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INTELLECTUAL PROPERTY AND THE POLITICS OF EMERGING TECHNOLOGY: INVENTORS, CITIZENS, AND POWERS TO SHAPE THE FUTURE

STEPHEN HILGARTNER*

INTRODUCTION

Modern states depend on law, administration, and technical expertise to define contained spaces of decision making that can be legitimately treated as separate from the zone of politics. From time to time, however, the political aspects of decision making in these putatively apolitical domains become visible to large audiences, generating calls for reform that sometimes yield significant institutional change. In the 1960s, for example, the normative choices and power relations embedded in decision making about the technological hazards of modern societies achieved new levels of visibility.[1] Public controversies about which risks were "acceptable," and who should decide and how, proliferated in a wide range of technical domains. People grew reluctant to trust private companies, or the scientists and engineers in their employ, to manage environmental hazards or ensure consumer safety, and they called for the creation of new systems of public oversight. Social movements demanded a voice in decision making, and the federal government responded by creating a new regulatory apparatus, embodied in such agencies as the Environmental Protection Agency, the Consumer Products Safety Commission, and the Occupational Health and Safety Administration. In short, a legal and policy discourse that had defined technological risk as a narrow, technical realm, appropriately ad-

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1. As just one index of this new visibility consider the following best-selling books and the social movements with which they are now associated: BOSTON WOMEN'S HEALTH BOOK COLLECTIVE, OUR BODIES, OURSELVES: A BOOK BY AND FOR WOMEN (1973) (on medicine and feminism); RACHEL CARSON, SILENT SPRING (1962) (on pesticides and the environment); RALPH E. LAPP, THE VOYAGE OF THE LUCKY DRAGON (1957) (on above-ground nuclear testing); RALPH NADER, UNSAFE AT ANY SPEED (1965) (on automobile safety and consumer protection).

dressed through private expert deliberation and post-hoc tort litigation, broke down as new modes of public accountability and public participation took shape.[2]

There is much evidence that in an analogous way the conceptual and institutional machinery of intellectual property policy may be in the process of losing its capacity to contain the politics of this domain.[3] Thirty years ago intellectual property seemed to be a topic primarily of interest to a narrow group of specialists.[4] Disputes over patent and copyright infringement might have involved large sums of money, but they appeared to matter mainly to the immediate parties, or perhaps to investors, rather than to broad groups of citizens. Patent law seemed to be safely left to the few experts, schooled in the relevant technical and doctrinal details, capable of understanding the arcane legal issues. Most legal scholars saw intellectual property as politically uninteresting, far removed from the excitement of such fields as constitutional law. Today, in contrast, intellectual property is widely perceived as a domain where important societal decisions are routinely made. In the 1980s and increasingly in the 1990s, visible public controversies often surrounded intellectual property decisions. Much of the debate centered around areas of rapidly emerging technology, such as biotechnology, software, and the Internet, with ongoing controversy about digital copyright and the patenting of life forms, genes, algorithms, and business methods. Not only did intellectual property expand into new technical domains, but since 1994 its international reach has grown enormously with the passage of the controversial agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS). In this context, a growing number of scholars, non-governmental organizations (NGOs), activists, and other

2. *See, e.g.*, ULRICH BECK, RISK SOCIETY: TOWARDS A NEW MODERNITY (Mark Ritter trans., Sage Publications 1992) (1986); RONALD BRICKMAN ET AL., CONTROLLING CHEMICALS: THE POLITICS OF REGULATION IN EUROPE AND THE UNITED STATES (1985); MARY DOUGLAS & AARON WILDAVSKY, RISK AND CULTURE: AN ESSAY ON THE SELECTION OF TECHNICAL AND ENVIRONMENTAL DANGERS (1982); SHEILA JASANOFF, THE FIFTH BRANCH: SCIENCE ADVISORS AS POLICYMAKERS (1990); ORGANIZATIONS, UNCERTAINTIES, AND RISK (James F. Short, Jr. & Lee Clarke eds., Westview Press 1992) (1989); *see also* THE POLITICS OF REGULATION (James Q. Wilson ed., 1980).

3. Stephen Hilgartner, *Acceptable Intellectual Property*, 319 J. MOLECULAR BIOLOGY 943, 943–46 (2002).

4. This is not to say that intellectual property was never controversial until recently. Indeed, debate about copyright and patent policy stretches back for centuries. *See, e.g.*, MARK ROSE, AUTHORS AND OWNERS: THE INVENTION OF COPYRIGHT (1993); ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT (2004); Paul A. David, *Intellectual Property Institutions and the Panda's Thumb: Patents, Copyrights, and Trade Secrets in Economic Theory and History*, *in* GLOBAL DIMENSIONS OF INTELLECTUAL PROPERTY RIGHTS IN SCIENCE AND TECHNOLOGY 19 (Mitchell B. Wallerstein et al. eds., 1993). However, a number of features of the present historical moment (e.g., the centrality of science and emerging technology in contemporary societies) inflect the current debate and heighten its significance.

observers came to see intellectual property policy as a battleground implicated in far-reaching decisions about the future of contemporary societies and the terms of global governance.[5]

The symptoms of this change can be found in many places: the rise of social movement activism challenging intellectual property policies in such domains as information technology, genetic technologies, and global health; extensive discussion on the Internet and in blogs; a burgeoning scholarly and popular literature; a cascade of policy reports; the creation of new institutions, such as Creative Commons,[6] aimed at constituting a robust public domain; and even, in Sweden and several other countries, attempts to launch a political party—the Pirate Party—calling for major changes, including the gradual abolition of patents.[7] By no means is there agreement among the diverse people and groups active in the increasingly visible politics of intellectual property. But there is little doubt that a growing number of actors are convinced that something is seriously amiss with the governance of intellectual property.

The expanding public debate raises the question of whether the foundations of intellectual property policy remain adequate for managing the new, visible politics of decision making in this realm. Are the prevailing conceptual frameworks and institutions underlying patent policy showing signs of losing the ability to convincingly render decision making in this realm into a matter of law, administration, and expert judgment? Is the basic structure of intellectual property policy sound and only in need of relatively minor adjustments in doctrine and implementation? Or is the traditional framework running up against deeper problems that can only be addressed through more fundamental reforms?

5. This vast and diverse literature cannot be reviewed here, but a few illustrative sources include: LORI ANDREWS & DOROTHY NELKIN, BODY BAZAAR: THE MARKET FOR HUMAN TISSUE IN THE BIOTECHNOLOGY AGE (2001); JAMES BOYLE, SHAMANS, SOFTWARE, AND SPLEENS: LAW AND CONSTRUCTION OF THE INFORMATION SOCIETY (1996); LAWRENCE LESSIG, THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A CONNECTED WORLD (2001); CORYNNE MCSHERRY, WHO OWNS ACADEMIC WORK?: BATTLING FOR CONTROL OF INTELLECTUAL PROPERTY (2001); NEGOTIATING HEALTH: INTELLECTUAL PROPERTY AND ACCESS TO MEDICINES (Pedro Roffe et al. eds., 2006); BRONWYN PARRY, TRADING THE GENOME: INVESTIGATING THE COMMODIFICATION OF BIO-INFORMATION (2004); PERSPECTIVES ON PROPERTIES OF THE HUMAN GENOME PROJECT (F. Scott Kieff ed., 2003); ERIC S. RAYMOND, THE CATHEDRAL AND THE BAZAAR: MUSINGS ON LINUX AND OPEN SOURCE BY AN ACCIDENTAL REVOLUTIONARY (1999); RICHARD M. STALLMAN, FREE SOFTWARE, FREE SOCIETY: SELECTED ESSAYS OF RICHARD M. STALLMAN (Joshua Gay ed., 2002); SIVA VAIDHYANATHAN, COPYRIGHTS AND COPYWRONGS: THE RISE OF INTELLECTUAL PROPERTY AND HOW IT THREATENS CREATIVITY (2001); JOHN WILLINSKY, THE ACCESS PRINCIPLE: THE CASE FOR OPEN ACCESS TO RESEARCH AND SCHOLARSHIP (2006); LAW & CONTEMP. PROBS., Winter/Spring 2003, at 1–483 (James Boyle ed.).

6. *See* Creative Commons, http://creativecommons.org/ (last visited Mar. 24, 2009).

7. *See* The Pirate Party, Piratpartiet, http://www.piratpartiet.se/international/english (last visited Mar. 24, 2009).

This paper argues that there is a mismatch between traditional intellectual property doctrine and the new politics of intellectual property. To examine the nature of the mismatch, I contrast two frameworks that both appear in contemporary debate about intellectual property: the traditional discourse that focuses on innovation policy, and a newer, less clearly codified discourse that views intellectual property issues from the perspective of the politics of technology. This latter discourse focuses on the challenge of democratic governance in a world where emerging technologies have assumed a central role in constituting the future, raising far-reaching questions about how they should be fitted into social orders.[8] The traditional discourse still dominates policy discussion, a fact that has inspired some ingenious efforts to squeeze concerns about technology and democracy into the traditional innovation framework. In addition, some of the most impressive work on intellectual property, especially in the arena of digital technology, mixes innovation and politics-of-technology concerns.[9] To treat these dimensions of the current debate as separate, as this paper does, admittedly entails glossing over some complexities. Nevertheless, parsing the issues into these two perspectives is a useful heuristic device. In particular, recognizing the specific features of the politics-of-technology perspective—and presenting its distinctive vision of what is at stake in intellectual property—clarifies the struggles now in play.

