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Of Green Tulips and Legal Kudzu: Repacking Rights in Subpatentable Innovation

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Of Green Tulips and Legal Kudzu: Repackaging Rights in Subpatentable Innovation

*J. H. Reichman**

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I. INTRODUCTION

How to enable entrepreneurs to appropriate the fruits of their investments in cumulative and sequential innovation¹ without impeding follow-on innovation and without creating barriers to entry² has become one of the great unsolved puzzles that the law and

1. See generally, e.g., JAMES E. BESSEN & ERIC S. MASKIN, SEQUENTIAL INNOVATION, PATENTS, AND IMITATION (MIT Dep't of Econ., Working Paper No. 00-01, Jan. 2000), available at http://papers.ssrn.com/sol3/delivery.taf?28464&_UserReference=4EBC6F1F9361AC2139EC82E; Richard R. Nelson, *Intellectual Property Protection for Cumulative Systems Technology*, 94 COLUM. L. REV. 2674, 2676 (1994) (distinguishing "traditional, discrete invention model" from "cumulative systems model"); Suzanne Scotchmer, *Protecting Early Innovators: Should Second-Generation Products Be Patentable?*, 27 RAND J. ECON. 322 (1996); Margaret Sharp, *Technological Trajectories and Corporate Strategies in the Diffusion of Biotechnology*, in TECHNOLOGY AND INVESTMENT: CRUCIAL ISSUES FOR THE 1990S, at 93, 94-97 (1990) ("Technological trajectories . . . describe the pathway by which the technology, given the thought-set, develops over time . . . [and] reflect, not the radical shifts in technology, but the incremental innovation which results from the continuous, marginal improvements in product and process technology.").

For the development of the importance of technological trajectories, i.e., cumulative and sequential innovation, see Richard R. Nelson, *Preface to Part IV: Innovation and the Evolution of Firms*, in TECHNICAL CHANGE AND ECONOMIC THEORY 219-20 (Giovanni Dosi et al. eds., 1988); Richard R. Nelson & Sidney G. Winter, *In Search of a Useful Theory of Innovation*, 6 RES. POL'Y 37, 37-76 (1977); see also Giovanni Dosi, *The Nature of the Innovation Process*, in TECHNICAL CHANGE AND ECONOMIC THEORY 221-35, *supra*; Giovanni Dosi, *Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change*, 11 RES. POL'Y 147, 147-62 (1982).

2. See, e.g., Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1041-42, 1065-67 (1997); Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and Patent Law*, J. ECON. PERSP., Winter 1991; see also Wendy J.

economics of intellectual property rights needs to address as the new millennium gets underway.³ This Article draws briefly from my earlier works⁴ to identify some of the key historical difficulties encountered in protecting small grain-sized innovations⁵ that do not rise to the level of “novel and nonobvious inventions” or “original and creative works of authorship.”⁶ It then re-examines these difficulties through the lens of a hypothetical “green tulip” problem, which encapsulates certain recurring investment dilemmas that afflict entrepreneurs operating under the hybrid intellectual property regimes available from both the domestic and international intellectual property systems.⁷ Without focusing on the technical operations of any of these hybrid regimes in detail, the green tulip exercises set out below will demonstrate why, from a structural perspective, they tend systematically to thwart the most socially desirable outcomes, especially with regard to follow-on innovations. The Article goes on to show how innovators and second comers working on common technical trajectories could better resolve these same problems by a more rational allocation of their collective costs of research and development (“R&D”).⁸

Gordon, *On Owning Information: Intellectual Property and the Restitutionary Impulse*, 78 VA. L. REV. 149, 222-24, 230-38 (1992); Ejan Mackaay, *An Economic View of Information Law*, in INFORMATION LAW TOWARDS THE 21ST CENTURY 43, 56 (Willem F. Korthals et al. eds., 1992).

3. See, e.g., Rochelle C. Dreyfuss, *Information Products: A Challenge to Intellectual Property Theory*, 20 N.Y.U. J. INT'L L. & POL. 897, 908 (1988); William Kingston, *The “Thesis” Chapters*, in DIRECT PROTECTION OF INNOVATION 1-124 (William Kingston ed., 1987) [hereinafter Kingston, *Thesis Chapters*]; Pamela Samuelson, Randall Davis, Mitchell D. Kapur, & J.H. Reichman, *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308, 2332-65 (1994) [hereinafter Samuelson, et al., *Manifesto*]; William Kingston, *Unlocking the Potential of Intellectual Property* 3-4 (June 2000) (paper presented to the Swedish International Symposium on Economics, Law and Intellectual Property, Gotheberg, June 26-30, 2000) (on file with author) [hereinafter Kingston, *Unlocking*].

4. See *infra* note 40.

5. I am indebted to Mitchell D. Kapur for directing my attention to the behavioral aspects of small grain-sized innovation in the software industries.

6. See J.H. Reichman, *Charting the Collapse of the Patent-Copyright Dichotomy: Premises for a Restructured International Intellectual Property System*, 13 CARDOZO ARTS & ENT. L.J. 475, 485-96 (1995) [hereinafter Reichman, *Charting the Collapse*] (stressing foundational role of patent and copyright systems in protecting relatively large grain-sized intellectual productions, viz, “novel and nonobvious inventions” and “original and creative works of authorship,” and identifying negative economic premises thought to underlie these systems). For universal minimum standards harmonizing the protection of both inventions and literary and artistic productions, see Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, LEGAL INSTRUMENTS—RESULTS OF THE URUGUAY ROUND vol. 31; 33 I.L.M. 1197, arts. 2(1), 9-14, 27-34 (1994) [hereinafter TRIPS Agreement].

7. See generally J.H. Reichman, *Legal Hybrids Between the Patent and Copyright Paradigms*, 94 COLUM. L. REV. 2432, 2448-53 (1994) [hereinafter Reichman, *Legal Hybrids*].

8. See *supra* note 1.

More broadly, I seek to refocus the attention of legal and economic analysis on the potential benefits of liability rules over property rules in the subpatentable environment⁹ and to emphasize the role of the public domain in a technological universe in which the funding of small-scale applications of know-how to industry is increasingly critical to entrepreneurial success.¹⁰ I will suggest that a crucial test of any socially desirable regulatory model for small-scale innovation is the extent to which measures that deter free-riding appropriation also retain a capacity to enrich—rather than diminish—the public domain.¹¹ Besides demonstrating the high but often hidden opportunity costs that inherently result when a proliferation of hybrid regimes of exclusive property rights govern small-scale innovation, this Article concretely illustrates the ways in which an alternative regime built on compensatory liability principles could stimulate investment without chilling follow-on innovation and without creating legal barriers to entry.¹² It ends by noting

9. See Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092 (1972). For recent debate, see generally, for example, Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement to Facilitate Coasean Trade*, 104 YALE L.J. 1027, 1036-39 (1995); Louis Kaplow & Steven Shavell, *Do Liability Rules Facilitate Bargaining? A Reply to Ayres and Talley*, 105 YALE L.J. 221, 222-31 (1995); Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713 (1996). For the view that property rules are always socially more desirable for large grain-sized intellectual creations, see Robert P. Merges, *Of Property Rules, Coase, and Intellectual Property*, 94 COLUM. L. REV. 2655, 2664-67 (1994). This Article takes the opposite view with respect to small grain-sized innovation.

10. For new thinking about the problems of funding innovation, see, for example, Brett Frischmann, *Innovation and Institutions: Rethinking the Economics of U.S. Science and Technology Policy*, 24 VT. L. REV. 347, 349-53 (2000); Carole Ganz-Brown, *Patent Policies to Fine Tune Commercialization of Government-Sponsored Research*, 26 SCI. & PUB. POL. 403 (1999).

11. See, e.g., David Lange, *Recognizing the Public Domain*, LAW & CONTEMP. PROBS., Autumn 1981, at 147. For renewed attention to the role of the public domain in intellectual property law, see generally, for example, JAMES BOYLE, *SHAMANS, SOFTWARE, AND SPLEENS* 155-57 (1996) (stressing undervaluation of public domain in copyright law premised on expanded notion of originality); Yochai Benkler, *Free as the Air to Common Use: First Amendment Constraints on Enclosure of the Public Domain*, 74 N.Y.U. L. REV. 354 (1999); Julie Cohen, *Lochner in Cyberspace: The New Economic Orthodoxy of "Rights Management,"* 97 MICH. L. REV. 462, 468-80 (1998); Jessica Litman, *The Public Domain*, 39 EMORY L.J. 965 (1990).

12. This Article thus builds on my previous efforts to clarify the pro-competitive role of the liability rules used to stimulate investment in subpatentable innovation during the Industrial Revolution. See Roichman, *Legal Hybrids*, *supra* note 7, at 2520-29 ("Nature and Limits of Classical Trade Secret Law"); see also Steven N.S. Cheung, *Property Rights in Trade Secrets*, 20 ECON. INQUIRY 40, 44 (1982); David D. Friedman, William M. Landes, & Richard A. Posner, *Some Economics of Trade Secret Law*, J. ECON. PERSP., Winter 1991, at 61, 64. It benefits from other recent work that underscores the risk of balkanizing the public domain through inappropriate legal responses to the risk of market failure. See, e.g., Rebecca S. Eisenberg, *Bargaining Over the Transfer of Proprietary Research Tools: Is This Market Failing or Emerging?*, in EXPANDING THE BOUNDS OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY (Rochelle C. Dreyfuss et al., eds., forthcoming 2000); Michael A. Heller & Rebecca S.

ways in which the compensatory liability rules proposed to address the puzzle of small grain-sized innovation would also go a long way toward answering hard questions about how to protect applications of traditional biological and cultural knowledge to industry, questions that are of increasing importance to developing and least-developed countries.¹³

II. RETHINKING THE PUZZLE OF SMALL GRAIN-SIZED INNOVATION

So long as innovators can keep their know-how under actual or legal secrecy, and the resulting innovations are relatively difficult to copy, they expect a period of natural lead time during which they may try to recoup their investments and turn a profit. Even in the earliest days of the Industrial Revolution, however, it was clear that investors in some small-scale applications of intangible know-how to products sold in the open market would suffer from a chronic shortage of natural lead time in the brave new world of free competition.¹⁴ As far back as the seventeenth century, for example, producers of textile and fabric designs had voiced complaints about a

Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698, 698-701 (1998); Mark D. Janis, *Second Tier Patent Protection*, 40 HARV. INT'L L.J. 151, 215-18 (1999). See generally Michael A. Heller, *The Boundaries of Private Property*, 108 YALE L.J. 1163 (1999) [hereinafter Heller, *Boundaries*]; Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998).

13. See generally ROSEMARY J. COOMBE, *THE CULTURAL LIFE OF INTELLECTUAL PROPERTIES: AUTHORSHIP, APPROPRIATION, AND THE LAW* (1998); Rosemary J. Coombe, *Intellectual Property, Human Rights & Sovereignty: New Dilemmas in International Law Posed by the Recognition of Indigenous Knowledge and the Conservation of Biodiversity*, 6 IND. J. GLOBAL LEGAL STUD. 59 (1998); Thomas Cottier, *The Protection of Genetic Resources and Traditional Knowledge: Towards More Specific Rights and Obligations in World Trade Law*, 1 J. INT'L ECON. L. 555 (1998); Kamal Puri, *Preservation and Conservation of Expressions of Folklore*, COPYRIGHT BULL. (UNESCO), Oct.-Dec. 1998, at 5.

14. Although the worldwide intellectual property system has always experienced difficulties in stimulating investment in some types of small-scale innovation, traditional legal scholarship perceived these shortcomings as a pesky but relatively minor problem that exerted little adverse influence on its core operations. See, e.g., 2 STEPHEN P. LADAS, *PATENTS, TRADEMARKS, AND RELATED RIGHTS: NATIONAL AND INTERNATIONAL PROTECTION* 828-31 (1975) (discussing evolution of early design protection laws and noting perception of industrial designs as the "poor relation" or stepchild of industrial property law). At the core were the fledgling patent and copyright paradigms, which had still to be worked out in ways that enabled inventors and creators to capture the value of their intangible productions within and across territorial boundaries, but without subverting the public interest in free competition. See, e.g., BRAD SHERMAN & LIONEL BENTLY, *THE MAKING OF MODERN INTELLECTUAL PROPERTY LAW: THE BRITISH EXPERIENCE, 1760-1911*, at 2-4, 61-100 (1999) (describing the fluid nature of intellectual property categories prior to 1850, when the patent and copyright systems crystallized); see also *id.* at 101-28 (discussing the "crystalliz[ation] of the categories"); Fritz Machlup & Edith Penrose, *The Patent Controversy in the Nineteenth Century*, 10 J. ECON. HIST. 1 (1950).

lack of legal protection against unauthorized imitations.¹⁵ During the nineteenth century, when the dominant patent and copyright paradigms crystallized, these complaints gave way to more robust demands by manufacturers of goods produced in series for special design laws to protect the ornamental features of useful articles (including nonfunctional, three-dimensional product configurations) and for utility model laws to protect novel functional shapes that improved the usefulness of handtools and everyday household articles.¹⁶ Because entrepreneurs who developed innovative industrial designs falling within either category could not keep their noncopyrightable and subpatentable know-how secret once it had been embodied in products distributed in the open market, slavish imitators could reduce their natural lead time to zero without incurring any significant R&D costs of their own.¹⁷

15. The first statute to deal explicitly with the legal protection of designs was the Calico Printers' Act of 1787, which conferred two months protection on new and original patterns "for printing linens, cottons, calicos or muslins." SHERMAN & BENTLY, *supra* note 14, at 63-64 (citing An Act for the Encouragement of the Arts of Designing and Printing Linens, Cottons, Calicos and Muslins by vesting the Properties thereof in the Designers, Printers and Proprietors for a Limited Time, 1787, 27 Geo. III ch. 38 (Eng.) (1787 Calico Printers' Act)).

16. See, e.g., 2 LADAS, *supra* note 14, at 828-30, 837-40 (discussing industrial designs); *id.* at 949-51 (discussing utility models); SHERMAN & BENTLY, *supra* note 14, at 64-67, 77-94 (discussing Great Britain's 1842 Ornamental Designs Act and 1843 Utility Designs Act); UMA SUTHERSANEN, DESIGN LAW IN EUROPE 383-93 (2000) (discussing various European utility model laws). See generally Janis, *supra* note 12, at 155-59 (classifying and discussing classical utility model regimes).

