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PARADISE LOST IN THE PATENT LAW? CHANGING VISIONS OF TECHNOLOGY IN THE SUBJECT MATTER INQUIRY

Dana Remus Irwin[*]

Abstract

In recent decades, the Patent and Trademark Office and the federal courts have dramatically expanded the scope of patentable subject matter—the set of inventions eligible for patent protection. Existing scholarship has taken a narrow view of this expansion. Scholars argue on efficiency grounds that without more meaningful limits on the scope of patentable subject matter, future invention will be impeded rather than encouraged. This Article takes a broader view of the subject matter inquiry, tracing its historical development and its changing theories of technology, from the patent system's inception to the present. This Article demonstrates that through these theories of technology the subject matter inquiry has shaped the patent system's vision of the social role and meaning of technology, and defined the social good that the patent law serves. While the early inquiry placed the patent system in the service of a broad array of social values, the current inquiry places it in the exclusive service of economic value. This change, in turn, has facilitated the expansion of patent rights into all aspects of human life. Recognizing the discontent that this expansion has caused, this Article proposes that we consider legislative reform of the subject matter inquiry to better align its theory of technology with that of contemporary society.

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I. INTRODUCTION

In the 1980s, three university doctors discovered that heightened blood levels of a particular amino acid indicate depressed levels of folic acid and vitamin B_{12}.[1] In 1986, they applied for a patent on this naturally-occurring correlation, claiming it as a two-step method for diagnosing a vitamin B deficiency in the human body.[2] The first step entailed measuring a patient's blood levels of the amino acid homocysteine. The second step entailed drawing the appropriate conclusion: an elevated level indicated a deficiency, while a normal level did not.[3]

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1. Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 126 S. Ct. 2921, 2923 (2006) (Breyer, J., dissenting).

2. *See* U.S. Patent No. 4,940,658 (filed Nov. 20, 1986). The '658 patent was issued on July 10, 1990. *Id.*

3. *See Lab. Corp.*, 126 S. Ct. at 2923–24 (Breyer, J., dissenting). Claim 13 of the '658 patent claimed a method for diagnosing a cobalamin or folate deficiency by "assaying a body fluid for an elevated level of total homocysteine; and correlating an elevated level of total homocysteine in said

Notwithstanding a well-established prohibition on patenting laws of nature and natural phenomena, the Patent and Trademark Office (PTO) granted the patent, and the Federal Circuit upheld it.[4] In 2005, the Supreme Court granted a writ of certiorari in *Laboratory Corp. of America Holdings v. Metabolite Laboratories, Inc.* (*LabCorp*)[5] to determine whether a patent can validly "claim a monopoly over a basic scientific relationship," such that a doctor would infringe the patent "merely by thinking about the relationship after looking at a test result."[6] In June 2006, the Court dismissed certiorari as improvidently granted because the issue had not been developed below.[7] The patent therefore stands.

Scholars and commentators have been virtually unanimous in concluding that the *LabCorp* patent is not directed to patentable subject matter.[8] Section 101 of the Patent Act of 1952 (the 1952 Act)[9] defines patentable subject matter[10] as "any new and useful process, machine, manufacture or composition of matter, or any new and useful improvement thereof."[11] This provision has been interpreted expansively by Congress and the Supreme Court to encompass "'anything under the sun that is

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body fluid with a deficiency of cobalamin or folate." *Id.* at 2924.

4. Metabolite Labs., Inc. v. Lab. Corp. of Am. Holdings, 370 F.3d 1354, 1358 (Fed. Cir. 2004).

5. 546 U.S. 975 (2005); *Lab. Corp.*, 126 S. Ct. at 2922 (Breyer, J., dissenting). For a description and analysis of the factual and procedural history of the case, see generally Kevin Emerson Collins, *Propertizing Thought*, 60 SMU L. REV. 317 (2007); Robert Kent, LabCorp v. Metabolite*: Providently Dismissed*, 20 HARV. J.L. & TECH. 253 (2006); Sue Ann Mota, *What is Patentable Subject Matter? The Supreme Court Dismissed* LabCorp v. Metabolite Laboratories*, but the Issue is not Going Away*, 11 MARQ. INTELL. PROP. L. REV. 181 (2007).

6. *Lab. Corp.*, 126 S. Ct. at 2925 (Breyer, J., dissenting).

7. *Id.* at 2921 (majority opinion).

8. *See, e.g.*, Daniel T. Marvin, *The Supreme Court's Missed Opportunity to Settle the Handiwork of Nature Exception to Patentable Subject Matter in* Laboratory Corporation of America v. Metabolite Laboratories, 26 TEMP. J. SCI. TECH. & ENVTL. L. 113, 132–33 (2007); Michael Meehan, *The Handiwork of Nature: Patentable Subject Matter and* Laboratory Corporation v. Metabolite Labs, 16 ALB. L.J. SCI. & TECH. 311, 340–41 (2006); Mota, *supra* note 5, at 181–82; John G. New, *Patently Wrong: The U.S. Supreme Court Punts in the Case of* LabCorp v. Metabolite, 10 VAND. J. ENT. & TECH. L. 147, 172–74 (2007).

9. Patent Act of 1952, ch. 950, 66 Stat. 792 (codified as amended in scattered sections of 35 U.S.C.).

10. Patentable subject matter is the first of four principal patentability requirements set forth in the Patent Act of 1952, the other three being utility, novelty, and non-obviousness. *See* 35 U.S.C. §§ 101–103 (2000).

11. *Id.* § 101. This statutory definition has remained remarkably consistent for the past two hundred years. The Patent Act of 1793 defined subject matter as "any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement [thereon]." Patent Act of 1793, ch. 11, § 1, 1 Stat. 318, 319 (repealed 1836). The sole change has been the substitution of "process" for "art" in the Patent Act of 1952. Legislative history reveals that the intent of the substitution was to clarify, but not change, the meaning of the provision. *See* S. REP. NO. 82-1979, at 5 (1952), *reprinted in* 1952 U.S.C.C.A.N. 2394, 2398–99.

made by man.'"[12] Notwithstanding this broad definition, courts have consistently excluded certain classes of discoveries from patentability.[13] Various labels have been used to describe these exclusions, including principles, ideas, products of nature, fundamental truths, original causes, and motives.[14] Today, the exclusions are articulated as "laws of nature, physical phenomena, and abstract ideas."[15] Critics of the *LabCorp* case argue that a naturally-occurring relationship between blood levels of an amino acid and vitamin B is a law of nature or a natural phenomenon and therefore, does not constitute patentable subject matter.[16]

LabCorp is only the most recent patentable subject matter case to attract widespread commentary. In the last three decades, the PTO and the courts have dramatically expanded the bounds of patentable subject matter.[17] Every advance in the expansion—from the patentability of microorganisms,[18] to computer software,[19] to genetic information,[20] to business and tax methods[21]—redefined the contours of patentable subject matter. Every advance provoked intense criticism from scholars and commentators, who argued that courts and the PTO had misinterpreted the

12. Diamond v. Chakrabarty, 447 U.S. 303, 309 (1980) (quoting S. REP. NO. 82-1979, at 5, *reprinted in* 1952 U.S.C.C.A.N. at 2399, and H.R. REP. NO. 82-1923, at 6 (1952)).

13. These exclusions were created by courts early in the history of the patent system but never codified by statute.

14. *See, e.g.*, Mackay Radio & Tel. Co. v. Radio Corp. of Am., 306 U.S. 86, 94 (1939) (scientific truth); Risdon Iron & Locomotive Works v. Medart, 158 U.S. 68, 77 (1895) (agencies of nature); Morley Sewing-Mach. Co. v. Lancaster, 129 U.S. 263, 278 (1889) (principle or scientific fact); The Tel. Cases, 126 U.S. 1, 532–33 (1888) (law of nature, force of nature, natural force, natural process); Tilghman v. Proctor, 102 U.S. 707, 721, 728 (1880) (chemical principle, scientific fact, conceptions of the mind); Rubber-Tip Pencil Co. v. Howard, 87 U.S. (20 Wall.) 498, 507 (1874) (an idea of itself); Burr v. Duryee, 68 U.S. (1 Wall.) 531, 570 (1863) (idea, principle); O'Reilly v. Morse, 56 U.S. (15 How.) 62, 131–33 (1853) (Grier, J., dissenting) (principle in natural philosophy or physical science, known principle, law of nature, power of nature); Le Roy v. Tatham, 55 U.S. (14 How.) 156, 175 (1852) (abstract principle, fundamental truth, original cause, motive); Wilson v. Simpson, 50 U.S. (9 How.) 109, 113 (1850) (mental processes); Phila. & Trenton R.R. v. Stimpson, 39 U.S. (14 Pet.) 448, 462 (1840) (intellectual process or operation).

15. *Chakrabarty*, 447 U.S. at 309 (citing cases). Examples include the law of gravity, naturally-occurring living organisms, and mathematical equations. *Id.* at 309–10.

16. *See* sources cited *supra* note 8.

17. For a detailed review of this expansion, see Robert Greene Sterne & Lawrence B. Bugaisky, *The Expansion of Statutory Subject Matter Under the 1952 Patent Act*, 37 AKRON L. REV. 217 (2004).

18. *Chakrabarty*, 447 U.S. at 309–10.

19. Diamond v. Diehr, 450 U.S. 175, 184 (1981).

20. Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1206 (Fed. Cir. 1991).

21. State St. Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368, 1373–75 (Fed. Cir. 1998). For a discussion of this case and the patentability of tax strategies, see William A. Drennan, *The Patented Loophole: How Should Congress Respond to This Judicial Invention?*, 59 FLA. L. REV. 229, 237–67 (2007).

patent law by allowing for "limitless subject matter."[22] Viewing the task of the patent system as creating efficient incentives to maximize invention,[23] most scholars advocate more discrete limits on the scope of patentable subject matter and greater protection of the exclusions in the public domain. Otherwise, they argue, the patent system will impede technological advance by limiting access to the basic tools of invention and innovation.[24]

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22. John R. Thomas, *Liberty and Property in the Patent Law*, 39 HOUS. L. REV. 569, 570 (2002) [hereinafter Thomas, *Liberty and Property*]; *see also* Margo A. Bagley, *Patent First, Ask Questions Later: Morality and Biotechnology in Patent Law*, 45 WM. & MARY L. REV. 469 (2003) (arguing that judicial misinterpretation of patentable subject matter has led to a problematic "patent first" approach by U.S. courts); John M. Conley & Roberte Makowski, *Back to the Future: Rethinking the Product of Nature Doctrine as a Barrier to Biotechnology Patents (Part I)*, 85 J. PAT. & TRADEMARK OFF. SOC'Y 301 (2003) (arguing that misinterpretation of the product of nature doctrine has led to some improper granting of biotechnology patents); Michael D. Davis, *The Patenting of Products of Nature*, 21 RUTGERS COMPUTER & TECH. L.J. 293 (1995) (questioning the patentability of products of nature); Linda J. Demaine & Aaron Xavier Fellmeth, *Reinventing the Double Helix: A Novel and Nonobvious Reconceptualization of the Biotechnology Patent*, 55 STAN. L. REV. 303 (2002) (arguing that the modern trend of granting genetic patents is legally unfounded); William A. Drennan, *The Patented Loophole: How Should Congress Respond to This Judicial Invention?*, 59 FLA. L. REV. 229, 271–320 (2007) (arguing for a prohibition on tax strategy patents); Eileen M. Kane, *Patent Ineligibility: Maintaining a Scientific Public Domain*, 80 ST. JOHN'S L. REV. 519 (2006) (examining the patentable subject matter doctrine and recommending a codification of patent inelligibilities); Arti K. Rai, *Intellectual Property Rights in Biotechnology: Addressing New Technology*, 34 WAKE FOREST L. REV. 827 (1999) (arguing that the Court of Appeals for the Federal Circuit should defer more to the PTOs decisions on patentability); Pamela Samuelson, Benson *Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025 (1990) (arguing that computer program algorithms and other program-related inventions are unpatentable subject matter); John R. Thomas, *The Patenting of the Liberal Professions*, 40 B.C. L. REV. 1139, 1167, 1175 (1999) [hereinafter Thomas, *Liberal Professions*] (arguing for a discrete restrained technological definition to avoid an expansive interpretation in the patent law). Notwithstanding the dominant scholarly criticism, some scholars support expansive subject matter standards. *See, e.g.*, Richard S. Gruner, *Intangible Inventions: Patentable Subject Matter for an Information Age*, 35 LOY. L.A. L. REV. 355 (2002) (proposing a broad patentable subject matter test); Robert A. Kreiss, *Patent Protection for Computer Programs and Mathematical Algorithms: The Constitutional Limitations on Patentable Subject Matter*, 29 N.M. L. REV. 31 (1999) (arguing for a broader interpretation of the patentability of mathematical calculations).

23. This interpretation is the dominant approach to the study of the patent law. *See, e.g.*, WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 294–333 (2003); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1642–43 (2003).

24. *See, e.g.*, Kane, *supra* note 22, at 523, 558; Nari Lee, *Patent Eligible Subject Matter Reconfiguration and the Emergence of Proprietarian Norms—The Patent Eligibility of Business Methods*, 45 IDEA 321, 358 (2005) [hereinafter Lee, *Patent Eligible Subject Matter Reconfiguration*]; Peter Yun-hyoung Lee, *Inverting the Logic of Scientific Discovery: Applying Common Law Patentable Subject Matter Doctrine to Constrain Patents on Biotechnology Research Tools*, 19 HARV. J.L. & TECH. 79, 81–82 (2005) [hereinafter Lee, *Inverting the Logic*]; Meehan, *supra* note 8, at 340–41; Mota, *supra* note 5, at 181–82; *see also* 1 R. CARL MOY, MOY'S WALKER

This Article contends that this dominant understanding of the subject matter inquiry is incomplete. The inquiry's role extends far beyond striking an efficient balance between patent incentives and the public domain. By determining which technologies may be the subject of a patent, the inquiry shapes the patent system's vision of the meaning and role of technology in society.[25] In shaping this vision, the inquiry defines the social values that the patent system serves.[26] Accordingly, many actors have a stake in the subject matter inquiry—not only inventors, judges, and legislators—but also every member of society whose life is shaped by technology.

This Article seeks to restore richness to the subject matter inquiry. Drawing on scholarship from the interdisciplinary field of Science and Technology Studies (STS),[27] it tracks the changing theories and understandings of technology that have informed the subject matter inquiry from the patent system's inception to the present. The Article then

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ON PATENTS §§ 5.3–5.5 (4th ed. 2006).

25. "Technology" encompasses a wide spectrum of meanings. Narrow definitions are limited to products of industrial, mechanical, or engineering processes; broader definitions include all things created by people to exploit, manage, or manipulate their natural environments, *see* RUTH SCHWARTZ COWAN, A SOCIAL HISTORY OF AMERICAN TECHNOLOGY 2 (1997); the broadest definitions include all human action that seeks to control or transform a natural or social reality, *see* Arnold Gehlen, *A Philosophical-Anthropological Perspective on Technology*, *in* PHILOSOPHY OF TECHNOLOGY: THE TECHNOLOGICAL CONDITION 213, 213 (Robert C. Scharff et al. eds., 2003). Moreover, "technology" changes and expands with time. The technology of the modern era looked outward, focusing on the mastery and manipulation of nature. Many of today's technologies are more inward-looking, focusing on the mastery and manipulation of the self. *See* Richard M. Merelman, *Technological Cultures and Liberal Democracy in the United States*, 25 SCI. TECH. & HUM. VALUES 167, 178 (2000). The subject matter inquiry negotiates between these varied and changing meanings and expresses the patent law's definition of "technology."

26. Madhavi Sunder has called for intellectual property regimes to account for non-economic human values. She argues that intellectual property law must recognize that property rights have social effects, balance incommensurable values, and structure social relations. Madhavi Sunder, *IP3*, 59 STAN. L. REV. 257, 260 (2006); *see also* Anupam Chander & Madhavi Sunder, *Is Nozick Kicking Rawls's Ass? Intellectual Property and Social Justice*, 40 U.C. DAVIS L. REV. 563, 574–75 (2007). Within the patent law, the subject matter inquiry is a locus of such value judgments, expressing the patent system's vision of technology's role and meaning in society.

27. Science and Technology Studies (STS) is an umbrella field that encompasses many methodological approaches to the study of science and technology in society, including historical, sociological, and philosophical. Sharing the belief that the categories of "science" and "technology" are socially constructed rather than rationally constituted, STS scholars study the interdependent relationship between science and technology on the one hand, and society, politics and culture on the other. *See, e.g.*, 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 17, 17–19, 21–22 (Wiebe E. Bijker et al. eds., 1989); Stewart Russell, *The Social Construction of Artefacts: A Response to Pinch and Bijker*, 16 SOC. STUD. OF SCI. 331, 331 (1986); Steven Shapin, *Here and Everywhere: Sociology of Scientific Knowledge*, 21 ANN. REV. OF SOC. 303 (1995) (providing a history of the development of the sociology of scientific knowledge).

shows how the inquiry's conceptions of technology defined the purpose and goals of the patent system as a whole—purposes and goals that have changed dramatically over time. While the early patent system served a broad array of human values and promised broadly-defined social progress, the current system serves economic value and promises economic growth. This historical perspective is necessary to understand how the subject matter inquiry acquired its current breadth, and how it can be reformed in the future.