This paper begins by introducing each policy discourse in turn, then compares them systematically, examining how each views the nature of technological change, the powers that patents convey, the roles of inventors and citizens, and the criteria for evaluating policy. My discussion will focus on patent policy, but some similar issues arise in relation to copyright. Much of this argument is also relevant to other mechanisms that create

8. For an analysis of how technology becomes a site for reshaping rights, duties, liberties, and identities in fundamental, even quasi-constitutional, ways, see STATES OF KNOWLEDGE: THE CO-PRODUCTION OF SCIENCE AND SOCIAL ORDER (Sheila Jasanoff ed., 2004); Sheila Jasanoff, *In a Constitutional Moment*, *in* SOCIAL STUDIES OF SCIENCE AND TECHNOLOGY: LOOKING BACK, AHEAD 155 (Bernward Joerges & Helga Nowotny eds., 2003); *see also* LAWRENCE LESSIG, CODE AND OTHER LAWS OF CYBERSPACE (1999) (presenting an extended argument about how computer code functions like law in cyberspace, making information technology into a tool for reshaping social orders).

9. *See, e.g.*, BOYLE, SHAMANS, SOFTWARE, AND SPLEENS, *supra* note 5; TARLETON GILLESPIE, WIRED SHUT: COPYRIGHT AND THE SHAPE OF DIGITAL CULTURE (2007); LESSIG, *supra* note 5; STALLMAN, *supra* note 5. This mixing of innovation and politics-of-technology concerns is perhaps especially prevalent in debate over copyright, which directly and obviously invokes constitutional matters of free speech and the conditions necessary to sustain a democratic polity, *e.g.*, LAWRENCE LESSIG, FREE CULTURE: HOW BIG MEDIA USES TECHNOLOGY AND THE LAW TO LOCK DOWN CULTURE AND CONTROL CREATIVITY (2004), as well as matters of innovation and creativity.

intellectual property rights or quasi-rights in emerging technology, such as database protection regimes and Material Transfer Agreements.[10]

I. THE INNOVATION POLICY PERSPECTIVE

A first step in developing this argument is to characterize briefly the traditional policy discourse for framing intellectual property. By a "policy discourse" I refer to an organized assemblage of concepts, categories, narratives, metaphors, and frames that gives structure to an arena of policymaking.[11] Policy discourses define problems, frame tensions and choices, and create orientations toward the world that, as the discourse grows successful, become embodied in institutional structures, legal doctrine, analytic techniques, informal norms, and standard operating procedures. The policy discourse about intellectual property is thoroughly institutionalized in, for example, patent offices, business practices, and a huge body of legal and scholarly literature. Here I want to ignore the countless variations among patent and copyright, among jurisdictions, among disciplinary approaches (e.g., law, economics of innovation), and over time, so as to highlight some of the most basic, even mundane, features of traditional intellectual property policy discourse.

The discursive starting point for intellectual property policy is a familiar narrative that casts innovation as a social good, the inventor (or author) as hero, the free rider as the villain, limited property rights as the solution, and society as the ultimate beneficiary of the limited rights bargain.[12] This storyline, once translated into the language of patent law, generates a set of questions: What counts as a patentable invention? What constitutes infringement? How should novelty be codified? These questions are the bread and butter of the patent bar. Translated into economic terms, this story provides an analytic structure capable of framing a variety of more

10. For a discussion of database protection regimes, see, for example, J. H. Reichman and Paul F. Uhlir, *A Contractually Reconstructed Research Commons for Scientific Data in a Highly Protectionist Intellectual Property Environment*, LAW AND CONTEMP. PROBS., Winter/Spring 2003, at 315. For a discussion of Material Transfer Agreements, see Philip Mirowski, *Livin' with the MTA*, 46 MINERVA 317 (2008).

11. *See, e.g.*, FRANK FISCHER, REFRAMING PUBLIC POLICY: DISCURSIVE POLITICS AND DELIBERATIVE PRACTICES (2003); MAARTEN A. HAJER, THE POLITICS OF ENVIRONMENTAL DISCOURSE: ECOLOGICAL MODERNIZATION AND THE POLICY PROCESS (1995); GEORGE LAKOFF, MORAL POLITICS: HOW LIBERALS AND CONSERVATIVES THINK (2d ed. 2002); DONALD A. SCHÖN & MARTIN REIN, FRAME REFLECTION: TOWARD THE RESOLUTION OF INTRACTABLE POLICY CONTROVERSIES (1994); Maarten A. Hajer, *Rebuilding Ground Zero. The Politics of Performance*, 6 PLAN. THEORY & PRAC. 445 (2005); *see also* ERVING GOFFMAN, FRAME ANALYSIS: AN ESSAY ON THE ORGANIZATION OF EXPERIENCE (1974).

12. BOYLE, SHAMANS, SOFTWARE, AND SPLEENS, *supra* note 5; MARK ROSE, AUTHORS AND OWNERS: THE INVENTION OF COPYRIGHT (1993).

refined theoretical perspectives that can be brought to bear on the task of designing policy to increase social welfare by enhancing innovation. For example, the leading economic theories of patenting[13]—such as invention inducement theory (which holds that patents motivate inventive activity); disclosure theory (which contends that publication of patents allows future inventors to build on the patent); and development and commercialization theory (which argues that patent protection stimulates the additional investment needed to develop early-stage inventions into marketable forms)—all take stimulating innovation as the central policy goal.[14] There is, of course, some question about the extent to which patents actually contribute to innovation and welfare maximization,[15] but this debate generally assumes that innovation is the proper metric of success. Arguments about protecting the public domain are also typically framed in terms of innovation, as in the debate over the tragedy of the "anti-commons."[16] The innovation perspective thus defines a common ground on which advocates of competing schools of thought, such as intellectual property maximalists (who support more and stronger property rights) and intellectual property minimalists (who favor fewer and weaker rights), can conduct a policy debate limited to questions of means.[17] What is the proper level of intellectual property protection? How can intellectual property policy provide adequate incentives for invention without inhibiting follow-on inventions? Under what conditions does patenting in fact stimulate innovation?

These are important questions, especially given the growing number of scholars who raise doubts about the extent to which current intellectual

13. Roberto Mazzoleni & Richard R. Nelson, *Economic Theories About the Benefits and Costs of Patents*, 32 J. OF ECON. ISSUES 1031 (1998).

14. For a typology and analysis of the main rationales for patent, see Birgitte Andersen, *If "Intellectual Property Rights" is the Answer, What is the Question? Revisiting the Patent Controversies*, 13 ECON. OF INNOVATION AND NEW TECH. 417 (2004).

15. JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK (2008); DOMINIQUE FORAY, THE ECONOMICS OF KNOWLEDGE (MIT Press 2004) (2000); David, *supra* note 4; Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, *in* 3, 1987 BROOKINGS PAPERS ON ECONOMIC ACTIVITY: SPECIAL ISSUE ON MICROECONOMICS 783 (Martin N. Bailey & Clifford Winston eds., 1988); Edwin Mansfield, *How Rapidly Does New Industrial Technology Leak Out?*, 34 J. INDUS. ECON. 217 (1985).

16. Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998); *cf.* James Boyle, *Foreward: The Second Enclosure Movement and the Construction of the Public Domain*, LAW & CONTEMP. PROBS., Winter/Spring 2003, at 33. Sometimes this is expressed as the *freedom* to innovate—a formulation that moves substantially closer to the politics-of-technology perspective described below, without entirely abandoning the language of innovation. The constitutional significance of the freedom to innovate is especially obvious in the copyright domain, where issues of freedom of speech are involved, and this formulation often appears here.

17. James Boyle, *Enclosing the Genome: What Squabbles over Genetic Patents Could Teach Us*, *in* PERSPECTIVES ON PROPERTIES OF THE HUMAN GENOME PROJECT, *supra* note 5, at 97.

property policy is enhancing innovation.[18] For example, in an analysis firmly rooted in the innovation perspective, Adam Jaffe and Josh Lerner argue that recent changes in the operation of the U.S. patent system have led to a proliferation of spurious patents, producing significant transaction costs, spurring litigation, and creating inefficiencies that threaten productivity and continued innovation.[19] These innovation-based arguments for reform merit attention. For this paper, however, the relevant question is whether a policy discourse focused on innovation still provides an adequate tool kit for understanding and addressing the new, more visible contention that animates the contemporary politics of intellectual property.

