Diversity Levers

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Patent law is capable of prompting innovation across a wide range of technologies by virtue of flexible "policy levers" that allow patent standards to be calibrated to the impediments that characterize different economic sectors. But it has become increasingly clear that social bias also raises significant barriers to successful creativity and innovation. In this article, I argue that the same policy levers used to address economic impediments to innovation can also be used to address other social impediments to innovation. I offer as a detailed example one doctrinal response to the well-documented gender gap in patentable innovation. I conclude by suggesting that such doctrinal "diversity levers" are available to address innovation deficits among other underrepresented innovators, but that considerable work remains to identify when and where such intervention might be effective.

INTRODUCTION

Intellectual property, particularly in the form of patents or copyrights, is generally understood as providing a means of legal appropriability: encouraging beneficial new creations by securing the value of investments in such creations.[1] Because the exclusive rights conferred by a patent or copyright deter unauthorized copying or misappropriation of creative work, these intellectual property regimes are believed to foster innovations that might otherwise be under-produced. However, it is increasingly clear that in many instances, creative production is deterred by social rather than economic impediments. A growing body of scholarship indicates that social biases may erect unexpected and underappreciated barriers to the goals of intellectual property systems. Indeed, intellectual property laws themselves might inadvertently deter the creative activity of certain creators, such as women or racial minorities, and may skew new innovation away from disadvantaged communities that most desperately need its benefits.

In this article, I explore how existing features of intellectual property law might be deployed to address such impediments to innovation. In previous work, I have discussed certain doctrinal features of patent law, dubbed "policy levers," that allow the patent system to be modulated to match the innovation

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1. *See* Dan L. Burk, *Law and Economics of Intellectual Property: In Search of First Principles,* 8 ANN. REV. L. & SOC. SCI. 397, 403 (2012) (summarizing the economic justification for intellectual property); *see also* David J. Teece, *Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing, and Public Policy*, 15 RES. POL'Y 285 (1986) (outlining costs and benefits of various strategies for appropriating returns to innovation investment).

incentives needed in different economic sectors.[2] Here, I argue that the same mechanisms may be used to address social impediments to innovation. While such "diversity levers" might be used to correct a variety of social failures in the patent system, in this article I will focus my discussion on the pervasive deficit of patenting among women who are engaged in technical research. A substantial and growing body of empirical literature demonstrates that women patent and commercialize new inventions at only a fraction of the rate of similarly situated men, indicating a serious failure in the effectiveness of patent law's innovation incentive.[3] I offer as an illustration as to how patents might be calibrated to address this failure the example of a particular policy lever that modulates patent law's non-obviousness requirement. I conclude with some thoughts on how other features of the statute might be used to address similar social impediments deterring full participation in the innovation system.

I. PATENTS FOR HUMANITY

In 2013, the Obama Administration implemented an experimental program through the United States Patent Office, dubbed "Patents for Humanity."[4] The program, now in its second year, was implemented to encourage innovation in the service of economically impoverished and under-served populations. The "Patents for Humanity" program is structured as a competition in which companies that hold patents for life-saving or critical infrastructure technologies are publicly lauded for deploying such patents in the broader public interest, especially in the service of disadvantaged or developing populations. Such award-winning activities have included development and distribution of malarial drugs; development of high-protein, vitamin-enhanced sorghum; and development and distribution of water purification packets, all targeted toward developing nations.[5]

This program's recognition of humanitarian patent activity is not simply honorary, but includes a sort of patent prize: Patent holders who receive these awards are granted a special certificate that allows them to accelerate examination of a subsequent patent through the United States Patent Office. In essence, this is a type of prize for innovative activity that is particularly meritorious along a particular dimension— that of humanitarian relief.[6] These certificates might become even more valuable under legislation recently introduced by Senators Patrick Leahy and Chris Coons that would make such acceleration certificates transferable, essentially creating a secondary market in

2. *See, e.g.*, Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575 (2003).

3. *See infra* notes 29–46 and accompanying text.

4. *See Patents for Humanity*, U.S. PATENT & TRADEMARK OFFICE, http://www.uspto.gov/patents/init_events/patents_for_humanity.jsp (last visited Dec. 21, 2015).

5. *Id.*

6. In this sense the program constitutes a modest experiment toward engaging robust debate over whether prizes might serve as a substitute, or perhaps a supplement, to the exclusivity regime of patent law. *See* Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents-Prizes Debate*, 92 TEX. L. REV. 303 (2013); Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115 (2003); Benjamin N. Roin, *Intellectual Property Versus Prizes: Reframing the Debate*, 81 U. CHI. L. REV. 999 (2014); Steven Shavell & Tanguy Van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525 (2001).

such certificates.[7]

This initiative is intriguing for a variety of reasons, but particularly for what it suggests about the purposes and policy of patent law. Certainly the "Patents for Humanity" initiative is laudable simply as an effort to deploy innovation to improve human welfare. But the initiative also marks another, more important, and possibly less apparent milestone. The White House program and the accompanying Leahy-Coons bill are striking in their recognition that some types of patentable innovation are more desirable than others, not necessarily due to the economic value that can be realized from the innovation, but because the innovation serves particular social goals such as alleviating suffering, improving health, or enhancing human flourishing. To be sure, at some level each of these social benefits may ultimately produce measurable economic benefits, but recipients of the White House award are presumably not donating their intellectual property to impoverished communities in anticipation of a better monetary return on their investment, and the beneficiaries of the donation are likely to benefit from such donations in ways entirely out of proportion to the value of an accelerated prosecution certificate.

Additionally, the program implicitly recognizes that some types of socially valuable innovation may only occur when innovators are nudged or oriented in a particular direction. The "Patents for Humanity" program offers such orientation by means of a modest administrative subsidy coupled with what is likely a more valuable reputational reward. Of course, the underlying patent is already a type of subsidy—it entails state-sponsored and legally enforceable exclusivity intended to allow the holder to reap profits that would be unavailable in a competitive market. But it is not a direct subsidy, and depends upon an otherwise functioning market to license the patent or to sell products embodying the claimed technology. Innovation aimed at impoverished or underdeveloped communities may not be properly facilitated by this type of incentive; by definition, an impoverished or disadvantaged population has less money to spend and perhaps cannot afford the innovation at any price, let alone the inflated prices allowed under a patent. Sometimes sales of an innovation in wealthier regions can cross-subsidize lower prices for the innovation in impoverished regions, but this strategy may be unavailable where clean water or plentiful food supplies, or robust public health measures are already available in the wealthy regions—the population that needs the innovation cannot afford it, and the population that can afford it does not need it.