This Article proceeds in three parts. Part II describes the vision of technology embraced by the subject matter inquiry at the patent system's inception and throughout the nineteenth century. Tied to broad notions of social progress, technology was defined as the means by which humans controlled and transformed their natural surroundings. By embracing this Enlightenment vision,[28] the early subject matter inquiry defined the patent system's goal as promoting social welfare and advancing social progress.

Part III addresses a Modern vision of technology, which grew as the dominant social paradigm over the course of the nineteenth century but was not reflected in the subject matter inquiry until the middle of the twentieth century. Divorced from nature and broader social values, this view emphasized technology's ability to create economic wealth. By embracing this vision, the twentieth century subject matter inquiry shifted the patent system's focus from broad Enlightenment notions of social good toward the narrower goal of economic growth. Moreover, it surrendered control over the patent law's definition of technology to economic forces and embraced a form of technological determinism.[29]

Part IV critiques the current subject matter inquiry's definition of the patent system's goals in exclusively economic terms. This conception of

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28. As with all models, the two models used in this Article—the Enlightenment and Modern visions of technology—simplify and imperfectly capture reality. They are useful, however, in illustrating a central argument of this Article. The contrast between the two and the historical move away from the former in favor of the latter demonstrate that the current conception of the subject matter inquiry is not inevitable.

29. Technological determinism posits that technology is autonomous, possessing an inherent logic and structure that dictates not only its own future course, but society's future course as well. It is "the belief that social progress is driven by technological innovation, which in turn follows an 'inevitable' course." Michael L. Smith, *Recourse of Empire: Landscapes of Progress in Technological America*, *in* DOES TECHNOLOGY DRIVE HISTORY? THE DILEMMA OF TECHNOLOGICAL DETERMINISM 37, 38 (Merrit Roe Smith et al. eds., 1994); *see also* JACQUES ELLUL, THE TECHNOLOGICAL SYSTEM 125–50 (1980); Robert L. Heilbroner, *Do Machines Make History?*, 8 TECH. & CULTURE 335, 335 (1967). Technological determinism has been largely discredited among STS scholars, who recognize the deeply social nature of both science and technology. *See* Andrew Feenberg, *Subversive Rationalization: Technology, Power and Democracy*, *in* TECHNOLOGY AND THE POLITICS OF KNOWLEDGE 3, 3–22 (Andrew Feenberg et al. eds., 1995). However, determinism still holds influence within many areas of popular culture, and, as this Article demonstrates, within the patent system.

the inquiry—the culmination of the Modern vision—fails to account for the full array of human values implicit in technological advance—moral, social, and political, as well as economic. Discontent with *LabCorp* and other recent subject matter cases suggests that excluding these values from the analysis fails to reflect society's preferences. Accordingly, this Article concludes by proposing reform to the subject matter inquiry to better align its theory of technology with that of contemporary society.

II. SHAKING NATURE TO HER FOUNDATIONS:[30] PATENTABLE SUBJECT MATTER AND THE ENLIGHTENMENT VISION OF TECHNOLOGY

The subject matter inquiry of the early patent system expressed an understanding of technology that differs significantly from the understanding expressed by today's inquiry. Understanding technology as the means by which humans controlled their natural surroundings in furtherance of social progress,[31] early courts and commentators described patentable subject matter as those aspects of nature that had been sufficiently mastered to justify a property right. By rewarding the mastery of nature for human benefit and by defining the exclusions as elements of nature that had not yet been controlled, the patent system structured patentable subject matter as an expanding phenomenon and the exclusions as a receding one.

A. *Homo faber:*[32] *The Enlightenment Vision*

At the patent system's creation,[33] the Founding Fathers' understandings of technology drew deeply from Enlightenment thought.[34] In this tradition,

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30. *See* EVELYN FOX KELLER, REFLECTIONS ON GENDER AND SCIENCE 36 (1985) (paraphrasing Francis Bacon).

31. Of course, this Enlightenment view of progress—a unilinear path of domination over nature, economic growth, and expansion of knowledge—is not aligned with today's social norms. Today, we recognize that material progress does not necessarily lead to an improved way of life, and increasing knowledge does not necessarily correspond to increased social welfare. *See* Margaret Chon, *Postmodern "Progress": Reconsidering the Copyright and Patent Power*, 43 DEPAUL L. REV. 97, 124–27 (1993); Patricia Ewick, *Postmodern Melancholia*, 26 LAW & SOC'Y REV. 755, 760 (1992).

32. The idea of man the maker or *homo faber* has long captured scholarly attention. *See, e.g.*, HANNAH ARENDT, THE HUMAN CONDITION , 144–59, 294–313 (1958); COWAN, *supra* note 25, at 1; KENNETH PAGE OAKLEY, MAN THE TOOL MAKER (5th ed. 1963).

33. The United States patent system was created under the first patent statute, passed in 1790. Patent Act of 1790, ch. 7, 1 Stat. 109 (repealed 1793).

34. Thomas Jefferson, for example, held Francis Bacon, Isaac Newton, and John Locke in high regard. He wrote:

> The room being hung around with a collection of the portraits of remarkable men, among them were those of Bacon, Newton and Locke, Hamilton asked me who they were. I told him they were my trinity of the three greatest men the world had

nature was something to be discovered, mastered, and dominated on the path of progress.[35] Two intellectual traditions guided the journey along this path: the new science announced by Francis Bacon and early liberal economic thought.[36]

Francis Bacon espoused faith in the human ability to know nature through science[37] and to dominate nature through technology.[38] Bacon's science broke from the natural philosophy of the past and set aside moral and religious ideas of what the world should be in favor of objective views of what the world is.[39] The power of the resulting scientific knowledge, he explained, was rooted in its ability "to yield practical outcomes and to produce the means for technological control of nature."[40] In Bacon's view, technologies did not "'merely exert a gentle guidance over nature's course; they have the power to conquer and subdue her, to shake her to her foundations.'"[41] Technology could shield society from nature, provide for human needs, and restore the dominion over creation that was lost in the fall from the Garden of Eden.[42]

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ever produced, naming them.

Letter from Thomas Jefferson to Dr. Benjamin Rush (Jan. 16, 1811), *available at* http://etext.virginia. edu/toc/modeng/public/JefLett.html (follow second "Letter Rush" hyperlink); *see also* DAVID A.J. RICHARDS, FOUNDATIONS OF AMERICAN CONSTITUTIONALISM 24 (1989) (describing the Enlightenment tradition as "readily absorbed . . . by Americans" and noting that "the founders understood themselves to be participants in the best Enlightenment thought of Scotland, England, [and] France").

35. *See* MAX OELSCHLAEGER, THE IDEA OF WILDERNESS: FROM PREHISTORY TO THE AGE OF ECOLOGY 68–96 (1991). This path led to increased human achievement and progress. *See* Carl Mitcham, *Three Ways of Being With Technology*, in 3 FROM ARTIFACT TO HABITAT: STUDIES IN THE CRITICAL ENGAGEMENT OF TECHNOLOGY 31, 41–42 (Gayle L. Ormiston ed. 1990); Alex Geisinger, *Sustainable Development and the Domination of Nature: Spreading the Seed of the Western Ideology of Nature*, 27 B.C. ENVTL. AFF. L. REV. 43, 56, 58 (1999) [hereinafter Geisinger, *Sustainable Development*]. *Cf.* Mario Bunge, *Philosophical Inputs and Outputs of Technology*, *in* THE HISTORY AND PHILOSOPHY OF TECHNOLOGY 262 (George Bugliarello et al. eds., 1979).

36. *See* Alex Geisinger, *Uncovering the Myth of a Jobs/Nature Tradeoff*, 51 SYR. L. REV. 115, 123–26, 129–32 (2001); Geisinger, *Sustainable Development*, *supra* note 35, at 52–58.

37. Bacon's science should be distinguished from science as we know it today. In contrast to the deductive reasoning of the modern scientific method, Bacon advocated an inductive method. Moreover, in contrast to today's secular science, Bacon's science served religious ends. It enabled man to dominate nature so as to redeem human civilization and return to the state of grace. *See* BENJAMIN FARRINGTON, THE PHILOSOPHY OF FRANCIS BACON 28, 93 (1964).

38. I FRANCIS BACON, NOVUM ORGANUM § 129 (1620), *reprinted in* III THE WORKS OF FRANCIS BACON at 370–71 (Basil Montagu ed., Phila., Carey & Hart 1844).

39. The new scientist was trained to objectively measure and quantify nature. The new scientist still worked in the service of God, but did so as an impartial and disinterested observer of the natural world. *See* STEVEN SHAPIN, THE SCIENTIFIC REVOLUTION 3, 68 (1996).

40. *Id.* at 130 (citing Francis Bacon).

41. KELLER, *supra* note 30, at 36 (quoting Bacon).

42. *See* SHAPIN, *supra* note 39, at 139.

Early economic thinkers adopted Bacon's understanding of nature as something to be mastered for human benefit, but they transformed his religious view into a secular one.[43] John Locke explained that by harnessing the power of nature, human labor could create value and promote limitless economic growth:

> [I]t is labour indeed that puts the difference of value on everything . . . . If we will rightly estimate things as they come to our use, and cast up the several expenses about them, what in them is purely owing to nature, and what to labour, we shall find, that in most of them ninety-nine hundredths are wholly to be put on the account of labour.[44]

Adam Smith affirmed and strengthened the link between the transformation of nature and the growth of society. Nature could provide two forms of value, he explained: "value in use," which "expresses the utility of some particular object," and "value in exchange," which expresses "the power of purchasing other goods which the possession of that object conveys."[45] Untouched and unexploited, nature had neither utility nor exchange value. Transformed by human labor, however, aspects of nature acquired one or both types of value. Once imbued with value, aspects of nature were integrated into civilization.[46]

Both John Locke and Adam Smith emphasized the promise of material wealth as an end in itself. Other thinkers in the Enlightenment tradition emphasized that material wealth, in turn, promised political and social welfare.[47] David Hume summarized a widely held belief that "[i]n times

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43. *See* Carl Mitcham, *Three Ways of Being-With Technology*, *in* 3 FROM ARTIFACT TO HABITAT: STUDIES IN THE CRITICAL ENGAGEMENT OF TECHNOLOGY 31, 41 (Gayle L. Ormiston ed., 1990).

44. JOHN LOCKE, THE SECOND TREATISE OF GOVERNMENT § 40 (1690), *reprinted in* TWO TREATISES OF GOVERNMENT AND A LETTER CONCERNING TOLERATION 100, 117 (Ian Shapiro ed., 2003).

45. ADAM SMITH, AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS 28 (Edwin Cannan ed., Random House 1937) (1776).

46. *See id.* at 32–37.

47. Robert Nelson explains that technology not only promised economic wealth; it promised a just, peaceful society:

> [T]he history of the modern age (dating from the Enlightenment) reveals a widely held belief that economic progress will solve not only practical but also spiritual problems of mankind. Material scarcity and the resulting competition for limited resources have been widely seen as the fundamental cause of human misbehavior—the real source of human sinfulness. For holders of this conviction, to solve the economic problem would be, therefore, to solve in large part the problem of evil.

when industry and the arts flourish, men are kept in perpetual occupation, and enjoy, as their reward, the occupation itself, as well as those pleasures which are the fruit of their labor."[48] In a state of widespread material abundance, he explained, "every other social virtue would flourish, and receive tenfold increase."[49]

The Founding Fathers embraced this Enlightenment vision of technology as an agent of social progress. Their adoption of the Patent Clause "[t]o promote the Progress of . . . [the] useful Arts"[50] marked the first instance of a modern nation-state tying technology to social progress.[51] They saw the products of technology as "instruments of political liberation, essential tools for arriving at the ideal goal of progress: a more just, peaceful, less hierarchical, republican society based on the consent of the governed."[52] A 1792 pamphlet on patents explained that the "promotion of science and useful arts" would lead to "the happiness of men,—the primary, the grand object of their existence."[53] An 1810 patent treatise similarly explained that technologies would inspire higher levels of human achievement.[54] Technology, in short, was viewed as the harbinger of social progress.

B. *Naked Ideas and Barren Principles: The Unified Inquiry*

At the patent system's inception and through its early development, the subject matter inquiry reflected and reinforced the Enlightenment vision

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ROBERT H. NELSON, REACHING FOR HEAVEN ON EARTH: THE THEOLOGICAL MEANING OF ECONOMICS xxi (1991).

48. 3 DAVID HUME, *Of Refinement in the Arts*, *in* THE PHILOSOPHICAL WORKS 299, 301 (Thomas Hill Green et al. eds., Scientia Verlag Aalen 1992) (1742).

49. DAVID HUME, ENQUIRIES CONCERNING THE HUMAN UNDERSTANDING AND CONCERNING THE PRINCIPLES OF MORALS 183 (L.A. Selby-Bigge ed., 2d ed. 1902) (1777).

50. U.S. CONST. art. I, § 8, cl. 8.

51. *See* Frank D. Prager, *Historic Background and Foundation of American Patent Law*, 5 AM. J. LEGAL HIST. 309, 316–18 (1961).

52. *See* Leo Marx, *The Idea of "Technology" and Postmodern Pessimism*, *in* TECHNOLOGY, PESSIMISM, AND POSTMODERNISM 11, 19 (Yaron Ezrahi et al. eds., 1994).

53. JOSEPH BARNES, TREATISE ON THE JUSTICE, POLICY, AND UTILITY OF ESTABLISHING AN EFFECTUAL SYSTEM FOR PROMOTING THE PROGRESS OF USEFUL ARTS, BY ASSURING PROPERTY IN THE PRODUCTS OF GENIUS 9–10 (1792) (emphases omitted), *quoted in* CARROLL PURSELL, THE MACHINE IN AMERICA: A SOCIAL HISTORY OF TECHNOLOGY 98 (2d. ed. 2007).

54. THOMAS G. FESSENDEN, AN ESSAY ON THE LAW OF PATENTS FOR NEW INVENTIONS x–xi (Boston, D. Mallory, & Co. 1810). Fessenden believed that technology set learned men apart from manual laborers, and Europeans apart from non-Westerners. He explained that while one whose life is spent repeating manual tasks "'has no occasion to exert his understanding, or to exercise his invention in finding out expedients for removing difficulties,'" and "'becomes as stupid and ignorant as it is possible for a human creature to become,'" *id.* at xii (quoting SMITH, *supra* note 45, at 734), one who is challenged to develop new means of coping and new technologies improves the human condition, *see id.* at x–xi.

of technology. The exclusions represented aspects of nature that had not yet been brought under human control; patentable subject matter represented aspects of the natural world that had been incorporated into society. The categories created an oppositional pair: An invention either remained a part of nature and therefore an unpatentable exclusion, or qualified as a product of society and became patentable subject matter.

The first patent statute, the Patent Act of 1790,[55] described patentable subject matter as any "art, manufacture, engine, machine, or device, or any improvement therein not before known or used" that was "sufficiently useful and important" and described "clearly, truly and fully."[56] The Act therefore merged the subject matter requirement with other patentability requirements in a single statutory section. Starting in 1793 and continuing until 1952, the categories of patentable subject matter were articulated as "art, machine, manufacture or composition of matter."[57] As in the 1790 Act, the subject matter categories were included in the same statutory section as other patentability requirements.[58]

Courts and commentators interpreted these early patent statutes as creating a unified subject matter inquiry, which incorporated other patentability requirements. In the most prominent patent treatise of the nineteenth century, George Curtis explained that distinctions between different categories of subject matter were "not vitally important."[59] An alleged invention constituted patentable subject matter regardless of the

55. Patent Act of 1790, ch. 7, 1 Stat. 109 (repealed 1793).

56. *Id.* § 1.

57. Patent Act of 1793, ch. 11, § 1, 1 Stat. 318, 319 (repealed 1836).

58. Section 1 of the 1793 Act combined the subject matter and novelty requirements in a single section, providing patents for "any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement on any art, machine, manufacture or composition of matter, not known or used before the application." *Id.* Section 6 of the 1836 Act included subject matter, novelty, utility, definiteness and enablement requirements in a single section, providing patents for "any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used by others before his or their discovery or invention thereof, and not, at the time of his application for a patent, in public use or on sale" and requiring that the patentee first "deliver a written description of his invention or discovery, and of the manner and process of making, constructing, using, and compounding the same, in such full, clear, and exact terms . . . as to enable any person skilled in the art or science to which it appertains, or with which it is most nearly connected, to make, construct, compound, and use the same." Patent Act of 1836, ch. 357, § 6, 5 Stat. 117, 119 (repealed 1870). Section 24 of the 1870 Act combined subject matter, novelty, and utility requirements in a single section, providing patents for "any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement thereof, not known or used by others in this county, and not patented, or described in any printed publication . . . and not in public use or on sale for more than two years." Patent Act of 1870, ch. 230, § 24, 16 Stat. 198, 201 (repealed 1952).

59. GEORGE TICKNOR CURTIS, A TREATISE ON THE LAW OF PATENTS FOR USEFUL INVENTIONS § 27 (4th ed. Boston, Little, Brown, & Co. 1873).

specific statutory category "[i]f the thing itself is correctly described, and it appears to be novel and useful, and unites all the other requisites of the statute."[60] Elsewhere, in addressing the distinction between an unpatentable principle (an exclusion) and patentable subject matter, Curtis listed novelty, utility, and enablement as the "three requisites for a valid patent that is to comprehend the application of a principle."[61] Accordingly, although the various requirements—subject matter, novelty, utility, embodiment, and enablement—can be identified as individual elements of the analysis, they were typically treated as intertwined aspects of a unified inquiry under the pre-1952 patent acts.