A. Narrow Discourse

In an important paper, James Boyle[20] criticizes the structure of discourse in intellectual property scholarship using the example of gene patenting. Boyle gives a whirlwind tour of the major arguments against patents on genetic sequences that appear in public debate.[21] Among the objections he catalogs are the claims that genes cannot be patented for religious reasons or because the human genome is the "common heritage of all mankind."[22] Another line of argument contends that genes cannot be patented because they are already owned by "sources"—for example, by the people whose bodies contain them.[23] Critics of gene patents also argue that

18. *See, e.g.*, FORAY, *supra* note 15; ERIC VON HIPPEL, DEMOCRATIZING INNOVATION (2005); LESSIG, *supra* note 5; Boyle, *supra* note 16; Heller & Eisenberg, *supra* note 16; Robert P. Merges & Richard R. Nelson, *On The Complex Economics of the Patent Scope*, 90 COLUM. L. REV. 836 (1990); J. H. Reichman & Paul F. Uhlir, *supra* note 10.

19. JAFFE, *supra* note 4 (calling for reform in the patent system to make it function properly again).

20. Boyle, *supra* note 17, at 100–06.

21. *Id.* Professor Boyle notes that the arguments differ depending on what kind of genetic sequence is involved. Precisely what kind of sequence is involved and how the claims are structured are a critical part of the debate. Thus, people and organizations that support patenting of human genes that have been isolated and characterized, for example, may oppose patents on other kinds of sequences, such as expressed sequence tags. *E.g.*, Human Genome Organization, *HUGO Statement on the Patenting of DNA Sequences*, GENOME DIGEST, April, 6–9 (1995); NAT'L RESEARCH COUNCIL, INTELLECTUAL PROPERTY RIGHTS AND RESEARCH TOOLS IN MOLECULAR BIOLOGY: SUMMARY OF A WORKSHOP (1997) [hereinafter INTELLECTUAL PROPERTY AND RESEARCH TOOLS].

22. Boyle, *supra* note 17, at 98. See also WHO OWNS LIFE? (David Magnus et. al. eds., 2002) for a collection of ethical arguments about patenting of life forms and genes. Regarding religious objections (along with quasi-sacred arguments about the improper commodification of human life), see, for example, ANDREW KIMBRELL, THE HUMAN BODY SHOP (1993), JEREMY RIFKIN, THE BIOTECH CENTURY (1998).

23. For an example of a prominent genome scientist making claims about common heritage, mixed in with comments about confusing discovery and invention, see JOHN SULSTON AND GEORGINA FERRY, THE COMMON THREAD: A STORY OF SCIENCE, POLITICS, ETHICS, AND THE HUMAN GENOME 266–79 (2002). The most widely discussed dispute concerning "sources" is *Moore v. Regents of the Univ. of Cal.*, 793 P.2d 479 (Cal. 1990). *Moore* has inspired much commentary, including BOYLE,

DNA sequences fail to meet the basic criteria of novelty, nonobviousness, and utility that would render them patentable subject matter, or that genes are products of nature better understood as discoveries than inventions.[24] Finally, critics argue against gene patents (or some forms of gene patents) on the grounds that they would inhibit innovation.[25] Boyle's goal is not to support, oppose, or otherwise evaluate these arguments; however, his aim is rather to point out that most intellectual property scholars will consider all but two of these arguments to be entirely irrelevant to policy-oriented scholarship. The exceptions are the question of patentable subject matter, and the effects of gene patents on innovation. In other words, the discussion among specialists in intellectual property policy systematically excludes arguments that are not based in innovation-centered discourse.

Boyle attacks this narrow, innovation-centered focus. Contending that supplementing analysis of intellectual property with non-innovation concerns would strengthen research in the field, he challenges scholars to find ways to broaden the issues under consideration. By way of illustration, he also suggests several possible lines of research to add to the agenda.[26] The first, which cuts to the heart of one aspect of the innovation-centered discourse, is to move beyond the promotion of innovation as a generic category and begin to ask questions about what specific kinds of innovations in-intellectual property policies should seek to promote (for example, in order to enhance "human flourishing").[27] The second line concerns introducing questions about public choice, such as the impact of intellectual property rights on the policy process.[28] Boyle's suggestions make important moves in the direction of illustrating ways to move beyond traditional innovation-centered discourse. In this paper, I take up his challenge in a different way: namely, by launching a discussion of intellectual property policy from a different starting point.

supra note 5 at 97–107. The matter has sometimes been framed in terms of "biocolonialism," with activists connected to indigenous peoples objecting to having their DNA sampled and patented and legal scholars attempting to establish protcols for achieving group consent. JENNY REARDON, RACE TO THE FINISH: IDENTITY AND GOVERNANCE IN AN AGE OF GENOMICS 103–13 (2005).

24. *See, e.g.*, WHO OWNS LIFE? *supra* note 22; *see also* Jon F. Merz, et al., *Disease Gene Patenting is a Bad Innovation* 2 MOLECULAR DIAGNOSIS 299 (1997).

25. These arguments have been especially prominent in discussions of "research tools," such as expressed sequence tags (ESTs) and single nucleotide polymorphisms (SNPs). *See, e.g.*, Human Genome Organization, *supra* note 21; and INTELLECTUAL PROPERTY AND RESEARCH TOOLS, *supra* note 21.

26. Boyle, *supra* note 17, at 114–18.

27. *Id.* at 114.

28. *Id.* at 116–18.

II. THE POLITICS-OF-TECHNOLOGY PERSPECTIVE

One can gain a fresh perspective on what is at stake in the intellectual property domain by beginning with an increasingly familiar, if only partially institutionalized, policy discourse. Its point of departure—far removed from the traditional view—is not a microeconomic just-so story about inventors, free riders, and incentive structures, but a macropolitical one about the profound role of technological systems in the politics of contemporary societies.[29] The narrative might begin with the Manhattan Project, the thalidomide disaster, or *Silent Spring*; or perhaps with the double helix, the Karen Ann Quinlan case, or the rise of the Internet. But suffice it to say that during the second half of the twentieth century, people increasingly recognized that decisions about how to wield the awesome power of modern technologies had become matters of tremendous societal importance. The role of technology in political conflict and social control became visible in artifacts as earth shaking as the intercontinental ballistic missile[30] and as mundane as the speed bump.[31] Many observers came to see technological systems as inextricably woven into the social world in ways that simultaneously enable and constrain specific forms of life. Emerging technology—especially in such hotbeds of change as the life sciences, information technology, biomedicine, and nanotechnology—became a site of contention where competing groups pursued incompatible normative visions. Indeed, as people recognized that questions about the shape of technological systems were nothing less than questions about the future shape of societies, science and technology achieved central significance in contemporary democracies.[32] In this context, states face ongoing difficulties trying to mediate these tensions and establish mechanisms for addressing problems of

29. For useful reviews of how technology matters in politics, see Wiebe E. Bijker, *Why and How Technology Matters, in* THE OXFORD HANDBOOK OF CONTEXTUAL POLITICAL ANALYSIS 681 (Robert E. Goodwin & Charles Tilly eds., 2006); Sheila Jasanoff, *Technology as a Site and an Object of Politics, in* THE OXFORD HANDBOOK OF CONTEXTUAL POLITICAL ANALYSIS, *supra*, at 745; Judy Wajcman, *The Gender Politics of Technology, in* THE OXFORD HANDBOOK OF CONTEXTUAL POLITICAL ANALYSIS, *supra*, at 707; *see also* LANGDON WINNER, THE WHALE AND THE REACTOR: A SEARCH FOR LIMITS IN AN AGE OF HIGH TECHNOLOGY (1986). On the changing contextualization of science, see HELGA NOWOTNY ET AL., RE-THINKING SCIENCE: KNOWLEDGE AND THE PUBLIC IN AN AGE OF UNCERTAINTY (2001); *see also* CONTROVERSY: POLITICS OF TECHNICAL DECISIONS (Dorothy Nelkin ed., 1979).

30. DONALD A. MACKENZIE, INVENTING ACCURACY: A HISTORICAL SOCIOLOGY OF NUCLEAR MISSILE GUIDANCE (1990).

31. Bruno Latour, *Where are the Missing Masses? The Sociology of a Few Mundane Artifacts, in* SHAPING TECHNOLOGY/BUILDING SOCIETY: STUDIES IN SOCIOTECHNICAL CHANGE 225, 243–44 (Wiebe E. Bilker & John Law eds., 1992) [hereinafter SHAPING TECHNOLOGY/BUILDING SOCIETY]. *See also* WINNER, *supra* note 29, at 19–39.

32. *See* SHEILA JASANOFF, DESIGNS ON NATURE: SCIENCE AND DEMOCRACY IN EUROPE AND THE UNITED STATES (2005).

representation and participation in the sociopolitical process that shapes emerging technology.