Hence, the extra incentive of a publicly recognized award helps to cure a particular type of market failure. Again, the patent system itself is most often described as a remedy to pervasive market failure; the typical justification for patents holds that unaided market incentives will not tend to prompt inventions with the characteristics of public goods because once such goods are produced they will be costlessly appropriated by others besides the innovator who made the investment to produce them.[8] But to the extent that patents address a market failure, it is typically perceived only as a market failure of this particular kind—

7. Patents for Humanity Program Improvement Act of 2012, S. 3652, 112th Cong. (2d Sess. 2012).

8. *See* Burk, *supra* note 1 at 402–03.

specifically, the problem of recouping an investment in easily appropriated public goods. As it stands, the patent system is not necessarily calibrated to counter other types of market failures that may stifle creative production, nor is it necessarily calibrated to the problem of providing public goods in situations of impoverishment, when the problem of undersupply is more extensive or pervasive than usually contemplated.

"Patents for Humanity" approaches these issues by providing an add-on incentive to the grant of a patent. But the problems addressed by this add-on are not themselves add-ons; they are integral considerations to the goals of intellectual property, and there seems no reason that the exclusive rights provided under either patent or copyright must themselves be oriented only toward curing the public goods problem. In the United States, the federal intellectual property regimes of patent and copyright are governed by the constitutional requirement that they "promote the progress of science and the useful arts."[9] Such progress has typically been conceptualized in terms of the economic value of innovation prompted by a patent or copyright: the exclusivity of a patent or copyright is expected to allow patent holders to restrict output of the patented item for a limited term, inflating profits from that item to ensure a return on investments made in new creative enterprises, thus making such investments more attractive. The assumption inherent in such a rationale is that more innovation is better, so that facilitating more innovation constitutes progress.

But there is no particular limitation explicit in the constitutional text or concept of progress that constrains it to an advancement of economic value, or to prompting ever more capacious levels of creative output.[10] Progress might be imbued with different meaning; it might equally well indicate wider dissemination of knowledge,[11] or it might indicate the generation of works that are aesthetically more pleasing.[12] Perhaps it could indicate the creation of works that are less environmentally burdensome[13] or more socially just.[14] Even within a conventional utilitarian framework, an increase in non-monetary benefits such as happiness or dignity might represent progress in social welfare, as more people would consider themselves better off. But the concept of progress need not be

9. U.S. CONST, art. I, §8, cl. 8.

10. *See* Margaret Chon, *Postmodern "Progress": Reconsidering the Copyright and Patent Power*, 43 DEPAUL L. REV. 97 (1993) (questioning the conventional economic understanding of "progress" in the Constitution); *see also* Julie E. Cohen, *Copyright and the Perfect Curve*, 53 VAND. L. REV. 1799 (2000) (questioning whether neo-classical economics offers a neutral understanding of intellectual property "progress").

11. Malla Pollack, *What Is Congress Supposed to Promote?: Defining "Progress" in Article I, Section 8, Clause 8 of the United States Constitution, or Introducing the Progress Clause*, 80 NEB. L. REV. 754 (2001).

12. Alfred C. Yen, *Copyright Opinions and Aesthetic Theory*, 71 S. CAL. L. REV. 247 (1998); John Tehranian, *Dangerous Undertakings: Sacred Texts and Copyright's Myth of Aesthetic Neutrality, in* THE SAGE HANDBOOK OF INTELLECTUAL PROPERTY 418 (Matthew David & Debora Halbert, eds., 2014).

13. *See, e.g.*, Michael A. Gollin, *Using Intellectual Property to Improve Environmental Protection*, 4 HARV. J.L. & TECH. 193 (1991); Gregory N. Mandel, *Promoting Environmental Innovation with Intellectual Property Innovation: A New Basis for Patent Rewards*, 24 TEMP. J. SCI. TECH. & ENVTL. L. 51 (2005); Andrew Torrance, *Patent Law, HIPPO, and the Biodiversity Crisis*, 9 J. MARSHALL REV. INTELL. PROP. L. 624 (2010).

14. *See, e.g.*, Dan L. Burk, *Do Patents Have Gender?*, 19 AM. U. J. GENDER SOC. POL'Y & L. 831, 918 (2011).

confined to utility and might plausibly encompass incommensurables such as human flourishing or dignity.

II. BIAS IN PATENT LAW

Suggesting that the proper metric for constitutional progress might not be solely utilitarian or economic may elicit some protest that intellectual property law is merely a mechanism for promoting creativity, and was not intended as the vehicle for promoting goals such as equity or social justice. And yet it should be clear from the outset that intellectual property law already promotes certain social outcomes with respect to social status, privileges, and opportunities, whether those outcomes are intended or not. Certainly intellectual property cannot be entirely value neutral; it is specifically intended to promote particular social activity at the expense of other social activity. Patentable innovation is rewarded by exclusivity at the expense of curtailed access to the claimed invention, and possibly at the expense of non-patentable innovation, as resources are channeled toward projects that qualify for patenting.[15] It should not be surprising if re-allocation of such resources has disparate or unequal effects.

But recent scholarship has increasingly recognized that intellectual property regimes are not value-neutral with respect to other social goods such as justice and diversity.[16] To some degree, this should also not be surprising; intellectual property is a product of its social milieu, and to the extent that society is generally biased to one degree or another by assumptions about race, class, gender, or other socially constructed norms, those assumptions might be expected to seep into the formulation of intellectual property.

What may be surprising to some observers is that values not intended or explicitly contemplated in the formulation of intellectual property law become implicated in its execution. Unlike areas of the law such as family law or voting law or employment law, where issues of social bias are an integral consideration to the goals of the law, and so are pervasively considered in its formulation and application, intellectual property might be thought of by many observers as socially neutral. The goals and structure of intellectual property law are not generally thought of as being associated with race, gender, or other historically disadvantaged social classifications.

And yet on closer examination, what seems ostensibly neutral may hold hidden biases. Recent scholarship examining race-specific drug patenting illustrates such unwitting social bias. Such issues became apparent during the controversy over BiDil, a combination of two existing pharmaceuticals, a vasodilator and a hypertensive compound, which were the subject of a process

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15. *See* Burk, *supra* note 1, at 402–03 (2012) (discussing social costs of exclusive rights in intellectual goods).