In addition to being tied to other patentability requirements, patentable subject matter was bounded by two doctrines, both of which demonstrate the influence of Enlightenment thought. The first was the moral utility doctrine. In 1817, Justice Story explicitly authorized courts to consider social and moral values in determining whether an invention deserved patent protection.[62] He defined "useful invention" within the meaning of the patent law as an "invention [which is] not frivolous or injurious to the well-being, good policy, or sound morals of society;" in other words, one which may be applied to a beneficial use in society.[63] Examples included technologies "to poison people, or to promote debauchery, or to facilitate private assassination."[64] Courts relied on the moral utility doctrine in rejecting the patentability of such inventions as gambling machines[65] and dangerous medical devices.[66] By the end of the nineteenth century, courts were interpreting the moral utility doctrine to preclude only patents on inventions that had *no* legal or moral application. The courts let stand those patents that had applications both legal and illegal, moral and immoral.[67] Even in this weakened form, the moral utility doctrine limited

60. *Id.*

61. *See id.* § 141 ("First, the principle itself must be new in respect to practical application . . . . Second, the patentee must have invented and described some mode of carrying the principle into effect. . . . Third, the means described by the patentee must be so described as to enable competent persons skilled in the art to effect a practical application of the principle, or, in other words, to work or practise the invention." (emphasis omitted)).

62. Lowell v. Lewis, 15 F. Cas. 1018, 1019 (C.C.D. Mass. 1817) (No. 8,568). For a history, discussion and explanation of the moral utility doctrine, see Bagley, *supra* note 22, at 489–93.

63. *See Lowell*, 15 F. Cas. at 1019.

64. *Id.*

65. *See, e.g.*, Nat'l Automatic Device Co. v. Lloyd, 40 F. 89, 90 (C.C.N.D. Ill. 1889) (invalidating patent on toy horse race course, used for betting); Reliance Novelty Co. v. Dworzek, 80 F. 902, 904 (C.C.N.D. Cal. 1897) (invalidating patent on design for cover of a slot machine); Schultz v. Holtz, 82 F. 448, 449 (C.C.N.D. Cal. 1897) (invalidating patent on coin return device for coin-operated machines, such as slot machines).

66. *See, e.g.*, Mahler v. Animarium Co., 111 F. 530, 532, 537 (8th Cir. 1901) (invalidating patent for medical device using electricity to cure diseases).

67. *See, e.g.*, Klein v. Russell, 86 U.S. (19 Wall.) 433, 445, 468 (1873) (affirming jury instruction that stated that inventions with no honest uses were unpatentable); Fuller v. Berger, 120

the scope of patentable subject matter by excluding inventions that would serve purposes deemed not to be in society's interest.[68] Such inventions found no place in the Enlightenment conception of technology as a tool of social progress.

A second limit on the scope of patentable subject matter, which also reveals the influence of Enlightenment thought, were the judicially-created exclusions. Until the twentieth century,[69] these exclusions were commonly articulated as laws,[70] agencies,[71] powers and properties of nature,[72] principles,[73] scientific facts,[74] abstractions,[75] naked ideas,[76] mental processes,[77] intellectual processes or operations,[78] and conceptions of the mind.[79] These exclusions addressed two broad categories of subject matter:

F. 274, 275 (7th Cir. 1903) (describing the utility requirement as precluding patents for those inventions "incapable of serving any beneficial end"); Steven Lubar, *The Transformation of Antebellum Patent Law*, 32 TECH. & CULTURE 932, 939 (1991) (discussing the weakening of the moral utility doctrine during the nineteenth century).

68. *See, e.g.*, Scott & Williams, Inc. v. Aristo Hosiery Co., 7 F.2d 1003, 1004–05 (2d Cir. 1925) (invalidating patent for stockings with a false seam, which made the stockings resemble stockings of a higher quality); Rickard v. Du Bon, 103 F. 868, 872–73 (2d Cir. 1900) (invalidating patent for a process of spotting tobacco to make less desirable domestic tobacco look like a more desirable variety). *See generally* Robert P. Merges, *Intellectual Property in Higher Life Forms: The Patent System and Controversial Technologies*, 47 MD. L. REV. 1051, 1062–64 (1988).

69. Exclusions for algorithms and mathematical formulas were developed during the twentieth century. *See, e.g.*, Don Lee, Inc. v. Walker, 61 F.2d 58, 59, 66 (9th Cir. 1932); *In re* Bernhart, 417 F.2d 1395, 1398 (C.C.P.A. 1969).

70. *See, e.g.*, Parker v. Hulme, 18 F. Cas. 1138, 1141 (C.C.E.D. Penn. 1849) (No. 10,740) (laws of nature).

71. *See, e.g.*, Risdon Iron & Locomotive Works v. Medart, 158 U.S. 68, 77 (1895) (agencies of nature).

72. *See, e.g.*, O'Reilly v. Morse, 56 U.S. (15 How.) 62, 131–32 (1853) (Grier, J., dissenting) (power of nature); Foote v. Silsby, 9 F. Cas. 385, 390 (C.C.N.D.N.Y. 1851) (No. 4,919) (property of nature).

73. *See, e.g.*, McComb v. Brodie, 15 F. Cas. 1290, 1294 (C.C.D. La. 1872) (No. 8,708) (principle).

74. *See, e.g.*, Tilghman v. Proctor, 102 U.S. 707, 724 (1880) (scientific fact).

75. *See, e.g.*, Burr v. Duryee, 68 U.S. (1 Wall.) 531, 570 (1863) (abstraction).

76. *See, e.g.*, Atl. Works v. Brady, 107 U.S. 192, 200 (1882) (ordinarily occuring idea); *McComb*, 15 F. Cas. at 1292 (naked idea). "Naked" was used to refer to uncivilized things, for example, people who were in a state of nature without the benefits of civilization. *See, e.g.*, FESSENDEN, *supra* note 54, at xi ("[T]he want of which [necessaries] would convert the human race into hordes of wandering, naked, and houseless savages, much more miserable and defenceless than the brute inhabitants of the wilderness."). Use of "naked" in describing an exclusion helped the nineteenth century distinction between unpatentable exclusion and patentable subject matter track the distinction between things in their natural state and those that had been incorporated within civilization. *See infra* text accompanying notes 87–112.

77. *See, e.g.*, Wilson v. Simpson, 50 U.S. (9 How.) 109, 113–14 (1850) (mental processes).

78. *See, e.g.*, Phila. & Trenton R.R. v. Stimpson, 39 U.S. (14 Pet.) 448, 462 (1840) (intellectual process or operation).

79. *See, e.g.*, *Tilghman*, 102 U.S. at 728 (conceptions of the mind).

aspects of the natural world[80] that were merely discovered by an inventor but not applied, and un-embodied innovations that remained within an inventor's mind. Both categories encompassed things that remained in their natural state and were not yet subject to human control.[81]

The original reasoning behind the exclusions was drawn from the law of real property. At common law, title to land was consummated by possession, which entailed the exclusion of others.[82] Effectively, this was a control requirement—property rights necessitated control of the land. This requirement also applies to the creation and enforcement of intellectual property rights, but is much more difficult to apply in this context given the nature of ideas. Unlike land, ideas cannot be physically controlled. Thomas Jefferson explained that ideas were "incapable of confinement or exclusive appropriation."[83] Jefferson believed that this quality foreclosed any possibility that intellectual properties could be the subject of property rights in natural law.[84] Courts, however, concluded that this quality excluded only *some* discoveries and ideas from property rights. An 1862 case explained that the discovery of an abstract principle "can not be the subject of the exclusive control of the patentee, or the patent law, until it inhabits a body, no more than can [sic] a disembodied spirit be subjected to the control of human laws."[85] In other words, a discovery remained in the category of unpatentable exclusion until an inventor established sufficient control to justify the characterization of patentable

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80. Reference here is to the natural world or nature as understood at the patent system's inception. This understanding stands in sharp contrast to contemporary conceptions of nature. Today, nature is recognized as a collective social representation, such that there is no domain of nature independent and apart from a domain of society. *See, e.g.*, Keith H. Hirokawa, *Dealing with Uncommon Ground: The Place of Legal Constructivism in the Social Construction of Nature*, 21 VA. ENVTL. L.J. 387, 388 (2003).

81. For example, Thomas Jefferson described ideas as "benevolently designed by nature, when she made them, like fire, expansible over all space, without lessening their density in any point, and like the air in which we breathe, move, and have our physical being, incapable of confinement or exclusive appropriation." Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813), *reprinted in* 13 THE WRITINGS OF THOMAS JEFFERSON 326, 334 (Andrew A. Lipscomb ed., 1905).

82. *See, e.g.*, Johnson v. M'Intosh, 21 U.S. (8 Wheat.) 543, 572–73 (1823). *See generally* JOSEPH WILLIAM SINGER, INTRODUCTION TO PROPERTY § 1.4.2.1 (2d ed. 2005) (discussing importance of first possession as a normative justification for property rights).

83. Letter from Thomas Jefferson to Isaac McPherson, *supra* note 81.

84. For the countervailing view that patent rights were a civil right securing a property right, see Adam Mossoff, *Who Cares What Thomas Jefferson Thought About Patents? Reevaluating the Patent "Privilege" in Historical Context*, 92 CORNELL L. REV. 953, at 953 (2007) (discussing the connection between social contract theory and the development of patent law).

85. Morton v. N.Y. Eye Infirmary, 17 F. Cas. 879, 882 (C.C.S.D.N.Y. 1862) (No. 9,865); *see also* Le Roy v. Tatham, 55 U.S. (14 How.) 156, 174–75 (1852) ("A principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an *exclusive* right." (emphasis added)); CURTIS, *supra* note 59, § 159a.

subject matter. Once an inventor established such control, however, the discovery could, in fact, be the subject of a property right.[86]

A crucial question in determining whether an inventor had established the requisite control was whether human labor had taken the idea, law of nature, or other exclusion out of its natural state and brought it into human control. Justice Grier explained that often, the relevant labor took the form of scientific experimentation: It was "wholly empirical; as the discovery that a certain degree of heat, when applied to the usual processes for curing India rubber, produced a substance with new and valuable qualities."[87] In his patent treatise, Curtis characterized the requisite labor as "caus[ing] the particles of matter existing in the universe to change their former places, by moving them, by muscular power or some other force."[88] The inventor could then bring to bear the "vast latent forces in nature, which come to the aid of man, and enable him to produce effects and results of a wholly new character, far beyond the mere fact of placing the particles in new positions."[89] Patentable subject matter included "every object upon which art or skill can be exercised, so as to afford products fabricated by the hand of man, or by the labor which he directs."[90] Echoing Locke's labor theory of value,[91] courts and commentators explained that once transformed by human labor in a new and useful way, nature became artifice, and exclusion became patentable subject matter.

The question of whether human labor had brought an exclusion within human control addressed the novelty and utility aspects of the early subject matter inquiry which, as noted, incorporated these other patentability requirements in creating a unified inquiry. The embodiment aspect of this unified inquiry similarly exhibited a concern that inventors establish control over their discoveries. The Supreme Court explained that a pure discovery, absent tangible application, fell into an exclusion category.[92] To achieve patentable subject matter, the "mental conception" at the base of a new invention had to take the shape of a mechanical device or process,[93]

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86. Many authorities viewed patents as granting inchoate property rights, not artificial monopolies. *See, e.g.*, Singer v. Walmsley, 22 F. Cas. 207, 208–09 (C.C. Md. 1860); Thompson v. Haight, 23 F. Cas. 1040, 1047 (C.C. N.Y. 1826); CURTIS, *supra* note 59, at 2–3.

87. O'Reilly v. Morse, 56 U.S. (15 How.) 62, 132 (1853) (Grier, J., dissenting). Grier acknowledged, however, that an invention could also result from "a happy thought or conception, without the labor of an experiment." *Id.*

88. CURTIS, *supra* note 59, at xxiii–xxv.

89. *Id.* at xxiv.

90. *Id.* § 7.

91. *See supra* text accompanying note 44.

92. Atl. Works v. Brady, 107 U.S. 192 (1882); *see* Lyman v. Ladd, 347 F.2d 482, 483 (D.C. Cir. 1965) ("[N]aked ideas, independent of the means to carry them out, are not patentable." (citing *Atlantic Works*)).

93. *Atl. Works*, 107 U.S. at 200.

and "[t]he abstract" had to be "resolved into the concrete."[94] A circuit court explained in 1862:

> It is only where the explorer has gone beyond the mere domain of discovery, and has laid hold of the new principle, force, or law, and connected it with some particular medium or mechanical contrivance by which, or through which, it acts on the material world, that he can secure the exclusive control of it under the patent laws. He then controls his discovery through the means by which he has brought it into practical action, or their equivalent . . . .[95]

Notwithstanding frequent statements to this effect, an invention did not have to be embodied in a "thing" to constitute patentable subject matter.[96] An invention could constitute a process—a set of steps for producing a certain result. After disclosing one embodiment of a process, a patentee received protection against all methods of implementing the process to obtain the claimed result.[97] Courts did require that the invention be *represented* by a physical embodiment, but this entailed a different type of analysis. Specifically, whether or not a claimed apparatus suitably represented a larger class of inventions rested on whether the invention's utility was reproducible by others.[98] If a patentee's disclosure was

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94. Detmold v. Reeves, 7 F. Cas. 547, 549 (C.C.E.D. Pa. 1851) (No. 3,831).

95. Morton v. N.Y. Eye Infirmary, 17 F. Cas. 879, 881 (C.C.S.D.N.Y. 1862) (No. 9,865).

96. *See* O'Reilly v. Morse, 56 U.S. (15 How.) 62, 102 (1853) (citing cases "illustrating the proposition that the rights of the patentee are not restricted to the particular application or embodiment of his invention, but extend to the exclusion of other like applications").

97. In *Tilghman v. Proctor*, a seminal case in the development of the doctrine of process patents, the Supreme Court held that a patentee was entitled to protection against all uses of a specified process for separating fatty bodies into fatty acids and glycerine, notwithstanding the fact that the claimed apparatus for executing the process was not commercially viable. The Court held that the patent was for a process, and that process patents offer protection against all methods of carrying out the same process. 102 U.S. 707, 721–22 (1880); *accord* Cochrane v. Deener, 94 U.S. 780, 787 (1876); Le Roy v. Tatham, 55 U.S. (14 How.) 156, 175 (1852). Moreover, under the doctrine of pioneer patents, a patent could cover a set of potential inventions, represented though not fully embodied, by a claimed apparatus. *See, e.g.*, Morley Sewing Machine Co. v. Lancaster, 129 U.S. 263, 273 (1889).

98. Curtis explained:

> If the specification discloses, by sufficient and clear directions, some practical means by which persons of competent skill in the art can apply the principle and work it, so as to produce the effect contemplated by the patentee, it discloses a patentable invention, that invention consisting in a machine or other thing embodying the principle; or, stated in the other way, the patentable invention consists in the practical application of the principle.

CURTIS, *supra* note 59, § 136 (explaining the lessons to be gleaned from *Neilson v. Harford*, (1841)

sufficient to enable others to reproduce or use the invention, the patentee's invention was sufficiently embodied to constitute patentable subject matter.[99] At base, the embodiment requirement was therefore an enablement requirement.[100]

In *O'Reilly v. Morse*,[101] the Supreme Court addressed Samuel Morse's patent for the electromagnetic telegraph.[102] Morse's patent contained eight claims, the first seven of which were directed to an apparatus that used electromagnetism to transmit and record characters.[103] The eighth claim was directed to use of an electric current as a "motive power," in any form, "however developed[,] for marking or printing intelligible characters" at a distance.[104] The Supreme Court upheld the first seven claims, because they were "description[s] . . . given of the whole invention and its separate parts."[105] The Court invalidated the eighth claim because it attempted to claim an "exclusive right to every improvement where the motive power is the electric . . . current" and did not entail a transformation of the natural force that it claimed.[106] Drawing on enablement concerns,[107] the Court characterized the claim as being directed to a "manner and process which [Morse] ha[d] not described and indeed had not invented, and therefore

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151 Eng. Rep. 1266).

99. More precisely, an invention was sufficiently embodied to constitute patentable subject matter if the disclosure was sufficient to enable one "skilled in the art" to reproduce or use it. *See, e.g.*, Page v. Ferry, 18 F. Cas. 979, 983 (C.C.E.D. Mich. 1857) (No. 10,662).

100. The enablement requirement was described by a circuit court in 1857 as requiring that the invention "be so described in the specifications, in such clear, full and exact terms, that persons of competent skill and knowledge, may construct and reproduce the machine, or thing described, by following the specification, with the aid of drawings." *Id.*; *see also* 2 WILLIAM C. ROBINSON, THE LAW OF PATENTS FOR USEFUL INVENTIONS §§ 481, 483 (Boston, Little, Brown, & Co. 1890). For a description of the modern enablement requirement, see 2 MOY, *supra* note 24, § 7.2.

101. 56 U.S. (15 How.) 62 (1853).

102. 126 U.S. 1 (1888).

103. *See Morse*, 56 U.S. at 112, 119.

104. *Id.* at 112.

105. *Id.*

106. *See id.* at 112–13, 119–20.