To respond to these political challenges, governments have developed a variety of new policy machinery in a number of institutional sites.[33] One salient example is in the arena of science advice, where governments introduced policies, such as the Federal Advisory Committee Act, aimed at responding to demands for transparency and for wider avenues for public participation.[34] In addition, new mechanisms intended to facilitate "public engagement" in deliberation about technological choices have proliferated.[35] Research funding agencies have also devoted increasing attention to the challenges of governing emerging technologies. Thus, in Europe and the United States, government funders of high-profile scientific initiatives (e.g., in genomics, nanotechnology, and converging technologies) established programs intended to "anticipate and address" societal implications. The extent to which these official efforts are actually succeeding in making the governance of science and technology more effective and/or more democratic remains a matter of debate,[36] and the recurring calls for finding new ways to involve citizens in deliberative processes are accompanied by hard-nosed consideration of the obstacles to doing so and of the paradoxes of representational techniques.[37] Beyond these official responses, a variety of citizens, social movements, and non-governmental organizations continue to demand a greater role in shaping emerging technologies and the rules under which they will operate.[38]

33. *See* DAVID H. GUSTON, BETWEEN POLITICS AND SCIENCE: ASSURING THE INTEGRITY AND PRODUCTIVITY OF RESEARCH (2000).

34. *See* JASANOFF, *supra* note 2; STEPHEN HILGARTNER, SCIENCE ON STAGE: EXPERT ADVICE AS PUBLIC DRAMA (2000).

35. ALAN IRWIN & MIKE MICHAEL, SCIENCE, SOCIAL THEORY AND PUBLIC KNOWLEDGE (2003); JAMES WILSDON & REBECCA WILLIS, SEE-THROUGH SCIENCE: WHY PUBLIC ENGAGEMENT NEEDS TO MOVE UPSTREAM (2004); Robin Grove-White, *Britain's Genetically Modified Crop Controversies: The Agriculture and Environment Biotechnology Commission and the Negotiation of "Uncertainty"*, 9 COMMUNITY GENETICS 170 (2006); Gene Rowe and Lynn J. Frewer, *A Typology of Public Engagement Mechanisms*, 30 SCI. TECH. & HUM. VALUES 251 (2005).

36. *See, e.g.*, PHILIP KITCHER, SCIENCE, TRUTH, AND DEMOCRACY 187–92 (2001).

37. *See, e.g.*, Ulrike Felt et al., *Visions and Versions of Governing Biomedicine: Narratives on Power Structures, Decision-Making and Public Participation in the Field of Biomedical Technology in the Austrian Context*, 38 SOC. STUD. SCI. 233 (2008); Javier Lezaun & Linda Soneryd, *Consulting Citizens: Technologies of Elicitation and the Mobility of Publics*, 16 PUB. UNDERSTANDING SCI. 279 (2007); Steve Rayner, *Democracy in the Age of Assessment: Reflections on the Roles of Expertise and Democracy in Public-Sector Decision Making*, 30 SCI. & PUB. POL'Y 163 (2003).

38. *See* CONTROVERSY: POLITICS OF TECHNICAL DECISIONS (Dorothy Nelkin ed., 1979); STEVEN EPSTEIN, IMPURE SCIENCE: AIDS, ACTIVISM, AND THE POLITICS OF KNOWLEDGE (1996); THE NEW POLITICAL SOCIOLOGY OF SCIENCE: INSTITUTIONS, NETWORKS, AND POWER (Scott Frickel & Kelly Moore eds., 2006); Jasanoff, *supra* note 29.

In such a context, decisions about intellectual property bear not only on the traditional issues of innovation policy but also on the question of how influence over the structure of emerging technological systems will be allocated. A first-step in understanding the new politics of intellectual property is therefore to recognize that much of the contemporary debate is not about stimulating innovation, but centers on concerns about who governs technology and in pursuit of what goals. In a variety of technical domains, activists and analysts are arguing that intellectual property sometimes grants its owners too much power over the architecture of technological systems and the structure of emerging social orders.[39] At the same time, from a more theoretical perspective, a politics-of-technology view leads to inquiry about the forms of citizenship that intellectual property policy facilitates and about the kinds of subjects and objects that the patent system constitutes.[40] Thus, rather than focusing on innovation, the politics-of-technology perspective raises questions about how intellectual property affects the ways in which democratic polities govern their technological and social futures. How do patents alter the balance of power in processes that shape emerging technological systems? Do patents sometimes limit the ability of citizens to have a voice and exercise choice in these processes? More deeply, what forms of democratic representation, participation, and citizenship does intellectual property policy tend to support?

A. Contested Boundaries

Such questions are a recognizable feature of the contemporary politics of intellectual property, but they have been more successful in stimulating debate and inspiring activism than in influencing policy. One reason is that politics-of-technology discourse is somewhat diffuse, especially in comparison with the tightly-focused innovation discourse. At the level of the basic narrative, the macropolitical story about the challenges of democratic governance in technological societies is much more untidy than the neat little tale that serves to launch the innovation-centered discourse. The cast of characters is larger, and a host of conflicting values and interests animate the story, with some observers seeing the central challenge as generating the knowledge base for sound decisions, whereas others stress democratic

39. Biotechnology patents are a good example; see the discussion of the patents on the breast cancer genes below. *See also* Javier Lezaun, *Pollution and the Use of Patents: A Reading of* Monsanto v. Schmeiser, *in* BIOTECHNOLOGY: BETWEEN COMMERCE AND CIVIL SOCIETY 135 (Nico Stehr ed., 2004). Similar arguments are made about software and other information technology. *See, e.g.*, STALLMAN, *supra* note 5.

40. *See* ANDREW BARRY, POLITICAL MACHINES: GOVERNING A TECHNOLOGICAL SOCIETY (2001).

decision making and public accountability. Most important, this macropolitical story lacks the clean narrative closure of the innovation story, which reaches a satisfying denouement when the social bargain creating limited property rights transforms the policy problem into the (superficially) manageable task of striking a "balance" that maximizes technological progress. In contrast, policy discourse about the politics of technology clearly remains a story without an ending. To what extent and precisely how this unresolved narrative will be fashioned into institutional form (in the innovation domain or anywhere else) remains unclear.

The failure of the politics-of-technology discourse to be expressed in intellectual property policy also stems from a second, more fundamental reason; namely, that questions about technology and democracy do not fit comfortably within the worldview of the innovation policy discourse.[41] The innovation perspective frames societal decision making about which technologies to develop and how to deploy them as being "outside" the intellectual property arena: they are not matters of patent policy but questions to be resolved by such means as market mechanisms, regulatory action, criminal law, and so forth. The traditional discourse assumes that the proper purview of intellectual property policy is stimulating the creation of new technologies; social choices about new technologies should be made "elsewhere."[42] This institutional cartography can be presented as an empirical claim (this is how things are as a matter of law) or as a normative one (this is how things should be). Often, it seems to encompass a blending of *is* and *ought*.

The politics-of-technology perspective rejects the traditional definition of the boundaries of intellectual property policy: first, because this perspec-

41. In his critique of structure of scholarly discourse about intellectual property, James Boyle argues that:

> [O]ur concentration on the clash between maximalist and minimalist visions of intellectual property has produced as an unintended side effect: a curious methodological tunnel vision. The critical scholars most likely to question the ambit of new rights are, paradoxically, firmly wedded to the notion that the only legitimate rubric for intellectual property policy is the maximization of innovation. All other normative criteria are to be exiled beyond the pale of the discipline.

Boyle, *supra* note 17, at 110.

42. The major exception to this idea is the doctrine that the scope of patentable subject matter should not include inventions contrary to "ordre public" or morality. *See, e.g.*, European Patent Convention art. 53(a), which states that European patents shall not be granted in respect of "inventions the commercial exploitation of which would be contrary to 'ordre public' or morality; such exploitation shall not be deemed to be so contrary merely because it is prohibited by law or regulation in some or all of the Contracting States." Gold and Caulfield have proposed expanding the doctrine of denying patents on ethical grounds to create a "moral tollbooth" that would allow patents to be withheld, revoked, or suspended to restrain unethical conduct. *See* E. Richard Gold & Timothy A. Caulfield, *The Moral Tollbooth: A Method That Makes Use of the Patent System to Address Ethical Concerns in Biotechnology*, 359 LANCET 2268 (2002).

tive questions the empirical validity of a bright-line distinction between creating technologies and making social choices about them; second, because it sees the traditional cartography as tending to constitute members of the public as "consumers" of prepackaged technologies rather than "citizens" engaged in shaping them; and third, because it has a normative commitment to enabling citizens to exercise voice and choice about emerging technology before irreversible commitments in specific directions are made. In short, the politics-of-technology perspective considers patent policy from a point of view that focuses on questions of democratic governance and political legitimacy.

III. COMPARING THE PERSPECTIVES

To further explore what is distinctive about the politics-of-technology view of intellectual property, let us compare it systematically with the more familiar innovation perspective, examining several fundamental issues: the nature of technological change; the forms of power that patents convey; the effect of patents on openness; the roles of inventors and citizens; and the criteria for evaluating policy.