16. *See, e.g.*, Carys J. Craig, *Reconstructing the Author-Self: Some Feminist Lessons for Copyright Law*, 15 AM. U. J. GENDER SOC. POL'Y & L. 207 (2007); Debora Halbert, *Feminist Interpretations of Intellectual Property*, 14 AM. U. J. GENDER SOC. POL'Y & L. 431 (2006); Rebecca Tushnet, *My Fair Ladies: Sex, Gender, and Fair Use in Copyright*, 15 AM. U. J. GENDER SOC. POL'Y & L. 273 (2007); Burk, *supra* note 14; Laura A Foster, *Situating Feminism, Patent Law, and the Public Domain*, 20 COLUM. J. GENDER & L. 262 (2011). Kara Swanson, *Getting a Grip on the Corset: Gender, Sexuality, and Patent Law*, 23 YALE J.L. & FEMINISM 57 (2011).

patent for use to treat congestive heart failure.[17] Both pharmaceuticals were well known in the art, and their combination to treat congestive heart failure was considered unpatentably obvious by the Patent Office. The patent was allowed, however, after the applicant pointed out that treatment data for the combination showed unexpectedly good results among African-American patients, and amended the claims of the patent to restrict its scope to a method of treating hypertension in that population.[18]

The BiDil patent is troubling in part because the exclusive rights in the invention are framed in terms of a racial label—"African-American" or equivalent terms—designating social constructs rather than scientific classifications.[19] Individuals with a wide range of physical and genetic characteristics might identify or be socially classified as "African-American."[20] But Jonathan Kahn has pointed out that the claims of this patent additionally serve to expose certain troubling features of current patent doctrine.[21] In particular, the determination of patentable *non-obviousness* for the treatment incorporates a troubling racial assumption. Patents are only granted to inventions that represent a significant advance over the technology that is already available; the legal metric for assessing such a level of invention is to determine whether the claimed invention, taken as a whole, would have been obvious to a person of ordinary skill in the art at the time the patent application was filed.[22]

Kahn aptly observes that the BiDil combination of drugs could only be judged inventive, or non-obvious, if the baseline for judging obviousness is the effect of the drugs in the majority Caucasian population.[23] An enhanced effect in the African-American population is only unexpected or surprising if that population is somehow considered to be outside the norm. Not only is there no genetic or physiological basis for the social classification, the patent assumes that the classification constitutes something aberrant. By examining the framing of the obviousness inquiry, it becomes clear that the legal requirement for non-obviousness intersected with a social classification to set a racial baseline for patentability. Thus, the patent is in some sense premised upon the marginalization or "othering" of the African-American social grouping.

Patent law may similarly incorporate social biases against other marginalized classes. In previous work, I have pointed out several dimensions of the U.S. patent statute that intersect with the social construction of gender to produce unexpected, aberrant, and largely unappreciated outcomes.[24] For

17. *See* Howard Brody & Linda M. Hunt, *BiDil: Assessing a Race-Based Pharmaceutical*, 4 ANN. FAM. MED. 556 (2006).

18. Jonathan Kahn, *Race-ing Patents/Patenting Race: An Emerging Political Geography of Intellectual Property in Biotechnology*, 92 IOWA L. REV. 353, 379–81 (2006).

19. *See* Brody & Hunt, *supra* note 17, at 557.

20. Nonetheless, there is a long history of racial and ethnic terminology in U.S. patents. *See* Shubha Ghosh, *Race-Specific Patents, Commercialization, and Intellectual Property Policy*, 56 BUFF. L. REV. 409 (2008).

21. Kahn, *supra* note 18.

22. 35 U.S.C. § 103 (2015).

23. Kahn, *supra* note 18, at 403.

24. *See* Burk, *supra* note 14.

example, the metrics by which the statutory criteria for a patent are measured entail a very particular mode of thinking about invention, assuming that it occurs by means of certain analytical and rational processes.[25] However, both anecdotal and empirical evidence suggest that women in Western cultures have been socialized to approach problem solving differently than their male counterparts, and that they function with different cognitive parameters in a different professional and interpersonal milieu.[26] Inventive methods that might be labeled "intuitive" or "emotive" are more typically associated with and performed by those society assigns to the female gender.[27] There is no reason to think that such approaches necessarily produce less useful or less valuable innovation than methods labeled "rational" or "analytical," and both likely play a role in technical creativity. But the latter approaches are more easily codified and documented than the former,[28] so they are more amenable to satisfaction of the teaching and disclosure requirements of patent law as currently formulated.

III. THE PATENT GENDER GAP

Such concerns over the epistemology of the patent statute may seem largely speculative or theoretical. And yet a substantial and growing body of empirical evidence demonstrates gendered outcomes associated with patents. Although social and epistemic explanations of this evidence remain elusive, the descriptive empirics of gender in the patent system are relatively straightforward: women are at every level pervasively absent from the patent system. In the United States, far fewer patent attorneys and patent agents are women than are men.[29] Female inventors account for a relatively small proportion of patent applications, even when counted as co-inventors as part of an inventive team.[30] This female deficit holds true at every career stage and has remained persistent over time, with only small recent increases in female inventorship.[31] This discrepancy in inventorship is not limited to the United States; a number of studies indicate that

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25. *See id.*at 891–92; *see also* Dan L. Burk, *Feminism and Dualism in Intellectual Property*, 15 AM. U. J. GENDER SOC. POL'Y & L. 183, 192–94 (2007) (discussing patent law's elevation of mental effort over physical effort).

26. The most classic, influential, but controversial formulation of this proposition remains CAROL GILLIAN, IN A DIFFERENT VOICE: PSYCHOLOGICAL THEORY AND WOMEN'S DEVELOPMENT (1982).

27. *See* Burk, *supra* note 14, at 904–05.

28. *See* Dan L. Burk, *The Role of Patent Law in Knowledge Codification*, 23 BERKELEY TECH L.J. 1009 (2008) (discussing codification requirements in patent doctrine); *see also* Peter Lee, *Transcending the Tacit Dimension: Patents, Relationships, and Organizational Integration in Technology Transfer*, 100 CALIF. L. REV. 1503 (2012) (noting the inability of patents to transmit uncodified or tacit knowledge).

29. *See* Annette I. Kahler, *Examining Exclusion in Woman-Inventor Patenting: A Comparison of Educational Trends and Patent Data in the Era of Computer Engineer Barbie*, 19 AM. U. J. GENDER SOC. POL'Y & L. 733, 792 (2011); Saurabh Vishnubhakat, *Gender Diversity in the Patent Bar*, 14 J. MARSHALL REV. INTELL. PROP. L. 67 (2014).