107. Commentators have noted that it is unclear whether *Morse* was a case about the subject matter requirement or the enablement requirement. *See, e.g.*, Vincent Chiappetta, *Defining the Proper Scope of Internet Patents: If We Don't Know Where We Want to Go, We're Unlikely to Get There*, 7 MICH. TELECOMM. & TECH. L. REV. 289, 317 n.147 (2002); A. Samuel Oddi, *Regeneration in American Patent Law: Statutory Subject Matter*, 46 IDEA 491, 514 (2006). The core issue was whether Morse's eighth claim was directed to an unpatentable force of nature—a subject matter issue—but the Court's reasoning rested on its characterization of Morse's claim as directed to a "manner and process which he has not described and indeed had not invented, and therefore could not describe when he obtained his patent"—an enablement issue. *Morse*, 56 U.S. at 113. This confusion does not detract from the significance of this case for understanding nineteenth century patentable subject matter standards. It just shows the extent to which courts approached the patentability requirements as a unified inquiry.

could not describe when he obtained his patent."[108] Morse's eighth claim did not demonstrate sufficient control over the natural force it claimed and did not, therefore, constitute patentable subject matter.

Dissenting, Justice Grier disagreed with the majority's conclusion, while sharing the majority's understanding of technology as the transformation and control of nature for human purposes:

> The mere discovery of a new element, or law, or principle of nature, without any valuable application of it to the arts, is not the subject of a patent. But he who takes this new element or power, as yet useless, from the laboratory of the philosopher, and makes it the servant of man; who applies it to the perfecting of a new and useful art, or to the improvement of one already known, is the benefactor to whom the patent law tenders its protection.[109]

Justice Grier believed Morse had sufficiently controlled electromagnetism to justify the characterization of patentable subject matter.

Thirty years later, the Court addressed a parallel claim in the *Telephone Cases*,[110] but came to the opposite result. Claiming to follow the *Morse* majority while appearing to adopt the reasoning of the dissent, the Court concluded that Alexander Graham Bell's claim to the use of electricity to transmit sound at a distance did, in fact, constitute patentable subject matter.[111] The Court distinguished *Morse* by noting that while Morse's eighth claim had claimed electromagnetism as an unaltered force of nature, Bell claimed specific changes to the natural force to achieve a specific use.[112] Bell's claim was not for the use of a current of electricity "in its natural state" since it was only with Bell's changes that the current could serve as a medium for speech.[113] Rather, Bell's "art consist[ed] in [so] controlling the force as to make it accomplish the purpose" of transmitting vocal sounds at a distance.[114] Bell's invention brought the force of nature within the control of human society and furthered human progress. It was therefore patentable subject matter.

Notwithstanding that they drew seemingly contradictory conclusions, both *Morse* and the *Telephone Cases* illustrate the unified nature of the early subject matter inquiry, and its grounding in an Enlightenment vision

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108. *Morse*, 56 U.S. at 113.

109. *Id.* at 132–33 (Grier, J., dissenting).

110. 126 U.S. 1 (1888).

111. *See id.* at 534–35. Many commentators believe that *Morse* and the *Telephone Cases* cannot be distinguished, despite the Court's attempt in the *Telephone Cases* to do so.

112. *See id.* at 534.

113. *Id.*

114. *Id.* at 532.

of technology. In both cases, the Court drew on other patentability requirements—novelty, utility, embodiment, and enablement—in determining whether an asserted invention was patentable subject matter or an unpatentable exclusion. In both cases, patentable subject matter—the apparatuses of the telephone and the telegraph—represented human control over nature. Judicial exclusions in these cases—the forces of electromagnetism—represented elements of the natural world that had not yet been removed from their natural state. Under this approach, every invention was either nature or artifice, unpatentable exclusion or patentable subject matter. As a result, as more of the natural world came under human control, the exclusions contracted, patentable subject matter expanded, and social progress advanced.[115]

Equipped with this Enlightenment vision of technology, the early inquiry rejected the patentability of medical procedures and business methods, both of which qualify as patentable subject matter today. In 1862, a New York district court invalidated a patent for the administration of ether for use as an anesthetic, despite its conclusion that this was one of the "great discoveries of modern times."[116] The court explained that to be patentable, the idea behind an invention had to "be embodied and set to work" and "the natural functions of an animal upon which or through which it may be designed to operate" could not "form any essential parts of the [invention], however they may illustrate and establish its usefulness."[117] Dependent on the often unpredictable reaction of the "natural functions" of patients' bodies, medical procedures in the nineteenth century often produced inconsistent results. Unlike inventions such as the telegraph and telephone, they did not establish sufficient

115. The extent and pace of the contraction of the exclusions and the expansion of subject matter depended on courts' construction of litigated patents. A patent on a particular application of a principle, such as use of electromagnetism through a telegraph machine, left electromagnetism as an unapplied principle in the category of exclusion. *See* O'Reilly v. Morse, 56 U.S. (15 How.) 62, 113 (1853). A patent on all applications of a principle, in contrast, effectively removed that principle from the category of exclusion. In the *Telephone Cases*, the Court recognized that it was potentially granting a patent for all applications of electricity for the purposes of communicating sound at a distance. *Tel. Cases*, 126 U.S. at 535 ("It may be that electricity cannot be used at all for the transmission of speech, except in the way Bell has discovered, and that therefore, practically, his patent gives him its exclusive use for that purpose . . . ."); *see also* Neilson v. Harford, (1841) 151 Eng. Rep. 1266, 1274–75 (granting a patent for every application of the principle that hot air heats a fire more effectively than cold air). Regardless of the extent of the shift, every patent that implicated a principle of nature diminished the scope of the exclusions, while expanding the scope of patentable subject matter.

116. Morton v. N.Y. Eye Infirmary, 17 F. Cas. 879, 883 (C.C.S.D.N.Y. 1862) (No. 9,865).

117. *Id.* at 884; *see also Ex parte* Brinkerhoff, 24 Off. Gaz. Pat. Office 349 (Comm'r Pat. Off. 1883), *reprinted in* 27 J. PAT. OFF. SOC'Y 797, 797–98 (1945) (citing *Morton* and invalidating a method for the treatment of hemorrhoids). *See generally* 1 DONALD CHISUM, CHISUM ON PATENTS § 1.03[3] (2007).

control over an aspect of nature to justify the characterization as patentable subject matter.

At the opposite end of the spectrum from innovations that were still viewed as a part of the natural world were those, such as business methods, that had no connection to the natural world whatsoever. These also failed to constitute patentable subject matter under an Enlightenment vision. An 1869 patent office opinion concluded that business methods did not constitute patentable subject matter because "[i]t is contrary . . . to the spirit of the law . . . to grant patents for methods of book-keeping."[118] The patent office did not articulate its rationale, nor did courts invalidating business methods patents,[119] but it was likely based on a vision of technology as the physical transformation and control of nature.

Admittedly, even though the Enlightenment vision of technology was pushing the early subject matter inquiry to account for all types of social value, economic value—or the lack thereof—was serving as the patent system's incentive mechanism. The patent system incentivized those transformations of nature, beneficial to society, that could be translated into monetary value.[120] Throughout the nineteenth century, however, the inquiry's grounding in the transformation of nature, and its goal of broad social progress, limited the influence of economic factors. Into the early twentieth century, an Enlightenment view of technology continued to animate the subject matter inquiry and to place the patent system as a

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118. *Ex parte* Abraham, 1869 Dec. Comm'r Pat. 59, 59 (Comm'r Pat. Off. 1869).

119. In 1908, in *Hotel Security Checking Co. v. Lorraine Co*., the Second Circuit held a method of bookkeeping designed to prevent fraud by waiters was not patentable subject matter. 160 F. 467, 468–69 (2d Cir. 1908). This case was thereafter cited for the existence of a business methods exclusion, despite the fact that it was decided on novelty grounds. In dicta, the court stated: "A system of transacting business disconnected from the means for carrying out the system is not [patentable subject matter]." *Id.* at 469; *see also In re* Moeser, 27 App. D.C. 307, 310 (D.C. Cir. 1906) (concluding that a "mere contract" was unpatentable); U.S. Credit Sys. Co. v. Am. Credit Indem. Co., 53 F. 818, 819 (C.C.S.D.N.Y. 1893) (concluding that "a method of transacting common business" was unpatentable).

120. The patent grant fostered invention and disclosure by assigning potential economic value to an invention. Such economic value was realized only if consumers were willing to pay monopoly rents. As a result, although patentable subject matter was defined as any transformation of nature that was beneficial to society, the system incentivized only a subset of such transformations. Moreover, during the patent term, the system indirectly discouraged use of inventions for non-economic purposes. The patent holder realized an invention's potential value by excluding from use anyone who did not pay a licensing fee. This requirement precluded use in furtherance of competing values by anyone other than the owner, without the owner's permission. A patent holder could choose to forgo economic value and license an invention in furtherance of a variety of social purposes, but the system would not reward such a choice. As a result, most patent holders chose to maximize economic value. This preference was evidenced by a booming market in technology rights during the middle of the nineteenth century. *See* Naomi R. Lamoreaux & Kenneth L. Sokoloff, *Market Trade in Patents and the Rise of a Class of Specialized Inventors in the 19th-Century United States*, 91 AM. ECON. REV. (PAPERS & PROC.) 39, 41 (2001).

whole in the service of a broad array of human values.

III. "'ANYTHING UNDER THE SUN THAT IS MADE BY MAN'":[121] PATENTABLE SUBJECT MATTER AND THE MODERN VISION OF TECHNOLOGY

Over the course of the late nineteenth and early twentieth centuries, the dominant social paradigm of technology underwent gradual but significant changes. Even as the subject matter inquiry continued to embrace the Enlightenment vision of technology, society's focus shifted away from concepts of nature and broad social value and toward technology's potential to foster economic growth. A new Modern vision emerged, which posited technology as an assured means to economic growth—so assured that the technological means were often viewed as ends in themselves. To the extent technology served broader social values under this vision, it only did so indirectly, through the creation of economic value. By the middle of the twentieth century, this Modern vision was reflected in a changed subject matter inquiry, which focused on rationalizing and perfecting the processes of invention and innovation in order to create economic value.

A. *"'Back to Nature? Never!'":*[122] *The Modern Vision*

Throughout the nineteenth century, two sets of influences gradually pushed the Enlightenment understanding of technology as an agent of social progress from the forefront and replaced it with a Modern understanding of technology as a spur to economic growth. The first set of influences came from the practices of science and the other from economic thought.

Traditionally, the enterprises of science and technology had been pursued by individuals from different segments of society. Science was the work of a gentlemen class, who learned their methods in formal educational institutions and viewed their pursuit as a noble one.[123] Technology was the work of artisans, who learned their skills from mentors in guilds, factories, or elsewhere, and practiced their craft to make a living.[124] Over the course of the nineteenth century, barriers between the two enterprises broke down.[125] Formal scientific and engineering education

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

122. PURSELL, *supra* note 53, at 229 (quoting Edwin E. Slosson, *Back to Nature? Never! Forward to the Machine*, INDEP., Jan. 3, 1920, at 37, 37).

123. COWAN, *supra* note 25, at 302; *see also* John C. Greene, *Science and the Public in the Age of Jefferson*, 49 ISIS 13, 14 (1958).

124. Cowan, *supra* note 25, at 302.

125. *See* Edwin Layton, *Mirror-Image Twins: The Communities of Science and Technology*

became prevalent among inventors.[126] Scientific methods came to inform technological innovations and inventions,[127] and technological tools and applications came to inform scientific research.[128] By the early twentieth century, multiple points of interaction, overlap, and mutual influence linked the two enterprises.[129]

Within the patent law, this merger translated into an increasing awareness of the influence of science on technological advance. As early as 1829, Justice Story had urged craftsman to obtain scientific knowledge and scientists to obtain craft knowledge.[130] Later in the century, scientific training and methods arose as issues in patent litigation with increasing frequency. Empirical methods were touted as frequently leading to invention,[131] and access to scientific knowledge was seen as evidence that an inventor could both conceive of an invention and reduce it to practice.[132]

As science was altering the means of technological advance, the economy was altering its ends. By the end of the nineteenth century, a second phase of the Industrial Revolution had transformed the country's social and economic structure.[133] By the first decade of the twentieth century, the value of American manufactures equaled that of Britain,

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in 19th-Century America, 12 TECH. & CULTURE 562 (1971).

126. Between 1790 and 1865, less than a quarter of all patent-holding inventors had any college education, and less than half had any schooling at all. B. Zorina Khan & Kenneth L. Sokoloff, *"Schemes of Practical Utility": Entrepreneurship and Innovation Among "Great Inventors" in the United States, 1790–1865*, 53 J. ECON. HIST. 289, 292, 293 tbl.2 (1993). Of inventors born after 1870, in contrast, 95% had at least some college education. *See* Lamoreaux & Sokoloff, *supra* note 120, at 42, 43 tbl.3.

127. *See* Barry Barnes, *The Science-Technology Relationship: A Model and a Query*, 12 SOC. STUD. SCI. 166, 166–69 (1982); Lubar, *supra* note 67, at 957 (discussing the general belief beginning in the 1840s that technology was based on science).

128. *See* Layton, *supra* note 125, at 562; *see also* Ronald Kline, *Construing "Technology" as "Applied Science": Public Rhetoric of Scientists and Engineers in the United States*, *1880-1945*, 86 ISIS 196, 217–20 (1995).

129. *Id.*

130. Frank D. Prager, *The Changing Views of Justice Story on the Construction of Patents*, 4 AM. J. LEGAL HIST. 1, 12 (1960).

131. *See, e.g.*, O'Reilly v. Morse, 56 U.S. (15 How.) 62, 132 (1853) (Grier, J., dissenting) ("In many cases, [the new application of an element or agent] is the result of numerous experiments; not the consequence of any reasoning *a priori* but wholly empirical . . . .").

132. *See, e.g.*, The Tel. Cases, 126 U.S. 1, 296 (1888) (statement of Bell's counsel describing Bell's background).

133. Driven by the substitution of steel for iron and coal for petroleum, the phase saw a dramatic increase in production capacities, international corporatization, and technological innovation. MICHAEL ADAS, DOMINANCE BY DESIGN 109–13 (2006). Moreover, as the economy changed, so too did economic thought. Motivated by the success of the natural sciences, neoclassical economists embraced a scientific approach and theorized that empirical data about social interactions could be gathered and used to further economic growth. SCOTT GORDON, THE HISTORY AND PHILOSOPHY OF SOCIAL SCIENCE 151, 562–63 (1991).

Germany, and France combined.[134] Many Americans came to believe that the United States was "the most progressive and prosperous society in all [of] human history."[135] Moreover, many came to believe that technological advances caused this prosperity.[136] Technologies were an "undeniable blessing," rendering "'the conveniences and elegancies of life accessible to the many instead of the few.'"[137] In a 1920 magazine article entitled "Back to Nature? Never! Forward to the Machine," Edwin Slosson explained that man must look to "'the divinity of machinery . . . for the salvation of society.'"[138]

In the 1930s, Joseph Schumpeter captured and formalized this faith in technology with an economic theory that identified innovation as a crucial element of growth, and inspired a scholarly movement that modeled economic development around technological change, invention, and innovation.[139] With economic progress the inevitable result of technological advance, society focused its resources on accelerating the pace of technology. Lewis Mumford later criticized the prevalent "belief in mechanical progress as an end in itself" for assuming that human improvement would occur "almost automatically" if society simply devoted all of its energies to science and technology.[140] Meanwhile, as instrumental views of law gained influence, the patent law itself began to be viewed as a tool of economic progress.[141]

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134. *See* ADAS, *supra* note 133, at 112–13.

135. *Id.* at 113.

136. Technology was viewed as the cause of the nation's "unprecedented economic growth," and "its hard-won dominance in . . . [the] international arena." *See id.*

137. LANGDON WINNER, THE WHALE AND THE REACTOR, A SEARCH FOR LIMITS IN AN AGE OF HIGH TECHNOLOGY 44–45 (1986) (quoting Denison Olmsted). To some, technology became a replacement for politics. Howard Scott, the founder of the short-lived technocracy movement, argued that "[o]nly when that government had collapsed, and another made up of engineers and other technicians had taken power, would the problem of production and distribution be solved." PURSELL, *supra* note 53, at 252. The technological optimism of the nineteenth and early twentieth centuries did not go unchallenged, however. The nineteenth century romantic movement was defined in opposition to it, inspiring writers, artists, and intellectuals to express skepticism. Henry David Thoreau famously characterized new technologies such as the telegraph as "but improved means to an unimproved end." HENRY D. THOREAU, WALDEN 52 (J. Lydon Shanley ed., Princeton Univ. Press 1989) (1854). "We are in great haste to construct a magnetic telegraph from Maine to Texas;" he explained, "but Maine and Texas, it may be, have nothing important to communicate." *Id.* Such opposing strains of thought did not quell the dominant optimism, however, nor did they interfere with the embrace of technology as a key tool of progress. *See* Chon, *supra* note 31, at 140–41.

138. PURSELL, *supra* note 53, at 229–30 (quoting Edwin E. Slosson, *supra* note 122, at 37–39).

139. *See* Herbert Giersch, *The Age of Schumpeter*, 74 AM. ECON. REV. 103, 103–05 (1984); Vernon W. Ruttan, *Usher and Schumpeter on Invention, Innovation, and Technological Change*, 73 Q.J. ECON. 596, 597 (1959).

140. LEWIS MUMFORD, *The Case Against "Modern Architecture*," *in* THE LEWIS MUMFORD READER 73, 74–75 (Donald L. Miller ed., Pantheon Books 1986).