A. Inventive Steps or Technology in Social Context

The two policy discourses conceptualize technological change in very different ways. The patent law casts technological change as stemming from a series of *inventive steps* taken by identifiable inventors, and its central policy goal is to ensure that inventions are efficiently produced, developed, and introduced into the economy. The traditional discourse tends to imagine technological change as a rising-tide-raises-all-boats phenomenon that yields social and economic benefits for everyone, at least in the aggregate and over the long run. It would be an exaggeration (though perhaps not a great one) to say that innovation discourse often refers to technology as if it were a one-dimensional variable whose "level" and "rate" of growth should be the key metrics for measuring policy success. Generally speaking, however, this approach to intellectual property treats technology and innovation at a high level of abstraction: the focus is on enhancing technological innovation as a generic category, maximizing its rate, and propelling society forward on the path of progress. The traditional discourse also frames the innovation process as an activity mainly involving technical experts and managers rather than as one that could, should, or sometimes

does involve much broader collections of participants.[43] It is also more compatible with the romanticized vision of the heroic inventor[44] than with the distributed, collective character of many contemporary research networks.[45]

The politics-of-technology discourse appreciates change in a very different way; for it focuses on *technology in social context.* The contextual approach leaves this perspective ambivalent about technological change, which it neither categorically rejects nor uncritically embraces. Technological artifacts, standards, and systems are not conceptualized as isolated entities but as phenomena that are woven into the social world in complex and consequential ways. To get a handle on technology in context, the politics-of-technology perspective draws intellectual inspiration from social and historical studies of technology, rather than the mainstays of the innovation discourse, economics and law.[46] In recent decades, a growing body of scholarship has examined the social processes that shape technological artifacts and systems and lead them to take particular forms.[47] The field sports a variety of theoretical perspectives, which I can barely gesture toward here, but central to the enterprise is the notion that technology does not simply advance in a teleological way toward optimal solutions but is shaped through a process of negotiation in which normative values about what constitutes a good solution are themselves at issue.

One of the most influential frameworks is the social construction of technology (SCOT) approach.[48] SCOT conceptualizes the construction of

43. In contrast to this focus on traditional innovators, such as professional designers and managers, a growing body of literature demonstrates that the users of technologies are sometimes—and perhaps even often—important innovators. *See,* VON HIPPEL, *supra* note 18. In many contexts, users also play a central role in designing technologies, subverting designers' intentions, or employing and interpreting technologies in unexpected ways. *See, e.g.,* HOW USERS MATTER: THE CO-CONSTRUCTION OF USERS AND TECHNOLOGIES (Nelly Oudshoorn & Trevor Pinch eds., 2003) [hereinafter HOW USERS MATTER].

44. BOYLE, *supra* note 5.

45. *See, e.g.,* SCIENTIFIC AUTHORSHIP: CREDIT AND INTELLECTUAL PROPERTY IN SCIENCE (Mario Biagioli & Peter Galison eds., 2003); Stephen Hilgartner & Sherry I. Brandt-Rauf, *Data Access, Ownership, and Control: Toward Empirical Studies of Acess Practices,* 15 SCI. COMM. 355 (1994); Stephen Hilgartner, *Mapping Systems and Moral Orders: Constituting Property in Genome Laboratories, in* STATES OF KNOWLEDGE: THE CO-PRODUCTION OF SCIENCE AND SOCIAL ORDER, *supra* note 8, at 131.

46. The fact that the two discourses connect to different fields of scholarship reinforces the traditional institutional cartography.

47. *See, e.g.,* HANDBOOK OF SCIENCE AND TECHNOLOGY STUDIES (Edward J. Hackett et al. eds. 3d ed. 2008); HOW USERS MATTER, *supra* note 43; SHAPING TECHNOLOGY/BUILDING SOCIETY, *supra* note 31; THE SOCIAL CONSTRUCTION OF TECHNOLOGICAL SYSTEMS: NEW DIRECTIONS IN THE SOCIOLOGY AND HISTORY OF TECHNOLOGY (Wiebe E. Bijker et al. eds., 1987) [hereinafter THE SOCIAL CONSTRUCTION OF TECHNOLOGICAL SYSTEMS].

48. Trevor J. Pinch & Wiebe E. Bijker, *The Social Construction of Facts and Artifacts: Or How the Sociology of Science and the Sociology of Technology Might Benefit Each Other, in* THE SOCIAL CONSTRUCTION OF TECHNOLOGICAL SYSTEMS, *supra* note 47, at 17.

technology as a dynamic negotiation among social groups, who often define goals, problems, and solutions in different ways and work to push these definitions into alternative designs. The ultimate shape that an artifact takes is the upshot of these multidirectional struggles.[49] Another approach focuses on technological systems, such as an electric power network or the Internet, emphasizing how these systems weave together diverse components (including machines, people, organizations, and laws) into functioning systems.[50] The process that shapes these systems is often contentious, and is heavily freighted with normative stakes. Other analysts argue that designers of technologies build their preconceptions about the users of technology into artifacts and systems.[51] Drawing on visions of users with particular tastes, competencies, and motives, designers inscribe "scripts" into technologies that cast users in specific roles,[52] operating like regimes of governance.[53] A piece of software, for example, invites certain modes of user interaction while constraining or preventing others. To be sure, users may resist these roles (at some cost and with varying degrees of success), so these scripts cannot completely determine their actions, but it is undeniable that the designers of technologies often aim to choreograph human action.[54]

Scholars in the field reach diverse conclusions about how much users can influence technological design or employ technologies in ways that designers did not imagine.[55] But for our purposes, the key point is that this body of research suggests that technology is not produced through an apolitical process of invention and application but through often-contentious negotiations that reshape technology and reorder societies. Instead of a rising tide that raises all boats, specific technological changes create winners and losers and support more or less desirable forms of life. The politics-of-technology perspective thus frames the ability to influence the shape of emerging technologies as a key source of power in contemporary socie-

49. *Id.* at 24–47.

50. THOMAS PARKE HUGHES, NETWORKS OF POWER: ELECTRIFICATION IN WESTERN SOCIETY, 1880–930 (1983). See also Latour, *supra* note 31, for a related but distinct approach.

51. Steve Woolgar, *Configuring the User: The Case of Usability Trials*, *in* A SOCIOLOGY OF MONSTERS: ESSAYS ON POWER, TECHNOLOGY AND DOMINATION 57 (John Law ed., 1991).

52. Madeleine Akrich, *The De-Scription of Technical Objects*, *in* SHAPING TECHNOLOGY/BUILDING SOCIETY, *supra* note 31, at 205.

53. Stephen Hilgartner, *Biomolecular Databases: New Communication Regimes for Biology?*, 17 SCI. COMM. 240 (1995).

54. For intellectual property scholars, debate over the use of technology to control users has been especially visible in the realm of digital copyright. *See, e.g.*, LESSIG, *supra* note 9; GILLESPIE, *supra* note 9.

55. For a discussion of differences on this point between a number of frameworks, including those of Woolgar and Akrich mentioned above, see HOW USERS MATTER, *supra* note 43.

ties. In contrast, the innovation discourse, with its teleological vision of apolitical progress, leaves little space for the idea that technological design even *has* a politics.

Viewing technology in social and political context leads to an outlook on intellectual property policy that little resembles the traditional view. If the policy problem for the innovation discourse is economic maximization, then the problem for the politics-of-technology discourse is democratic decision making. Abandoning the notion that technological change is apolitical and imaging it as involving choices among ways of life immediately raises important questions: Who participates in making these choices? Through what institutions? With what implications for the operation of power and the legitimacy of political institutions? Thus, the politics-of-technology perspective suggests that patent policy should be evaluated in terms of its role in shaping the dynamics of democratic choice, the nature of citizenship, and the legitimacy of political institutions in societies undergoing rapid technological and social change.

B. Market Power or Configuration Power

The two discourses also differ sharply on the kinds of power that they imagine patents convey to their owners. The innovation perspective frames patents primarily as a source of *market power*, emphasizing their role in enabling inventors (or their licensees) to profit from their creations. In the paradigmatic case, the patent provides a means to solve free rider problems and encourage investments in research and development (R&D), commercialization, and other innovative activity. But the politics-of-technology perspective takes a broader view of the uses of patent rights, focusing on the powers that patents grant over the social relations surrounding and embedded in specific technologies. Rather than only conveying market power, intellectual property rights also convey what one might call *configuration power*—the ability to influence how technologies are intertwined with the social world. Configuration power can be exerted in the negotiations that shape technological artifacts, infrastructures, or systems, but the key point is that it involves not only technology but also social relations.[56]

The traditional discourse pays little attention to configuration power.[57] It is often said that patents "merely" grant the inventor the right to exclude others from selling or using the invention, and this truism is accurate

56. Market power and configuration power, of course, often operate hand in hand, with each enhancing the other.

57. To the extent it does, it is mainly through discussions of establishing technical standards that produce orderly markets and paths to commercialization.

enough in a rigidly literal sense. But such formulations obscure the extent to which the right to exclude creates leverage that yields additional powers, such as what Eleanor Ostrom and her colleagues,[58] have termed "management rights"—which grant control over decision making about a resource. With a patented invention, such managerial rights radiate outward from the invention itself to encompass a variety of decisions aimed at shaping the terms under which the invention is intertwined with broader social and technical orders. Put otherwise, patents can serve as a vehicle for asserting managerial dominion not only over the invention itself, but also over the social relations surrounding it.

