may be used only *before* an application is published (unless the applicant consents to post-publication submissions),⁸⁸ and that is thus of little practical use for those without some external reason to know of the patent.

The USPTO “considers inappropriate any third-party inquiry, or submission in an application that is not provided for in” the third-party preissuance submissions provision or the prepublication protest

84. 35 U.S.C. § 122(e) (2012). Submissions are not allowed after a notice of allowance is mailed for the application, and third parties may have more than six months if a first rejection has not yet been mailed. *Id.*; 37 C.F.R. § 1.290(b)(2) (2016).

85. See Changes To Implement the Preissuance Submissions by Third Parties Provision of the Leahy-Smith America Invents Act, 77 Fed. Reg. 42,150 (July 17, 2012) (codified at 37 C.F.R. pt. 1, 41).

86. From September 16, 2012 to October 25, 2013, the USPTO received 1204 submissions, of which only 870 were deemed compliant with the necessary procedures. See SARAH KAPELNER ET AL., AN ASSESSMENT OF THE IMPACT OF PRE-ISSUANCE SUBMISSIONS ON THE PATENT EXAMINATION PROCESS 23 (2013), https://www.wpi.edu/Pubs/E-project/Available/E-project-122013-161237/unrestricted/FINAL_PAPER_pdf_version.pdf [<https://perma.cc/A2Y8-JYT7>]. As of March 27, 2015, the USPTO received 2580 submissions. *AIA Statistics*, U.S. PAT. & TRADEMARK OFF., <http://www.uspto.gov/patent/laws-and-regulations/america-invents-act-aia/aia-statistics> [<https://perma.cc/EJG5-EDTZ>]. In comparison, the USPTO has received over 500,000 utility patent applications each year since 2011. *U.S. Patent Statistics Chart: Calendar Years 1963–2015*, U.S. PAT. & TRADEMARK OFF., http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm [<https://perma.cc/U5JY-PWQE>].

87. One of the only pieces on the new provision is a student note that contends that the provision should be expanded to allow argumentation. Alexander R. Trzeciak, Note, *Taboo, the Game: Patent Office Edition—The New Preissuance Submissions Under the America Invents Act*, 63 DUKE L.J. 245 (2013).

88. See 37 C.F.R. § 1.291 (2012).

procedure.⁸⁹ Thus, not only is there no formal effort to reach out to third-party experts who may have valuable insight regarding the adequacy of patent disclosures, there is also no opportunity for interested experts to voluntarily contribute to examination.

III. BRINGING THE PERSON OF EXTRAORDINARY SKILL INTO THE PATENT EXAMINATION PROCESS

The previous two Parts have explained that patents are often granted too early, because patent examiners lack the expertise needed to recognize that the patent disclosure is not yet sufficient to enable those of ordinary skill to create the invention and that those who have this expertise have no opportunity to share their knowledge with the USPTO. In this Part, I argue it is worth experimenting with a robust peer review system to solicit input from those of extraordinary skill in the field of an application.

Such a system could of course be mandated by statute, but it would also be possible to use a similar legal mechanism as that implemented by the Peer To Patent pilot: applicants could opt in to the peer review system and thereby consent to a limited waiver of the bar on post-publication protests under 37 C.F.R. § 1.291.⁹⁰ (A mandatory version would of course be preferable from a policy perspective, given that applicants would be unlikely to opt in with their most important patents.) Under either version, given the uncertainty about the causal effect of peer review, it would be important to initially test the program in a rigorous way, such as by randomly choosing some applications that could not be sent out for review to serve as a control group.⁹¹

There are many possible design choices: Examiners could send every application in the treatment group out for review or only those for which they think outside expertise would be valuable. (It may even be possible to design a market mechanism in which competitors can flag applications that seem most in need of expert review.) Examiners could ask very specific questions or simply give the experts an open-ended opportunity for their thoughts on the application. Experts could be sent individual applications within their field of expertise (as for review of most journal articles) or they could be recruited to serve on review

89. MPEP, *supra* note 39, § 1134.

90. For the Peer To Patent framework, see John J. Doll, *Pilot Concerning Public Submission of Peer Reviewed Prior Art*, 1319 OFFICIAL GAZ. PAT. & TRADEMARK OFFICE 146 (June 26, 2007), <http://www.uspto.gov/web/offices/com/sol/og/2007/week26/patsuba.htm> [<https://perma.cc/K6S4-X2X7>].