141. Lubar, *supra* note 67, at 932–33; Frank D. Prager, *Trends and Developments in American*

Notwithstanding the two world wars, the Depression, and the development of the atomic bomb,[142] technological optimism continued to inspire technological advancement and economic growth throughout the middle decades of the twentieth century.[143] Carroll Pursell characterized the three decades following World War II as "that 'American Century' of which some had dreamed."[144] Shortly before his death in 1965, Adlai Stevenson expressed the dominant technological optimism as follows:

> "Science and technology are making the problems of today irrelevant in the long run, because our economy can grow to meet each new charge placed upon it. . . . This is the basic miracle of modern technology. . . . It is a magic wand that gives us what we desire!"[145]

By the middle of the twentieth century, technology's Enlightenment promise of holistic social progress yielded to a narrower but assured vision of economic promise. A Modern understanding of technology had become the dominant social paradigm.

Patent Law from Jefferson to Clifford (1790–1870) (pt. II), 6 AM. J. LEGAL HIST. 45, 59 (1962). With the patent system furthering technology and technology furthering the economy, Americans began to conceive of the patent grant as an integral part of economic growth. Lubar, *supra* note 67, at 942–43.

142. For historical reasons, the sobering realities of industrialization, war, and the atomic bomb failed to grip the United States with the same salience as they did Europe. *See* Ronald N. Giere, *Science and Technology Studies: Prospects for an Enlightened Postmodern Synthesis*, 18 SCI. TECH. & HUM. VALUES 102, 105 (1993). Whereas Europe engaged in extensive debate about the desirability of monopoly patent rights during the nineteenth century, leading in some cases to the total repeal of patent monopolies, the United States did not revisit the existence of a patent system. *See* Fritz Machlup & Edith Penrose, *The Patent Controversy in the Nineteenth Century*, 10 J. ECON. HIST. 1, 3 (1950).

143. This trend was due at least in part to increasing government involvement in the technological enterprise. World War II caused the government to invest heavily in research and development efforts in order to spur the development of new and more effective weapons. CARROLL PURSELL, TECHNOLOGY IN POSTWAR AMERICA: A HISTORY 1–2 (2007). Moreover, following the war, governmental funding of research and development continued, culminating in the founding of the National Science Foundation in 1950. *Id.* at 9–11.

144. PURSELL, *supra* note 53, at 272.

145. Walter A. McDougall, *Technocracy and Statecraft in the Space Age—Toward the History of a Saltation*, 87 AM. HIST. R. 1010, 1032 (1982) (alterations in original) (quoting ADLAI STEVENSON, SCIENCE AND SOCIETY: A SYMPOSIUM (1965)).

B. *The Anatomy of the Patent Act*:[146] *The Modern Vision and the Changed Inquiry*

By the middle of the twentieth century, these shifts in the social views of technology were reflected in changes to the subject matter inquiry in three main ways: (1) Science replaced nature as the construct informing the exclusions, (2) the 1952 Act initiated a new segmented patentability inquiry, and (3) courts developed a new utilitarian justification for the exclusions. These three changes illustrate the divorce of technology from conceptions of nature and the desire to rationalize and perfect the human processes of invention and innovation. Together, they created a twentieth century subject matter inquiry that focused on technology as an end in itself, with the assumption that technological advance would inevitably spur economic growth.

1. Understanding the Exclusions as Science

The first manifestation of the Modern vision of technology was the replacement of nature with science as the construct informing the exclusions. In the course of the nineteenth century, scientific training and methods appeared with increasing frequency in litigation involving patentable subject matter.[147] Not until the middle of the twentieth century, however, did courts, litigants, and commentators begin replacing nature with science as a central consideration of the subject matter inquiry. Technology was no longer envisioned as the control and transformation of the natural world. It was viewed as applied science.

The traditional Western distinction between the enterprises of science and technology dates back to antiquity.[148] Science, under this traditional Western view, revealed fundamental truths about the natural world.[149] Technology, in contrast, employed these truths to manipulate and control the natural world.[150] The two enterprises employed different reward structures. Science facilitated openness by granting recognition and prestige to the first to publish new findings.[151] Technology encouraged

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146. *See In re* Bergy, 596 F.2d 952, 959 (C.C.P.A. 1979), *vacated in part by* Diamond v. Chakrabarty, 444 U.S. 1028 (C.C.P.A.), *aff'd*, 447 U.S. 303 (1980). Judge Giles Rich used a similar expression to refer to the new approach to the subject matter inquiry initiated by the Patent Act of 1952. *See infra* text accompanying notes 198–202.

147. *See supra* text accompanying notes 131–32.

148. *See* David Hull, *Openness and Secrecy in Science: Their Origins and Limitations*, 10 SCI. TECH. & HUM. VALUES 4, 4 (1985); Ernan McMullin, *Openness and Secrecy in Science: Some Notes on Early History*, 10 SCI. TECH. & HUM. VALUES 14, 15–16 (1985).

149. *See* Hull, *supra* note 148, at 6.

150. *See* McMullin, *supra* note 148, at 15–16.

151. *See* Hull, *supra* note 148, at 12.

secrecy, granting a competitive advantage if competitors were precluded from use of a new craft or skill.[152]

Under this traditional model, the patent incentive was viewed as necessary to open the closed culture of technological practice. An inventor was granted a limited monopoly in exchange for full disclosure of the invention.[153] Disclosure made the innovation widely available and fostered further innovation.[154] In the culture of science, in contrast, patent incentives were viewed as unnecessary and undesirable: Unnecessary because science's reward structure already encouraged disclosure,[155] and undesirable because of a perceived dampening effect on scientific innovation.[156] Expressing the traditional view, Charles Jackson declared in 1851 that "'no true man of science will ever disgrace himself by asking for a patent.'"[157]

As noted, the two enterprises converged over time, rendering these distinctions an inaccurate representation of actual practice.[158] By the end of the nineteenth century, the content of basic scientific research was frequently determined by technological applications, while its direction and pace were frequently determined by the development of technological equipment.[159] Scientific methods and practices, meanwhile, were being applied to problems traditionally associated with technology.[160] Today, Science and Technology Studies scholars conclude that clear distinctions between science and technology are artificial and unhelpful.[161] As a result,

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152. *See* McMullin, *supra* note 148, at 15–16.

153. 3 CHISUM, *supra* note 117, § 7.01.

154. By requiring full disclosure of the invention at the time the patent issues, the patent system ensures that society will have access to information regarding the invention during the patent term, and full access to the invention when the patent term expires. *See* CHISUM, *supra* note 117, § 7.01.

155. The first to publish and disseminate new findings and knowledge receives prestige and associated benefits. *See* Lee, *Inverting the Logic*, *supra* note 24, at 103–04. Scholars have questioned this generalization, however, noting that openness is not always incentivized. *See, e.g.*, Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 YALE L.J. 177, 215 (1987).

156. Commentators worry that the imposition of property rights in pure science will impede the dissemination and exchange of research results. They also worry that fear of infringement liability will chill research efforts. *See* Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1017 (1989); Clarisa Long, *Patents and Cumulative Innovation*, 2 WASH. U. J.L. & POL'Y 229, 229 (2000).

157. PURSELL, *supra* note 53, at 220 (quoting Dr. Charles T. Jackson).

158. *See supra* text accompanying notes 125–29.

159. *See* Layton, *supra* note 125, at 562; *see also* Barnes, *supra* note 127, at 168–69; Emmanuel G. Mesthene, *How Technology Will Shape the Future*, SCIENCE, July 12, 1968, at 135, 135; Pinch & Bijker, *supra* note 27, at 17.

160. Layton, *supra* note 125, at 567–70.

161. *See, e.g.*, Pinch & Bijker, *supra* note 27, at 17, 19–21.

some scholars rely on the term "technoscience" in referring to both enterprises.[162]

Notwithstanding the traditional distinction's shortcomings in describing actual practice, mid-twentieth century courts and commentators began using the rhetoric of science and technology to describe the difference between unpatentable exclusion and patentable subject matter. They created new exclusions to address the science of mathematics[163] and described exclusions as the products of scientific processes.[164] For example, in finding patentable subject matter in a combination of naturally-occurring bacteria that resulted in a valuable inoculant,[165] a circuit court explained that "[t]his was application of scientific knowledge to things existing in nature and the utilization of them in a desirable composite product which had not been previously achieved."[166] Because the inventor applied scientific knowledge to a useful end, the resulting inoculant was a technology.[167] The Supreme Court disagreed, but within the same epistemological framework—the inoculant was a pure scientific discovery and therefore an exclusion.[168]

Replacing nature with science as the relevant construct facilitated the PTOs mid-century change in position on medical procedure patents.[169] As

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162. *See, e.g.*, BRUNO LATOUR, SCIENCE IN ACTION: HOW TO FOLLOW SCIENTISTS AND ENGINEERS THROUGH SOCIETY 174–75 (1987). Others recognize the existence of two enterprises, but remain acutely aware that their boundaries are a matter of social negotiation and construction. *See, e.g.*, Michael Lynch, *Circumscribing Expertise: Membership Categories in Courtroom Testimony*, *in* STATES OF KNOWLEDGE: THE CO-PRODUCTION OF SCIENCE AND SOCIAL ORDER 161, 164–65 (Sheila Jasanoff ed., 2004).

163. *See, e.g.*, Mackay Radio & Tel. Co. v. Radio Corp. of Am., 306 U.S. 86, 92–94 (1939) (noting the employment of a mathematical formula to fix the appropriate angle between antenna wires for a directive antenna system used in radio communication); Halliburton Oil Well Cementing Co. v. Walker, 146 F.2d 817, 818, 823 (9th Cir. 1944) (measuring the distance between an oil well head and the surface of subterranean liquid by calculating through acoustics using a mathematical formula), *aff'd*, 326 U.S. 696, *rev'd*, 329 U.S. 1 (1946); Don Lee, Inc. v. Walker, 61 F.2d 58, 58–59 (9th Cir. 1932) (using a mathematical formula as a solution for a method of counterbalancing engine shafts by calculating weight and position requirements); *In re* Bolongaro, 62 F.2d 1059, 1059–60 (C.C.P.A. 1933) (using simple mathematical methods to convert manuscripts to print publications).

164. *See infra* text accompanying notes 165–82.

165. Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948). Specifically, the combination resulted in a non-inhibitory inoculant—a combination of inoculants, in which the component inoculants did not cancel each other's beneficial effects. *Id.*

166. Kalo Inoculant Co. v. Funk Bros. Seed Co., 161 F.2d 981, 986 (7th Cir. 1947), *rev'd*, 333 U.S. 127 (1948).

167. *Id.*

168. *Funk Bros.*, 333 U.S. at 130 ("Discovery of the fact that certain strains of each species of these bacteria can be mixed without harmful effect to the properties of either is a discovery of their qualities of non-inhibition. It is no more than the discovery of some of the handiwork of nature and hence is not patentable.").

169. *See Ex parte* Scherer, 103 U.S.P.Q. (BNA) 107, 110 (Pat. Off. Bd. App. 1954) ("To the

noted, the initial exclusion followed from the critical role nature played in the utility of medical procedures—their efficacy depended on the reaction of the human body.[170] As courts and commentators dropped nature from the inquiry and replaced it with science, this problem disappeared. As an application of scientific knowledge, medical procedures fit easily within a definition of patentable subject matter as applied science.[171]

Since the middle of the century, courts have repeatedly explained that scientific discovery, absent practical application, constitutes an unpatentable exclusion.[172] Applied scientific discovery, however, is technological innovation and therefore patentable subject matter. In *Diamond v. Chakrabarty*,[173] the Court explained that "Einstein could not patent his celebrated law that $E=mc^2$; nor could Newton have patented the law of gravity. Such discoveries are 'manifestations of . . . nature, free to all men and reserved exclusively to none.'"[174] Other examples include the Pythagorean theorem[175] and the Arrhenius equation.[176] In *Parker v. Flook*,[177] in invalidating a patent claiming a mathematical algorithm, the Court reasoned that "[t]he underlying notion is that a scientific principle, such as that expressed in respondent's algorithm, reveals a relationship that has always existed."[178] The relationship may have been first discovered by the inventor, but it was not applied so as to constitute patentable subject matter.

Some legal scholars, adopting this judicial narrative, are even more explicit in describing the exclusions in terms of basic science, and

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extent that *Ex parte Brinkerhoff* holds or implies that all medical or surgical methods are unpatentable subject matter merely because they involve treating the human body, that decision is expressly overruled.").

170. *See supra* text accompanying notes 115–17.

171. Since 1996, medical procedure patents have been unenforceable against medical practitioners, but they still constitute patentable subject matter. *See* 35 U.S.C. § 287(c)(1) (2000). Patent holders can pursue remedies against contributory infringers, such as pharmaceutical companies and medical device manufacturers. *See* Todd Martin, *Patentability of Methods of Medical Treatment: A Comparative Study*, 82 J. PAT. & TRADEMARK OFF. SOC'Y 381, 404–05 (2000).

172. *See, e.g.*, Parker v. Flook, 437 U.S. 584, 593 & n.15 (1978) (noting that a scientific principle reveals a relationship that always existed, and thus "[t]he rule that the discovery of a law of nature cannot be patented rests, not on the notion that natural phenomena are not processes, but rather on the more fundamental understanding that they are not the kind of 'discoveries' that the statute was enacted to protect").

173. 447 U.S. 303 (1980).

174. *Id.* at 309 (alteration in original) (quoting Funk Bros. Seed Co. v. Kalo Inoculant Co., 333 U.S. 127, 130 (1948)).

175. *In re* Bergy, 596 F.2d 952, 965 (C.C.P.A. 1979), *vacated in part by* Diamond v. Chakrabarty, 444 U.S. 1028 (C.C.P.A.), *aff'd*, 447 U.S. 303 (1980).

176. Diamond v. Diehr, 450 U.S. 175, 178, 187 (1981).

177. 437 U.S. 584 (1978).

178. *Id.* at 593 n.15.

patentable subject matter in terms of applied technology. Rebecca Eisenberg refers to patentable subject matter as being limited to "inventions in fields of applied technology, as opposed to basic scientific research."[179] Calling for a strengthening of the exclusions to protect the open culture of science, Eileen Kane contends that the exclusions' purpose is to protect the scientific public domain, so as to ensure that scientific knowledge and fundamental scientific tools are freely accessible.[180] Peter Lee argues that the exclusions represent the patent law's means of "keeping basic tools of science within the public domain and outside the realm of individual property."[181] Lee characterizes judicial reasoning regarding the scope of subject matter as espousing the belief that foundational elements of scientific research should not be subject to property rights.[182]

The replacement of nature with science is a significant shift within the subject matter inquiry, both rhetorically and analytically. It draws the inquiry's attention away from nature and redirects it toward the human activities and institutions that produce technology. It envisions the distinction between subject matter and exclusion as that between two human enterprises—both involved in innovation and invention. Moreover, by speaking in the seemingly objective language of science and technology, it allows courts and commentators to obscure implicit value judgments.[183]

2. The Segmented Approach of the 1952 Act

The second manifestation of the Modern vision of technology within the subject matter inquiry was the new doctrinal approach initiated by the 1952 Act.[184] Affirming the shift in focus away from nature and toward technology, the 1952 Act redirected the inquiry from the boundary between exclusion and subject matter (by definition implicating nature) and toward the statutory categories of patentable subject matter (by definition implicating the products of human creation).[185] The Act did not address the exclusions—either to codify or to eliminate them.

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179. Rebecca Eisenberg, *Genetics and the Law: Patenting the Human Genome*, 39 EMORY L.J. 721, 722–23 (1990).

180. Kane, *supra* note 22, at 525.

181. Lee, *Inverting the Logic*, *supra* note 24, at 104.

182. *Id.* at 81.

183. *See* Diamond v. Chakrabarty, 447 U.S. 303, 307 (1980) (discussing the authority of Congress to promote progress through patent laws); SHEILA JASANOFF, DESIGNS ON NATURE: SCIENCE AND DEMOCRACY IN EUROPE AND THE UNITED STATES (2005).

184. *See* Patent Act of 1952, ch. 950, 66 Stat. 792 (codified as amended in scattered sections of 35 U.S.C.).

185. *See supra* text accompanying notes 55–61.

The intent of the 1952 Act was to make the patenting process easier and more predictable and to curb judicial hostility toward patents.[186] One commentator explained that "the primary purpose of the revision was to modernize and strengthen the patent laws, to give the patent right effectiveness, and to make the statute an understandable and well-written document."[187] Moreover:

> The revision of the cumbersome, sometimes inconsistent, provisions that had become more and more difficult to understand or justify, particularly in view of the great advances of the technologies with which they were so intimately associated, into the compact, simple, definite, and practical provisions of the Act, arranged and organized into an efficient working tool, was a matter of prime importance.[188]

The Act's drafters, most of whom were patent attorneys,[189] brought their scientific worldview to the task of creating a more mechanical, systematized statute.[190] In each of the four prior patent acts, the patentable subject matter inquiry had been articulated with other patentability requirements in the same section.[191] The 1952 Act separated the subject matter, novelty, and inventiveness (restated as non-obviousness) requirements into separate sections.[192] Section 101 of the Act covers subject matter and utility,[193] § 102 covers novelty,[194] § 103 covers

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186. *See* Reiner v. I. Leon Co., 285 F.2d 501, 503 (2d Cir. 1960) ("There can be no doubt that the [Patent] Act of 1952 meant to change the slow but steady drift of judicial decision[s] that had been hostile to patents . . . ."); *see also* L. James Harris, *Some Aspects of the Underlying Legislative Intent of the Patent Act of 1952*, 23 GEO. WASH. L. REV. 658, 658–62 (1955).