The patents on the breast cancer genes, BRCA1 and BRCA2, issued to Myriad Genetics, Inc. and Oncormed, Inc. or licensed by them, offer a case in point.[59] These companies, along with several other providers, wanted to market genetic testing services to women seeking predictive information about their breast and ovarian cancer risk. The two companies engaged in litigation, but reached an out-of-court settlement that left Myriad with exclusive rights to diagnostic testing for the BRCA genes in the United States.[60] These rights not only gave the company power to make decisions about pricing and licensing, but also to configure the social and technical "architecture" of breast cancer testing services in a manner of its choosing.[61] These architectural decisions included, but also extended beyond, matters of market power, such as price and "access" to testing services. Indeed, a number of organized groups—breast cancer activists, physicians, bioethicists, genome scientists, and professional societies, such as the American Society for Human Genetics—engaged in robust debate about the sociotechnical architecture of testing services: Who was an appropriate "user" of novel, incompletely-studied, and potentially risky predictive genetic tests? How should eligibility for testing be determined and by whom? Should such tests be made available only in a research context or as a commercial service? What kind of technological platform should be used to

58. *See, e.g.*, Charlotte Hess & Elinor Ostrom, *Ideas, Artifacts, and Facilities: Information as a Common-Pool Resource*, LAW & CONTEMP. PROBS. 111 (2003).

59. For a book length analysis of the introduction of breast cancer genetic testing in the U.S. and U.K., see SHOBITA PARTHASARATHY, BUILDING GENETIC MEDICINE: BREAST CANCER, TECHNOLOGY, AND THE COMPARATIVE POLITICS OF HEALTH CARE (2007). Parthasarathy describes how a number of patents were involved, setting the stage for interference and litigation. *Id.* at 116–18, 236–37. OncorMed was granted a BRCA1 patent covering its consensus sequence. U.S. Patent No. 5,654,155 (filed Feb. 12, 1996). Myriad was granted BRCA1 patents shortly thereafter. *See* U.S. Patent 5,693,473 (filed June 7, 1995); U.S. Patent No. 5,709,999 (filed June 7, 1995); U.S. Patent No. 5,710,001 (filed June 7, 1995). In addition, OncorMed obtained exclusive licenses to two BRCA2 patents. U.S. Patent No. 5,622,829 (filed Apr. 19, 1995); U.S. Patent No. 6045997, (issued Apr. 4, 2000).

60. PARTHASARATHY, *supra* note 59, at 117–120.

61. *Id.* at 57.

implement testing? How should quality standards for conducting tests be structured? Should post-test counseling be provided as part of the testing package? How should uncertainties about the meaning of test results be presented to non-geneticists? Should tests be advertised directly to women or only to physicians?[62] Myriad's exclusive managerial rights gave it the capacity to make decisions about these aspects of the architecture of BRCA testing services in the United States, and the company systematically eliminated the alternative architectures that had been put in place before it consolidated control over the U.S. market.[63]

As this example suggests, patents do not just allocate the economic benefits of successful inventions; they also allocate voice and choice in processes that shape technological systems, providing patent holders with managerial rights that may yield considerable power to make architectural decisions (and the normative choices embedded in them). To be sure, configuration power, like market power, is not absolute. Individuals and groups can still resist the efforts of patent holders to configure their relationships with particular technologies. In the Myriad case, a number of other countries configured BRCA testing in rather different ways,[64] a task that sometimes required actively resisting Myriad's efforts to use its patent position to impose its architectural preferences.[65] But there is little doubt that intellectual property can be a powerful resource in social negotiations about the shape of emerging technological systems or artifacts. Patents, of course, are far from the only source of configuration power, just as they are far from the only source of market power; nevertheless, the importance of emerging technologies and the exclusive rights that they convey make patents a significant source of both. Patents that are difficult to invent around,

62. Widely discussed risks include the possibility that women and their physicians would take unnecessary and undesirable interventions, such as prophylactic mastectomies, on the basis of uncertain information. Alternatively, favorable results might produce unwarranted confidence, leading people to stop getting mammograms.

63. As Shobita Parthasarathy shows, in 1996 there was no consensus about how breast cancer testing services should be organized and how these novel services should be introduced into widespread use while their efficacy and risks remained incompletely understood. PARTHASARATHY, *supra* note 59, at 58–95. Several very different testing architectures were put in place by different actors. For example, Myriad, which promoted BRCA testing with direct-to-consumer advertising and would test any sample sent to it by a physician, took a very different approach than did Oncormed, a company that only offered tests to women deemed to be at high risk. *See id.* at 93–95 (Table 2.1) (systematically comparing the architectures of four American testing centers that offered the tests prior to Myriad establishing complete control over the test in the United States).

64. For a comparison of the configuration of breast cancer testing in the U.S., the U.K., and France, see Ilana Löwy & Jean Paul Gaudillière, *Localizing the Global: Testing for Hereditary Risks of Breast Cancer*, 33 SCI. TECH. & HUM. VALUES 299 (2008).

65. For an analysis of Myriad's efforts to extend its testing regime to the United Kingdom, see PARTHASARATHY, *supra* note 51.

such as disease gene patents, may yield configuration power that is especially significant in constraining citizen participation in decision making.

C. *Transparent or Opaque*

The two discourses also differ in their views of the effect of patents on the openness of decisions about emerging technologies. The innovation perspective frames patents as a source of transparency, contrasting them with trade secrecy as a means of protecting innovations. Because of the disclosure requirement, patents appear at first glance to be more public and open than trade secrets; after all, the inventor must publish the patent rather than conceal the trade secret. Future inventors therefore can build on knowledge that would be locked away under a trade secret regime. Of course, within the economics literature there is some debate about whether and under what conditions the disclosure requirement actually enhances innovation, since trade secrets do not prevent competitors from using inventions that they independently replicate, whereas patents do.[66] Also, under some circumstances, the goal of seeking patent protection may encourage secrecy in the research process. Even among academic scientists (not to mention private companies) efforts to secure patents may, at least to some degree, encourage delays in publication or inhibit data sharing.[67] Not only can secrecy propagate upstream from the point of potential patent,[68] but university research is often entangled in a variety of elaborate practices for controlling access to emerging research results.[69] The extent to which the

66. JAFFE & LERNER, *supra* note 4; LEVIN ET AL., *supra* note 15; Mazzoleni & Nelson, *supra* note 13.

67. *See, e.g.*, MARTIN KENNEY, BIOTECHNOLOGY: THE UNIVERSITY-INDUSTRIAL COMPLEX 121–31 (1986); Blumenthal et al., *Data Withholding in Genetics and the Other Life Science: Prevalences and Predictors*, 81 ACAD. MED. 137 (2006); Eric G. Campbell et al., *Data Withholding in Academic Genetics: Evidence From a National Survey*, 287 JAMA 473 (2002); Rebecca S. Eisenberg, *Patents and Data-Sharing in Public Science*, 15 INDUS. & CORP. CHANGE 1013 (2006); John P. Walsh, Charlene Cho & Wesley M. Cohen, *View From the Bench: Patents and Material Transfers*, 309 SCIENCE 2002 (2005). See also Phil Mirowski, *supra* note 10, who argues that extant survey research, especially the study by Walsh et al. *supra*, underestimates the extent to which intellectual property concerns are restricting data sharing in university-based science. Historical studies point out that university patenting and secrecy in academic research are not simply a "new" phenomenon. *See, e.g.*, STEVEN SHAPIN, THE SCIENTIFIC LIFE: A MORAL HISTORY OF A LATE MODERN VOCATION (2008); Grischa Metlay, *Reconsidering Renormalization: Stability and Change in 20th-Century Views on University Patents*, 36 SOC. STUD. SCI. 565 (2006).

68. *See, e.g.*, Stephen Hilgartner, *Access to Data and Intellectual Property: Scientific Exchange in Genome Research*, in INTELLECTUAL PROPERTY RIGHTS AND RESEARCH TOOLS, *supra* note 21, at 28–39.

69. See Mirowski, *supra* note 10, for an analysis of how Material Transfer Agreements are increasingly functioning as a form of "quasi-IP" with significant effects on data sharing in university research. The technology licensing practices of universities are also relevant here. *See, e.g.*, Lori Pressman, et al., *The Licensing of DNA Patents by U.S. Academic Institutions: An Empirical Survey*, 24 NATURE BIOTECH. 31 (2006).

"inherently public" nature of patents actually accelerates innovation clearly merits ongoing study and debate.

But from the politics-of-technology perspective, a different issue emerges; for a patent grants the right to make managerial decisions pertaining to an invention in an opaque, proprietary space. Generally speaking, the holders of patent rights enjoy the right to conduct private, closed deliberations about whether or not to develop a patented invention, how aggressively to invest in it, how to structure licensing agreements, how to configure the roles of users, how to structure system architecture, and so forth. As a result, sociotechnical roads-not-taken may remain invisible even after infrastructures stabilize or products are brought to market. In the Myriad case, diverse architectural possibilities became visible—in part owing to alternative business models and in part because activists and professionals were already energetically engaged in contention about genetic testing when the BRCA genes were found.[70] But public disclosures about roads-not-taken are the exception not the norm. The politics-of-technology perspective thus stresses that the patent system, at least as presently constituted, is completely consistent with opaque decision making that creates barriers to wider participation in social negotiations about technology. The same, of course, might be said for trade secrets, which obviously entail closed decision making, but the fact that trade secrets do not create exclusive rights leaves open the possibility that competing firms will offer alternative sociotechnical configurations in the marketplace.