17. In principle, the classical intellectual property system underlying the later Industrial Revolution relegated the bulk of all subpatentable innovation to a loose set of liability rules sounding in unfair competition law that gave investors only a period of natural lead time in which to recoup their investments and establish their marks. See, e.g., RESTATEMENT (THIRD) OF UNFAIR COMPETITION § 1 cmt. a (1995) ("The freedom to compete"); *id.* § 38 introductory note, cmt. a ("rejecting the recognition of exclusive rights in intangible trade values"); JEROME PASSÁ, CONTREFAÇON ET CONCURRENCE DÉLOYALE 241-310 (1997) (surveying tensions with respect to servile imitation and parasitical copying); ANSELM KAMPERMAN SANDERS, UNFAIR COMPETITION LAW: THE PROTECTION OF INTELLECTUAL AND INDUSTRIAL CREATIVITY 6-77, 121-54 (1997) (advocating "new action of malign competition"). See generally Reichman, *Legal Hybrids*, *supra* note 7, at 2436-42 ("Historical Dependence of Intellectual Property Systems on a Substratum of Liability Rules"). Within this laissez-faire regulatory environment, the temporary monopolies of the domestic patent laws, whose social costs arguably served to elevate the industrial techniques of competition to their next highest level, were viewed as islands of protection in a sea of competition. See, e.g., HECTOR L. MACQUEEN, COPYRIGHT, COMPETITION AND INDUSTRIAL DESIGN 19-20 (1989); Michael Lehmann, *Property and Intellectual Property: Property Rights as Restrictions on Competition in Furtherance of Competition*, 20 INT'L REV. INDUS. PROP. & COPYRIGHT L. 1, 9-11 (1989) [hereinafter Lehmann, *Property and Intellectual Rights*]; Michael Lehmann, *The Theory of Property Rights and the Protection of Intellectual and Industrial Property*, 16 INT'L REV. INDUS. PROP. & COPYRIGHT L. 525, 540 (1985) [hereinafter Lehmann, *The Theory of Property Rights*].

*A. Hybrid Intellectual Property Rights as Anti-Competitive Kudzu*¹⁸

By the late twentieth century, it was clear that the vulnerability of industrial designs to slavish imitation had merely foreshadowed a wave of small-scale technical innovations whose similar predicament would destabilize the patent-copyright dichotomy on which the worldwide intellectual property system was, by then, firmly grounded.¹⁹ Computer programs,²⁰ integrated circuit designs,²¹ biogenetically engineered organisms,²² new plant varieties,²³ and, most recently, electronically generated databases,²⁴ all

18. Kudzu is a Japanese vine that was brought to the United States to prevent soil erosion and that has spread uncontrollably over the southern states. See *Kudzu*, in *ENCYCLOPEDIA OF SOUTHERN CULTURE* 383-84 (Charles R. Wilson & William Ferris eds., 1989).

19. See Paris Convention for the Protection of Industrial Property, Mar. 20, 1883, as last revised at Stockholm, July 14, 1967, 21 U.S.T. 1629, 828 U.N.T.S. 305 [hereinafter Paris Convention]; Berne Convention for the Protection of Literary and Artistic Works, Sept. 9, 1886, as last revised at Paris, July 24, 1971, S. TREATY DOC. NO. 99-27 (1986) [hereinafter Berne Convention]; TRIPS Agreement, *supra* note 6.

20. See, e.g., Samuelson et al., *Manifesto*, *supra* note 3, at 2332-65.

21. See, e.g., Semiconductor Chip Protection Act of 1984, Pub. L. No. 98-620, 98 Stat. 3347 (codified as amended at 17 U.S.C. §§ 901-914 (1994)); TRIPS Agreement, *supra* note 6, arts. 35-38 (incorporating by reference selected provisions of the Treaty on Intellectual Property in Respect of Integrated Circuits, May 26, 1989, 28 I.L.M. 1484, which never entered into force); ANDREW CHRISTIE, *INTEGRATED CIRCUITS AND THEIR CONTENTS: INTERNATIONAL PROTECTION* 3-8, 23-47 (1995).

22. See, e.g., Heller & Eisenberg, *supra* note 12, at 698-701; Kingston, *Unlocking*, *supra* note 3, at 17-19; Sharp, *supra* note 1, at 101 (characterizing pharmaceutical trajectory of new biotechnology in terms of "one step leads logically to the next," i.e., based on internal logic of science, with rapid routinization and few discontinuities); see also Dan L. Burk, *Biotechnology and Patent Law: Fitting Innovation to the Procrustean Bed*, 17 *RUTGERS COMPUTER & TECH. L.J.* 1, 24-85 (1991); Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 *YALE L.J.* 177, 193 (1987) (stressing the ease with which a small sample of a culture can supply competitor with quantities of commercially valuable organisms); Ganz-Brown, *supra* note 10, at 406-09 (stressing the differences in patterns of technical advance). A cottage industry of proposals to protect biotech products under copyright law has predictably surfaced. See, e.g., Reichman, *Legal Hybrids*, *supra* note 7, at 2472 n.193 (citing several such proposals).

23. See, e.g., International Convention for the Protection of New Varieties of Plants, Dec. 2, 1961, 33 U.S.T. 2703, 815 U.N.T.S. 89 [hereinafter UPOV I], as amended on March, 19, 1991, reprinted at 3 *EUR. PAT. HANDBOOK (MB)* ch. 90, available at www.upov.int/eng/convtnts/1991/content.htm [hereinafter UPOV II]; Joshua V. Funder, *Rethinking Patents for Plant Innovation*, 21 *EUR. INTELL. PROP. REV.* 551 (1999); Margaret Llewelyn, *Patenting or Plant Variety Protection?*, in *WORLD TRADE FORUM 1999* (T. Cottier ed., forthcoming 2001). See generally Henrique Freire de Oliveira Souza, *Genetically Modified Plants: A Need for International Regulation*, 6 *ANN. SURV. INT'L & COMP. L.* 129 (2000); David S. Tilford, *Saving the Blueprints: The International Legal Regime for Plant Resources*, 30 *CASE W. RES. J. INT'L L.* 373 (1998).

24. See, e.g., Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the Legal Protection of Databases, 1996 O.J. (L 77) 20 [hereinafter E.C. Directive on Databases]; H.R. 354, 106th Cong. (1999) ("Collections of Information Antipiracy Act"); H.R. 1858, 106th Cong. (1999) ("Consumer and Investor Access to Information Act of 1999"). See generally Jane C. Ginsburg, *Copyright, Common Law, and Sui generis Protection of Databases in the United States and Abroad*, 66 *U. CIN. L. REV.* 151 (1997); J.H. Reichman & Paul Uhlir, *Data-*

repropose conditions favoring market failure like those that in an earlier period afflicted investors in both ornamental and functional designs.²⁵

In place of the breakthrough or "pioneer" inventions of the past, which still dominate our thinking about patents (and about related contractual rights as well),²⁶ it is the "routine" engineers' cumulative and sequential working out of shared or common technical trajectories that increasingly drives the post-modern economy in Silicon Valleys and their equivalents throughout the world.²⁷ As in the past, what today's routine engineer produces is essentially technical know-how: that is to say, a store of information about methods or processes of production that confers some commercial advantages on those who possess it.²⁸ What primarily differentiates the production of today's cutting-edge technical know-how from the bulk of the technical information generated during the Industrial Revolution, however, is the chronic inability of those who invest in its commercial exploitation to keep their know-how secret from would-be competitors who can rapidly reproduce any incremental innovation borne on or near the face of a product distributed in the open market.²⁹

The vulnerability of small grain-sized innovation to free-riding duplicators who incur no appreciable costs of reverse engineering and who confer no appreciable lead time advantages on

base Protection at the Crossroads: Recent Developments and Their Impact on Science and Technology, 14 BERKELEY TECH. L.J. 793 (1999); J.H. Reichman & Pamela Samuelson, *Intellectual Property Rights in Data?*, 50 VAND. L. REV. 51 (1997).

25. On the problem of market failure, see Wendy J. Gordon, *Asymmetric Market Failure and Prisoner's Dilemma in Intellectual Property*, 17 U. DAYTON L. REV. 853, 854-59 (1992).

26. See generally Merges, *supra* note 9; Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293 (1996); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839 (1990).

27. See, e.g., BESSEN & MASKIN, *supra* note 1 (stressing high rate of innovation in software, semiconductors, and computer industries despite historically weak patent protection); Sharp, *supra* note 1, at 109-12 (discussing "[t]echnological trajectories, corporate strategies and biotechnology").

28. See, e.g., 2 LADAS, *supra* note 14, at 1617; Kingston, *Thesis Chapters*, *supra* note 3, at 2-3. See generally FRANÇOIS DESSEMONTET, *THE LEGAL PROTECTION OF KNOW-HOW IN THE UNITED STATES OF AMERICA* 11 (2d rev. ed. 1976); FRANÇOIS MAGNIN, *KNOW-HOW ET PROPRIÉTÉ INDUSTRIELLE* 14-22, 93-94, 381-88 (1974).

29. Like appearance designs or the novel shapes of everyday useful articles, today's most commercially valuable sets of subpatentable technical information are often literally "applied to industry," in the sense that they are bundled into products that circulate in the open market. See generally J.H. Reichman, *Computer Programs as Applied Scientific Know-How: Implications of Copyright Protection for Commercialized University Research*, 42 VAND. L. REV. 639, 656-69 (1989) [hereinafter Roichman, *Computer Programs*].

those who first performed the underlying R&D under these conditions breeds fears of market failure that border on panic.³⁰ The resulting dilemma is that, if unbridled competition appears likely to induce suboptimal investment in the absence of natural lead time, lessening competition under the patent and copyright paradigms tends to stretch these regimes to the breaking point in order to accommodate ever smaller grain-sized innovations.³¹

The typical legislative response to this threat of market failure is to enact *sui generis* regimes of exclusive property rights, built on modified patent and copyright principles, which afford target classes of investors fixed periods of artificial lead time.³² In other words, when faced with the risk of suboptimal investment in small-scale applications of know-how to industry, legislators and administrators turn instinctively to a property rule, and they assume that some efficient admixture of modified patent and copyright principles will resolve every problem.³³

30. See, e.g., Reichman, *Legal Hybrids*, *supra* note 7, at 2511-20; Samuelson et al., *Manifesto*, *supra* note 3, at 2332-65. This chronic shortage of natural lead time under present-day conditions distorts foundational premises of a competitive economy that are still taken for granted in traditional legal and economic thinking. Its inherent capacity to deter investment is aggravated by the soaring costs of even routine innovation in some cutting edge disciplines and by the shortened product cycles under which most manufacturers of consumer goods labor to recoup those costs. See, e.g., Sharp, *supra* note 1, at 97-109 (discussing developments in the biotech market); Samuelson et al., *Manifesto*, *supra* note 3, at 2371-78 (discussing nature of software market and its consequences).

31. Typical signs of this malaise include the stuffing of software into copyright law, the spread of software patents, a general lowering of the nonobviousness criterion, and the extension of patent protection to business methods. See, e.g., John H. Barton, *Intellectual Property Rights: Reforming the Patent System*, 287 *SCIENCE* 1933, 1933-34 (2000) (stressing need for stricter standards of "nonobviousness" and measures favoring follow-on innovation); Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 *CAL. L. REV.* (forthcoming 2001) (stressing need to allow reverse-engineering of software patents and need for narrow range of equivalents); Rechelle Cooper Dreyfuss, *Are Business Method Patents Bad for Business?*, 16 *SANTA CLARA COMPUTER & HIGH TECH L.J.* 263, 267-77 (2000); Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 *BERKELEY TECH. L.J.* 577, 584-606 (1999). See generally Samuelson et al., *Manifesto*, *supra* note 3, at 2332-65 (demonstrating inability of existing regimes adequately to protect computer software).

32. See generally Reichman, *Legal Hybrids*, *supra* note 7, at 2453-2500.

33. For the record, let me confess that, as late as 1989, I, too, remained hopeful of finding the right "admixture" of modified copyright principles to solve the problem. See, e.g., J.H. Reichman, *Design Protection and the New Technologies: The United States Experience in a Transnational Perspective*, 19 *U. BALT. L. REV.* 5, 141-53 (1989/1990) [hereinafter Reichman, *Design Protection*] ("Logic of a Modified Copyright Approach"). The blinders were lifted during the three-year investigation of computer programs with Samuelson, Davis, and Kapor, which led to the insights, published, respectively, in Samuelson et al., *Manifesto*, *supra* note 3, and Reichman, *Legal Hybrids*, *supra* note 7. By the same token, these same "blinders" led me to too harshly criticize the United Kingdom's Unregistered Designs Act of 1988, Reichman, *supra*, at 148-50; see also SUTHERSANEN, *supra* note 16, at 303-17 (summarizing this law), which, in retro-

In this climate, the European Community has recently taken steps to strengthen and harmonize the design protection laws of its member countries,³⁴ and to mandate utility model laws that will confer patent-like protection on small-scale (i.e. less than nonobvious) innovation generally.³⁵ Other miniature legal monopolies, derived from the same historical matrix that the early design and utility model laws first established, are routinely enacted in Europe and elsewhere to protect ever smaller fragments of innovative contributions. Recent examples include *sui generis* laws protecting integrated circuit designs, plant breeders' varieties, boat hull designs, and most egregiously computer-generated databases,³⁶ whose proprietors obtain a strong perpetual monopoly in return for mere investment in non-original collections of data.³⁷

This proliferation of technology-specific mini-monopolies has proceeded with no assessment of the aggregate social costs resulting from diminished opportunities to compete and with little regard to the historical role of the public domain as the source of inputs for cumulative and sequential innovation in dynamic free-market

spect, possessed some features of a nascent liability regime to which I was insufficiently attentive.