187. Harris, *supra* note 186, at 698 (footnotes omitted).

188. *Id.* at 660.

189. The Act's passage is attributed largely to the initial efforts of Judge Giles Rich (at the time a patent attorney) and the New York Patent Law Association, and to the later efforts of a coordinating committee of many patent law associations. *See* George E. Frost, *Judge Rich and the 1952 Patent Code—A Retrospective*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 343, 356 (1994).

190. *See A Bill to Revise and Codify the Laws Relating to Patents and the Patent Office, and to Enact into Law Title as of the United States Code Entitled "Patents": Hearings on H.R. 3760 Before Subcomm. No. 3 of the H. Comm. on the Judiciary*, 82d Cong. 121 (1951) (statements of Rep. Bryson and Rep. Willis).

191. *See supra* text accompanying notes 55–58.

192. *See* 35 U.S.C. § 101 hist. n. (2000) ("The corresponding section of existing statute is split into two sections, § 101 relating to the subject matter for which patents may be obtained, and § 102 defining statutory novelty and stating other conditions for patentability."). For a history of the patent system leading up to the 1952 Act, see Frank D. Prager, *Standards of Patentable Invention from 1474 to 1952*, 20 U. CHI. L. REV. 69 (1952).

193. 35 U.S.C. § 101. The utility and patentable subject matter requirements are both in § 101, but they were intended and are treated as independent requirements. *See* S. REP. NO. 82-1979, at 5 (1952) ("Section 101 sets forth the subject matter that can be patented, 'subject to the conditions

non-obviousness,[195] and § 112 covers enablement and written description.[196] This new structure articulated the inquiry as a number of straightforward steps,[197] which courts could then apply in a disinterested, scientific manner.[198]

Judge Giles Rich, credited as the primary drafter of the 1952 Act,[199] offered a particularly telling title for the intended approach in *In re Bergy*: "Anatomy of the Patent Statute."[200] The relationship between the statute's sections, he said, could be analogized to separate doors to be opened in succession by separate keys.[201] The subject matter requirement was the first door and was relatively easy to open because subject matter was meant to be expansive.[202] Only after opening this door would a court move to the latter doors, which entailed more rigorous inquiries.[203]

Also in *In re Bergy*, Judge Rich criticized the Supreme Court's approach in *Parker v. Flook*,[204] decided earlier the same year, for:

> an unfortunate and apparently unconscious, though clear, commingling of distinct statutory provisions which are conceptually unrelated, namely, those pertaining to the *categories* of inventions in § 101 which *may* be patentable and to the *conditions* for patentability demanded by the statute for inventions within the statutory categories . . . .[205]

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and requirements of this title.' The conditions under which a patent may be obtained follow, and section 102 covers the conditions relating to novelty.").

194. 35 U.S.C. § 102.

195. *Id.* § 103.

196. *Id.* § 112.

197. *See* Frost, *supra* note 189, at 352; MOY, *supra* note 24, § 1:23.

198. This approach had been foreshadowed by courts addressing claims covering mental steps and mathematical formulae. *See, e.g.*, *In re* Yuan, 188 F.2d 377, 381–82 (C.C.P.A. 1951).

199. *See supra* note 189.

200. *In re* Bergy, 596 F.2d 952, 959 (C.C.P.A. 1979), *vacated in part by* Diamond v. Chakrabarty, 444 U.S. 1028 (C.C.P.A.), *aff'd*, 447 U.S. 303 (1980).

201. *Id.* at 960.

202. Writing for the majority in *In re* Bergy, Judge Rich explained that for "nearly 200 years . . . [the Patent Act has] been liberally construed to include the most diverse range imaginable of unforeseen developments in technology. . . . We believe § 101 and its predecessor statutes were broadly drawn in general terms to broadly encompass unforeseeable future developments . . . ." *Id.* at 973–74 (footnotes omitted); *see also* A. Samuel Oddi, *Assault on the Citadel: Judge Rich and Computer-Related Inventions*, 39 HOUS. L. REV. 1033, 1096 (2002).

203. For a discussion of the insistence of the Court of Customs and Patent Appeals and the Federal Circuit on a segmented approach even in the face of Supreme Court resistance, see Sam S. Han, *Analyzing the Patentability of "Intangible" Yet "Physical" Subject Matter*, 3 COLUM. SCI. & TECH. L. REV. 1, 45–52 (2002).

204. 437 U.S. 584 (1978).

205. *In re Bergy*, 596 F.2d at 959.

Although it was decided a number of years after the introduction of the segmented approach, *Flook* followed the early unified inquiry.[206] The *Flook* Court explained that when addressing an invention implicating an exclusion—in the case at hand, an algorithm—a court should treat the exclusion as a familiar part of the prior art and determine whether the claims disclosed a novel, inventive concept.[207] Echoing the novelty element of the early unified subject matter inquiry, the *Flook* Court explained that algorithms reveal "a relationship that has always existed,"[208] while "[p]atentable subject matter must be new (novel); not merely heretofore unknown."[209] To Judge Rich and other advocates of a segmented and systematized approach, this "commingling of distinct statutory provisions" was unacceptable.[210] Under the 1952 Act, there was to be no unified inquiry that drew upon various requirements.[211] The patentability requirements were to be addressed separately.[212]

When addressing *In re Bergy* on appeal in *Diamond v. Chakrabarty*,[213] the Supreme Court adopted Judge Rich's segmented approach and emphasized the independence of the subject matter requirement.[214] The Court displayed an awareness of the Founding Fathers' broad understanding of technology by noting that the categories of patentable subject matter had been "cast in broad terms" in order to promote "'the Progress of Science and the useful Arts' with all that means for the social and economic benefits envisioned by Jefferson."[215] The Court did not act on this broad vision, however. After noting a "gruesome parade of horribles"[216] that the infringer predicted would result from genetic research patents, the Court declared itself incompetent to engage in technology assessment: "we are without competence to entertain these arguments—either to brush them aside as fantasies generated by fear of the unknown, or to act on them."[217] Implicitly rejecting the moral utility

206. 437 U.S. at 594.
207. *Id.* at 595.
208. *Id.* at 593 n.15.
209. *Id.*
210. *In re Bergy*, 596 F.2d at 959.
211. *See* 35 U.S.C. § 101 (2000).
212. *See id.*
213. 447 U.S. 303 (1980).
214. *Id.* at 309–10.
215. *Id.* at 315 (quoting U.S. CONST. art. I, § 8, cl. 8). Other Supreme Court cases show a similar awareness of this broader context. *See, e.g.*, Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480 (1974) (noting that the patent laws were established in the hope that "[t]he productive effort thereby fostered will have a positive effect on society through the introduction of new products and processes of manufacture into the economy, and the emanations by way of increased employment and better lives for our citizens").
216. 447 U.S. at 316.
217. *Id.* at 317.

doctrine,[218] the Court interpreted its role as the narrow one of applying a technical statute and "determin[ing] whether respondent's micro-organism constitutes a 'manufacture' or 'composition of matter' within the meaning of the statute."[219]

In the Federal Circuit's opinion in *In re Bergy* and the Supreme Court's opinion in *Chakrabarty*, human labor, a key element of the early unified subject matter inquiry, played a role in the analysis. Its role had changed, however. In the early inquiry, labor had been valued as an indicator of control over nature. In these cases, labor constituted evidence that the alleged invention fell within the statutory category of manufacture. In *In re Bergy,* Judge Rich explained that a claimed bacterial culture was a manufacture because it could not be found in nature and had to be produced by scientists under carefully controlled laboratory conditions.[220] On appeal in *Chakrabarty*, the Court similarly concluded that the oil-eating bacteria qualified as patentable subject matter because it was "not nature's handiwork, but [the inventor's] own,"[221] and a "nonnaturally occurring manufacture . . . a product of human ingenuity."[222] The salient inquiry had shifted. The question was no longer whether human labor had controlled an aspect of nature. It was whether human labor had produced a manufacture. And the focus was no longer on nature as something that stood apart from humanity, waiting to be dominated; it was exclusively on the human realm, and its ability to create and produce.

The next term, in *Diamond v. Diehr*,[223] the Court explicitly rejected *Flook*'s method of claim analysis, concluding that it was "inappropriate to dissect the claims into old and new elements and then to ignore the presence of the old elements in the analysis."[224] In upholding the patentability of an algorithm applied in a process for curing rubber, the Court explained that "[t]he 'novelty' of any element or steps in a process, or even of the process itself, is of no relevance in determining whether the subject matter of a claim falls within the § 101 categories of possibly patentable subject matter."[225] A claim was directed to patentable subject matter if it was directed to an application of a mathematical form or

218. For a discussion of the moral utility doctrine in the nineteenth century, see *supra* text accompanying notes 62–68 and for a discussion of the Federal Circuit's explicit repudiation of the doctrine, see *infra* note 295 and accompanying text.

219. 447 U.S. at 307 (footnote omitted); *id.* ("The question before us in this case is a narrow one of statutory interpretation requiring us to construe 35 U.S.C. § 101 . . . .").

220. *In re* Bergy, 563 F.2d 1031, 1035 (1977).

221. 447 U.S. at 310.

222. *Id.* at 309.

223. 450 U.S. 175 (1981).

224. *Id.* at 188.

225. *Id.* at 188–89 (footnotes omitted).

algorithm in a structure or process, rather than to the formula or algorithm itself.[226] Novelty played no role in the analysis.[227]

Some courts struggled with the new analysis.[228] In 1998, in *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*,[229] the Federal Circuit discredited the notion of a business methods exclusion and upheld a business methods patent.[230] The court equated subject matter with utility, explaining that an alleged invention based on an algorithm could only constitute patentable subject matter if it produced a "'useful, concrete, and tangible result.'"[231] Harkening back to Curtis's description of the unified patentability analysis,[232] the court explained that a proper analysis "should not focus on *which* of the four categories of subject matter a claim is directed to . . . but rather on the essential characteristics of the subject matter, in particular, its practical utility."[233] The *State Street* court did not adopt the approach of the early inquiry wholesale, however. While the early inquiry relied on other patentability requirements in identifying transformations of nature, *State Street* focused on the technology itself, asking whether the result of the algorithm was sufficiently tangible to constitute patentable subject matter.[234]

The Federal Circuit recently reaffirmed the segmented approach in *In re Nuijten*,[235] which addressed the patentability of a watermarked signal (an electrical signal encoded with additional data).[236] The court first discussed the question of whether the signal was an unpatentable abstract idea.[237] Because the signal required a physical form, the court concluded

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226. *See id.* at 189.

227. *Id.* at 189–90.

228. In *Gottschalk v. Benson*, 409 U.S. 63, 68 (1972), and *Parker v. Flook*, 437 U.S. 584, 589 (1978), the Court followed the unified approach to the subject matter inquiry, despite the fact that the cases were litigated a number of years after the introduction of the 1952 Act. The Court explicitly adopted the segmented approach in *Diehr*, 450 U.S. at 191–92, and *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980), but some courts' analyses continue to echo the early unified inquiry.

229. 149 F.3d 1368 (Fed. Cir. 1998).

230. *Id*. at 1375.

231. *Id.* (quoting *In re* Alappat, 33 F.3d 1526, 1544 (Fed. Cir. 1994)).

232. *See* CURTIS, *supra* note 59, § 27 (explaining that an alleged invention constituted patentable subject matter regardless of the specific statutory category "[i]f the thing itself is correctly described, and it appears to be novel and useful, and unites all the other requisites of the statute").

233. 149 F.3d at 1375 (footnote omitted). Interestingly, the patent requirement that the Federal Circuit collapsed the subject matter requirement into—utility—is the one requirement that remains in the same statutory section as the subject matter requirement under the 1952 Act. 35 U.S.C. § 101 (2000).

234. *Id.* at 1373.

235. 500 F.3d 1346 (Fed. Cir. 2007).

236. *Id.* at 1348, 1353.

237. *Id.* at 1353.

that it was not an abstract idea.[238] This finding did not resolve the case, however. The court proceeded to the bulk of its analysis, which asked whether the signal fit within any of the four statutory categories of patentable subject matter: process, machine, manufacture, or composition of matter.[239] The court concluded that it did not and invalidated the patent. Ultimately, therefore, the court concluded that the watermarked signal was neither patentable subject matter nor unpatentable exclusion.[240]

In re Nuijten casts doubt on the approach of *State Street* and signals a renewed commitment to a segmented approach. It also offers a useful illustration of how the new approach functions. The early inquiry asked if an alleged invention was patentable subject matter or exclusion, such that the salient question was whether the alleged invention fell within the category of artifice or of nature. Under the segmented approach, the focus shifts to the four statutory categories of patentable subject matter. The salient question becomes whether an alleged invention qualifies as one of the four types of human creation listed in the statute: process, machine, manufacture, or composition of matter.[241] This framework fractures the oppositional pairing between subject matter and exclusion and creates a new category of innovations—such as the watermarked signal in *In re Nuijten*[242]—that are neither subject matter nor exclusion.

3. The Exclusions' New Rationale

The third manifestation of the Modern vision, initiated later in the century, was the emergence of a new rationale for the exclusions. As noted, the exclusions' original purpose was to withhold property rights from aspects of nature that had not been sufficiently controlled for human benefit.[243] When nature dropped from the analysis in the middle of the twentieth century, this purpose no longer offered a convincing justification for the exclusions.[244] By the end of the twentieth century, a new rationale

238. *Id.*

239. *Id.* The PTO currently follows this line of analysis in evaluating patent applications. In oral arguments in *In re Ferguson*, No. 2007-1232 (Fed. Cir. argued Dec. 5, 2007), PTO Solicitor Raymond Chen's reasoning about the business method claims at issue, which entailed a method of marketing software, was summarized as "non-statutory because they [fell] outside the patentable subject matter categories delineated in Section 101." *See CAFC Considers Business Method Marketing Claims Under Section 101*, AIPLA REPORTS, Dec. 11, 2007, http://www.aipla.org/Template.cfm?template=/ContentManagement/ContentDisplay.cfm&ContentID=16738.

240. 500 F.3d at 1353.

241. *See id.* ("Our inquiry here, like that of the Board, will consider whether a transitory, propagating signal is within any of the four statutory categories: process, machine, manufacture, or composition of matter.").

242. *Id.* at 1348.

243. *See supra* text accompanying notes 82–84.

244. *See supra* Parts III.A, III.B.

had materialized—namely, that the exclusions offered protection to the basic tools of invention in the public domain.[245] Because this new rationale aimed to facilitate innovation and invention rather than exclude areas of nature, it affirmed the Modern inquiry's focus on perfecting the means of technological advance.

In 1972, in *Gottschalk v. Benson*,[246] the Supreme Court addressed whether a computer algorithm converting decimal numbers to binary numbers was patentable.[247] The Court quoted the 1852 case of *LeRoy v. Tatham*[248] for the proposition that "'[a] principle, in the abstract, is a fundamental truth; an original cause; a motive; these cannot be patented, as no one can claim in either of them an exclusive right.'"[249] The *Gottschalk* Court explained this quote by adding, without citation: "Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable, as they are the basic tools of scientific and technological work."[250] This dicta marked the Supreme Court's announcement of the exclusions' new rationale. The exclusions' function was to free up the tools of scientific and technical research. Increased access to these tools, in turn, would increase the patent system's inventive output.

Since *Gottschalk*, courts have repeated this rationale: "The underlying notion is that a scientific principle, such as that expressed in respondent's algorithm, reveals a relationship that has always existed"[251] and is "one of the 'basic tools of scientific and technological work.'"[252] "[S]cientific truth, mathematical formulas, phenomena of nature and abstract intellectual concepts are not patentable because, as basic tools of research, no one may claim an exclusive right in them."[253] Dissenting from the dismissal of certiorari in *Laboratory Corp. of America Holdings v.*

245. *See, e.g.*, Gottschalk v. Benson, 409 U.S. 63, 67–68 (1972).

246. 409 U.S. 63 (1972).

247. *Id.* at 66.

248. 55 U.S. (1 How.) 156 (1852).

249. 409 U.S. at 67 (quoting LeRoy v. Tatham, 55 U.S. (1 How.) 156, 175 (1852)).

250. *Id.* at 67.

251. Parker v. Flook, 437 U.S. 584, 593 n.15 (1978).

252. *Id.* at 591 (quoting Gottschalk v. Benson, 409 U.S. 63, 67 (1972)); *see, e.g.*, Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 126 S. Ct. 2921, 2923 (2006) (Breyer, J., dissenting); Diamond v. Diehr, 450 U.S. 175, 216 n.41 (1981); *In re* Comiskey, 499 F.3d 1365, 1377 (Fed. Cir. 2007); SmithKline Beecham Corp. v. Apotex Corp., 403 F.3d 1331, 1360 (Fed. Cir. 2005); SmithKline Beecham Corp. v. Apotex Corp., 365 F.3d 1306, 1329 (Fed. Cir. 2004), *vacated on reh'g en banc*, 403 F.3d 1331 (Fed. Cir. 2005); *In re* Trovato, 42 F.3d 1376, 1383 (Fed. Cir. 1994), *withdrawn on reh'g*, 60 F.3d 807 (Fed. Cir. 1995); *In re* Alappat, 33 F.3d 1526, 1553 (Fed. Cir. 1994).

253. Howes v. Great Lakes Press Corp., 679 F.2d 1023, 1029 (2d Cir. 1982) (citing Parker v. Flook, 437 U.S. 584, 589 (1978)).