91. See *supra* note 81 and accompanying text (noting the problems with evaluating Peer To Patent given that it was not implemented with any degree of randomization).

panels (as for review of most federal grant applications). Applications could be sent to varying numbers of experts. The most plausible design options could be tested as part of the policy experiment.⁹²

Likely objections to such an experiment are that (1) there are not sufficient experts willing to review patents to cover the massive influx of applications the USPTO receives; (2) the few experts who would agree to review would be biased competitors of the applicant; and (3) the reviews would have little effect on examination such that they would not be worth the cost. The remainder of this Part considers these objections in turn.

First, would sufficient numbers of experts be motivated to contribute their efforts to a patent peer review system to cover demand from the USPTO? As an initial note, if recruiting experts is a problem, then the response should not be to abandon the idea altogether—it should be to limit the requests for review to those applications for which examiners think outside input would be most valuable. But I am optimistic about the viability of a large-scale program.

As I have noted previously, the feasibility of patent peer review would not be limited by the number of scientists willing to provide peer reviews in general; the number of patents issued per year is significantly smaller than the number of peer-reviewed scientific journal articles.⁹³ Scientists are accustomed to reviewing these journal articles for free as part of their service to the scientific community, and it is not implausible that they would also willingly review patents if they viewed the patent system as benefiting scientists as well as lawyers. Given the commercial nature of the patent system and the high fees paid by patent applicants, it should be feasible to pay reviewers an honorarium for their participation.⁹⁴

To obtain some measure of scientists' willingness to participate in such a program, for my recent survey on when researchers read patents, I also asked respondents about patent peer review: "Some have suggested that patent examination should occasionally rely on peer

92. A more radical (but insightful) proposal for attracting outside expertise is to turn the patenting decision completely over to third-party private entities. See Michael Abramowicz & John F. Duffy, *Ending the Patenting Monopoly*, 157 U. PA. L. REV. 1541 (2009).

93. Ouellette, *supra* note 1, at 592 ("For the past ten years, the USPTO has typically issued roughly 150,000 utility patents per year. The ISI Science Citation Index, which covers 6650 major peer-reviewed scientific journals, averages nearly one million new articles per year. In 2009, the USPTO issued 2675 patents with 'nano' in one of their claims, while the Science Citation Index contains 67,294 articles from 2009 with 'nano' in the topic field." (footnotes omitted)).

94. If the cost of filing a patent increases slightly, that might have the independent benefit of screening out more low-value patents. See Jonathan Masur, *Costly Screens and Patent Examination*, 2 J. LEGAL ANALYSIS 687 (2011) (discussing the benefits of cost screens in the patent process).

reviews from researchers in the field of the invention. Would you be willing to occasionally review patents for the U.S. Patent & Trademark Office to help improve the patent literature?"⁹⁵ Out of 813 respondents, thirty-three percent said they would occasionally review patents for free, and another thirty-eight percent said they would occasionally review patents if they were paid at least a certain amount.⁹⁶ The median requested payment was \$300 for those who named a flat rate and \$250/hour for those who named an hourly fee.⁹⁷ These were not all academics: out of 201 industry respondents, thirty-six percent said they would review for free, and thirty-five percent said they would review for a fee.⁹⁸ And to be clear, there is no reason that those asked to review patents should be only the primarily academic scientists who already peer review for scientific journals; all users of the patent system, including private-sector applicants who do not publish their results in scientific journals, should be incentivized to participate.

Of course, these numbers are likely biased upward: the people who are willing to respond to a survey for free are also more likely to be the ones who would do peer review for free (or for a small honorarium). But these results are at least suggestive that a non-negligible number of researchers might be willing to participate in such a program.

A second potential concern with a patent peer review program is that the results would be biased.⁹⁹ I have previously argued that this concern would be mitigated by making clear that patent examiners—like editors at top peer-reviewed science journals—are not bound by reviewers' opinions on the ultimate merits of the application.¹⁰⁰ If a reviewer has a competitive relationship with an applicant, then this may increase his or her motivation to scrutinize the application for patentability problems, but all that ultimately matters is whether the reviewer provides information that is relevant to the examiner.¹⁰¹ Sometimes the most helpful reviewers are the most critical ones, as long

95. Ouellette, *supra* note 66.

96. *Id.*

97. The twenty-fifth and seventy-fifth percentiles were \$100 and \$500 for those who named a flat rate and \$100/hour and \$500/hour for those who named an hourly fee. *Id.*

98. *Id.*

99. See Fromer, *supra* note 9, at 592 n.245:

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.