34. See Directive 98/71/EC of the European Parliament and of the Council of 13 October, 1998 on the Legal Protection of Designs, 1998 O.J. (L 289) 28 [hereinafter E.C. Directive on Designs]; SUTHERSANEN, *supra* note 16, at 28-54. See generally Graeme B. Dinwoodie, *Federalized Functionalism: The Future of Design Protection in the European Union*, 24 AM. INTELL. PROP. L. ASS'N Q. J. 611 (1996). Whether a proposed E.C. Design Regulation, which would further strengthen registered design protection throughout the European Union and possibly introduce a second tier of unregistered, more copyright-like scheme of design protection will also be enacted remains to be seen. See SUTHERSANEN, *supra* note 16, at 55-80; Annette Kur, *The Green Paper's Design Approach: What's Wrong with It?* 15 EUR. INTELL. PROP. REV. 374 (1993).

35. See, e.g., Janis, *supra* note 12, at 155-77; Jerome H. Reichman, *Electronic Information Tools: The Outer Edge of World Intellectual Property Law*, 24 INT'L REV. INDUS. PROP. & COPYRIGHT L. 446, 451-55 (1993) [hereinafter Reichman, *Electronic Information Tools*]. The European Commission proposes to extend utility model protection to all European Union countries and their affiliates. See SUTHERSANEN, *supra* note 16, at 494-502 (reprinting the Amended Proposal for a European Parliament and Council Directive Approximating the Legal Arrangements for the Protection of Inventions by Utility Model (Draft E.C. Directive on Utility Models)); Janis, *supra* note 12, at 153-55.

36. See Vessel Hull Design Protection Act, Pub. L. No. 105-304, 112 Stat. 2905 (1998) (codified at 17 U.S.C. §§ 1301-32) (1994 & Supp. IV 1998)); Reichman, *Legal Hybrids*, *supra* note 7, at 2453-500; *supra* notes 20-24 and accompanying text.

37. See *supra* note 24; see also KAMPERMAN SANDERS, *supra* note 17, at 31 (discussing a 1992 French proposal for a miniature exclusive right in "any creation that is capable of being exploited for profit resulting from intellectual work"); Christian Le Stanc, *Intellectual Property on Procrustes' Bed: Observations on a French Draft Bill for the Protection of 'Reserved Creations'*, 14 EUR. INTELL. PROP. REV. 438, 438-44 (1992).

economies.³⁸ If legislatures in developed countries keep adding these epicycles to the classical intellectual property system while ignoring the real, rather than the apparent, causes of its breakdown in the post-industrial age, I predict that a spreading thicket of poorly conceived and overly protective intellectual property rights may progressively discourage, rather than encourage, investment in subpatentable innovation across large segments of the global marketplace.³⁹

B. The Flawed Historical Models: Design and Utility Model Laws

My first articles examined the historical models—design and utility model laws—that were used to address the puzzle of small-scale innovation in the nineteenth century.⁴⁰ I tried to understand why the design laws had uniformly failed to live up to the expectations placed in them, why no consensus solution to the quest for a model design protection law had come to light after so much time and effort,⁴¹ and why local design industries in some countries with relatively weak protection (notably, Italy) had prospered and even outperformed similar industries in countries with relatively strong protection (notably, France).⁴² These articles revealed an inherent tension between relatively weak and relatively strong forms of design protection that triggered a recurring cyclical movement be-

38. See *supra* note 11; cf. James Boyle, *Cruel, Mean or Lavish? Economic Analysis, Price Discrimination and Digital Intellectual Property*, 53 VAND. L. REV. 2007 (2000) (stressing benefits of competition and need for public domain inputs into the information economy).

39. *Accord* Janis, *supra* note 12, at 200-19; Kingston, *Unlocking*, *supra* note 3. This kudzu-like thicket could eventually weaken the comparative advantages that developed countries currently enjoy in the market for knowledge goods and make them increasingly vulnerable to products from those developing countries that took pains to gear their catch-up efforts to more competitively organized systems of local innovation. Cf. Michael North, *The U.S. Expansion of Patentable Subject Matter: Creating a Competitive Advantage for Foreign Multinational Companies?*, 18 B.U. INT'L L.J. 111 (2000).

40. See, e.g., J.H. Reichman, *Design Protection in Domestic and Foreign Copyright Law: From the Berne Revision of 1948 to the Copyright Act of 1976*, 1983 DUKE L.J. 1143 [hereinafter Reichman, *Designs Before 1976*]; J.H. Reichman, *Design Protection After the Copyright Act of 1976: A Comparative View of the Emerging Interim Models*, 31 J. COPYRIGHT SOC'Y 267 (1984) [hereinafter Reichman, *Designs After 1976*]; Reichman, *Electronic Information Tools*, *supra* note 35, at 451-55; Reichman, *Design Protection*, *supra* note 33.

41. See Reichman, *Design Protection*, *supra* note 33, at 133-35 ("Failings of the Modified Patent Approach").

42. See, e.g., Reichman, *Designs Before 1976*, *supra* note 40, at 1153-58 ("The Unity of Art Thesis in France"); *id.* at 1182-86 (noting that Italian law rejects copyright protection of industrial designs); *id.* at 1213-23 (discussing the relatively weak protection of Italian designs under *sui generis* design laws. See, e.g., SILVIA MAGELLI, L'ESTETICA NEL DIRITTO DELLA PROPRIETA INTELLETTUALE 57-87 (1998); SUTHERSANEN, *supra* note 16, at 137-71.

tween states of perceived underprotection and states of perceived overprotection.⁴³

In more recent articles, I have tried to explore the root causes of this cyclical pattern and of the other infirmities that my study of hybrid regimes brought to light, particularly the economic and doctrinal contradictions associated with the ever-growing practice of rewarding less than nonobvious innovation with powerful exclusive property rights.⁴⁴ I concluded that what undermined the hybrid intellectual property regimes was not just their ad hoc, technology-specific birthmarks or the inability of legislatures to craft appropriate admixtures of modified patent and copyright principles. It was, rather, that from the oldest to the newest, most of these regimes suffered from a common structural defect: namely, that legal theory had blindly, and by a series of historical accidents, committed itself to solving the puzzle of small-scale innovation by means of a property rule, whereas the problems entrepreneurs actually faced resulted from the failure of a liability rule for which some functional equivalent was badly needed and long overdue.⁴⁵

Since publishing those articles, I have gained new insights into the puzzle of small-scale innovation from the critical attention

43. For a discussion of the "cyclical nature of the design phenomenon in all legal environments," see Reichman, *Design Protection*, *supra* note 33, at 123-35. For an economist's difficulties with conceptualizing states of "under" and "over" protection, see Ejan Mackaay, *Legal Hybrids: Beyond Property and Monopoly?*, 94 COLUM. L. REV. 2630, 2634-39 (1994). Some countries that experimented with a relatively weak form of protection against slavish imitation (which I choose to call a "copyright-like" approach) were likely to shift to relatively stronger forms of protection that covered imitations and follow-on products (usually at the cost of imposing higher standards of eligibility); while other countries (and sometimes the very same countries that had at one time embraced that more "patent-like" approach) might shift away from stronger forms of protection back to softer, more copyright-like forms of protection (a move logically accompanied by lower, more accessible standards of eligibility). For details, see Reichman, *Design Protection*, *supra* note 33, at 123-35. Viewed over a two-hundred year period, indeed, design protection law seemed like a legal merry-go-round on which legislatures, courts, and commentators in different countries kept changing seats, often without perceiving the recurring pendular movement of which they were a part.

44. See Reichman, *Legal Hybrids*, *supra* note 7, at 2504-29; Reichman, *Charting the Collapse*, *supra* note 6, at 504-20; see also Reichman, *Electronic Information Tools*, *supra* note 35, at 472-75; Samuelson et al., *Manifesto*, *supra* note 3, at 2330-69.

45. See Reichman, *Legal Hybrids*, *supra* note 7, at 2519-57. I argued, in short, that it was not the mature patent and copyright paradigms operating within their historical spheres of influence that had broken down, but classical trade secret law that had broken down under present day conditions, leaving small-scale innovators to cope with a chronic shortage of natural lead time. To properly resolve the puzzle of small-scale innovation, therefore, a new kind of regime was needed, which I called "a general purpose innovation law on modified liability principles," and which might appropriately be thought of as a "portable trade secret" law. See *id.*; see also Reichman & Samuelson, *supra* note 24, at 145-51; Samuelson et al., *Manifesto*, *supra* note 3, at 2368-2426.

given to my previous work;⁴⁶ from ongoing efforts to adapt my proposed regime to the needs of developing countries in order to stimulate local innovation;⁴⁷ and, above all, from practical experience in seeking to defend the interests of science and education against overly broad legislative proposals to protect databases.⁴⁸ The single most important insight gleaned from all these sources—and the one that most compels me to write the present Article—is that the hybrid regimes of exclusive property rights uniformly saddle the process of follow-on innovation with unacceptably high social costs.⁴⁹

To be sure, there is continuing debate about the ability of even the mature patent and copyright paradigms to satisfactorily balance public and private interests in promoting follow-on innovation.⁵⁰ While this is not the place to discuss that topic,⁵¹ I stress at

46. See, e.g., Symposium, *Toward a Third Intellectual Property Paradigm*, 94 COLUM. L. REV. 2307, 2559-2677 (1994).

47. See, e.g., J.H. Reichman, *From Free Riders to Fair Followers: Global Competition Under the TRIPS Agreement*, 29 N.Y.U. J. INT'L L. & POL. 11, 67-74 (1996/1997) [hereinafter Reichman, *Free Riders*]; see also KEITH E. MASKUS, *INTELLECTUAL PROPERTY RIGHTS IN THE GLOBAL ECONOMY* 178-81 (2000).

48. See Reichman & Uhler, *supra* note 24, at 832-38. See also Yochai Benkler, *Constitutional Bounds of Database Protection: The Role of Judicial Review in the Creation and Definition of Private Rights in Information*, 15 BERKELEY TECH. L.J. 535 (2000); Marci A. Hamilton, *A Response to Professor Benkler*, 15 BERKELEY TECH. L.J. 605 (2000); see generally Symposium, *The Impact of Technological Change on the Creation, Dissemination, and Protection of Intellectual Property*, 62 OHIO ST. L.J. (forthcoming 2001).

49. See Janis, *supra* note 12, at 200-07 (predicting anticommons effects for follow-on improvers under expanded utility model laws). Some fine work concerning the economics of follow-on improvers in patents and copyrights applies with even greater force, in my view, to the puzzle of subpatentable innovation. See generally Lemley, *supra* note 2; Scotchmer, *supra* note 1; Scotchmer, *supra* note 2; see also MARK SCHANKERMAN & SUZANNE SCHOTCHMER, *DAMAGES AND INJUNCTIONS IN PROTECTING PROPRIETARY RESEARCH TOOLS* (Univ. of Cal. Inst. of Bus. & Econs. Research Working Paper No. E-00-288, 2000), available at <http://socrates.berkeley.edu/~scotch/tools11.PDF>.

50. See generally, e.g., Cohen & Lemley, *supra* note 31; Scotchmer, *supra* note 1; Scotchmer, *supra* note 2; Paul Edward Geller, *Hiroshige v. Van Gogh, Resolving the Dilemma of Copyright Scope in Remediating Infringement*, 46 J. COPYRIGHT SOC'Y 39, 51-56 (1998); Lemley, *supra* note 2; Maureen A. O'Reurke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177 (2000).

51. A worldwide concern to stimulate risky investments in patentable inventions and original works of authorship has nonetheless elicited an internationally binding set of baseline entitlements that initially favor inventors and authors, while subjecting them to countervailing ambiguities in doctrines controlling the scope of protections that are left to the domestic intellectual property laws. These offsetting doctrines vary in strength from one jurisdiction to another and often within single jurisdictions at different times, and there is no consensus about how to draw the lines in specific cases or with respect to certain subject matter categories of protection. See, e.g., Reichman, *Free Riders*, *supra* note 47, at 29-42. Even so, the social costs of assigning inventors and authors exclusive rights to "equivalent inventions" and "derivative works" are attenuated in practice by thus judicially limiting the range of equivalents in crowded fields or when competitors have added significant value of their own, and perhaps above all, by encour-

the outset that a different calculus of social costs and benefits applies when small grain-sized innovation is at stake. Without the big social pay-offs expected from major innovations—patentable inventions and copyrightable works of authorship—one may question *a priori* the use of powerful exclusive rights to elicit technical contributions within the reach of routine engineers, which entrepreneurs would usually need to make anyway simply to maintain a competitive advantage.⁵² There is likewise a compelling need to seek alternative solutions to the problem of appropriability so as to encourage investment without necessarily entitling the first- or the second comer to all the returns from follow-on innovation.⁵³

In what follows, I will try to show why a liability rule correctly addresses this critical problem of follow-on innovation at the subpatentable level. Using a single, hypothetical problem—the “green tulip problem”—against which we can test the prototypical models underlying all the *sui generis* regimes of intellectual property rights,⁵⁴ I propose to demonstrate concretely why a property rule fails to solve the problem of follow-on applications of subpatentable know-how to industry, and why a properly crafted liability rule would solve that same problem with fewer social costs and without impoverishing the public domain.

III. THE “GREEN TULIP” PROBLEM: UNPACKING RIGHTS IN SUBPATENTABLE INNOVATION

In order to see how hybrid intellectual property regimes affect decisions to invest in small grain-sized innovation, we turn now to the green tulip problem. Before proceeding further, however, I need to clarify that the ensuing discussion about the investment dilemmas that hypothetical plant breeders might face when evalu-

aging resort to private contractual agreements to overcome the ambiguities otherwise built into legal rules governing the scope of protection. See also MASKUS, *supra* note 47, at 199-233.

52. See Matthew Nimetz, *Design Protection*, 15 COPYRIGHT L. SYMP. (ASCAP) 79 (1967) (making this point nicely in the context of a legal and economic analysis of design protection laws). See generally Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977); A. Samuel Oddi, *Un-Unified Economic Theories of Patents: The Not-Quite-Holy Grail*, 71 NOTRE DAME L. REV. 267 (1996).