Metabolite Laboratories, Inc.,[254] Justice Breyer explained that the exclusions are based on the "basic judgment that protection in such cases, despite its potentially positive incentive effects, would too often severely interfere with, or discourage, development and further spread of useful knowledge itself."[255] These examples express the fear that if property rights were granted in the scientific content of the exclusions, technological progress would be impeded.[256]

Like the segmented approach of the 1952 Act and the replacement of nature with science within the subject matter inquiry, the exclusions' new rationale reflects a Modern understanding of technology as an end in itself. The exclusions are no longer viewed as aspects of nature undeserving of property rights because they have not yet been controlled for human benefit. They are viewed as tools of invention and innovation that should remain freely accessible in order to maximize technological advance. The subject matter inquiry's focus is rationalizing and perfecting the human activity that produces technology, and under the new rationale, the exclusions are understood to help in this task.

C. Laissez Innover:[257] *Technological Determinism and the Current Inquiry*

Economic value has always occupied a privileged position within the patent system.[258] The patent incentive mechanism works by assigning potential monetary value to an invention, which is realized only if consumers are willing to pay licensing fees. Notwithstanding this privileged position, the Enlightenment vision of technology limited the influence of economic factors in the early inquiry.[259] Specifically, the Enlightenment vision anchored conceptions of technology in the control and transformation of nature, a framework that limited the reach of the

254. 126 S. Ct. 2921 (2006).

255. *Id.* at 2923 (Breyer, J., dissenting); *see also id.* at 2922 ("[T]he reason for the exclusion is that sometimes *too much* patent protection can impede rather than 'promote the Progress of Science and useful Arts,' the constitutional objective of patent and copyright protection." (quoting U.S. CONST. art. I, § 8, cl. 8)). Moreover, in the first paragraphs of his opinion, Justice Breyer noted that "those who engage in medical research," among others, would benefit from the Court's "authoritative answer," *id.*, implying a concern that without a decision, future research would be hindered.

256. This view resonates with the dominant scholarly understanding and critique of the subject matter inquiry discussed in the introduction. *See supra* notes 22–24 and accompanying text. Scholarship that picks up on this concern is not incorrect to do so, it is just incomplete if it does not place it in the larger context of the history and development of the subject matter inquiry.

257. John McDermott uses this term to describe the deterministic position of those whose answer to the problems of technology was more technology. *See* PURSELL, *supra* note 143, at 153.

258. *See supra* text accompanying note 120.

259. *See supra* Part II.B.

patent system.[260] And, it defined technology as a tool to achieve political and social well-being, which permitted consideration of non-economic values.[261]

By the end of the twentieth century, these limits had disappeared and the Modern vision had inspired a subject matter inquiry that focused on technology as an end in itself, without reference to nature or social progress. This situation is illustrated by current categories of subject matter, which exhibit little connection to an understanding of technology as that which transforms nature for social benefit. Some categories seem entirely disconnected from the natural world, while others seem to remain unchanged in their natural state. The patentability of computer software marked a milestone in the expansion of patentable subject matter,[262] and has been followed by the patentability of business methods,[263] tax methods,[264] and legal methods.[265] These technologies predominantly control social relations and have no effect on the natural environment. Meanwhile, after the Supreme Court's decision in *Chakrabarty*,[266] the Patent and Trademark Office began issuing patents on a variety of biotechnology products and processes, including isolated and purified DNA sequences.[267] Many of these technologies, which exist in the natural world independent of human creation, appear to be purely natural. Patents for genes of unknown function offer a particularly clear repudiation of the Enlightenment vision. It is difficult to characterize an aspect of nature with

260. *See supra* text accompanying notes 116–19.

261. Under the moral utility doctrine, courts and the PTO rejected inventions, which although marketable and useful, did not serve purposes in society's moral interests. *See supra* text accompanying notes 62–68.

262. *See* Diamond v. Diehr, 450 U.S. 175, 187 (1981).

263. *See, e.g.*, State St. Bank & Trust Co. v. Signature Fin. Group, Inc., 149 F.3d 1368, 1375 (Fed. Cir. 1998).

264. *See, e.g.*, Establishing and Managing Grantor Retained Annuity Trusts Funded by Nonqualified Stock Options, U.S. Patent No. 6,567,790 (filed Dec. 1, 1999) (issued May 20, 2003); *see also Background and Issues Relating to the Patenting of Tax Advice: Hearing Before the Subcomm. on the Select Revenue Measures of the H. Comm. on Ways and Means*, 109th Cong. 19 (2006) (document prepared by the Joint Comm. on Taxation), *available at* http://www.house.gov/jct/x-31-06.pdf; Brant J. Hellwig, *Questioning the Wisdom of Patent Protection for Tax Planning*, 26 VA. TAX REV. 1005, 1005–06 (2007).

265. *See, e.g.*, Method for Providing Property Rights Based Guarantees, U.S. Patent No. 7,158,949 (filed Dec. 17, 2004) (issued Jan. 2, 2007); Systems and Methods for Making Jury Selection Determinations, U.S. Patent No. 6,607,389 (filed Dec. 3, 2001) (issued Aug. 19, 2003); *see also* Helen Gunnarsson, *Can Lawyers Patent Their Legal Techniques?*, 95 ILL. B.J. 344, 344 (2007).

266. 447 U.S. 303 (1980).

267. *See, e.g.*, Isolated and Purified DNA Molecule and Protein for the Degradation of Triazine Compounds, U.S. Patent No. 6,284,522 (filed Oct. 23, 1995) (issued Sept. 4, 2001); DNA Sequences Encoding the Osteoinductive Proteins, U.S. Patent No. 5,166,058 (filed Jul. 11, 1989) (issued Nov. 24, 1992).

an unknown function as having been controlled for human benefit.[268]

Without the Enlightenment constraints of nature and broad social value, economic value was granted an almost exclusive role in defining the patent system's vision of technology. With the Modern inquiry aiming to rationalize and maximize the inventive process, and inventors taking advantage of a patent system that had shed its Enlightenment limits, subject matter standards expanded dramatically. Today, the standards encompass any product of human action that creates economic value.[269] If something has value in use or exchange—a statistical correlation between a human hormone level and a vitamin deficiency,[270] a method of swinging a golf club,[271] or a method of reducing tax liability[272]—it now constitutes patentable subject matter. Through this definition of technology, the subject matter inquiry no longer conceives of the patent grant as a tool of social progress. Rather, it conceives of it as a tool of economic growth. The direct social good that the patent system serves is envisioned in exclusively market-utilitarian terms, and other social values can be served only indirectly as the result of increased wealth.

The current subject matter inquiry has therefore internalized two premises of the Modern vision: that technological advance and economic growth are inextricably linked, and that incentivizing economic growth will fulfill the patent system's constitutional role of incentivizing technological progress. By accepting these premises, the subject matter inquiry (and through it, the patent system as a whole), assumes that as long as the patent system incentivizes value creation, it will properly incentivize

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268. *See* Bryan J. Boyle, Comment, *Fishing for Utility with Expressed Sequence after* In re Fisher, 23 SANTA CLARA COMPUTER & HIGH TECH. L.J. 589, 590 (2007) (questioning whether partial gene sequences of unknown function continue to constitute patentable subject matter after *In re Fisher*, 421 F.3d 1365, 1370 (Fed. Cir. 2005)).

269. In analyzing business methods patents in the United States, the European Union and Japan, Nari Lee speculates: If patent law is there simply to protect any kind of commercial value-creating action, and if the subject matter of patent law should be any intangible idea or human activity that creates commercial value and is repeatable by another person, then a business method patent may not be much of a problem. Lee, *Patent Eligible Subject Matter Reconfiguration*, *supra* note 24, at 326. What Lee fails to recognize is that this hypothetical precisely captures the current state of subject matter standards in the United States.

270. *See* Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc., 126 S. Ct. 2921, 2923 (2006) (Breyer, J., dissenting).

271. Method of Putting, U.S. Patent No. 5,616,089 (filed Mar. 29, 1996) (issued Apr. 1, 1997). Other sport-related patents include a method for fitness training, Fitness Method, U.S. Patent No. 6,190,291 (filed June 26, 1997) (issued Feb. 20, 2001); a method for training baseball pitchers, Training Apparatus, Method for Training an Athlete, and Method for Producing a Training Device, U.S. Patent No. 5,639,243 (filed Apr. 26, 1995) (issued Jun. 17, 1997); and a method for training swings, Method of Swing Training for Sports, U.S. Patent No. 6,176,790 (filed Nov. 23, 1998) (issued Jan. 23, 2001).

272. Establishing and Managing Grantor Retained Annuity Trusts Funded by Nonqualified Stock Options, U.S. Patent No. 6,567,790 (filed Dec. 1, 1999) (issued May 20, 2003).

technological advancement. It proceeds on the belief that the patent system can influence the *pace* of technological advancement, but not its *shape* or *direction*.[273] This sense of technological determinism—the culmination of the Modern vision of technology within the patent law—may be a fundamental source of the discontent surrounding new types of patented technologies. It shows that the subject matter inquiry has surrendered the patent law's definition of technology to economic forces. Moreover, it suggests that unless the subject matter inquiry is deliberately re-crafted, the patent system will continue to preclude consideration of non-quantifiable costs, while extending its reach into all corners of human activity.

IV. "PROPERTY RIGHTS SERVE HUMAN VALUES":[274] RE-CRAFTING PATENTABLE SUBJECT MATTER STANDARDS

In the second half of the twentieth century, society became increasingly concerned with the risks and harms associated with technology, with the social good that technology could serve absent monopoly rights, and with the pervasive creep of technology into formerly sacrosanct areas of life. The Modern vision of technology lost its stronghold as the dominant social paradigm.[275] In many segments of society, it yielded to a Postmodern understanding that for every solution technology offers, it poses multiple new problems.[276] Technological determinism, meanwhile, was largely

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273. The Supreme Court has expressed this understanding. In *Gottschalk*, the Court referred to "the new, onrushing technology," Gottschalk v. Benson, 409 U.S. 63, 71 (1972), exhibiting an understanding of technological advance as autonomous and inevitable. In *Chakrabarty*, the Court limited its agency in controlling technology's path, noting "[t]he large amount of research that has already occurred when no researcher had sure knowledge that patent protection would be available suggests that legislative or judicial fiat as to patentability will not deter the scientific mind from probing into the unknown any more than Canute could command the tides." Diamond v. Chakrabarty, 447 U.S. 303, 317 (1980).

274. State v. Shack, 277 A.2d 369, 372 (N.J. 1971).

275. *See* Howard P. Segal, *Technology, Pessimism, and Postmodernism: Introduction*, *in* TECHNOLOGY, PESSIMISM, AND POSTMODERNISM, *supra* note 52, at 1. In 1979, *New York Times* writer John Noble Wilford reported on a symposium on modern technology: "[A] mood of pessimism is overtaking and may have already displaced the old optimistic view of history as a steady and cumulative expansion of human power, the idea of inevitable progress born in the Scientific and Industrial Revolutions and dominant in the 19th century and for at least the first half of this century. This pessimism is fed by growing doubts about society's ability to rein in the seemingly runaway forces of technology . . . ." *Id.* (quoting John Noble Wilford, *Scholars Confront the Decline of Technology's Image*, N.Y. TIMES, Nov. 6, 1979, at C1).

276. *See* COWAN, *supra* note 25, at 326 ("[N]o new technology has ever been the unalloyed blessing that its advocates say it is—or the unalloyed curse that its opponents insist it is. All technological changes have unintended and unexpected social and ethical outcomes, few of which have been predicted by even the best of experts . . . some people will be affected positively and others negatively by the outcome of any technological change; indeed, the same person can be affected negatively or positively depending on which of several possible social roles that person

discredited as a theory of technology's role in society.[277] Nonetheless, a Modern vision of technology continues to animate the patentable subject matter inquiry. This, in turn, blinds the inquiry to two broad and problematic categories of invention. The first encompasses inventions that are so dangerous or morally controversial that it is questionable whether society should incentivize them.[278] The second encompasses inventions that are so socially beneficial that it is questionable whether any one individual or group should be granted exclusionary rights in them.[279] If the patent system is to align with social understandings of technology and serve society effectively, the subject matter inquiry must account for both problematic categories. To do so, it must shed its sense of determinism and embrace a more nuanced understanding than is provided by the Modern vision. Just as the Enlightenment vision of the subject matter inquiry gave way to the Modern vision, the Modern vision needs to now give way to a Postmodern vision.

Throughout the twentieth century, society increasingly acknowledged the risks of technology.[280] World wars, atomic weapons, and irreversible environmental pollution offered vivid illustrations of technology's potential for destruction.[281] During the late 1960s and 1970s, the "appropriate technology movement" sparked mainstream criticism of technology, raising awareness not only of its risks and harms, but also of its pervasive creep into all aspects of human life.[282] Even proponents of

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happens to be playing.").

277. *See* Segal, *supra* note 275, at 3. STS scholars have shown that technologies are not pre-programmed with determinate forms, results, and trajectories, nor do they steer society's course in an inevitable direction. Rather, technologies are the product of a web of political, cultural, and social forces. *See* Feenberg, *supra* note 29, at 3–18; WINNER, *supra* note 137, at 19–20, 25, 38.

278. Restricting or precluding a patent would alter incentives, but it would not dictate or preclude particular forms of conduct. It would not preclude the underlying research or prevent the invention from being created and used. *See* Bagley, *supra* note 22, at 513, 535–36. The Supreme Court recognized this point in *Chakrabarty.* 447 U.S. at 317.

279. The costs associated with restricting access to highly beneficial inventions could also be addressed through limited enforcement. *See, e.g.*, 35 U.S.C. § 287(c)(1) (2000) (precluding enforceability of medical procedure patents against medical practitioners).

280. *See* Bunge, *supra* note 35, at 276–77. As commentators have noted, human cloning, genetically-altered life forms, and nuclear technologies threaten genetic diversity, human health, and national security, while reproductive technologies, genetically altered food, and psychotropic medications manipulate human relationships and human nature in new and unpredictable ways. *See* Merelman, *supra* note 25, at 168–69, 177–78; Thomas, *Liberty and Property*, *supra* note 22, at 574.

281. *See* DON IHDE, PHILOSOPHY OF TECHNOLOGY: AN INTRODUCTION 87 (1993).

282. *See* ROBERT FRIEDEL, A CULTURE OF IMPROVEMENT: TECHNOLOGY AND THE WESTERN MILLENIUM 531–37 (2007). The "appropriate technology movement" was based on the premise that many of the ills technology had created—pollution, increased energy costs, resource depletion—could be effectively addressed through reliance on only "appropriate" technologies. Expressing the core sentiment of this movement, the economist E.F. Schumaker argued that "'[w]isdom demands a new orientation of science and technology towards the organic, the gentle,

technology acknowledged risks and potential harms. They argued, however, that solutions could be found in the production of new technologies.[283]

In the second half of the twentieth century, a variety of governmental entities responded to technology's risks. The Environmental Protection Agency required impact statements;[284] the Department of Health, Education and Welfare established a commission to study the implications of biotechnology research;[285] the Food and Drug Administration expanded its pre-market drug approval process;[286] and a Congressional Office of Technology Assessment began studying and reporting on social and environmental effects of emerging technologies.[287] The subject matter inquiry and the patent system as a whole, in contrast, showed little awareness of technology's risks.[288] The inquiry continues to promote indiscriminately innovation in the name of economic growth. With few exceptions,[289] the patent law fails to acknowledge that financial incentives may be inappropriate for some technologies.

Patent advocates argue that this situation is appropriate, and that regulatory agencies, not the PTO, are the proper forums for technology assessment.[290] They note that a patent grants only negative rights to exclude others from practicing an invention,[291] and that in the case of many technologies, an inventor must still seek regulatory approval to use an

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the non-violent, the elegant and beautiful.'" WINNER, *supra* note 137, at 62 (quoting E.F. SCHUMACHER, SMALL IS BEAUTIFUL: ECONOMICS AS IF PEOPLE MATTERED 31 (Harper & Row, 1973)).

283. PURSELL, *supra* note 143, at 153; *see* WINNER, *supra* note 137, at 5.

284. *See* National Environmental Policy Act of 1969 § 102, 42 U.S.C. § 4332 (2000).

285. *See* National Research Act, Title II, PL 93-348, 88 Stat. 342 (1974).

286. *See* Food, Drug, and Cosmetics Act Amendments of 1962, PL 87-781, 76 Stat. 781 (1962).

287. *See* Office of Technology Assessment Act, PL 92-484, 86 Stat. 797 (1972); *see also* Gregory C. Kunkle, *New Challenge or Past Revisited? The Office of Technology Assessment in Historical Context*, 17 TECH. IN SOC'Y 175 (1995).

288. One significant exception to this generalization is the statutory ban on patents on nuclear technologies, which demonstrates that the patent system can react to technology's dangers if it chooses to do so. 42 U.S.C. § 2181(a) (exempting from patent protection inventions that are "useful solely in the utilization of special nuclear material or atomic energy in an atomic weapon").

289. *See supra* note 288.