30. Jennifer Hunt et al., *Why Are Women Underrepresented Amongst Patentees?*, 42 RES. POL'Y 831, 831 (2013).

31. *See id*. One recent commercially commissioned study found a very large uptick in recent female inventorship. *See* NATIONAL WOMEN'S BUSINESS COUNCIL, INTELLECTUAL PROPERTY AND WOMEN ENTREPRENEURS (2012). This finding is sufficiently far out of line with other studies that experts in the field have questioned the data collection and analysis. *See* Karen A. Frenkel, *The Reporting Gap on the Patent Gender Gap*, ACM NEWS (May 30, 2013), http://cacm.acm.org/news/164776- the-reporting-gap-on-the-patent-gender-gap/fulltext (quoting critiques of the study).

it is found consistently across multiple jurisdictions.[32]

As a general matter it is well known that, despite some progress toward gender parity, women continue to enter science and engineering fields in substantially smaller numbers than men.[33] The failure to attract women into science and engineering fields undoubtedly contributes to the smaller total number of patents involving women. But the gender gap in patenting can only partially be explained by the lower number of women entering patent-intensive sectors involving engineering or the physical sciences.[34] Even taking into account the absolute number of male and female patentees in such fields, those women who *do* work in these areas acquire patents at a lower rate than their male counterparts.[35] This does not appear to have changed over time despite growing numbers of women entering these fields.[36]

Additionally, certain technical sectors, notably biotechnology, are known for attracting a higher number of female researchers, but studies of women who work in biotechnology show that they still patent at a fraction of the rate of similarly situated men.[37] This is true both for academic and industrial researchers, although the gap is more pronounced in the former field.[38] The patents that women do acquire in these areas appear to be of equal or greater significance as those acquired by male scientists and engineers.[39] But women who obtain patents are less likely to commercialize them via licensing or product development than their male counterparts.[40] As in other technical areas, this has remained true for successive generations of female scientists over decades, despite an increase of women entering the life sciences.[41]

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32. *See, e.g.*, Ranier Frietsch et al., *Gender Specific Patterns in Patenting and Publishing*, 38 RES. POL'Y 590 (2009) (surveying European Patent Office gender data from 14 countries).

33. *See* DAVID N. BEEDE ET AL., U.S. DEP'T OF COMMERCE, WOMEN IN STEM: A GENDER GAP TO INNOVATION, ECONOMICS AND STATISTICS ADMINISTRATION ISSUE BRIEF NO. 04-11 (2011). Because a science or engineering background is required to practice before the USPTO, the smaller numbers of women holding science and engineering degrees certainly helps explain why women are underrepresented among patent agents and patent attorneys.

34. Hunt et al., *supra* note 30, at 840–42.

35. *Id*. at 834.

36. *Id*.

37. *See* Waverly W. Ding et al., *Gender Differences in Patenting in the Academic Life Sciences*, 313 SCI. 665 (2006); Kjersten Bunker Whittington & Laurel Smith-Doerr, *Women Inventors in Context: Disparities in Patenting Across Academia and Industry*, 22 GEN. & SOC'Y 194 (2008) [hereinafter Whittington & Smith-Doerr, *Women Inventors*]; Kjersten Bunker Whittington & Laurel Smith-Doerr, *Gender and Commercial Science: Women's Patenting in the Life Sciences*, 30 J. TECH. TRANSFER 355 (2005) [hereinafter Whittington & Smith-Doerr, *Gender and Commercial Science*]; G. Steven McMillan, *Gender Differences in Patenting Activity: An Examination of the U.S. Biotechnology Industry*, 80 SCIENTOMETRICS 683 (2009).

38. Whittington & Smith-Doerr, *Gender and Commercial Science*, *supra* note 37, at 360; Whittington & Smith-Doerr, *Women Inventors*, *supra* note 37, at 207.

39. Whittington & Smith-Doerr, *Gender and Commercial Science, supra* note 37, at 364–365; Ding, Murray, & Stuart, *supra* note 37, at 666; McMillan, *supra* note 37, at 690.

40. *See* Paula E. Stephan & Asmaa El-Gainainy, *The Entrepreneurial Puzzle: Explaining the Gender Gap*, 32 J. TECH. TRANSFER 475 (2007).

41. Whittington & Smith-Doerr, *Gender and Commercial Science, supra* note 37, at 358, 360; *see generally* Ding et al., *supra* note 37.

This gap in innovation is economically significant, representing by one estimate a loss of 2.7% U.S. GDP per capita.[42] While it is difficult to account for the deficit in female patenting, ethnographic work has begun to suggest some of the underlying reasons. The causes of the patent gender gap are likely complex, arising from an intricate milieu of deeply-seated social factors.[43] Women may have been socialized to take fewer risks, to push their projects less aggressively, and to think about commercialization of their work less often than their male counterparts.[44] Venture capitalists and other start-up funding sources that might support invention development may take female innovators less seriously, and view their inventions less favorably than they would the inventions produced by similarly situated men.[45] Women may be either intentionally or inadvertently excluded from opportunities and institutions, such as advisory boards or business consultancies, that would facilitate opportunities for innovation, and women may otherwise lack the social connections that are often vital to innovation development.[46]

Thus, it is clear that there are severe impediments to female participation in the patent system, and every indication is that social biases and historic subordination serve to create such innovation barriers. And here the parallel to earlier work on modulating the patent statute to accommodate industry-specific innovation profiles is striking. Much as the firms in some economic sectors, innovating in particular technological environments, will experience the patent system in a radically different way than firms in other environments, so a wealth of data indicates that female inventors will experience the patent system in a radically different way than an otherwise similarly situated male counterpart. The female inventor is more likely to face disapproval and resistance to securing a patent, and is less likely to have access to the expertise and resources necessary to bring an innovation to fruition.

Of course, the particular obstacles faced by the female inventor could be addressed by means of add-on incentives along the lines of "Patents for Humanity." We might provide special prizes or reduced application fees for female patent applicants, or provide subsidized loans or specialized grants to finance innovation by female inventors.[47] And such programs may well be desirable for any number of reasons; just as the gender disparity problem likely stems from the interaction of a variety of innovation deterrents, so overcoming the problem will likely require a suite of ameliorative efforts. But the barriers before female innovators appear in large measure to be barriers to product development and commercialization. These are precisely the kind of impediments to innovation that the patent system itself is intended to address,

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42. *See* Jennifer Hunt et al., *Why Don't Women Patent?* (Nat'l Bureau of Econ. Research, Working Paper No. 17888, 2012).

43. *See* Fiona Murray & Leigh Graham, *Buying Science and Selling Science: Gender Differences in the Market for Commercial Science*, 16 INDUS. & CORP. CHANGE 657, 660 (2007).

44. *Id.*at 483; Stephan & El-Gainainy, *supra* note 40, at 479–80.

45. *See* Stephan & El-Gainainy, *supra* note 40, at 481.

46. *Id.*; Ding, Murray, & Stuart, *supra* note 37, at 666–67.