53. See generally Paul A. David & Dominique Foray, *Accessing and Expanding the Science and Technology Knowledge Base*, 16 STI REV. 14 (1995); Lester Thurow, *Needed: A New System of Intellectual Property Rights*, HARV. BUS. REV., Sept.-Oct. 1997, at 95. Indeed, it is precisely their inability to solve the problem of follow-on innovation in the subpatentable environment that largely accounts for the recurring cycles of perceived under- and overprotection that plague the *sui generis* regimes in the first place.

54. See *infra* text accompanying notes 80-101.

ating the uncertain market prospects for a new variety—the “green tulip”—is not put forward with a view to illustrating the vagaries of existing plant variety protection laws as such.⁵⁵ On the contrary, for the purpose of this exercise, I have deliberately assimilated all the hybrid regimes built around modified patent and copyright principles—both past and present—to two simple historical models or prototypes, a strategy that ignores the many nuanced features that actually distinguish such regimes in practice.

One basic model provides small grain-sized innovations with relatively weak protection against copying under a low eligibility requirement of “originality.”⁵⁶ Known historically as a “copyright approach,” I prefer to call this type of regime “a copyright-like approach” to distinguish it from full copyright protection (such as France gives to industrial designs)⁵⁷ and to emphasize that it would not typically protect against unauthorized follow-on creations in the way that the mature copyright paradigm clearly prohibits unauthorized derivative works.⁵⁸ The other basic model, which I call the “patent-like approach,”⁵⁹ would typically condition eligibility on

55. For these laws, see generally UPOV I, *supra* note 23; UPOV II, *supra* note 23; Funder, *supra* note 23; Margaret Llewelyn, *Patenting or Plant Variety Protection?*, in WORLD TRADE FORUM 1999, *supra* note 23.

56. Selected real-world examples might include the following: some early design protection laws, such as the United Kingdom’s 1842 Ornamental Designs Act, *see* SHERMAN & BENTLY, *supra* note 14, at 64-67, the German Law Concerning Copyright in Designs and Models of January, 11, 1876, as originally enacted, *see* SUTHERSANEN, *supra* note 16, at 173, the French 1806 Design Law, *see id.* at 135-36, the United Kingdom’s 1843 Utility Designs Act (soon repealed), *see* SHERMAN & BENTLY, *supra* note 14, at 64, 67, the first plant variety protection laws under UPOV I, *see supra* note 23, the laws protecting integrated circuit designs (semiconductor chip protection), *see* 17 U.S.C. §§ 901-914 (1994), the United Kingdom’s Unregistered Design Right, Part III, Copyright, Designs and Patents Act of 1988, §§ 213-263, *see* SUTHERSANEN, *supra* note 16, at 303-17 (summarizing this law); *id.* at 628-38 (providing extracts covering both functional and nonfunctional designs), the United States’ Vessel Hull Design Protection Act of 1998 (which covers one class of functional designs), *see* 17 U.S.C.A. §§ 1301-32 (West 2000), the so-called Nordic Catalogue Rule, i.e., the first *sui generis* laws to protect noncopyrightable collections of facts or data, *see, e.g.*, Reichman, *Legal Hybrids*, *supra* note 7, at 2492-93. Many of these laws would require more originality than mere independent creation alone.

57. *See, e.g.*, SUTHERSANEN, *supra* note 16, at 136-38; *supra* note 42. The term “copyright approach” often refers to the unsuccessful movement to incorporate industrial designs into the Berne Convention, which was defeated in 1948, *see* Reichman, *Designs Before 1976*, *supra* note 40, at 1153-67, although it could also ambiguously indicate *sui generis* regimes that protect against copying only. Hence, I shall use “copyright-like” to indicate the latter category only.

58. *See, e.g.*, 17 U.S.C.A. § 106(2) (West 2000); Berne Convention, *supra* note 19, art. 12. *But see* Geller, *supra* note 50, at 59-70 (arguing for a more nuanced use of remedies to encourage follow-on creations under copyright law).

59. The term “patent-like approach” is used to distinguish it from laws applying full patent protection (“patent approach”) to industrial designs, such as still occurs only under United States law. *See* 35 U.S.C.A. §§ 171-73 (West 2000). Most other countries have *sui generis* regimes based on modified patent (and/or modified copyright) principles, and these are evoked by the term “patent-like.” *See, e.g.*, 2 LADAS, *supra* note 14, at 837-40; SUTHERSANEN, *supra* note 16, at

some form of novelty that was higher than an "originality" standard though lower than the nonobviousness standard of the mature patent paradigm. It would confer a so-called absolute right that, at least in principle, would prohibit the making of unauthorized, follow-on innovations even in the absence of slavish imitation as such.⁶⁰

In the real world of hybrid intellectual property rights, matters quickly become more complicated. For example, courts hostile to specific legal monopolies or generally concerned about weakening competition may, by interpretation, elevate any nominal threshold of eligibility to functional equivalents of nonobviousness that only legislatures can correct.⁶¹ Courts may likewise narrow the scope of protection by declining to see "equivalent" creations in practice, so as to curb a regime that was nominally supposed to protect against unauthorized follow-on creations.⁶² Conversely, courts hostile to free-riding or imbued with natural property right views may, by a process of interpretation, lower a nominally stiff eligibility requirement or impede follow-on imitations in the name of "copying"

13-15. The United States now protects one category of designs (boat hull designs) under a *sui generis* law. See 17 U.S.C.A. § 1301 (West 2000). In the literature, the term "patent approach" can often signify what is unambiguously designated as the "patent-like approach" in this Article.

60. See, e.g., 2 LADAS, *supra* note 14, at 837-40. Selected examples might include: the United Kingdom's Registered Designs Act of 1949, as last amended by the Copyright, Designs and Patents Act 1988, see SUTHERSANEN, *supra* note 16, at 276-303 (providing a summary); *id.* at 593-604 (providing extracts), Benelux and Nordic Design Laws, see SUTHERSANEN, *supra* note 16, at 123-34 (providing a summary of Benelux design law); *id.* at 506-14 (providing extracts from Uniform Benelux Designs Law); *id.* at 323-28 (providing a summary of Nordic design laws); see also *supra* notes 14-16, 34-35, 40, the E.C. Directive on Designs, *supra* note 34, which should oblige all European Union member countries to adopt a patent-like *sui generis* approach, all existing utility model laws, see Janis, *supra* note 12, at 151-52 & n.5 (usefully subdividing these into at least three subcategories), and the most recent round of plant variety protection laws under UPOV II, see *supra* note 23.

61. German courts did this to the German design law, which started out as a copyright-like model. See SUTHERSANEN, *supra* note 16, at 556-57 (reproducing extracts of the Law Concerning Copyright in Industrial Designs (Designs Law) of Jan. 11, 1876, as last amended by the Law of Dec. 18, 1986, art. 1(2)); *id.* at 197 (noting that courts rejected softer "subjective novelty" standard that academics preferred in favor of "objective relative novelty"). The standard of "originality" under the United Kingdom's Registered Designs Act of 1949, see SUTHERSANEN, *supra* note 16, at 276-303 (providing a summary); *id.* at 593-604 (providing extracts), was in fact tantamount to a nonobviousness standard until legislative adjustment in 1988. See, e.g., Reichman, *Design Protection*, *supra* note 33, at 148-49 n.948.

62. See, e.g., Reichman, *Design Protection*, *supra* note 33, at 133-134 & n.853. Even United States courts applying design patent law are usually expected to see a zero range of equivalents, despite nominal application of the full nonobviousness standard. See, e.g., *id.* at 53 (suggesting that the range of equivalents may vary in practice with the functionality or decorativeness of the design in question).

even when the statute provides no formal basis for that result.⁶³ Moreover, in crafting any given hybrid exclusive right, legislatures may deliberately blur the admixture of ingredients so that one cannot confidently classify it as either a “copyright-like” or a “patent-like” regime⁶⁴ (and it may empirically turn out to be more like one or the other at different periods of time).⁶⁵

Nonetheless, for purposes of the “green tulip” exercise, we shall keep matters simple by assuming perfect judicial compliance with our perfectly crafted prototypical models. We shall also relax the threshold of eligibility to the point where it usually ceases to impinge on the analysis, that is, by assuming that all the small-scale innovations in question would normally meet any requirements of “originality or novelty” that might apply.⁶⁶

If either of these prototypes appeared likely to produce socially positive responses to our hypothetical investment dilemmas in the abstract, we could profitably descend into an examination of the more nuanced structural details that distinguish one hybrid

63. See, e.g., *id.* at 134 & nn.855-57 (noting bias toward protection of big firms in such cases).

64. Recent examples might include: the United Kingdom’s Unregistered Design Right, Part III, Copyright, Designs and Patents Act 1988, see SUTHERSANEN, *supra* note 16, at 303-17 (summarizing this law), which protects both functional and nonfunctional designs against copying, and is subject to a user’s compulsory license after five years, E.C. Directive on Databases, *supra* note 24, which relaxes the eligibility requirements to mere “investment” and yet protects against unauthorized follow-on databases in perpetuity, see, e.g., Reichman & Samuelson, *supra* note 24, at 164 (deeming this a “monstrous caricature” of an intellectual property law). Efforts to attain more patent-like protection for plant varieties led to the adoption of UPOV II, see *supra* note 23, but the end result remains too weak for some and too strong for others. See, e.g., Reichman, *Legal Hybrids*, *supra* note 7, at 2469-72 (noting strengthened protection of derived varieties, but also cumulative protection with plant patents and optional farmers’ rights exception); Margaret Llewelyn, *The Relationship Between Plant Breeders Rights and Patents for Biotechnological Inventions* (1996) (on file with author).

65. The German Designs Law, see *supra* note 61, which is nominally a copyright-like model, has a relatively high threshold of eligibility and will protect against unauthorized follow-on designs; however, independent creation remains a defense, see, e.g., SUTHERSANEN, *supra* note 16, at 193-201. The French Design Law of 1909 (as recodified in 1992) though nominally patent-like, contains odd copyright-like features, and industrial designers may routinely fall back on French copyright law. See, e.g., *id.* at 136-38. The Italian Legislative Provisions on Industrial Patents, Royal Decree No. 1411 of August 25, 1940, arts. 1, 5-13, see *id.* at 575-77 (reproducing these provisions), which adopts a patent-like model, gave only three years of protection (extended to fifteen years in 1977) and has relatively soft standards of eligibility. See, e.g., *id.* at 219-23; Reichman, *Designs Before 1976*, *supra* note 40, at 1213-23.

66. In the real world, this assumption would skew the assessment of social costs because a higher threshold of eligibility, by limiting the availability of a hybrid exclusive right, would to some extent offset the costs accruing from a greater power to exclude. I ignore this factor here in order to focus attention on the calculus of social costs as affected by a few constant variables pertaining to follow-on innovation and no others. For the same reason, I ignore variants of the novelty standard or stiff examination requirements that may also reduce the social costs (and/or impede the social value) of any given hybrid regime.

regime from another. In reality, because the exercises set out below will show why neither of these historical prototypes yields socially justifiable results in the abstract, we need not further encourage the quest for some unattainably perfect admixture of patent and copyright principles by closely scrutinizing specific hybrid regimes in these pages.

The chief advantage of this method is that, by simplifying the standard components from which the hybrid regimes are crafted, we shall clarify the most important recurring problems they collectively fail to solve. Three caveats, however, should be kept in mind. First, because important structural nuances do actually differentiate one copyright-like regime or one patent-like regime from another, were we to inquire more deeply, we should find that these nuances would significantly affect the calculus of social costs and benefits in actual practice. Second, even if the only option available to legislators were a choice between a bad copyright-like regime and a bad patent-like regime, the calculus of social costs and benefits would differ significantly in the two cases, and different countries might logically exercise their limited options differently.⁶⁷ In the real world of *sui generis* plant variety protection laws, for example, where a copyright-like and a patent-like model have co-existed since 1991, there are good reasons why developing countries in general might prefer the former and developed countries the latter, even if both models produced undesirable results in the end and either might backfire on single firms operating within either group of countries under the right set of circumstances.⁶⁸ Third, we shall also close our eyes to the ways in which the existence and character of any given *sui generis* regime affects the willingness of courts and legislatures to expand or contract the domestic patent and copyright laws in order to accommodate borderline subject matter that may have nowhere else to go. Although this issue seriously affects the overall calculus of social costs,⁶⁹ it would take us too far afield here.⁷⁰

67. See, e.g., *supra* note 33 (acknowledging my preference for a copyright-like approach to design protection in 1989 over a patent-like approach)

68. See *supra* note 23 and accompanying text; see also MASKUS, *supra* note 47, at 224; JAYASHAREE WATAL, INTELLECTUAL PROPERTY RIGHTS IN THE WORLD TRADE ORGANIZATION: THE WAY FORWARD FOR DEVELOPING COUNTRIES, ch. 3 (forthcoming 2000).

69. Cf. Reichman, *Design Protection*, *supra* note 33, at 123-26 ("Cyclical Nature of the Design Phenomenon in all Legal Environments").

70. If the green tulip exercises persuade us to seek a better model law or different operating principles, we would expect it automatically to reduce the tensions with patent and copyright

However important all these matters are in the real-world operations of specific hybrid regimes, we ignore them here and concentrate instead only on the two prototypical approaches mentioned above. By applying these abstract regulatory models drawn from all the hybrid regimes of exclusive property rights to a hypothetical but characteristic problem of follow-on innovation, we can obtain a generic picture of the social costs and benefits more or less attributable to all the relevant approaches in this particular respect. By thus isolating a common set of problems and solutions, and by identifying a common set of errors or flawed results as well, the "green tulip" exercise reveals a common basis for reforms that might put an end to the current tendency to multiply ad hoc, technology-specific mixtures of modified patent and copyright principles.

A. Stating the Problem

The hypothetical problem concerns three firms of established plant breeders who regularly grow and sell flowers and who, from time to time, introduce novel varieties bred from their own stocks. One of the firms, Breeder A, develops a green tulip for the first time ever. However, this firm gains little commercial success from its innovative variety because the consuming public does not appreciate green tulips enough to buy them.