100. Ouellette, *supra* note 1, at 592.

101. Cf. Noveck, *supra* note 72, at 156 ("If people produce information that is useful to the examiner, their personal agendas are irrelevant.").

as the decisionmaker (here, the examiner) is a neutral third party. Indeed, if a direct competitor is unable to identify any clear validity problem with an application, then that might be evidence that the application should be granted.

To be sure, examiners can only fulfill this role if they have enough expertise to *understand* the reviews from experts, even if they would not have spotted all of these problems themselves. It may be that peer review will only really be successful if it is a complement, not a substitute, to improving in-house expertise. But the USPTO cannot reject patents simply based on conclusory statements that inventions are trivial or even based on their own “assessment of what would be basic knowledge or common sense”; rather, examiners “must point to concrete evidence in the record to support these findings.”¹⁰² And applicants have many opportunities to rebut biased arguments: the USPTO can never issue a truly final rejection.¹⁰³

In any case, if bias turns out to be a problem, it would be straightforward to require reviewers to disclose conflicts of interest, as is already done at journals and grant agencies using scientific peer review such as *Nature*,¹⁰⁴ *Science*,¹⁰⁵ the National Science Foundation,¹⁰⁶ and the National Institutes of Health.¹⁰⁷ If disclosed

102. *In re Zurko*, 258 F.3d 1379, 1386 (Fed. Cir. 2001). For example, the USPTO rejected the following claim to a rowing machine as obvious in light of a prior art chest press machine that could perform the same function:

A row exercise machine comprising an input assembly including a first handle portion adapted to be moved from a first position to a second position by a pulling force exerted by a user on the first handle portion in a rowing motion, the input assembly defining a substantially linear path for the first handle portion from the first position to the second position.

In re Giannelli, 739 F.3d 1375, 1376 (Fed. Cir. 2014). The Federal Circuit reversed, concluding that the USPTO had not carried its burden of showing a prima facie case of obviousness, because chest press machines are not designed to be pulled rather than pushed and thus do not meet the “adapted to” limitation of this claim. *Id.* at 1379–81.

103. See Sean Tu, *Understanding the Backlog Problems Associated with Requests for Continued Examination Practice*, 13 DUKE L. & TECH. REV. 216, 219–20 (2015) (listing the numerous options for patent applicants who receive a “final” rejection).

104. *Getting Published in Nature*, *supra* note 70 (“*Nature* requires potential referees to disclose any professional and commercial competing interests before undertaking to review a paper . . .”).

105. *Peer Review at Science Publications*, SCIENCE, <http://www.sciencemag.org/authors/peer-review-science-publications> [<https://perma.cc/A624-3XN3>] (requiring disclosure of “any professional or financial affiliations that may be perceived as a conflict of interest in reviewing the manuscript, or a history of personal differences with the author(s)”).

106. *Appendix B—Potentially Disqualifying Conflicts of Interest*, NAT’L SCI. FOUND., http://www.nsf.gov/pubs/gpg/nsf04_23/appb.jsp [<https://perma.cc/N2FQ-JPJS>].

107. NAT’L INSTS. OF HEALTH, NIH CONFLICT OF INTEREST RULES: INFORMATION FOR REVIEWERS OF NIH APPLICATIONS AND R&D CONTRACT PROPOSALS (2015), http://grants.nih.gov/grants/peer/NIH_Conflict_of_Interest_Rules.pdf [<https://perma.cc/ZU6K-XAH5>].

conflicts of interest are found to be disqualifying, this would exacerbate any problem with finding sufficient reviewers, but there would still likely be many academics and other experts in any given field who do not have a commercial interest in the technology.

A final possible objection is that patent peer reviews may have little effect on examination—or at least that their effect may not be worth the cost of administering such a program, including the significant costs for the outside experts.¹⁰⁸ As Professor Mark Lemley has observed, given how few patents are litigated or even licensed, spending more resources on examination is not always rational.¹⁰⁹ And it would certainly be irrational to invest considerable resources in a peer review program if examiners end up ignoring the experts' reports. Professors Chris Cotropia, Mark Lemley, and Bhaven Sampat have found “that patent examiners rarely use applicant-submitted art in their rejections to narrow patents, relying almost exclusively on prior art they find themselves.”¹¹⁰ Examiners are typically allotted only around twenty total hours per application,¹¹¹ and if they think their limited time is most efficiently spent on their own search processes, they might pay little attention to outside peer reviews.

One reason to be more optimistic in this context is that preliminary survey evidence of patent examiners suggests that they generally have found third-party preissuance submissions to be helpful.¹¹² This does not necessarily mean, however, that the submissions had an impact on examination decisions or that their benefit was worth the submitters' time. It is possible that a larger effect might be observed by simply allowing the examiners to spend the additional time that the experts would be spending on peer review.