47. *See, e.g.*, Lisa Larrimore Ouellette, *Patentable Subject Matter and Non-Patent Innovation Incentives*, 5 U.C. IRVINE L. REV. (forthcoming 2015) (discussing alternate incentive mechanisms for innovation).

although the conventional supposition is that these impediments will arise due to systematic economic factors rather than systematic cultural or social factors. Whatever the source of the impediments, the existing statutory system includes at least some tools, or policy levers, to combat them.

IV. POLICY LEVERS

The general concept of policy levers in intellectual property is now well established, and has become a fixture in the analysis of the patent system.[48] In previous work with Mark Lemley, I have argued that the patent statute can and indeed must incorporate "policy levers"—that is, doctrinal standards that are mutable and responsive to the characteristics of new technologies, new industries, and even the changed circumstances of existing industries.[49] Different technologies have different commercialization profiles; industries based on those technologies face different innovation challenges. For example, although creating new candidate molecules in pharmaceutical research is fairly simple, characterizing, testing, and securing regulatory approval for new drugs is an enormously expensive undertaking. By contrast, developing a new software product, although technically complex, is orders of magnitude less expensive.[50] A very substantial incentive is needed to prompt the investment of hundreds of millions of dollars in a new drug; a much smaller incentive, or perhaps no incentive at all, is needed to prompt the necessary investment to produce new software.

Thus, providing the necessary patent incentive to commercialization necessarily varies with the challenges faced by a particular industry. It is impossible to foresee what challenges an industry may face. Some technologies will be nascent, emerging, or entirely unknown when a statute is formulated, meaning that the legislature cannot have the information necessary to specifically provide incentives for the innovation configuration of industries based on those technologies. Consequently, the patent statute must be equipped to allow ongoing modulation of the level of reward available to meet the needs of different economic contexts. Lemley and I argued that our current patent statute contains such provisions, which we term "policy levers," and that courts are particularly well positioned to employ such levers.[51] Different statutory

48. *See* Michael W. Carroll, *One Size Does Not Fit All: A Framework for Tailoring Intellectual Property Rights,* 70 OHIO ST. L.J. 1361 (2009); Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 YALE L.J. 1575 (2001); Michael J. Burstein, *Rules for Patents*, 52 WM. & MARY L. REV. 1747 (2011); Oren Bracha & Talha Syed, *Beyond Efficiency: Consequence-Sensitive Theories of Copyright*, 29 BERKELEY TECH. L.J. 229 (2014). The concept has also experienced an uptake in other areas of legal analysis. *See, e.g.*, Jonathan R. Macey, *Regulatory Globalization as a Response to Regulatory Competition*, 52 EMORY L.J. 1353 (2003) (international banking law); Seth L. Cooper, *Seeing Competition, Eyeing Regulation: FCC Wireless Policy Following the Wireless Report*, 20 COMMLAW CONSPECTUS 41 (2011) (telecommunications law); Victor Fleischer, *A Theory of Taxing Sovereign Wealth*, 84 N.Y.U. L. REV. 440 (2009) (tax); Alex Rice Kerr, *Why We Need a Carbon Tax*, 34 ENVIRONS ENVTL. L. & POL'Y J. 69 (2010) (environmental law).

49. *See* DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT (2009); Burk & Lemley, *supra* note 2; Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155 (2003).

50. BURK & LEMLEY, supra note 49 at 39–40.

51. *See* Burk & Lemley, *supra* note 2.

provisions within the patent statute provide differing tailoring tools to vary the scope, quantity, or characteristics of patents by industry.

To take only one example of such a provision, out of many possible levers: as mentioned previously, to qualify for a patent, an invention must be deemed "non-obvious," that is, it must comport with a requirement set out in section 103 of the patent statute.[52] Section 103 provides that a patentable invention cannot have been obvious to a "person having ordinary skill in the art"—sometimes abbreviated to the acronym PHOSITA—when taken as a whole, at the time a patent application was filed.[53] The statute specifies considering the context of a particular technology or "art" in deciding whether to award a patent. Thus, applying this provision requires tailoring the legal standard to specific technologies; what is obvious to a person of ordinary skill in one art may not be the same as what would be obvious to a person having ordinary skill in a different art.

Indeed, the levels of ordinary skill in different arts will vary according to specific circumstances over the lifetime of the particular field. In order to satisfy the statutory standard, courts reviewing patents, and the United States Patent Office issuing patents, will have to inquire into the characteristics surrounding specific technologies to know what would be obvious in each of them.[54] Developments in technologies in which innovation is easier will be more likely to be obvious, and so those areas will receive fewer and narrower patents, which is the proper outcome from a policy standpoint, since less incentive is needed there. Developments in technologies in which innovation is more difficult will be more likely to be judged non-obvious, so that those fields receive more and broader patents, which is the correct policy outcome, as more incentive is needed to overcome the obstacles faced by innovators in those fields.

Such flexible standards allow decision makers to tailor a unitary statute that would otherwise be "one size fits all" to meet the needs of diverse industries.[55] In the previous published work on such policy levers, our major concern was the calibration of economic patent incentives to the innovation profiles of various industries, so as to offer the proper reward to innovators.[56] But there is no divine decree or law of nature that mandates patent incentives must be solely calibrated to optimize the benefit of the system to innovation *producers*. This is purely a choice of social policy. As the White House "Patents for Humanity" initiative suggests, it is entirely possible to calibrate the patent system according to the needs of innovation *consumers*. This possibility has been largely overlooked, probably in large measure because of the assumption that once an incentive is available to overcome barriers to investment in what is essentially a public good, competitive market forces will prompt the production of output that meets the needs of consumers.

As I have already noted, the "Patents for Humanity" program, together with the Leahy-Coons bill, implicitly recognizes both that, without intervention,

52. 35 U.S.C. § 103 (2015).
53. *Id.*
54. *See* Graham v. John Deere Co. of Kansas City, 383 U.S. 1, 17 (1966).
55. *See* BURK & LEMLEY, *supra* note 49, at 109.
56. *See id.*

market failures or other impediments will keep certain beneficial innovation from occurring, *and* that patent incentives can and sometimes should be nudged in a direction that benefits particular classes of consumers.[57] Such nudges might be accomplished through an external program such as the added rewards of "Patents for Humanity." But such add-on incentives may not be necessary. If the patent system is already loaded with policy levers, these might be employed to the same ends as an add-on program, without the need to devise new incentives. The necessary tools may already be available in the statute. Patents could be calibrated to address more than one type of market failure.