Shortly thereafter, Breeder B develops a red, white, and green tulip by combining Breeder A's green tulip variety with stocks of his own. This new variety of tulip scores a commercial success in the relevant market segment, largely because Italian-Americans love it. Subsequently, other breeders (collectively designated "Breeder C") cash in on B's success by using A's and B's varieties to produce an array of tulips in new color combinations built around a green foundation.

Tulip Breeder A	Tulip Breeder B	Other Breeders (C)
Breeds a green tulip for the first time ever, but there is no consumer market	Breeds a green, white, & red tulip, using A's technology; he gains commercial success	Other breeders cash in on this success and extend the technology to new color combinations

laws by providing a workable alternative at acceptable social costs. See *infra* text accompanying notes 187-88.

The purpose of this hypothetical "green tulip" problem is to clarify the ways in which existing intellectual property regimes that deal with small grain-sized innovation articulate the relations between innovators and second comers. The core questions bear on the extent to which different regimes enable the first comer, Breeder A, to appropriate more or less of the fruits of his or her initial investment by participating in the gains from other breeders' follow-on applications of the technical know-how initially generated.

To address these question, I must rely on certain basic assumptions that underlie the rest of the exercise. First and foremost, we assume that the green tulip variety represents a small grain-sized innovation, based on cumulative and sequential know-how, that falls below the prevalent standard of nonobviousness applicable under relevant domestic patent laws (i.e., *it is subpatentable by definition*).⁷¹ On this assumption, no plant patent is available, even if Breeder A operated in a country that recognized plant patents, and even if a green tulip variety might otherwise constitute patentable subject matter in that country.⁷² We also assume that trade secret law will not affect the outcome because the technical know-how, once embodied in the product, is available to the world. Moreover, there is no actual secret, because any breeder examining the tulip will understand how to produce it from available exem-

71. Cf. 35 U.S.C.A. § 103 (West 2000); TRIPS Agreement, *supra* note 6, art. 27; HANNS ULLRICH, STANDARDS OF PATENTABILITY FOR EUROPEAN INVENTIONS: SHOULD AN INVENTIVE STEP ADVANCE THE ART? (1977).

72. See, e.g., Funder, *supra* note 23, at 551-56 (distinguishing plant patents from plant variety rights; noting impact of biotech methods on manipulation of sub-cellular components, which undermined "whole organism" approach of breeders' rights and gave rise to patents on "genes, proteins, biological processes as well as whole organisms, including varieties;" and also noting that extension of UPOV II to cover "essentially derived varieties" was maybe a move away from the protection of innovation towards "a limited invention"). In reality, the standard of nonobviousness as applied to cutting-edge technologies that fit imperfectly into the patent and copyright paradigms has tended to decline nearly everywhere, so that a plant patent might actually be available for such a variety in any country that enacts a plant patent law. How to maintain a line of demarcation between plant patents and plant breeders' rights is thus another problem raised but not addressed by the analysis below. See, e.g., Pioneer Hi-Bred Int'l Inc. v. J.E.M. AG Supply, 200 F.3d 1374 (2000) (patentable subject matter under 35 U.S.C. § 101 includes seeds and plants grown from seed notwithstanding availability of plant variety protection under 7 U.S.C. § 2321); see also Funder, *supra* note 23, at 558-66 (discussing the difficulties in distinguishing patentable and unpatentable elements under art. 53(b) of the European Patent Convention).

plars,⁷³ and we will further assume that no copyright or unfair competition laws impede other breeders from doing just that.⁷⁴

Still another simplifying assumption is that, even though the valuable know-how embodied in the "look" or design of the green tulip results from a relatively small variation on technical solutions already known to most other plant breeders who compete in the relevant markets, this small variation on the prior art nonetheless meets the threshold eligibility requirements of either of our prototypical regimes.⁷⁵ Finally, we assume that all the firms appearing in our exercises operate within a single territorial unit, and only territorial law applies.⁷⁶

B. Standard Legal Solutions

If one reviews all the hybrid intellectual property regimes that deviate from the mature patent and copyright paradigms for likely solutions to the problem of Breeder A's vulnerability to other breeders' appropriating the fruits of his or her investment, one can identify three basic fact patterns that recur with sufficient regularity as to merit particular attention. Two of these patterns flow from the basic regulatory models identified above, namely, a relatively weak, copyright-like form of protection and a relatively strong, patent-like approach. A third fact pattern arises when no baseline entitlements govern a specific type of innovation, and the fate of relevant investments depends entirely on free-market conditions. This last situation is the raw or primordial state of affairs that we shall look at first.

1. The Raw State of Affairs

In the raw state of affairs, there is no exclusive property right in subpatentable technical innovation of any kind, and free

73. See, e.g., Funder, *supra* note 23, at 555 (discussing the logic of plant variety rights whereby "[g]iven that [a] plant can replicate itself, the means by which others can make industrial use of the plant is disclosed by the plant itself").

74. Cf., e.g., MACQUEEN, *supra* note 17, at 39-52 (criticizing extension of United Kingdom copyright law to protect industrial designs prior to 1988). But see, e.g., KAMPERMAN SANDERS, *supra* note 17, at 121-211 (advocating broad protection in unfair competition law).

75. See, e.g., Funder, *supra* note 23, at 554-55; *supra* note 23 and accompanying text.

76. In reality, the TRIPS Agreement mandates some *sui generis* protection of plant varieties, without specifying that a UPOV regime must be adopted. See TRIPS Agreement, *supra* note 6, art. 27(3)(b); Carlos M. Correa, *Harmonization of Intellectual Property Rights in Latin America: Is There Still Room for Differentiation?* 29 N.Y.U. J. INT'L L. & POL. 109, 129-30 (1996/1997); Reichman, *Free Riders*, *supra* note 47, at 36-39.

competition prevails.⁷⁷ Under these conditions, Breeder A has no legal right to protect the fruits of his or her investment (the green tulip being neither patentable nor copyrightable). Therefore, Breeders B and C may free-ride on the former's investment to their heart's content, especially in view of our operating assumption that Breeder A will benefit from virtually no actual or legal secrecy.⁷⁸ In the worst case scenario (which interests us here for purposes of sharper comparisons), the free-riding second comers take the market altogether. Unless Breeder A's other commercial activities prove more successful, he may go out of business or avoid further investment in risky R&D, despite the objective commercial success of a follow-on innovation built around his own earlier innovation.

In such a case, both the relevant technical community and the public at large will have lost Breeder A's potential for developing further innovative contributions. This negative result follows in part because Breeder A failed to share in the fruits of at least one major commercial success and also because he received no direct or indirect contributions to his sunk costs of R&D from either Breeders B or C.⁷⁹

2. Hybrid Copyright-Like Solutions Apply

If we assume that Breeder A's legislature had responded to complaints about the raw state of affairs by enacting a *sui generis* regime loosely derived from the copyright model,⁸⁰ then Breeder A could presumably invoke a weak intellectual property right against the "copying" of his innovative product. This model, however, typically denies protected innovators any claim to rights in follow-on innovation, such as Breeder B's red, white, and green tulip,⁸¹ espe-

77. Cf. *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989) (boat hull design slavishly imitated); *Sears, Roebuck & Co. v. Stiffel Co.*, 376 U.S. 225 (1964); *Compco Corp. v. Day-Brite Lighting*, 376 U.S. 234 (1964) (lamp designs slavishly imitated).

78. See *supra* note 23 and accompanying text. This is usually a safe assumption in most design-related activities. In the field of computer software, however, where it is also a prevailing assumption, there has been more debate about the relative difficulties of reverse-engineering by proper means. See, e.g., Samuelson et al., *Manifesto*, *supra* note 3, at 2333-42.

79. Of course, the raw state of affairs actually prevailed before UPOV I, see *supra* note 23. For an interesting example drawn from the software milieu, consider that the producers of the VisiCalc spreadsheet, which was immensely improved by Lotus 1-2-3, benefitted from no intellectual property rights and eventually went out of business. See NATIONAL RESEARCH COUNCIL, INTELLECTUAL PROPERTY ISSUES IN SOFTWARE 64 (1991).

80. See *supra* notes 56-58 and accompanying text.

81. See, e.g., UPOV I, *supra* note 23. Also relevant are the laws protecting integrated circuit designs, see 17 U.S.C. §§ 901-914 (1994), and the Nordic Catalogue Rule, see Reichman,

cially when the second comer has invested funds, time, and effort of his own to obtain it (a result that is not inconsistent with principles of unfair competition law that some countries apply).⁸²

From an economic perspective, the copyright-like approach to small-scale innovation either removes some of the uncertainties of invoking an unfair competition law (in those countries that allow actions against servile imitation as such) or it allows a roughly equivalent action to be maintained against "copying" in countries that do not recognize misappropriation as a business tort without dirty tricks.⁸³ Because such a pure misappropriation action clashes with the principle of free competition, copyright-like regimes tend to attenuate or mask this conflict by prohibiting wholesale duplication without necessarily conferring any rights against value-adding producers who invest considerable time, money, and skill of their own.

In principle, courts operating under a copyright-like regime remain free to hold in specific cases involving follow-on productions that a second comer appropriated too much of the first comer's creative or technical contribution, and such decisions can help to establish a jurisprudence deterring market-destructive conduct over time. In practice, however, no two judges see alike in these matters, and courts may balk at engrafting a pseudo-derivative work right onto a copyright-like regime that lacks this legislative specification and that operates with a low threshold of eligibility.⁸⁴ Moreover,

Legal Hybrids, *supra* note 7, at 2492-93. However, some copyright-like regimes will protect follow-on creations, *see, e.g.*, German Design Law of 1876, SUTHERSANEN, *supra* note 16, at 556-57, and each *sui generis* regime would have to be carefully evaluated in the light of case law before pronouncing on this question in the real world. Conversely, even under copyright law, some courts may coordinate the extent of follow-on creativity in derivative works with a nuanced mix of remedies. *See* Geller, *supra* note 50, at 59-70.

82. *See, e.g.*, KAMPERMAN SANDERS, *supra* note 17, at 24-66 (discussing possible actions sounding in slavish imitation or parasitical copying in France, Benelux, Germany, and—in principle—Switzerland, but noting general unavailability of similar actions in United Kingdom and Italian unfair competition laws).

83. *Compare, e.g.*, RESTATEMENT (THIRD) OF UNFAIR COMPETITION, *supra* note 17, §§ 1, 38 & cmt. b (no misappropriation of trade values, especially information or other intangible assets, without dirty tricks, lest exclusivity "impede access to valuable information and restrain information"), with 17 U.S.C. §§ 1301-32 (1994 & Supp. IV 1998) (providing copyright-like protection against copied boat hull designs).

84. The stronger the protection given against follow-on creations under a copyright-like regime, the more blurred becomes the line of demarcation between that *sui generis* regime and full copyright protection. Courts may decide that such distinctions are not worth making and open up copyright law (or patent law, as the case may be) to borderline small-scale creations. *See* SUTHERSANEN, *supra* note 16, at 114-17 (discussing *Screenoprints, Ltd. v. Citroen Nederland BV*, Benelux Court of Justice, May 22, 1987, which opened Benelux copyright laws to industrial designs and thereby undermined patent-like Benelux *sui generis* design laws).

experience with industrial design laws demonstrates that if the legislature does specify a derivative work right (even by inference), courts may elevate the eligibility requirements by interpretation so as to narrow the anticompetitive effects of such regulatory action after the fact.⁸⁵

To the extent that our prototypical regime either removes or glosses over uncertainties in the ways such laws have actually been applied in the past, the creator of the green tulip in our hypothetical problem, Breeder A, would wind up with a very weak claim for relief under a copyright-like regime. So long as neither Breeder B nor Breeders C slavishly imitated Breeder A's variety, but acted instead as value adding (or, in some dubious usage, "transformative") users, they would not likely infringe under this prototypical regime, which does not protect against the making of derivative varieties as such.

In a worst case scenario, the absence of any right to control follow-on innovation or value-adding uses of his technical contribution thus means that Breeder A's position in the end is not appreciably better than it was under the raw state of affairs. Nevertheless, Breeder B's (and C's) success comes with something of a free ride on Breeder A's initial investment. Carrying forward our worst-case scenario, Breeder A may again be forced to exit from the market because he failed to share in the commercial success of posterior applications of his green tulip technology, or he may lack sufficient capital to invest in further risky ventures that depend on R&D.

3. Hybrid Patent-Like Solutions Apply

If we assume that Breeder A's legislature had instead responded to the vulnerability of small-scale innovators by adopting a *sui generis* regime loosely identified with the patent model, then that regime would, at least in theory, protect qualifying innovators against value-adding users who appropriated all or a substantial part of the first comer's technical know-how. Here, in other words, Breeder A could invoke a stronger right that would allow him to interdict the production of unauthorized follow-on (or "derivative") varieties notwithstanding the small grain-size of his own initial innovation (which was assumed to be less than nonobvious by hypothesis).

85. See *supra* note 61 (discussing case of German design law).

Real world examples of such a regime might include many present-day design protection laws, all utility model laws that cover small (i.e., less than nonobvious) inventions,⁸⁶ and even the latest model law of plant breeders' rights that was negotiated at the international level in 1991.⁸⁷ In actual practice, however, courts applying either utility model laws or design protection laws at the infringement stage tend to narrow the range of protected equivalents when the alleged infringer adds substantial value of his or her own to the underlying innovation.⁸⁸ Because utility models (and some protected appearance designs) are not subject to any qualifying examination of the prior art, and because in that case even the eligibility requirements are tested retroactively at the infringement stage,⁸⁹ any serious judicial resistance to the recognition of an appreciable range of equivalents tends to reduce their impact to a codified form of unfair competition.⁹⁰

For purposes of the green tulip problem, however, let us ignore these real-world infirmities of the patent-like model and suppose that our prototypical regime possesses the structural capacity to overcome them. Breeder A will then find himself in a good position. He can interdict unauthorized follow-on varieties, such as the red, white, and green tulip, so long as they are deemed impermissibly "derivative" of, or "equivalent" to, Breeder A's underlying technical contribution. In this situation, Breeders B and C will need a license from Breeder A in order to develop follow-on products that apply Breeder A's earlier technology.