108. For a discussion of the challenges in conducting a cost-benefit analysis of a patent policy change, see Jonathan S. Masur, *CBA at the PTO*, 65 DUKE L.J. 1701, 1701–03 (2016).

109. Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495 (2001). Professor Beth Noveck puzzlingly states that having costs “borne by a ‘third party’ to the [examination] proceedings” somehow “sidesteps this problem,” Noveck, *supra* note 72, at 158, but there is no reason that costs to third parties should not be included in the welfare analysis of the program.

110. Christopher A. Cotropia, Mark A. Lemley & Bhaven Sampat, *Do Applicant Patent Citations Matter?*, 42 RES. POL'Y 844, 844 (2013).

111. See Michael D. Frakes & Melissa F. Wasserman, *Does Agency Funding Affect Decisionmaking?: An Empirical Assessment of the PTO's Granting Patterns*, 66 VAND. L. REV. 67, 72 n.16 (2013).

112. See KAPELNER ET AL., *supra* note 86, at xiii:

For the examiners who had reviewed a submission thus far, general attitudes were positive about the Program, with the submission frequently helping the examiner save time during the application review process. The submission was helpful in narrowing the scope of the prior art search for the examiner, and the concise description of relevance often helped the examiner read through the references more quickly when the claims were mapped out.

If this turns out to be a problem, it would be an additional argument in favor of limiting peer review requests to those applications for which examiners affirmatively request outside input. Or perhaps peer review should only be used for patents undergoing post-grant review, for which there is an external signal that the patent is worth extra scrutiny. But this currently speculative concern about costs is not a reason not to try peer review of patent disclosures; rather, it is one of the issues that should be monitored when experimenting with such a program. I have previously advocated greater use of policy experimentation in the USPTO,¹¹³ and a peer review system that facilitates input on patent disclosures seems ripe for such an experimental test.

At the very least, even if patent examiners do not affirmatively reach out to experts who may be able to provide useful information, it seems worth lifting the ban on voluntary submissions of information related to the adequacy of patent application disclosures.¹¹⁴ Nothing about the patent examination process necessitates such a limitation on information flow, and the European Patent Office is ahead of the USPTO in this regard: Article 115 of the European Patent Convention allows “any third party” to “present observations concerning the patentability of the invention to which the application or patent relates.”¹¹⁵ Their examination guidelines make clear that such observations “may . . . be directed to . . . sufficiency of disclosure.”¹¹⁶ It is time for the United States to catch up.

CONCLUSION

Over two hundred years after it was decided, *Pierson v. Post* continues to introduce first-year law students to the basic tradeoffs in determining when a new property right should be rewarded.¹¹⁷ I have argued that when one considers these tradeoffs in the patent context, it seems that patents are often awarded too early and also that it is too unclear when these early patents will be allowed. The fundamental

113. Ouellette, *Patent Experimentalism*, *supra* note 69.

114. *See supra* note 89 and accompanying text.

115. Convention on the Grant of European Patents art. 115, Oct. 5, 1973, 1065 U.N.T.S. 199 (as amended Nov. 29, 2000), <http://www.epo.org/law-practice/legal-texts/html/epc/2013/e/ar115.html> [<https://perma.cc/8RN7-FZMK>].

116. EUROPEAN PATENT OFFICE, GUIDELINES FOR EXAMINATION IN THE EUROPEAN PATENT OFFICE, Part E, Ch. V, § 3 (Nov. 2015 ed.), <https://www.epo.org/law-practice/legal-texts/guidelines.html> [<https://perma.cc/D2WY-SGAJ>] (download “Part E”).

117. And perhaps also “to horrify” them “with the thought that success in law school means understanding debates among nineteenth century judges regarding the relevance of sixth century treatises about the ownership of a dead fox.” Berger, *supra* note 2, at 1091.

problem is that even though a patent disclosure need only enable a person of ordinary skill in the art to make and use the invention, it often takes extraordinary skill to spot a disclosure problem based merely on reading the patent application. A promising possibility for overcoming this information asymmetry is to introduce a peer review program that allows patent examiners to seek input from scientists with greater expertise. Justice Livingston's dissent in *Pierson v. Post* argued that the "knotty point" of ownership of the fox "should have been submitted to the arbitration of sportsmen"; perhaps bringing scientists into the patent examination process will clarify and improve the rules for ownership of ideas.