I have observed in other work that the patent system comprises a networked ecology of constituent communities.[58] Patent doctrine could be attuned to address failure in any of them. One could, for example, calibrate various policy levers in the patent statute to optimize the system for the benefit of the courts or the Patent Office.[59] (Indeed, one might sometimes worry that exactly this has happened, perhaps without the sanction of the legislature.) It is unclear that optimizing the system for the benefit of judges or bureaucrats would be desirable as a general policy, although certain aspects of the system probably ought to be tailored for administrative efficiency. Similarly, one might adjust various policy levers to optimize the system for the benefit of patent attorneys and other advocates. Again, it is unclear that this would be sensible as an overall goal, although certain aspects of patent doctrine such as inequitable conduct should likely take into account the role of an inventor's representative or advocate.[60]

To achieve the goals of "Patents for Humanity," doctrinal policy levers might be calibrated to increase the likelihood of a patent, or increase the magnitude of a patent reward, where the innovation in question might offer particular benefit to impoverished or economically disadvantaged populations. The availability of the patent might, for example, allow price discrimination between wealthy and less wealthy populations, allowing the former to subsidize the latter.[61] To take the example of the PHOSITA obviousness lever, policy analysis of the obviousness standard in patent law has long recognized that this lever plays a critical role in responding to the degree of uncertainty that attends innovative activity, and particularly in fostering the chancy development of newly discovered technologies.[62]

Decisional models of the obviousness standard indicate that the patent system should reward the innovator who develops a new invention when it is more likely than not that an invention will not succeed.[63] The riskier an innovation is, the less likely it is to succeed; the less likely it is to succeed, the larger the incentive needs to be to prompt investment. Non-obvious inventions are risky inventions, and receive a patent reward when successful. Typically the

57. *See supra* notes 7–8 and accompanying text.

58. *See* Dan L. Burk & Jessica Reymann, *Patents as Genre: A Prospectus*, 26 L. & LIT. 163 (2014)

59. *See id*. at 185–86.

60. *See, e.g.,* Therasense Inc. v. Becton-Dickinson, Inc., 649 F.3d 1276 (Fed. Cir. 2011) (setting standards for inequitable conduct before the Patent Office).

61. SUZANNE SCOTCHMER, INNOVATION AND INCENTIVE 37 (2004).

62. *See* Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1 (1992).

63. *Id*. (sketching a decisional model for obviousness determination).

risk taken is a technological risk, but innovation also entails regulatory or financial risks.[64] Such risks could well include innovation where the return on investment will likely be impeded by the poverty of the most likely consumers of the innovation, but where the inchoate social benefit of the invention would nonetheless exceed the private cost of development. The PHOSITA who succeeds in developing beneficial technology in the face of such an impediment could be said to have a non-obvious invention.

V. DEPLOYING DIVERSITY LEVERS

The same rationale holds for failures of the patent system to engage the innovative capacity of traditionally marginalized groups. Just as the patent system incorporates certain assumptions that may restrict the type of innovation available to impoverished populations, it also appears to incorporate assumptions that limit the innovation produced by female innovators. Evidence of the sort I have detailed above, demonstrating the dramatic failure of the patent system to engage women, suggests as an initial matter that "progress," under pretty much any socially plausible definition of that term, is being impeded. But such evidence also suggests ways in which the existing levers in the patent stature might be deployed to begin addressing the gender patenting gap.

Taking once again my example of the Section 103 PHOSITA policy lever, we can draw a clear parallel to the deployment of the obviousness standard across industrial sectors. It is clear that the PHOSITA working on software development is quite different than the PHOSITA working in biotechnology.[65] But by the same token, the woman of ordinary skill in biotechnology experiences innovation and patenting very differently from her male counterpart. Statistically, she is significantly less likely to develop discoveries into innovations, and is far less likely to seek a patent for patentable innovations.[66] The result is an effective shift in the contextual standard for non-obviousness; where the male biotechnology innovator will recognize and develop an innovation, the female biotechnology innovator, hampered by social and cultural impediments, may not. The corollary is that innovation by women in biotechnology is in turn significantly more likely to be extraordinary—that is, innovation in this context, against heightened odds, is more likely to constitute non-obvious innovation.

Recognizing this difference within the PHOSITA standard could mean that innovation by women should be more amenable to patentability in at least one respect. As described above, the obviousness standard is generally seen as a lever that increases the incentives for success in the face of uncertain innovation outcomes, essentially rewarding risk-taking.[67] Here I simply point out the gendered context of such an uncertainty assessment under the standard. The uncertainty of success is assessed from the point of view of the person having ordinary skill in the art, but that uncertainty is higher for a woman of ordinary skill. We know that female innovators are far less likely to develop a promising

64. BURK & LEMLEY *supra* note 49, at 39.

65. *Id.* at 63–64.

66. *See supra* notes 42–46 and accompanying text.

67. *See supra* note 43 and accompanying text.

technology, meaning that the ostensibly neutral obviousness standard incorporates a de facto gendered assumption about risk-taking.[68] Recognizing that the woman of ordinary skill faces a gender gap avoids the assumption that the PHOSITA makes a masculine uncertainty assessment and assists in overcoming the impediments faced by female innovators.

Indeed, the Supreme Court opened the door to this type of inquiry in its landmark 2007 opinion on patent obviousness, *KSR v. Teleflex*.[69] The United States patent statute says that obviousness must be judged against the understanding of a person having ordinary skill in the pertinent technology, but, as a practical matter this means that the adjudicator of obviousness must have some evidence of what the PHOSITA would know. A court, or the Patent Office, like any decisional forum, must have a record in the form of documents, or testimony, or other evidence of the relevant facts in order to make its obviousness judgment.[70] Prior to the *KSR* decision, the United States Court of Appeals for the Federal Circuit, which has exclusive appellate jurisdiction over all patent cases, had required very explicit documentary evidence of an invention's obviousness in order to deem it unpatentable.[71] The result was of course that many patents were issued because documentary evidence was lacking, rather than because the invention was a real advance over prior technology.

In *KSR*, the Supreme Court held that the Federal Circuit's standard was too rigid for the realities of actual product development.[72] In assessing obviousness, the Court held that the standard must take into account unwritten "design incentives and other market forces" that may prompt the PHOSITA to make changes to existing technology in predictable and evident fashion.[73] The opinion similarly counsels that the standard incorporates the unwritten "inferences and creative steps" ordinarily available to the PHOSITA as a matter of "common sense," even if those considerations are not explicit in the literature.[74] Thus, the *KSR* opinion specifically contemplates taking into consideration the social and economic context in which the PHOSITA works. Sometimes, the PHOSITA's surroundings will facilitate the ability to envision the claimed invention, making the invention more obvious. Presumably the PHOSITA could likewise face contrary design incentives, market forces, and influences that could impede his ability to formulate the claimed invention, making the invention less obvious.