Note, however, that this legal constraint also puts Breeders B and C at the mercy of Breeder A's willingness to deal and pricing strategy; and it requires them to negotiate with Breeder A about

86. See, e.g., SUTHERSANEN, *supra* note 16, at 383-97 (stressing that most utility model laws provide "a no examination registration system with protection . . . available quickly and cheaply"); Janis, *supra* note 12, at 151-54 (describing present and proposed utility model laws); *supra* note 60 (referring to design laws of Benelux and Nordic countries and the E.C. Directive on Designs).

87. See, e.g., UPOV II, *supra* note 23, art. 14 (protecting "essentially derived varieties"); Funder, *supra* note 23, at 556 (noting uncertainties of scope, especially possible extension of subject-matter protection "beyond the physical phenotype to include some of the genetic means by which a variety was produced," and generally questioning extension of "patent claims to plants as innovations").

88. See, e.g., 2 LADAS, *supra* note 14, at 955; Reichman, *Electronic Information Tools*, *supra* note 35, at 453-54.

89. See *supra* note 86.

90. Similar criticism is often leveled at nominally strong laws protecting ornamental (i.e., appearance) designs of useful articles, many of which still require an examination of the prior art, only to provide protection against slavish imitation in the end owing to judicial hostility. See, e.g., Reichman, *Design Protection*, *supra* note 33, at 133-36 (discussing the failings of the modified patent approach).

these matters at a time when Breeders B and C have the greatest uncertainty about the risks they face in extending A's innovation to untried commercial applications.⁹¹ Neither Breeders B nor C may yet know whether, and at what cost, they can successfully apply Breeder A's technical know-how to follow-on products. Above all, they may be unable to estimate the potential for commercial success of the proposed follow-on product without either committing to the license *ex ante*, and thereby disclosing their own market potential to A (who may then simply copy it),⁹² or risking an infringement action *ex post* by proceeding without authorization.⁹³

In the real world of hybrid intellectual property rights, legislatures concerned about the costs of this approach may sometimes decide to relax the first comer's grip on follow-on applications by denying the innovator a right to prevent independent creation.⁹⁴ In such a case, structural adjustments to the law may attempt to distinguish between unauthorized follow-on productions that result from "copying" the protected innovation and those that result from permissible forms of "independent creation." Because this requires a clear winner and a clear loser in every case, courts may find any such structural nuances hard to apply without leaving a trail of inconsistent decisions, and they represent a move toward a more copyright-like approach.⁹⁵ For present purposes, however, let us

91. Cf. Ian Ayres & Paul Klemperer, *Limiting Patentees' Market Power Without Reducing Innovation Incentives: The Perverse Benefits of Uncertainty and Non-injunctive Remedies*, 97 MICH. L. REV. 985 (1999).

92. The problem of bargaining over secret information is often called Arrow's Disclosure Paradox after Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY 609, 615 (National Bureau of Econ. Research ed., 1962), discussed in Merges, *supra* note 9, at 2657-58. One should note that it acquires different nuances in the subpatentable environment from that of large-scale innovation, and it is only the former context that I address.

93. On the *ex ante* versus *ex post* bargaining over the right to follow-on products in the context of patentable inventions, see generally Scotchmer, *supra* note 2; Scotchmer, *supra* note 1. I take no position in this Article on proposals to reform the patent law as such; however, Scotchmer's work has enhanced my understanding of the subpatentable environment.

94. An example is the German Design Law of 1876, see *supra* note 61, which denies an absolute right, despite a comparatively high threshold of eligibility, and allows independent creation as a defense. See, e.g., SUTHERSANEN, *supra* note 16, at 201. Another example might be the United Kingdom's short-lived utility model law of 1843. See SHERMAN & BENTLY, *supra* note 14, at 123; *supra* note 56.

95. See, e.g., Vessel Hull Design Protection Act, Pub. L. No. 105-304, 112 Stat. 2905 (1998) (codified at 17 U.S.C. §§ 1301-32) (1994 & Supp. IV 1998)) (protecting functional designs, using a mix of copyright-like and patent-like components, and allowing independent creation as a defense); SUTHERSANEN, *supra* note 16, at 303-17 (summarizing the United Kingdom's Unregistered Design Right of 1988, which also protects functional designs, using a mix of copyright-like and patent-like components, and allows independent creation as a defense). However, the pre-

make a clarifying best-case assumption to the effect that the relevant legislature had properly crafted some workable "independent creation" exception onto its hybrid, patent-like regime.

Even if this softer, more pro-competitive variant of the patent-like model were applied to the green tulip problem, however, it would not significantly improve the plight of Breeders B and C as described above. They must either acquire Breeder A's permission (which could be denied), or independently repeat the costs of critical development efforts that Breeder A had already sustained, and then proceed to incur the further investment costs associated with applying that technology to follow-on products. But Breeder A's own product—the green tulip—did not score a commercial success; and Breeder B's costs and risks in developing the red, white, and green tulip could seem disproportionately high absent some way to test the market for that project.⁹⁶ Furthermore, Breeder A could launch an harassing infringement action questioning Breeder B's good faith, and the latter might find it difficult to prove independent generation of the entire innovation. Under these circumstances, Breeders B and C are unlikely to develop follow-on products absent a license from Breeder A, in which case they face the same constraints on licensing that were set out above.

In the worst-case scenario, Breeders B and C may logically decide to avoid using the green tulip technology altogether, rather than run the risks of dealing with Breeder A up front. All that Breeders B and C bring to the table is an untried business idea that Breeder A might be perfectly capable of implementing without any present or future technical inputs from them. Faced with the decision to risk dealing with Breeder A or investing their resources in developing "novel" varieties of their own that would themselves qualify for relatively strong protection under a patent-like regime,⁹⁷ they will more logically incline to make the latter decision.

Here the small grain-size of the innovation makes spending the time and money to negotiate a contractual transaction less attractive than would be the case with respect to a large grain-sized

cise scope of protection under the United Kingdom's unregistered design right awaits further judicial clarification. *See, e.g.*, CHRISTINE FELLNER, INDUSTRIAL DESIGN LAW 202-07 (1995).

96. The follow-on innovator's need to test the market may differ from the initial innovator's need to test the market. When the latter's problem is solved by means of a novelty grace period, *see, e.g.*, E.C. Directive on Designs, *supra* note 34, art. 6 (2), that solution—as applied to small-scale innovation—may further deter the would-be follow-on innovator because it gives the first comer more time to commit (while holding a potential club against follow-on innovators who move too fast).

97. *Cf.* Funder, *supra* note 23, at 556-58 (noting apparently stricter standards of eligibility under UPOV II).

invention covered by the domestic patent laws.⁹⁸ In the latter case, if applying Inventor A's result to B's business plan proved technically difficult, Inventor A might rather cross-license than invest in efforts to solve the same problem and develop the follow-on product without potential Inventor B.⁹⁹

With regard to subpatentable innovation, however, follow-on applications usually lie within the reach of routine engineers, especially if there is a market opening and some basis (if only a hunch) for predicting a chance of commercial success. Once a green tulip exists that bears Breeder A's technical know-how literally on its face, a red, white, and green tulip becomes feasible, and there is mainly a first mover advantage to be obtained. Given that the market for routine innovation tends to be fast-moving and dynamic, in other words, because it encounters fewer technical obstacles, Breeders B's and C's ideas for follow-on applications are most valuable as potential business strategies (not as technical outcomes); but they also remain freighted with uncertainty as to whether consumers will in fact respond favorably to their initiatives.¹⁰⁰

The end result is that Breeders B and C will tend to avoid follow-on applications of the green tulip technology, especially if they require ex ante disclosures to Breeder A, lest Breeder A free-ride on their initiatives. Unless Breeders A and B agree to prospect and develop a red, white, and green tulip together (collectively or under a licensing arrangement), despite the risk of premature divulgation of B's business idea and/or of his own technical know-how, the public may not obtain such a tulip, the cycle of cumulative innovation may be broken, and—carrying matters to an extreme—both Breeders A and B may fail for lack of other commercial successes.

98. Disregarding the enforceability of a nondisclosure agreement in such a case (in the unlikely event Breeder A would sign one), the transaction costs of suing on an agreement covering such small-scale innovation look prohibitively high. Even if the second comer waits until he has developed the follow-on technology at the risk of wasting his time if no deal ensues, it could be hard to parry a claim that Breeder A was already directly or indirectly at work on similar technology, despite the nondisclosure agreement, just because the technical distance between the two may appear insignificant.

99. See, e.g., Merges, *supra* note 26, at 1305-06, 1352-54. In the case of "blocking" patents, the availability of compulsory licenses (under international law, at least) may further facilitate that outcome by giving Inventors B and C legal incentives (in addition to market incentives) to develop their technology with or without an ex ante transaction. See, e.g., TRIPS Agreement, *supra* note 6, art. 31; Robert Merges, *Intellectual Property Rights and the Bargaining Breakdown: The Case of Blocking Patents*, 62 U. TENN. L. REV. 75 (1994); see also Joseph Straus, *The Principle of "Dependence" Under Patents and Plant Breeders' Rights*, 26 INDUS. PROP. 433, 434-38 (1987).

100. On this element of uncertainty, see generally Ayers & Klemperer, *supra* note 91.

Moreover—and this point is easily overlooked—all other participants in the relevant breeder community are then deprived of the potential technical benefits that might have flowed from an influx of new investments attendant upon these undertakings or any commercial success to which they might have led. In other words, if Breeders B and C decline to invest in follow-on applications because of Breeder A's powerful hybrid intellectual property right, the rest of the relevant technical community may also suffer directly or indirectly from the loss of a potential stream of new investments that was thus prematurely aborted.¹⁰¹

C. Critique of the Standard Solutions

All of the standard regulatory solutions currently applied to stimulate investment in fields of small-scale innovation that suffer from a lack of actual or legal secrecy produce unsatisfactory results. Moreover, as single countries shift back and forth over time between relatively weak and relatively strong hybrid regimes of exclusive property rights, in response to pressures from different interest groups clamoring about the risks of under- or overprotection,¹⁰² policymakers seldom stop to reconsider the validity of the basic historical models that still control legislative action in this regard.¹⁰³

Meanwhile, the often poor and always costly economic performance of these hybrid exclusive property rights profoundly destabilizes the worldwide intellectual property system in ways that

101. For more insights into this problem in the context of patentable inventions and copyrightable works (i.e., large-scale innovations), see generally Geller, *supra* note 50; Lemley, *supra* note 2; Merges & Nelson, *supra* note 26. This Article takes no position on structural reforms of patent or copyright laws as such.

102. For details in regard to industrial designs, see Reichman, *Design Protection*, *supra* note 33, at 123-26 (identifying pendular swings in United States law); *id.* at 126-35 (regarding similar cycles in foreign law).

103. Even when they did pause to look around, there was no alternative *sui generis* liability regime articulated as such before the publication of the "Legal Hybrids," Reichman, *Legal Hybrids*, *supra* note 7, and "Manifesto," Samuelson, et al., *Manifesto*, *supra* note 3, articles in 1994. There was, however, at least one relevant alternative theory that had emerged, see Kingston, *Thesis Chapters*, *supra* note 3, at 59-86 (building on work of Kronz and finding that innovation warrants are needed to encourage investment at above average risk). Moreover, the drafters of the Semiconductor Chip Protection Act of 1984, see *supra* note 21, had stumbled into a softer, more copyright-like approach; the drafters of the United Kingdom's Unregistered Design Right of 1988, *supra* note 56, had extended that latter approach to both functional and aesthetic designs generally and had engrafted a liability component as well, in the form of a compulsory license that kicks in after five years, see, e.g., MACQUEEN, *supra* note 17, at 69-80; and there had been at least one real-world liability regime applicable to technical drawings and construction projects in Italy since the 1930s, see *infra* note 149.

one can only hint at here. The fact that no consensus solution for resolving the root problem of industrial designs has emerged despite two hundred years of fruitless experimentation with different admixtures of patent and copyright principles exposes both copyright and trademark laws to severe anticompetitive strains, as courts and legislators periodically open them up to investors in three-dimensional product configurations seeking shelter from slavish imitations.¹⁰⁴ The tensions surrounding the legal protection of both computer programs and biogenetic innovations have been worsened by the lack of any credible *sui generis* alternative to correct the manifest defects of stretching the patent and copyright paradigms beyond their traditional boundaries.¹⁰⁵ Most recently, the prospects of underprotecting computer-generated databases in copyright law have induced the European Commission to promulgate yet another ill-conceived (and potentially perpetual) hybrid regime, which threatens to undermine technical progress everywhere by elevating the social costs of generating and accessing scientific and technical information.¹⁰⁶

As matters stand today, when a proliferation of hybrid *sui generis* regimes increasingly provide patent-like protection in exchange for less than 'nonobvious inventions'¹⁰⁷ (and the European Commission plans to mandate utility model protection throughout the Union),¹⁰⁸ the green tulip exercise helps to pinpoint the precise nature of a flawed economic outcome. The exercise showed that any patent-like solution will give Breeder A a relatively strong legal monopoly for undertaking an investment in routine innovation motivated by his own business judgement about market opportunities. The public will obtain no significant creative contribution in return for rewarding Breeder A with monopoly rights (and monopoly rents) to *undertake an investment that Breeder A's own business judgement inclined him to make anyway*, at least in the absence of intolerable free-riding by second comers.¹⁰⁹ While the public stands to

104. See, e.g., SUTHERSANEN, *supra* note 16, at 109-12 (regarding the overlap with copyright law); *id.* at 402-24 (regarding overlap with unfair competition laws).

105. See generally Kingston, *Unlocking*, *supra* note 3.

106. See Reichman & Samuelson, *supra* note 24, at 84-95, 117-24; Reichman & Uhler, *supra* note 24, at 802-20; see generally E.C. Directive on Databases, *supra* note 24.