D. Inventors or Citizens

Perhaps the most fundamental difference between the two discourses is that each centers on a different figure. For the innovation perspective, that figure is the "inventor"; for the politics-of-technology discourse, it is the "citizen." Innovation discourse emphasizes a relatively narrow set of parties whose ownership rights arise from their proximity to the inventive step. In particular, the traditional discourse lavishes much attention on various species of inventors, including those who already hold patent rights (that must be protected from infringement), those who have created novel inventions (who deserve patent rights), and those who will create novel

70. In addition, comparative studies of science and technology, both historical and contemporary, can make visible alternative ways to structure technological systems. *E.g.*, THOMAS PARKE HUGHES, NETWORKS OF POWER: ELECTRIFICATION IN WESTERN SOCIETY, 1880–1930 (1983); JASANOFF, *supra* note 32; PARTHASARATHY, *supra* 59. Löwy and Gaudillière's comparison of BRCA testing in the United States, France, and the United Kingdom provides a good example and shows "how the ownership of tests shapes practices." Löwy & Gaudillière, *supra* note 64, at 303–06.

things in the future (but require access to information to do so). The legal machinery of the patent system focuses on inventors (along with their licensees, financial backers, and competitors, and the firms that develop and market their inventions), and the analytic approach of innovation economics pays inventors a similar compliment. While not absent from innovation discourse, the public plays a relatively passive role, appearing late in the R&D process as the beneficiary of technological progress. To the extent that members of the public play an active role in shaping technology, they do so mainly as "consumers" expressing choices in markets, or as citizens exercising political choice in a reactive mode—a situation that has stimulated the rise of a small social science industry aimed at anticipating which new technologies will spark active opposition.[71]

In contrast, the politics-of-technology discourse is centrally concerned with the challenges of legitimate decision making in democratic societies concerning technological change, and it focuses on the rights of citizens and problems of representation and participation in the sociopolitical processes that shape emerging technology. Accordingly, this discourse is concerned with a broad collection of actors with various stakes in technological development. These actors include not only those who claim rights based on their innovative activities, but also those who claim rights grounded in other ways, such as software engineers or computer users claiming rights to use algorithms or to modify code;[72] scientists claiming rights to forms of scientific life relatively unencumbered by commercial restrictions;[73] and disease activists who have claimed moral rights to influence research and sociotechnical systems related to their disease,[74] for example, by challenging the morality of high-priced patented drugs, resisting patenting of "their" genes,[75] or seeking to gain control by obtaining patents themselves.[76]

The politics-of-technology perspective also criticizes the active-inventor, passive-citizen frame that the innovation discourse takes to be natural. More precisely, this perspective holds that innovation discourse

71. *See, e.g.*, Baruch Fischhoff, Alain Nadai & Ilya Fischhoff, *Investing in Frankenfirms: Predicting Socially Unacceptable Risks*, 2 .J. PSYCHOL. & FIN. MARKETS 100 (2001).

72. STALLMAN, *supra* note 5.

73. INTELLECTUAL PROPERTY RIGHTS AND RESEARCH TOOLS IN MOLECULAR BIOLOGY; JOHN SULSTON & GEORGINA FERRY, *supra* note 23; Paul Ginsparg, *Next-Generation Open Access*, CT WATCH Q., August 2007, at 11.

74. EPSTEIN, *supra* note 38.

75. Eliot Marshall, *Genetic Testing: Families Sue Hospital, Scientist for Control of Canavan Gene*, 290 SCIENCE 1062 (2000).

76. Sharon F. Terry & Patrick F. Terry, *A Consumer Perspective on Forensic DNA Banking*, 34 J.L. MED. & ETHICS 408 (2006).

does not merely picture the world in this way, but that its institutional and conceptual machinery helps to build this vision into the world. Through its everyday operation in many dispersed sites, the patent system distills the continuities and complexities of research and development into such stylized categories as inventor, invention, and inventive steps. Issuing a patent constitutes an inventor-invention dyad, simultaneously producing an owner, an ownable entity, and a set of non-owners which includes not only free riders and competing firms, but also citizens, activists, users, and others. As it constitutes the subjects and objects of property in this way, the patent system not only depends on sharp distinctions between inventor and user, designer and consumer, and R&D and public choice, but renders them into legally significant social facts. By creating concentrations of configuration power, the patent system narrows the avenues through which citizens might expect to shape technology, although these avenues obviously are not (and cannot be) completely closed.

E. Efficient Innovation or Adequate Representation

Even the most pragmatic of policy discourses implicitly define normative ideals, and the two discourses clearly frame these ideals in different terms. For the innovation discourse, the central policy challenge is balancing the tensions among different various species of inventors (past, present, future, etc.), between creating incentives for innovation and creating monopolies, and so forth. Innovation analysts recognize that it would be utopian to imagine achieving such a balance in a real world of conflicting interests, incomplete knowledge, and blunt policy instruments. Most of them also concede that it is impossible to create an operational definition of economic efficiency that does not favor particular interests. But the innovation discourse nevertheless sets as its normative vision a world in which policies produce efficient markets, robust technological progress, economic and social benefits for all, and just rewards for innovators.

For the politics-of-technology discourse, the central policy challenge involves finding ways to ensure that society makes choices about emerging technology through procedures that reflect democratic values, ensuring adequate representation and addressing deficits in democratic decision making. Politics-of-technology analysts fully recognize that actual democracies will always fall short of utopian visions of the democratic state, and they are also well aware that democracy is an "essentially contested concept" that covers many competing definitions and machineries for instantiating them. Moreover, tensions between expertise and democracy are a major theme of scholarship on the politics of technology. Nevertheless, this

discourse holds as a normative ideal a world in which democratic institutions are structured in a manner that grants citizens the right to democratic choice about emerging technology and the future of society.

These distinct normative orientations imply different perspectives toward evaluating policy proposals. These differences do not necessarily mean that those who are committed to the innovation perspective will necessarily support different policies from those who take a politics-of-technology view. On the contrary, in some areas representatives of these different schools of thought may pursue different analytic paths to the same destination.

Consider, for example, proposals to tighten standards of patentability. A growing number of innovation analysts support rectifying what they perceive as the unduly lax standards for granting patents that have developed over the last few decades: they seek to raise the bar for the novelty, nonobviousness, and utility tests, to intensify scrutiny of patent claims, and to create new mechanisms for challenging them.[77] The precise proposals are numerous and varied, but the innovation analysts who advance such reforms do so with the goal of attacking perverse incentives and reducing litigation and other threats to economic efficiency.

Many politics-of-technology analysts would support similar reforms, seeking to set a high burden of proof against policies that expand patent rights to new domains, make them easier to obtain, or extend their reach.

77. There are a range of such reform proposals (which are at times incompatible). *See, e.g.*, BESSEN & MEURER, *supra* note 15 ch. 10–12 (arguing for improving the transparency of patent claims so the boundaries of claims are more predictable, enforcing strong limits on highly abstract claims that reach beyond what was actually discovered, and instituting institutional reforms in the patent office); JAFFE & LERNER, *supra* note 4, at 171–207 (arguing for instituting pre-grant opposition to allow outside parties to provide information on the prior art, establishing a strong re-examination producedure, and enhancing decision making about novelty and nonobviousness); John H. Barton, *Reforming the Patent System*, 287 SCIENCE 1933 (2000) (arguing for raising standards for patentability, establishing an automatic, royalty-free license for research use of patented inventions, and using the utility doctrine to prevent the patenting of fundamental concepts); Mark Lemley, et al., *What to Do about Bad Patents*, REGULATION, Winter 2005–2006, at 10 (arguing for weakening the presumption of validity of issued patents and for establishing a post-grant opposition system); *see also* MICHELE BOLDRIN & DAVID K. LEVINE, AGAINST INTELLECTUAL MONOPOLY (2009) (making an economic argument claiming that intellectual property is an "unnecessary evil"). Major policy reports include a 2003 Federal Trade Commission report that presented a number of recommendations, including enacting legislation to specify that courts "require only a 'preponderance of the evidence' to rebut the presumption of validity" [of a patent] rather than using the "clear and convincing evidence" standard, FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY 8 (2003), and a 2004 National Research Council report that offered seven recommendations, including assiduously observing the nonobviouness standard and considering legislation to open up review procedures and allow for third-party challenges, NAT'L RESEARCH COUNCIL, A PATENT SYSTEM FOR THE 21ST CENTURY: REPORT OF THE COMMITTEE ON INTELLECTUAL PROPERTY RIGHTS IN THE KNOWLEDGE-BASED ECONOMY ch. 4 (Stephen A. Merrill et al. eds., 2004). The policy debate since 2005 has been accompanied by ongoing struggle over major patent reform legislation in the U.S. Congress; at the time of this writing, major reform legislation has not been passed into law.