It is a small step from taking into account the design incentives, market pressure, and similar ambient influences on the PHOSITA, to similarly take into account the challenges the PHOSITA might face in devising and developing new inventions under pervasively adverse social conditions. Risk, success, and certainty are all socially determined perceptions. Aspects of such perceptions are in fact taken into account in the obviousness "secondary factors" articulated by

68. *See supra* notes 42–46 and accompanying text.
69. KSR Int'l Co. v Teleflex, Inc., 550 U.S. 398 (2007).
70. *See* Burk, *supra* note 28, at 1030.
71. 550 U.S. at 418–19.
72. *Id.* at 415.
73. *Id.* at 417.
74. *Id.* at 420.

the Supreme Court in *Graham v. John Deere*.[75] In *Graham* and its companion opinion, *United States v. Adams*,[76] the Court held that inventive success in the face of contrary teachings, against the advice and expertise offered by others of skill in the art, is strong evidence of non-obviousness.[77] Stated differently, an inventor who succeeds in innovating in the face of pervasive contrary social pressure, lack of funding and commercialization opportunities, and sparse encouragement or financial support, is more likely to have a non-obvious invention.

VI. THE WOMAN OF ORDINARY SKILL

The Section 103 policy lever thus provides an example of a patent metric that can be tailored to circumstance, including the impediments to innovation that might be considered under a standard of innovation appropriate to the woman of ordinary skill in the art. Of course, in this particular instance, taking such contextual obstacles into account pushes the obviousness standard in the opposite direction from the ambient influences considered by the Supreme Court in *KSR*; they could make an invention less likely, rather than more likely, to be obvious. But not all "diversity levers" will necessarily increase the availability or frequency of patenting in targeted circumstances. Some levers, responding to social impediments in innovation, may decrease the availability of patents. Patents are believed to offer incentives that on the whole benefit progress, but those incentives come at a cost. It is entirely possible that certain social goals might be furthered by restricting, rather than augmenting the availability of patents in targeted fields.

This approach may seem to fragment the PHOSITA standard, potentially changing a general objective metric into a series of narrowly specialized assessments. Complete particularization of the standard would of course shift the objective standard into a subjective standard, taking into account the individualized circumstances of innovation, yielding an actual knowledge metric measuring innovation according to the actual circumstances and abilities of a particular inventor. But this is not a call for a subjective standard; the PHOSITA standard already contains multitudes. The PHOSITA facing high-cost pharmaceutical development is not the PHOSITA facing Silicon Valley garage software coding. And as Mark Lemley and I have pointed out, circumstantial application of patent policy levers will inevitably result in discrete industry- or technology-specific metrics.[78] This effect is a version of Carol Rose's famous observation that no legal imperative is composed entirely of bright-line rules or of completely malleable standards; rather, law typically processes between the two.[79] Fact-sensitive standards will sometimes encounter repeated patterns of circumstance, and where this occurs, a rule-based expectation will coalesce around the common fact pattern. Such elaboration of particularized applications within a general standard is a normal and sensible development in the law.

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75. Graham v. John Deere Co. of Kansas City, 383 U.S. 1 (1966).
76. United States v. Adams, 383 U.S. 39 (1966).
77. *Graham*, 383 U.S at 17–18; *Adams*, 383 U.S. at 52.
78. *See* BURK & LEMLEY, *supra* note 49 at 110.
79. Carol Rose, *Crystals and Mud in Property Law*, 40 STAN. L. REV. 577 (1988).

Thus, parallels to a discrete "woman of ordinary skill" standard already exist in other areas of law that employ legal constructs conceptually related to the PHOSITA. Commentators have long observed that patent law's PHOSITA is in some sense a close relative of the "reasonably prudent person" found in Anglo-American tort law;[80] both are personified fictional images that define legal criteria.[81] Like the PHOSITA, the reasonably prudent person embodies contextually and factually specific application of a legal rubric.[82] The reasonably prudent person is intended to articulate an objective standard of behavior incorporating the particular circumstances of the actor. But of course this means that courts have over time developed a limited set of variants on the reasonably prudent person where particular circumstances favored a standard that was routinely different than that calibrated to the general population.

One such variant on the reasonably prudent person, the reasonable child, assesses proper caution within the limited ability appropriate to a child under the circumstances.[83] Another variant, the reasonable professional standard, is calibrated to the proper degree of caution that might be expected given the ability of a professional, such as a physician or attorney, who has an extraordinary degree of expertise.[84] And, for purposes of the statutorily created tort of sexual harassment, some courts have developed and applied a specialized reasonable woman standard for determining when conduct should be viewed as offensive or damaging.[85] The similar development of a particularized objective standard within the PHOSITA construct would thus not be unusual where a personified legal standard is used to specify policy outcomes.

An alternate concern might be that modulating the standard in this fashion could contribute to the problem at issue; that fashioning a separate "woman of ordinary skill" metric might seem to denigrate the abilities of female inventors by defining a PHOSITA that is less able to discern the claimed invention.[86] But such concern is largely misguided. First, the PHOSITA is a legal metric,

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80. RESTATEMENT (SECOND) OF TORTS § 283 (1965). The reasonable person also appears in various other branches of law, such as criminal law. *See* Mayo Moran, *The Reasonable Person: A Conceptual Biography in Comparative Perspective*, 14 LEWIS & CLARK L. REV. 1233, 1234 (2010) (discussing the different areas of the law utilizing the reasonable person standard).

81. *See, e.g.*, Panduit Corp. v. Dennison Mfg. Co. 810 F.2d 1561, 1566 (Fed. Cir. 1987) (comparing the PHOSITA to the "reasonable man" in tort law).

82. *See* Osborne M. Reynolds, Jr., *The Reasonable Man of Negligence Law: A Health Report on the "Odious Creature,"* 23 OKLA. L. REV. 410, 426–27 (1970).

83. RESTATEMENT (SECOND) OF TORTS § 283A (1965).

84. *See id.* § 299A; *see also id.* § 289(b) (stating that superior training or attributes possessed by an actor are to be taken into account in determining reasonableness).

85. *See e.g.*, Ellison v. Brady, 924 F.2d 872, 879 (9th Cir. 1991); Gray v. Genlyte Grp., Inc., 289 F.3d 128, 137–38 (1st Cir. 2002); Hurley v. Atlantic City Police Dep't, 174 F.3d 95, 116 (3d Cir. 1999); Torres v. Pisano, 116 F.3d 625, 632 (2d Cir. 1997). The possibility of a reasonable woman standard for the general law of negligence has additionally been the subject of extended commentary. *See* Naomi R. Cahn, *The Looseness of Legal Language: The Reasonable Woman Standard in Theory and in Practice*, 77 CORNELL L. REV. 1398 (1991); *see also* MAYO MORAN, RETHINKING THE REASONABLE PERSON: AN EGALITARIAN RECONSTRUCTION OF THE OBJECTIVE STANDARD (2003) (arguing that characteristics such as gender, race, and class should appropriately be incorporated into the reasonable person standard).