107. See generally Reichman, *Legal Hybrids*, *supra* note 7, at 2453-2504.

108. See Draft E.C. Directive on Utility Models, *supra* note 35; Janis, *supra* note 12, at 153-55.

109. For the willingness of patent and copyright laws to accept a similar result in return for a relatively large grain-sized social pay-off (which result is not under attack here), see *supra* notes 50-53 and accompanying text.

benefit from the green tulip innovation (despite the tepid initial consumer response), solving the free-rider problem by misbundling exclusive property rights imposes burdensome transaction costs on the relevant technical community, frustrates entrepreneurial initiative, and saddles the public with the social costs of misdirected, top-down incentives that deny equally capable second comers access to inputs from the public domain.¹¹⁰

More generally, any system that protects subpatentable applications of technical know-how to industry by means of hybrid exclusive property rights tends to reward individual creators and innovators *as if they had delivered big grain-sized innovations*. In reality, the individual's qualitative creative contribution over and above investment will typically be small (despite its potentially great commercial value) precisely because the relevant community of plant breeders had already cumulatively shared and sequentially developed the basic know-how of which the individual contribution partakes.

None of the hybrid solutions takes account of the community's role in the process of developing subpatentable innovations through minuscule additions to the common stock of technical know-how accruing from their combined efforts to work out the prevailing technical trajectories.¹¹¹ Indeed, because they remain pervasively structured around hybrid admixtures of patent and copyright principles that recognize only the contributions of individual creators, these solutions may actually undermine the community's own interests by artificially restricting access to the public-domain inputs on which it collectively depends.¹¹²

Phrased differently, the platform of hybrid intellectual property rights as currently structured lacks any systematic capacity to promote the needs—especially the investment needs—of the relevant technical community as a whole. Motivated by self-interest, the members of this community would presumably continue to invest in future applications of their shared technical know-how, with a concomitant expansion and deepening of that same know-how, but for the free-rider problem, the attendant risk of market failure, and the divisive influence of the hybrid exclusive rights elicited to cure

110. Cf. Heller & Eisenberg, *supra* note 12; Janis, *supra* note 12, at 200-15 (same conclusions for utility model laws); Benkler, *supra* note 11, at 434-35 (predicting chronic under-utilization of information). For a trenchant theoretical critique of misusing legal monopolies to such ends, see generally Boyle, *supra* note 38.

111. See *supra* notes 1-3, 26-29 and accompanying text; see generally David & Foray, *supra* note 53.

112. Cf. BOYLE, *supra* note 11, at 155-57; Benkler, *supra* note 11, at 434-35.

it. Yet, by rewarding individuals with strong exclusive property rights for routine applications of the community's technical know-how to industry, the system tends to make that shared know-how artificially scarce.¹¹³ It thereby exerts a divisive influence on the relevant community and elevates the transaction costs of working through its common, underlying technical trajectory.

On the positive side of the ledger, of course, hybrid exclusive property rights also attenuate the social costs of market failure by encouraging investment in routine innovation that might not otherwise take place in the raw state of affairs. This explains the tenacity of utility model laws, which—despite their obvious economic contradictions—continue to be adopted and are about to become mandatory in all European Union member countries and their affiliates.¹¹⁴

In this connection, one should not underestimate either the social costs of ignoring the cumulative market failure that results when investors in “incremental innovation bearing know-how on its face” suffer from a chronic shortage of natural lead time under present-day conditions¹¹⁵ or the countervailing social costs that arise from trying to close this gap in the classical intellectual property system by expedient admixtures of patent and copyright principles that tend to over- or underprotect their selected beneficiaries. The goal is not to achieve a perfect balance in some abstract sense; it is to preserve the conditions under which perfect competition remains at least a theoretical possibility.¹¹⁶

From this angle, we must not lose sight of the fact that competition often drives entrepreneurs to invest in small-scale innovation despite palpable risks of market failure, and the history of design protection law teaches some instructive lessons in this regard.¹¹⁷ Whenever there exists even the possibility that a desir-

113. Cf. Cohen, *supra* note 11.

114. See *supra* note 65 and accompanying text. However, Mark Janis shows that even these laws are far less stable than is commonly supposed. See Janis, *supra* note 12, at 199-218.

115. Cf. Gordon, *supra* note 2; Samuelson et al., *Manifesto*, *supra* note 3, at 2330-42; Reichman, *Computer Programs*, *supra* note 29, at 656 (stressing extent to which investors in innovative computer programs remain vulnerable to “trivial acquisitions of equivalence”).

116. For the capital importance of this point (and other reasons why perfect monopolies are undesirable), see Boyle, *supra* note 38; see also PETER DRAHOS, *A PHILOSOPHY OF INTELLECTUAL PROPERTY* 120-25 (1996).

117. See, e.g., DRAHOS, *supra* note 116, at 121, 124 (stressing information asymmetries that intellectual property rights introduce); Nimetz, *supra* note 52. The Italian design industries have thrived in a relatively pro-competitive environment, rather like that of Silicon Valley; the lack of multiple layers of legal protection available to their French counterparts has not demonstrably held them back.

able level of competition might be attained with or without the imposition of hybrid exclusive property rights, the burden of demonstrating lower social costs overall should logically fall on those advocating the imposition of top-down measures that will certainly diminish access to the public domain and that may do more harm in the end than would occur if innovators had to take their chances in a "malcompetitive" business environment.¹¹⁸

The questions that remain unasked so long as the hybrid regimes of exclusive property rights proliferate like kudzu are whether solving market failures by such means is truly worth the candle when all the social costs and benefits are added up, and whether a different, less individualistic approach might not yield greater benefits at lower social costs. In the green tulip problem, for example, we saw that Breeder B's commercial success depended on his meshing the cumulative state of the community's technical know-how with his own technical skills and business judgment. Yet, the legal tools provided by the current intellectual property system tend to focus solely on Breeder B's initiative, while ignoring the community's own evolving contribution, even though the success of Breeder B's initiative does not really depend on his ability to see beyond the prior art or to prospect a significant technical breakthrough.¹¹⁹

As we have seen, strong contractual rights linked to strong exclusive property rights in small grain-sized innovations under these conditions tend to foster new, unnecessary, and perhaps hidden transaction costs, as well as added barriers to entry. Second comers must negotiate permissions and pay monopoly prices, even when contemplating risky follow-on innovations of their own, and even when such follow-on innovation actually vindicates or validates the first comer's own investment. This need to bargain around an exclusive property right (which often tends to produce positive outcomes with respect to relatively larger-scale, patented inventions)¹²⁰ perversely complicates routine business transactions and adds new risks of disclosure (or the costs of defending infringement actions) to the innate risks of predicting market success.

118. See, e.g., Ralph S. Brown, *Design Protection: An Overview*, 34 UCLA L. REV. 1341 (1987); Robert C. Denicola, *Freedom to Copy*, 108 YALE L.J. 1661 (1999); Robert W. Kastenmeier & Michael J. Remington, *The Semiconductor Chip Protection Act of 1984: A Swamp or Firm Ground?*, 70 MINN. L. REV. 417, 438-42 (1985) (endorsing views of David Lange); see also KAMPERMAN SANDERS, *supra* note 17, at 121-212 (elaborating new action of "inalign competition"); Gordon, *supra* note 2, at 222-66 (proposing tort of "malcompetitive copying").

119. Cf. Kitch, *supra* note 52 (discussing the prospect theory of patent protection).

120. See generally Merges, *supra* note 26.

Moreover, these same contracts will tend to clutter the technical community's otherwise unrestricted field of use and add to all the participants' costs of doing business with no commensurate gain to the public.¹²¹

Under these conditions, lost opportunity costs will soar, and decreased competition may force those second comers still willing to purchase the latest additions to the community's know-how to pay premium prices. Ironically, these impediments to follow-on innovation, which flow from misguided efforts to cure market failure, occur even though the bulk of the protected innovation derives from the public domain to which the would-be second comers' own prior investments had already contributed and even though any member of the relevant technical community could, in principle, achieve the same small-scale technical advance at the right time, if and when a comparable business judgement prompted the initiative.

As tiny bundles of small-scale innovation covered by strong intellectual property rights and strong contractual rights thus multiply, they divide up the community's shared know-how into ever smaller parcels that are withdrawn from the public domain. This produces a tangled web of property and quasi-property rights that in itself constitutes a barrier to entry and a disincentive to further small-scale innovation.¹²² The transaction costs of reconstituting contractually the chain of sequential know-how previously available from the public domain become correspondingly high and increasingly prohibitive. In the long-run, these hybrid intellectual property regimes, and the suffocating weed-like thicket of exclusive rights they breed, threaten to throttle more innovation than they could ever possibly stimulate.

III. SOLVING THE GREEN TULIP PROBLEM

To arrest the pendular swings between states of chronic under- and overprotection that investors in small-scale innovation increasingly face under present-day conditions, the domestic systems

121. As the results of subpatentable innovation increasingly translate into genomic data or other information tools, there is a further risk that first comers may magnify their bargaining power by combining intellectual property rights with standard form electronic contracts and technical protection measures in ways that further disrupt or discourage routine follow-on innovation. See J.H. Reichman & Jonathan A. Franklin, *Privately Legislated Intellectual Property Rights: Reconciling Freedom of Contract with Public Good Uses of Information*, 147 U. PENN. L. REV. 875 (1999); *infra* text accompanying note 187.

122. See generally Benkler, *supra* note 11; Heller, *Tragedy of the Anticommons*, *supra* note 12; Heller & Eisenberg, *supra* note 12; Reichman & Franklin, *supra* note 121.

of innovation require a new type of intellectual property regime that would break with the tradition of multiplying hybrid exclusive rights to address technology-specific instances of potential market failure. Such a regime must avoid measures that impoverish the public domain or that otherwise foster legal barriers to entry, while empowering entrepreneurs to prevent free riders from rapidly appropriating the fruits of their investment in small-scale innovations without contributing to the costs of development. It must also serve as a buffer or transitional zone between the mature patent and copyright paradigms, on the one hand, and unbridled competition on the other.¹²³

A general purpose innovation law meeting these criteria can be built on modified liability principles. This law should entitle investors to compensatory contributions to defray their R&D costs from second comers who borrowed the resulting subpatentable know-how for industrial applications of their own during a specified period of time. It would not, however, endow small-scale innovators with an exclusive right to control such uses.¹²⁴ In what follows, I summarize the tenets of this proposal and show how, by combining the right set of legal incentives to invest with the benefits of free competition, a liability regime could resolve the dilemmas facing the green tulip protagonists and all similarly situated investors.

A. Mechanics of a Compensatory Liability Regime

To achieve the desired goals, the proposed compensatory liability scheme requires a basic set of default rules that obligate second comers to pay equitable compensation for borrowed improvements over a relatively short period of time.¹²⁵ With reference to the green tulip hypothetical, for example, we saw that Breeder A's main complaint in the raw state of affairs was that Breeders B

123. Rather than increasing competition with few social costs, as nineteenth century legal and economic tenets predict, a legislative decision to expose today's most valuable forms of subpatentable innovation to unbridled competition (with no intermediate zone to buffer the shocks) would simply reinforce the cyclical movement between chronic states of under- and overprotection that characterize the present impasse. History demonstrates that the end result of this process may be less, not more, competition than would have occurred under an appropriate buffer regime. See, e.g., Reichman, *Design Protection*, *supra* note 33, at 123-35.

124. See generally Reichman, *Legal Hybrids*, *supra* note 7, at 2529-57.

125. See generally Reichman, *Legal Hybrids*, *supra* note 7, at 2533-39; cf. Ian Ayres, *Preliminary Thoughts on Optimal Tailoring of Contractual Rules*, 3 S. CAL. INTERDISC. L.J. 1, 4 (1993) (distinguishing "off-the-rack" default rules applicable to all parties from "tailored" default rules that are more contextual); Jason Scott Johnston, *Strategic Bargaining and the Economic Theory of Contract Default Rules*, 100 YALE L.J. 615 (1990).

and C could swiftly turn the subpatentable know-how resulting from A's investment into commercially successful follow-on products without contributing to the underlying costs of development that had yielded a green tulip in the first instance.

Breeder A could not properly lodge any patent or copyright claims because the green tulip did not qualify either as a nonobvious invention or as an original work of authorship. Yet, because his innovative know-how was embodied in the green tulip variety itself, which any other breeder could purchase and reproduce, Breeders B and C could move immediately into adjacent market segments without incurring any significant R&D costs of their own, as regards the underlying innovation. If the green tulip had scored a commercial success on its own merits, moreover, Breeders B and C might have captured that initial market segment as well, because they had lower costs and Breeder A would have obtained no natural lead time from actual secrecy or from the operations of trade secret law.

1. A Functional Substitute for Natural Lead Time

My proposal responds to this dilemma by providing a functional substitute for the chronic lack of natural lead time that afflicts today's investors in small-scale innovation. It entitles Breeder A to a specified period of artificial lead time during which the use of his innovative "green tulip" know-how requires compensation but not authorization.¹²⁶ If, during the specified period of time, Breeder B borrows Breeder A's innovative know-how, he must compensate Breeder A according to the formulas discussed below,¹²⁷ which are aimed at roughly measuring the value added to B's products by the features or components borrowed from Breeder A.¹²⁸ In this way, Breeder B would contribute directly to Breeder A's costs of R&D.

Let me emphasize that while Breeder A would thus obtain some legal entitlement, his entitlement operates as a true liability rule and not as an exclusive property right. The whole idea is to recreate some functional equivalent of the natural lead time that once made competition with respect to most forms of subpatentable

126. See Reichman, *Legal Hybrids*, *supra* note 7, at 2547-48.

127. The formulas used in the case of head-to-head competition on the initial market segment may differ from those used in cases of follow-on applications. See *infra* text accompanying notes 148-53, 166-71.

128. This rough benchmark is refined in practice by other considerations that greatly reduce both the level of compensation and transaction costs. See *infra* text accompanying notes 151-53, 169-71.

innovation feasible.¹²⁹ Thus, Breeder A does not have the right to hold out: Breeder B need not seek Breeder A's permission to make use of his green tulip variety, and Breeder A cannot deter second comers from borrowing that small-scale innovation so long as they remain willing to pay and the term of protection has not expired.

Follow-on innovation is further encouraged because the operative period of legal liability must be short. If Breeder B remains patient and waits until that period expires, he may use the green tulip variety without payment as an input from the public domain. Moreover, an impatient Breeder B who possesses sufficient technical know-how of his own can independently generate a green tulip, and need not compensate Breeder A at all.¹³⁰ In that case, there would be no free-riding. On the contrary, Breeder B's application of that technique to the red, white, and green variety will then further contribute to the relevant technical community's aggregate investment in R&D, which presumably enabled both Breeders A and B to innovate in the first place.