290. *See, e.g.*, Merges, *supra* note 68, at 1068; Burton T. Ong, *Patenting the Biological Bounty of Nature: Re-examining the Status of Organic Inventions as Patentable Subject Matter*, 8 MARQ. INTELL. PROP. L. REV. 1, 5–6 (2004); Michael E. Sellers, *Patenting Nonnaturally Occurring, Man-Made Life: A Practical Look at the Economic, Environmental, and Ethical Challenges Facing "Animal Patents*," 47 ARK. L. REV. 269, 295 (1994); James R. Chiapetta, Comment, *Of Mice and Machine: A Paradigmatic Challenge to Interpretation of the Patent Statute*, 20 WM. MITCHELL L. REV. 155, 178 (1994).

291. *See* Ong, *supra* note 290, at 5–6.

invention.[292] Most emerging technologies, however, are not yet within the purview of a regulatory agency. More importantly, it is precisely because the decision to grant a patent is distinct from the decision to allow use of an invention that the patentable subject matter inquiry should account for technology's risks.[293]

Patent advocates will assert that moral and ethical concerns find no place within the patent system; that the system must remain technology-neutral; that it should promote all types of invention and innovation.[294] They will point to the Federal Circuit's 1998 repudiation of the moral utility doctrine[295] and to the consensus among patent attorneys that social, political, and moral values find no place within the patentability analysis. Technologies are not neutral tools, however, directed toward good or bad only by their user.[296] Nor do they have an innate logic directing their development. Rather, they are the product of a web of social and political forces, embedded with the values and goals of those who produce and control them.[297] If technologies are not neutral, a system that incentivizes

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292. *See id.* at 5.

293. The idea of regulating use rather than development of technology shows the lingering influence of a 1967 policy decision of the National Academy of Science that concerns about technology should be handled by regulating human behavior rather than regulating the production of technologies. PURSELL, *supra* note 53, at 301–02, 308–09. In the case of unreasonably dangerous and hazardous technologies, this policy raises serious questions of whether it is ever possible to prohibit use of technologies once they have been developed.

294. *See, e.g.*, Merges, *supra* note 68, at 1062; Benjamin D. Enerson, *Protecting Society from Patently Offensive Inventions: The Risk of Reviving the Moral Utility Doctrine*, 89 CORNELL L. REV. 685, 691 (2004).

295. *See* Juicy Whip, Inc. v. Orange Bang, Inc., 185 F.3d 1364, 1366–67 (Fed. Cir. 1999) (discrediting the moral utility doctrine); *see also* Bagley, *supra* note 22, at 469–70. Some commentators contend that the moral utility doctrine retains some force. *See, e.g.*, Enerson, *supra* note 294, at 691–92; Richard Guerra, *Therapeutic Cloning as Proper Subject Matter for Patent Eligibility*, 43 IDEA 695, 709–13 (2003). They point to a PTO Office Action rejecting a patent application claiming a process for creating a human-animal chimera in 2003, which noted that the application "raise[d] grave issues going to the core of what a useful invention is." *See* Image File Wrapper, U.S. Patent App. No. 08/993,564 (filed Dec. 18, 1999), *available at* http://portal.uspto.gov/external/portal/pair (enter application number 08/993,564, click "search," then click "Image File Wrapper," then click 01-29-2003 "Non-Final Rejection" to view the rejected patent application). The prevalent view, however, is that the doctrine no longer plays a role in patent jurisprudence.

296. *See* WINNER, *supra* note 137, at 6, 29. For example, television does not merely offer entertainment and information. It expands markets, influences political thought, changes family and other social relationships, and alters the ways in which people experience life. Chellis Glendinning, *Notes Toward a Neo-Luddite Manifesto*, *in* PHILOSOPHY OF TECHNOLOGY: THE TECHNOLOGICAL CONDITION, *supra* note 25, at 603, 604.

297. Yaron Ezrahi, *Technology and the Illusion of the Escape from Politics*, *in* TECHNOLOGY, PESSIMISM, AND POSTMODERNISM, *supra* note 52, at 29, 31–32 ("[A]ny technology, and indeed any technical action, has a hidden ethical and political "software"; that the transparency of actions captured within ends-means schemata conceals a multiplicity of normative choices that do not fully

them cannot be neutral. The patent system should acknowledge these realities.

Just as the subject matter inquiry fails to acknowledge the risks of emerging technologies, it also neglects the risks of widespread patentability. The patent mechanism functions by restricting access to new inventions on the belief that decreased access is a worthwhile price for increased innovation. In the case of highly beneficial inventions, this conclusion is not necessarily justified. Some technologies, such as life-saving medications, may be so socially desirable or beneficial that it is questionable whether one individual or group should be allowed to hold exclusionary rights.[298] The current subject matter inquiry offers no mechanism for even considering this issue.

Moreover, the current inquiry is facilitating the expansion of patent rights into all aspects of human activity and identity, raising new questions about the creation of new classes of property rights.[299] Scholars have noted the ethical and moral implications of patents on the human body and other forms of life. These issues include the problems of commodification of that which is human and personal,[300] denigration of human dignity,[301] and

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lend themselves to technical or computational treatment. Advocates of science- or technology-based democratic politics overlooked the fact that engineers do not just solve technical problems. They also generate changes in the distribution of values and scarce material and political assets."); *see also* JASANOFF, *supra* note 183, at 4–6; WINNER, *supra* note 137, at 6, 29.

298. Additional examples include disease treatments and certain up-stream technologies. Restricting the monopoly on classes of invention, or precluding patents outright, would impose a substantial cost—elimination of the financial incentive for innovation and disclosure. In some industries, such as biotechnology and pharmaceuticals, this cost may be an unacceptably high price to pay for increased access because it will dramatically decrease invention. *See* H. Jeffrey Lawrence, *The High Cost of Prescription Drugs: the Price of Success?*, 4 YALE J. HEALTH POL'Y L. & ETHICS 165, 169–71 (2004); Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 MGMT. SCI. 173, 173–80 (1986) (surveying twelve industries and 100 firms and finding that patents were much more important in the chemical and pharmaceutical industries). In other industries, however, such a restriction may ultimately maximize social welfare.

299. John Thomas notes that, "[a]s we read with amusement patent instruments claiming methods for swinging a golf club, treating cancer or administering a mortgage, we come to realize that the patent law seems poised to embrace the broadest reaches of human experience." Thomas, *Liberal Professions*, *supra* note 22, at 1139 (footnotes omitted).

300. An expansive body of literature addresses commodification of the human body and human identity. In a seminal article, Margaret Jane Radin argues that that which is personal—connected to development and flourishing of people—is not and should not be treated as fungible. Personal goods include goods involving personal communication and bodily integrity, both of which are implicated by many recent inventions. Margaret Jane Radin, *Market-Inalienability*, 100 HARV. L. REV. 1849, 1903–09 (1987); *see also* Demaine & Fellmeth, *supra* note 22, at 443–44 (discussing the opponents' argument for patenting the human genome as patenting "something larger than personal property"); Eileen M. Kane, *Splitting the Gene: DNA Patents and the Genetic Code*, 71 TENN. L. REV. 707, 725–26 (2004) (criticizing the valuation occurring by patenting biological materials); Ong, *supra* note 290, at 5 (examining whether organic inventions should qualify as patenable); Margaret Jane Radin, *A Comment on Information Propertization and*

interference with core personal liberties.[302] Meanwhile, in a culture in which information constitutes capital and creates power,[303] patents on information technologies create and exacerbate wealth and power inequalities. The current subject matter inquiry fails to recognize these potential problems.[304]

As long as technology is defined exclusively in terms of economic value-creation, there will be little incentive to address these problems. Innovators will continue to seek patent rights, the PTO will continue to grant them, and courts will continue to uphold them. The patent system as an institution will not recognize its role in the health, safety, and environmental problems of modern technology, or its potential role in creating solutions. Costs that cannot be monetarily quantified will continue to be ignored, and the patent system will serve the economic good, but not necessarily the social good, broadly defined.

A broad conception of social good, however, is the ultimate justification for the patent system's imposition of limited monopolies.[305] Social good should therefore be at the forefront of the patent system's conception of technology. In recognition of this ideal, the patent system's vision of technology should be re-envisioned as a means to the end of social good,[306] and a new subject matter inquiry should be crafted accordingly. To ensure that the inquiry reflects society's understanding of technology and of the social good that technology serves, it should be crafted through a political process, with debate in the public arena.[307] The

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its Legal Milieu, 54 CLEV. ST. L. REV. 23, 23 (2006) (arguing that propertization is bound by other concerns); Margaret Jane Radin, *Cloning and Commodification*, 53 HASTINGS L.J. 1123, 1123 (2002) (discussing commodification, commercialization, and the regulation of cloning).

301. Maureen L. Condic & Samuel B. Condic, *The Appropriate Limits of Science in the Formation of Public Policy*, 17 NOTRE DAME J.L. ETHICS & PUB. POL'Y 157, 159–60 (2003).

302. Thomas, *Future of Patent Law*, *supra* note 22, at 581–82 (exploring the implications of patenting abortion, law, and speech acts, and noting that "[n]ow that our patent system has engaged virtually every human endeavor, it is time to recognize that patents . . . present the possibility of impinging upon personal liberties long associated with core social values").

303. Marx, *supra* note 52, at 24.

304. Occasionally, awareness and concern for broader social values arise and are considered, such as the PTOs mention of the moral utility doctrine in rejecting a patent application on a process for creating a human-animal chimera. *See supra* note 295 and accompanying text.

305. *See* Eldred v. Ashcroft, 537 U.S. 186, 223–24 (2003) (describing patent quid pro quo); Brenner v. Manson, 383 U.S. 519, 534 (1966) (noting the benefits for both a patent grantee and the public).

306. Langdon Winner describes returning to a view of technology as a means to an end "a supremely important step." LANGDON WINNER, AUTONOMOUS TECHNOLOGY: TECHNICS-OUT-OF-CONTROL AS A THEME IN POLITICAL THOUGHT 327 (1977) (explaining that technology is a "means that, like all other means available to us, must only be employed with a fully informed sense of *what is appropriate*. Here, the ancients knew, was the meeting point at which ethics, politics, and technics came together.").

307. Legislative solutions always pose the potential problem of interest group capture—no less

value, meaning, and future course of technology are deeply social, political, and moral issues,[308] not always appropriate for judicial resolution.[309]

Legislation expressing a new vision of technology could take many forms. It could be specific, addressing particular areas of non-patentable subject matter. This approach has been used by Congress in the past, precluding patents for nuclear weapons and related technology.[310] Alternatively, legislation could entail a general re-codification of the subject matter requirement with a role for consideration of society's interest. For example, a new morality-based exclusion, similar to the moral utility doctrine, could be enacted.[311] Or a public objection period could be

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so in the case of patent law than other areas of law. *See, e.g.*, Mark D. Janis, *Patent Law in the Age of the Invisible Supreme Court*, 2001 U. ILL. L. REV. 387, 398–99. This concern is not a reason to avoid a legislative solution, however, particularly when Congress is the branch of government charged with the task of creating a patent system to "promote . . . Progress of . . . useful Arts," U.S. CONST. art. I, § 8, cl. 8, and the Supreme Court has repeatedly indicated its belief that Congress is the actor competent to delineate the proper scope of patentable subject matter. *See* Lauren Cirlin, *Human or Animal: A Resolution to the Biotechnological Blurring of the Lines*, 32 SW. U. L. REV. 501, 519 (2003). Moreover, the scope of patent rights in many areas of technology are of sufficient interest and immediacy to the public that with information and education, public involvement may mitigate the interest group issue. *See* Bagley, *supra* note 22, at 533 ("[A] decision to ban patents on humans, for example, would implicate ideological concerns that, if the public were sufficiently aroused, could overcome interest group capture to some extent, or at least focus it on the contours of the ban, versus on the ban itself.").

308. *See* Bagley, *supra* note 22, at 533.

309. The Supreme Court has repeatedly expressed unease at the prospect of addressing these issues. *See, e.g.*, Diamond v. Chakrabarty, 447 U.S. 303, 317 (1980) ("The choice we are urged to make is a matter of high policy for resolution within the legislative process after the kind of investigation, examination, and study that legislative bodies can provide and courts cannot."); Parker v. Flook, 437 U.S. 584, 595 (1978) ("Difficult questions of policy concerning the kinds of programs that may be appropriate for patent protection and the form and duration of such protection can be answered by Congress on the basis of current empirical data not equally available to this tribunal." (footnote omitted)); Gottschalk v. Benson, 409 U.S. 63, 73 (1972) ("If these programs are to be patentable, considerable problems are raised which only committees of Congress can manage, for broad powers of investigation are needed, including hearings which canvass the wide variety of views which those operating in this field entertain." (footnote omitted)).

310. 42 U.S.C. § 2181(a) (2000). Currently, Congress is considering similar legislation addressing tax methods. *See* H.R. 2365, 110th Cong. (2007).

311. *See* Bagley, *supra* note 22, at 469–70 (urging a return to the moral utility doctrine); John Thomas, *The Post-Industrial Patent System*, 10 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 3, 53 (1999) (urging adoption of an "industrial application standard"). International examples exist for this course of action. Notwithstanding a general prohibition against discriminating between fields of technology in granting patent rights, the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPs) provides that "[m]embers may exclude from patentability inventions . . . [where] necessary to protect order public or morality, including to protect human, animal or plant life or health" as an exception. Agreement on Trade-Related Aspects of Intellectual Property Rights, Including Trade in Counterfeit Goods, art. 27, Dec. 15, 1993, 33 I.L.M. 81. This provision recognizes that many countries' patent laws include a morality component to

instituted, similar to the European Patent Convention's post-grant objection period.[312] Finally, legislation could continue broad subject matter standards, but tailor use of the right or enforcement based on the underlying technology. For example, some inventions are subject to compulsory licensing,[313] and medical procedure patents are currently unenforceable against doctors and other medical practitioners.[314]

Discussing and crafting the patent system's vision of technology within the public sphere will raise awareness among legislators, judges, scholars, and the public of the subject matter inquiry's critical role within the patent system, and its critical impact on society. Despite the patentable subject matter inquiry's expansive scope and lenient standards in recent years, the inquiry is not obsolete.[315] Rather, it is a requirement with deep significance for the patent system as a whole. The subject matter inquiry is the patent system's expression of the definition, meaning, and role of technology in society. If the inquiry is not crafted with care, it will continue to preclude consideration of non-quantifiable costs while extending the patent system's reach into all corners of human activity. Commodification of all aspects of human existence will be a foregone conclusion, and the patent system, though creating economic value, will fail to serve the social good.

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patentability. The European Patent Convention, for example, contains an express morality-based exclusion, which not only allows patent examiners to reject a patent application, but allows members of the public to oppose the patent grant at any time within nine months of the decision to grant the patent. Article 53 states: "European patents shall not be granted in respect of: (a) inventions the publication or exploitation of which would be contrary to 'ordre public' or morality . . . ." European Patent Convention art. 53(a), Jan. 11, 1978, 1065 U.N.T.S. 199, 272. The Japanese patent law similarly provides that "inventions liable to contravene public order, morality or public health shall not be patented." Shōhō [Japanese Patent Law], Law No. 121 of 1959, amended by Law No. 220 of 1999, art. 32, *translated in* World Intellectual Property Organization, Collection of Laws for Electronic Access, http://www.wipo.int/clea/docs_new/en/jp/jp036en.html.

312. For a proposal for a post-grant opposition system in the United States, *see* Arti Rai, *Engaging Facts and Policy: A Multi-Institutional Approach to Patent System Reform*, 103 COLUM. L. REV. 1035, 1077 (2003). Creating a process for public involvement in the patenting process would more closely align patent grants with public perception of technology's benefits, risks, and meaning in society.

313. Under the Clean Air Act, certain inventions to control air pollution are subject to compulsory licenses, 42 U.S.C. § 7608 (2000), and under the Atomic Energy Act, certain inventions relating to atomic energy are subject to licenses as well. 42 U.S.C. § 2183 (2000). Also, the Bayh-Doyle Act grants a funding agency "march-in rights" to compel licenses in certain circumstances. 35 U.S.C. § 203 (2000).

314. The Medical Activity Act bars patent enforcement actions against medical practitioners. 35 U.S.C. § 287(b)(4)(C) (2000).

315. *But see, e.g.*, Kane, *supra* note 22, at 523 (referring to the subject matter requirement as the "least vital doctrine in the set of statutory requirements for patentability"); Jeffrey Kuhn, *Patentable Subject Matter Matters: New Uses for an Old Doctrine*, 22 BERKELEY TECH. L.J. 89, 89 (2007) ("Decades of subject matter expansion by the United States Patent and Trademark Office (USPTO) and Federal Circuit with no restrictions imposed by Congress or the Supreme Court created the impression that subject matter was effectively a dead doctrine.").

V. CONCLUSION

From the patent system's inception to the present, the subject matter inquiry's vision of technology has changed dramatically. The early inquiry, rooted in an Enlightenment vision, accounted for a broad array of values and defined technology as the control of nature for broad social benefit. The twentieth century inquiry, rooted in a Modern vision, accounted only for economic value and defined technology as a means to the assured end of economic growth. The current inquiry, representing the culmination of the Modern vision, has surrendered control over the definition of technology to economic forces, and embraced a sense of technological determinism. Technology has become any product of human action that creates economic value. And the patent law has become a technology itself, capable of methodical application to achieve economic progress.

If the patent law is a technology, however, it is a social technology—the product of a web of social and political interests.[316] And if the patent system currently embraces a vision of technological determinism, the system only does so because, over time, we have shaped the inquiry to empower that vision. Through a political process, we can reshape the inquiry and empower it with a different vision—one that more closely tracks society's conception of the social good.

316. WINNER, *supra* note 137, at 6.