86. Versions of this objection have long been recognized as a concern in other areas where a reasonable woman standard might apply. *See* Cahn, *supra* note 85, at 1415; Lucinda M. Finley, *A Break in the Silence: Including Women's Issues in a Torts Course*, 1 YALE J.L. & FEMINISM 41, 64 (1989).

calibrated to achieve a particular legal result, which takes into account, among other factors, the skill and training of inventors in a given technical field. Neither the familiar generalized PHOSITA standard nor the proposed woman of ordinary skill standard indicates the *actual* capability of any particular inventor or group of inventors.

Additionally, such concerns offer no valid reason to avoid correcting the gender gap, any more than similar concerns would be a reason to avoid correcting gender issues such as harassment. There is nothing demeaning about adjusting a legal standard to cure socially imposed imbalance. Just as an employment environment of sexual innuendo and "horseplay" will look very different to a reasonable man than it will to a reasonable woman given the history and circumstances of harassment in society, so too may the environment of assertion and self-promotion surrounding commercial innovation look very different to the reasonable man than it does to the reasonable woman. Women need prove neither that they are tough enough to endure harassment, nor that they are aggressive enough to personally overcome the innovation gender gap.

Indeed, even within patent law as it currently exists, the PHOSITA is not a monolithic concept, but shifts character depending upon the purpose to which the standard is oriented. The PHOSITA appears at a variety of junctures in patent law; the patent statute references the standard not only in Section 103, but again in Section 112.[87] Section 112 requires the applicant for a patent to disclose the invention in sufficient detail to allow the person of ordinary skill to make and to use it.[88] But previous commentators have noted that the PHOSITA of the Section 103 obviousness standard is not necessarily the PHOSITA of the Section 112 enablement standard.[89] The Section 103 obviousness PHOSITA appears to be more creative, more of a thinker, and more of a risk-taker than his 112 counterpart.[90] The 112 PHOSITA indeed seems to be a bit of a dullard, more conservative and pedestrian in his approach to the prior art.[91] This difference makes sense, as the two constructs take into account the purposes of their respective policy levers.

This division also reminds us that adjusting the PHOSITA standard for some purposes need not mean adjusting it for all purposes. The PHOSITA in Section 112 is engaged in following the teachings of the patent; the 112 PHOSITA embodies the standard for disclosure of the invention in the patent document.[92] The empirical literature I have referenced does not suggest that the woman of ordinary skill has any less knowledge or ability than her male counterpart. In fact, evidence shows quite the contrary—the contributions of women who do engage in innovation are comparable in quality to that produced by men.[93] Thus, there is no reason to think that the woman of ordinary skill would have any

87. 35 U.S.C. § 112(a) (2015).

88. *Id.*

89. John O. Tresansky, *PHOSITA - The Ubiquitous and Enigmatic Person in Patent Law*, 73 J. PAT. & TRADEMARK OFF. SOC'Y 37, 52–53 (1991).

90. *See* Orthopedic Equip. Co. v. United States, 702 F.2d 1005 (Fed. Cir. 1983); In re Grout, 377 F.2d 1019 (C.C.P.A. 1967).

91. Tresansky, *supra* note 89, at 54.

92. *See* BURK & LEMLEY, *supra* note 49, at 146–47.

93. *See supra* note 39 and accompanying text.

particular difficulty reading and following the teachings of a patent beyond whatever difficulty the conventional PHOSITA might have. Only if there were reasons to think that some gendering of patent disclosure dictated a more detailed disclosure requirement would it be necessary to adjust the 112 PHOSITA standard.

CONCLUSION

Patent law, like many other seemingly neutral areas of law, entails social biases that become apparent only on close examination. I have focused here on the use of policy levers to address systematic gender bias in the patent system, and have primarily explored the use of a single lever, the Section 103 obviousness PHOSITA, in that regard. I have focused here on gender in large measure because there already exists a fairly robust literature devoted to investigating the gender gap in innovation. The existence of the gap is therefore well documented and characterized, and we are beginning to understand its origins. This type of information is critical to guide the application of policy levers to resolve diversity issues, and the Section 103 PHOSITA standard offers a clear example of how a particular diversity lever might operate against such a background.

There are of course many other policy levers in the patent statute, and some of them may also prove to be useful in addressing aspects of the patent gender imbalance. Additionally, as I hope I have made clear throughout this article, gender does not define the only form of bias that may impede progress in science and the useful arts. My argument regarding diversity levers is likely salient for other social biases, such as those associated with race. There is for example a nascent literature investigating African-American innovators, which indicates a deficit in patenting among that social classification.[94] As the dimensions of this and similar problems become clearer, some diversity levers may be useful in correcting them.

Finally, I am well aware that I have adopted here a rather modest, "first wave" position regarding diversity and the patent system. I have largely assumed that, even within its own utilitarian paradigm, the patent system is failing in its stated goal to promote innovation if certain classes of innovators are either wittingly or unwittingly hindered from participation on grounds that are arbitrary vis-a-vis the goals of the system. I have similarly assumed that, so long as we have a system that confers certain societal benefits and advantages, women, impoverished communities, or other under-represented groups who wish to participate in the system would be better off if they were not arbitrarily excluded. One could of course question whether we ought to have a patent system at all,[95] or, if we have one, whether it should not have radically different

94. *See* Lisa D. Cook & Chaleampong Kongcharoen, *The Idea Gap in Pink and Black* (Nat'l Bureau of Econ. Research, Working Paper No. 16331, 2010) (exploring similar patenting deficits among female and African-American inventors); *see also* Lisa D. Cook, *Violence and Economic Activity: Evidence from African-American Patents 1870-1940*, 19 J. Econ. Growth 221 (2014) (finding linkage between declining African-American patenting activity and racial violence).

95. *See* Immaculada di Melo-Martín, *Patenting and the Gender Gap: Should Women Be Encouraged to Patent More?*, 19 SCI. & ENG. ETHICS 491 (2013) (questioning whether enhanced participation in patenting would be socially desirable).

goals than those commonly assumed.[96] But that is a more controversial conversation for the future; even without a radical re-thinking of the patent system there is already copious evidence for deploying diversity levers to achieve the commonly accepted goals of intellectual property.

96. *See* Burk, *supra* note 14, at 918 (suggesting plausible alternative objectives for the patent system).