But they would ground their arguments not in innovation terms but with reference to monopolies of configuration power and the effects of patents on democratic choice. They would also tend to support making patents easier to challenge, although unlike innovation analysts, they might advocate challenge procedures that admit arguments based on concentrations of configuration power or the moral claims of stakeholders, citizens, and users of technology. Most crucially, politics-of-technology analysts would seek intensive public engagement in cases involving fundamental technological developments widely expected to be implicated in "revolutionary" social change. While a patent on the random widget would not warrant special scrutiny, some intellectual property decisions raise deep, quasi-constitutional questions, owing to their potential to grant significant configuration power in a consequential domain.[78] Politics-of-technology analysts would insist that such decisions are simply too important to settle using traditional intellectual property doctrine and its narrow administrative procedures.

These distinct normative orientations are also reflected in stances toward open source production. Innovation analysts are engaged in debate about whether intellectual property policy should be modified to support new models of user-centered production (or peer-production), as exemplified in "free" or "open source" software. These labels reflect different political goals—with advocates of free software explicitly arguing for the moral and political advantages of such models—and cover a wide variety of institutional structures.[79] Some innovation analysts, such as Jaffe and Lerner, contend that the jury is still out as to whether open source or proprietary production of software is more successful.[80] They also believe that software developers should be allowed to choose whether to follow an open source or proprietary model, and that policy reforms designed specifically to promote open source are not justified. Others argue on innovation

78. Examples might include decisions that bear on control over the building blocks of synthetic biology or the terms of access to information on the Internet, as well as such crucial cases as *Diamond v. Chakrabarty* 447 U.S. 303 (1980), which allowed, in a 5–4 decision, the patenting of an engineered microorganism. On the challenges for intellectual property policy in synthetic biology, see Arti Rai & James Boyle, *Synthetic Biology: Caught between Property Rights, the Public Domain, and the Commons*, 5 PLOS BIOL 389 (2007). Regarding Internet search technology and control, see, for example, IAN H. WITTEN, ET AL., WEB DRAGONS: INSIDE THE MYTHS OF SEARCH ENGINE TECHNOLOGY (2007); see also LESSIG, CODE *supra* note 8; LESSIG, FREE CULTURE, *supra* note 9; LESSIG, THE FUTURE OF IDEAS, *supra* note 5.

79. YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM (2006); RAYMOND, *supra* note 5; STALLMAN, *supra* note 5; Ruben van Wendel de Joode et al., *Rethinking Free, Libre and Open Source Software*, KNOWLEDGE TECH. & POL'Y, Winter 2006, at 5.

80. *See, e.g.*, JAFFE & LERNER, *supra* note 4, at 200–02.

grounds that open source software has strong advantages. More generally, Eric von Hippel, for example, argues that user-centered innovation in software and many other domains has advantages that yield social welfare benefits, and that government policy, which now favors manufacturer-centered innovation, should be changed to level the playing field.[81]

For politics-of-technology analysts, however, efficiency is only a secondary concern. What is most interesting about the many projects grouped under such labels as "open source" are their political possibilities. At least some mechanisms for organizing open source production appear to distribute configuration power in new, and potentially more inclusive, ways than do traditional modes of innovation. From this standpoint, open source production looks like more than a new way to create innovative products; it is also a means to constitute new kinds of collective subjects for guiding the innovation process. Put otherwise, open source production (in its many possible forms) offers an arena for experimenting with new institutional structures for constituting the subjects and objects of property, offering alternatives to those embedded in traditional intellectual property law.[82] From a politics-of-technology view, such experiments would be of interest even in the (unlikely) event that open source production were shown to yield absolutely no innovation-based advantages.

Ultimately, however, the politics-of-technology discourse remains stronger on critique than on offering alternatives, not least because models for reform remain hard to develop and test given the constraints of existing law and policy. It is easy to imagine mechanisms for reducing monopolies on configuration power; for example, by awarding or licensing unusually important patents not to the inventor alone but to novel legal entities specifically constituted to give some managerial rights to representatives of relevant citizen and stakeholder groups. For example, a patent on a disease gene might be held by a legal entity that gave royalty rights to the named inventor but distributed voting rights on managerial decisions among a board whose members had fiduciary duties to citizens and relevant disease groups, medical specialties, and scientific societies. Charitable trust models, which have been proposed as an alternative to proprietary control over

81. *See* ERIC VON HIPPEL, *supra* note 18, at 1 (arguing that user-based innovation allows users "to develop exactly what they want, rather than relying on manufacturers to act as their (often very imperfect) agents."); and *id.*, at 107–19.

82. A sense of the range of possible structures for governing open source production can be gleaned by considering the range of governance structures found in common-property regimes. *See* Hess & Ostrom, *supra* note 58. *See also* RIGHTS TO NATURE: ECOLOGICAL, ECONOMIC, CULTURAL, AND POLITICAL PRINCIPLES OF INSTITUTIONS FOR THE ENVIRONMENT (Susan S. Hanna et al. eds.1996).

human biomaterials,[83] could also be extended to intellectual property. Given the political and legal obstacles to implementing such proposals, however, it is not surprising that activists whose concerns center on the control over technology often choose to package their arguments in terms of innovation and patentable subject matter rather than take on the burden of pressing for broader change.

CONCLUSION

Starting points matter. Observers who begin their analysis of intellectual property issues from within the traditional discourse often seem unable to escape its limited perspective. Many such observers contend that public opposition to controversial patents stems from misunderstandings of legal doctrine, from attempts to inject social issues into the patent domain, from sensational media coverage, and from policy analysis that treats anecdotes as evidence. These arguments, which parallel the "deficit model" in risk disputes,[84] tend to equate public opposition with public ignorance. However, the analysis above suggests that growing public debate about intellectual property is better understood as a symptom of institutional deficits in democratic decision making about emerging technologies. Explicitly recognizing an alternative politics-of-technology discourse—and outlining its distinctive perspective on intellectual property issues—clarifies the nature, and the extent, of the contradictions between existing patent policy and the increasingly vocal demands of activists, citizens, and others engaged in contention about emerging technology (see Table 1).

Rather than attributing controversy to public misunderstanding, this perspective sees activists who oppose patenting such entities as genes, algorithms, or business methods as legitimate stakeholders who *correctly* perceive intellectual property as bestowing not only market power, but also configuration power. In this view, such activists are not "injecting" questions of social policy into the patent domain; those issues are already present. Moreover, the claim that social concerns properly belong outside the intellectual property system (to be addressed "later" in the process of developing, commercializing, and regulating new technology) seems not to be grounded in necessity or wisdom, but to rest on rhetorical "boundary

83. David E. Winickoff & Richard N. Winickoff, *The Charitable Trust as a Model for Genomic Biobanks*, 349 NEW ENG. J. MED. 1180 (2003); *see also* David E. Winickoff, *Partnership in the U.K. Biobank: A Third Way for Genomic Property*, 35 J.L. MED. & ETHICS 440 (2007).

84. MISUNDERSTANDING SCIENCE?: THE PUBLIC RECONSTRUCTION OF SCIENCE AND TECHNOLOGY (Alan Irwin & Brian Wynne eds., 1996).

work"[85] aimed at shoring up an archaic institutional cartography that fails to recognize the degree to which emerging technology has become a principal site of emerging politics. Giving meaningful consideration to the politics of technology in the intellectual property domain in no way suggests that patents and copyrights should be simply eliminated or even vastly curtailed. But taking the politics of technology seriously does imply the need for a wider analysis—one that does not try to make a virtue of neglecting the quasi-constitutional dimensions of technology (see Table 1).

The analysis presented above admittedly provides a very high-altitude picture of an extremely complex terrain, highlighting coherences and neglecting much complexity and detail. However, if the broad contours of this analysis are correct, then there are reasons to expect that public contention about intellectual property policy will remain an ongoing feature of contemporary politics. Traditional doctrine, with its emphasis on innovation and its focus on a relatively narrow group of actors, is poorly equipped for considering questions of democratic representation in decision making about the shape of future technological and social orders. Bringing politics-of-technology concerns into dialogue with innovation discourse offers one avenue for broadening discussion to encompass many critical issues. In the longer run, however, states will need to make creative institutional adjustments—within and beyond the intellectual property domain—to preserve democratic values in a world where emerging technologies and emerging politics are everywhere intertwined.

85. THOMAS F. GIERYN, CULTURAL BOUNDARIES OF SCIENCE: CREDIBILITY ON THE LINE (1999).

Table 1: Summary of the two discourses about intellectual property

	Innovation	**Politics of Technology**
Normative Focus	Technological progress	Democratic choice
Central Figure	The inventor	The citizen
Emerging Technology	As a source of economic growth As politically neutral	As a means of (re)ordering social and technical worlds As a contested domain
Stakes	Economic	Shape of sociotechnical systems
Domain of Policymaking	R&D policy	Quasi-constitutional questions about the future
Form of Power Emphasized	Market power	Configuration power
Effect on Transparency	Open publication of the patent itself	Opaque decision making pre- and post- filing for the patent
Vision of Successful Policy	Economic efficiency	Adequate representation