Breeders C are treated like Breeder B. They remain free to extend Breeder B's improved red, white, and green variety to other follow-on products without seeking authorization. Any rapid borrowing of the claimed technical know-how pertinent to either the green tulip or the red, white, and green variant during the terms in which Breeder A's and Breeder B's rights are protected will, however, require Breeders C to compensate both Breeders A and B according to the applicable formulas.¹³¹ If some of the breeders who fall in category C wait until Breeder A's rights have expired, they need to compensate only Breeder B, and then only for the added value to their products of his specific contribution.¹³² If all of the Breeders in category C waited long enough, or if they all demonstrably generated follow-on varieties by dint of their own investments in the relevant R&D without borrowing protected know-how, none of them would become liable to Breeders A or B.

The element of free-riding is attenuated in all these cases by the obligation to contribute to the underlying costs of R&D either directly by compensation or indirectly by regenerating the know-

129. See *supra* note 29 and accompanying text.

130. Here, of course, Breeder B benefits from the knowledge that Breeder A has solved the problem, but not from a taking of the technical solution itself.

131. See generally Reichman, *Legal Hybrids*, *supra* note 7, at 2529-44.

132. A less aggressive, more workable formula would apply in practice. See *infra* text accompanying notes 151-53.

how in question with likely improvements.¹³³ If neither Breeders B nor C borrow the small grain-sized innovation within the applicable period of liability and accordingly pay nothing at all to Breeder A, the latter will nonetheless have benefited from a period of artificial lead time in which to emulate Breeder B's red, white, and green variety and Breeder C's other successful follow-on products. Whether Breeder A generates these competing products by virtue of his own independent efforts, without compensating Breeders B or C, or opts instead quickly to borrow back their improvements with a payment of compensatory liability depends entirely on A's business judgement and technical capacity. However, his decisions cannot be skewed by B's or C's refusal to authorize competing small-scale innovations for lengthy periods of time under top-down exclusive property rights.

This system does retain some residual element of free-riding: at the expiration of a relatively short period of protection, each breeder's small-scale innovation will lapse into the public domain where all competitors remain free to use it without incurring compensatory liability. But this is precisely what free competition entails. In a healthy competitive environment, any second comer can access any subpatentable innovation for purposes of reverse-engineering the underlying process of manufacture by proper means, because the time and money required to accomplish the task of reverse-engineering overcomes the inherent risk of market failure.¹³⁴ It is only in an environment in which incremental innovation bears the entrepreneur's know-how on (or near) its face—where the costs of reverse engineering are negligible—that a problem arises. The proposed compensatory liability regime would solve it by imposing functionally equivalent costs: it channels funds that might otherwise have been spent on the second comer's task of reverse-engineering directly to defray the first mover's real costs of R&D.

If Breeders B and C choose to wait out the period of protection and thus make no compensatory liability payments, they stand in the shoes of "healthy" competitors, whose only barriers to entry are natural lead time and the state of the art available to all other

133. *Cf., e.g.,* *Brooktree Corp. v. Advanced Micro Devices, Inc.*, 977 F.2d 1555, 1569-70 (Fed. Cir. 1992) (adopting Raskind's position); Leo J. Raskind, *Reverse Engineering, Unfair Competition, and Fair Use*, 70 MINN. L. REV. 385, 402 (1985) (stressing the importance of improvements in establishing defense of lawful reverse engineering under Semiconductor Chip Protection Act of 1984, 17 U.S.C. § 906(a)(2) (1994)).

134. *Cf. Friedman et al., supra note 12*, at 67-70 (stressing benefits of shared know-how and likelihood of improvements).

routine engineers. Their autonomous investments in small-scale innovations that improve existing products (and strengthen their own competitive prospects) will then redound to the benefit of the entire technical community. This follows because, even though on this scenario they owe nothing to Breeder A, all other breeders who share the common stock of technical know-how (including Breeder A) are themselves free to borrow back any new incremental additions to subpatentable know-how that patient Breeders B and C may contribute in return for equitable contributions to their respective costs of R&D within the applicable period of liability.

2. Implementing a Liability Rule

I have elsewhere outlined a legal framework for implementing a general purpose innovation law along these lines, which Professor Samuelson and I have referred to as a “modified liability regime”, and which I now prefer to call a “compensatory liability regime.”¹³⁵ Our previous work suggested that such a regime would benefit from the constitutive elements set out below.

a. Main Features

Some of these elements are fairly straight forward. First, there must be a subject matter denomination of the protectable bundles of commercially valuable information, which we call an “industrial compilation.” Second, the regime will need a flexible standard of novelty more or less equivalent to that which courts apply in trade secrecy cases. A third element is the period of artificial lead time available to entrepreneurs claiming protection for any given “industrial compilation.”¹³⁶ A fourth element is a national registration system for making these claims known, whose operations might be facilitated by online technologies and by reliance on designated agents for specific industries in many cases. Mediatory dispute and arbitral settlement arrangements should also be built into the system.¹³⁷

In principle, a compensatory liability regime would thus be crafted in general terms, so as to accommodate small-scale innovation from all sectors of industry. One advantage of this approach,

135. Reichman, *Legal Hybrids*, *supra* note 7, at 2544-57 (“In Search of a Community-Wide Know-How Transaction”); Samuelson et al., *Manifesto*, *supra* note 3, at 2426-29.

136. See Samuelson et al., *Manifesto*, *supra* note 3, at 2326-30.

137. For details, see Reichman, *Legal Hybrids*, *supra* note 7, at 2544-48, 2551, 2555-57.

however, is that, over time, codified variants might be tailored to meet the needs of particular industries; e.g., a database protection law could benefit from certain structural nuances not needed for the bulk of subpatentable innovation without gutting the liability regime as a whole.¹³⁸ In this and other respects, the compensatory liability regime constitutes a "third intellectual property paradigm," whose basic principles can be systematically developed without undermining the operations of the patent and copyright laws within their traditional spheres of influence.¹³⁹

Other constituent elements of a compensatory liability regime would include criteria for infringement; remedies that distinguished between slavish copying and the provision of a menu of users' liabilities for follow-on innovation;¹⁴⁰ a list of defenses, including misuse; and rules governing the relations between this regime and other laws, particularly unfair competition law.¹⁴¹ Some of these issues are amplified below.

b. Infringement

An implementing statute should set out the applicable standard of infringement, and I have elsewhere endorsed a "substantial identity" criterion for this purpose.¹⁴² However, the underlying purpose of a liability rule that requires payment of equitable contributions to the costs of development from which the later innovator benefited should affect the way courts apply that standard. They must ensure that virtually any use of a qualitatively or quantitatively significant component within the specified term of protection would "infringe" in the sense of triggering that duty to pay.¹⁴³

138. Cf. Reichman & Samuelson, *supra* note 24, at 145-51 ("A Modified Liability Approach").

139. See, e.g., Reichman, *Charting the Collapse*, *supra* note 6, at 511, fig. 4 ("The Legal Hybrids as a Potentially Autonomous Entity"); *id.* at 517-20 ("Need for a New Intellectual Property Paradigm"); see generally, Symposium, *Toward a Third Intellectual Property Paradigm*, 94 COLUM. L. REV. 2307, 2559-2677 (1994).

140. See *infra* text accompanying notes 151-57, 169-71.

141. Also desirable is the encouragement of sectoral agents (or quasi-collection societies) on an industry by industry basis, which would facilitate collective action on licensing, dispute resolution, and ancillary rule-making procedures of interest to particular sectors. See Reichman, *Legal Hybrids*, *supra* note 7, at 2544-57; cf. Merges, *supra* note 26.

142. See Samuelson et al., *Manifesto*, *supra* note 3, at 2399-2401 (favoring substantial identity test for software and industrial compilations); see also Raskind, *supra* note 133, at 398-402 (tracing legislative history of this test in context of § 906 of the Semiconductor Chip Protection Act of 1984).

143. Cf. E.C. Directive on Databases, *supra* note 24, art. 8 (adopting a "quantitative or qualitative" component test, but within the ambit of an ultra high-protectionist exclusive property right).

Some difficulties in proving "use" might arise, especially in countries where opportunities for discovery are sparse, although the small scale of the innovation at issue and the brevity of the liability period should help to alleviate such problems. At bottom, once a complainant satisfies a "substantial identity" test with respect to the accused technology or component thereof, the burden should shift to the defendant. The latter can then try to rebut this presumption of use by producing evidence of independent development.¹⁴⁴ Codifying the relative burdens of proof in such cases is a good idea,¹⁴⁵ for which there are analogies in existing law.¹⁴⁶ Moreover, a mandatory requirement of arbitration (and even mediation) for disputes should help to avoid litigation in most cases by focusing the parties' attention on their options under the menu of users' liabilities.¹⁴⁷

*c. Compensatory Remedies*¹⁴⁸

In theory, a liability rule could objectively require every user to contribute a proportionate share of the R&D costs from which he benefited or to pay the value that the borrowed fruits of this investment added to his or her own products. This rule seems consistent with the goal of defraying a first comer's costs, and it would also integrate some unjust enrichment principles into the framework.¹⁴⁹ Such a rule could, however, be difficult to implement.¹⁵⁰ A better alternative would be to require the parties to negotiate,

144. *Cf.* Semiconductor Chip Protection Act of 1984, Pub. L. No. 98-620, 98 Stat. 3347 (codified as amended at 17 U.S.C. §§ 901-914 (1994)).

145. I am indebted to Professor Rochelle C. Dreyfuss for this idea.

146. *See, e.g.*, TRIPS Agreement, *supra* note 6, art. 34 (shifting burden of proof for products obtained by patented processes).

147. *See* Reichman, *Legal Hybrids*, *supra* note 7, at 2548-51, 2555-57.

148. These remedies apply to follow-on innovations, which is the primary concern here. For remedies applicable to slavish imitation, including injunctions, see *infra* text accompanying notes 169-71.

149. *Cf.* Gordon, *supra* note 2. This is the calculus used in the sole existing liability regime that operates somewhat along the lines of the compensatory liability regime discussed here. *Cf.* Italian Copyright Law, No. 633 of April 22, 1941, as amended through 29, 1989, Art. 99. *See* PAUL EDWARD GELLER, *INTERNATIONAL COPYRIGHT LAW AND PRACTICE, ITALY*, § 8[2][d][vi] (1999) (use of engineering projects that constitute original solutions of technical problems); Reichman, *Legal Hybrids*, *supra* note 7, at 2477-78.

150. Procedural complications are easy to conjure up if plaintiffs had to identify many users and join them all in a single lawsuit, or if defendants held liable in one case sought contributions from others. In my proposal, however, all the industry players now know they must pay for use; the relevant scale of innovation is small; the period is short; and experience shows that an industry-approved standard-form contract administered by an authorized agent works well and would tend to reduce overall transaction costs. *Cf.* Merges, *supra* note 26, at 1311 (discussing Harry Fox licenses under 17 U.S.C. § 115 (1994)).

bearing in mind that arbitration would become mandatory if negotiations failed and that, because the parties operate under a liability rule, plaintiff could not simply refuse to license.¹⁵¹ This system could be made more manageable and efficient by reducing the duty to compensate to a set of royalties levied on a fixed percentage of the offender's gross revenues that varied within a specified range of options.

For example, a three-pronged sliding scale of royalty options could simple-mindedly distinguish between small, medium, and large contributions to added value that entailed corresponding duties to pay.¹⁵² A slightly more refined system might recognize a fourth category applicable to an "extra large" quantum of technical know-how added (without authorization) to the follow-on product in question. Whether these percentage options should fall into a modest range (say, 3%-6%-9%) or into a range with more bite (say 5%-10%-15% or higher) is an issue best deferred to more empirical investigation.¹⁵³

A number of factors combine to make this approach (or, in default, an arbitrator's decision to the same effect) more socially desirable than a nominally more serious assessment of the real value added in single cases. First, by insisting that Breeder B share in the costs of Breeder A's R&D, we are intentionally structuring a de facto legal partnership arrangement embracing all the members of the relevant technical community. One goal is to ensure that this partnership arrangement outperforms the zig-zag, hit-or-miss decisions that result when courts use unfair competition laws to fill gaps in the domestic intellectual property systems. As work on patent pools demonstrates,¹⁵⁴ a sliding scale of percentage royalties expresses this venture partnership principle (and the sharing of scientific and technical information that it implies).

A second reason for preferring a relatively uncomplicated scale of percentage royalties is that, even if we were serious about

151. See *supra* notes 124, 126-30 and accompanying text.

152. Even so, second comers like Breeder B in the green tulip example might want to quarrel with Breeder A about whether the latter was entitled to a relatively "large," "medium," or "small" percentage of Breeder B's revenues from sales of his red, white, and green tulip, given that the valuation of Breeder A's prior technical inputs (into a commercially unsuccessful green tulip) must also take account of the cost of Breeder B's own technical inputs (into a successful red, white, and green tulip) as well as the value of his superior marketing skills. In this scheme, failure to agree on this issue would be taken up by the arbitrator.

153. Paul Geller suggests a possible benchmark based on the fair market license fee that technical information would fetch if it had been kept secret.

154. See Robert P. Merges, *Institutions for Intellectual Property Transactions: The Case of Patent Pools*, in EXPANDING THE BOUNDS OF INTELLECTUAL PROPERTY, *supra* note 12.

quantifying real value added to follow-on innovation, *the single source of greatest value added to any small-scale innovation is always the public domain*. In the green tulip exercise, for example, the bulk of the value resides in the common store of plant breeders' know-how (or in this case, of specific tulip breeding know-how) that Breeders A, B, and C share in common with all the other breeders at work on the existing technical trajectory. Any of these breeders can freely make use of any of the cumulative and sequential innovations that enrich the public domain without owing any dues to anybody.

If, on top of this giant, Breeder A's green tulip technique adds a new and commercially valuable fragment to that common store of knowledge, it is fitting that Breeders B and C contribute a tangential percentage of the revenues resulting from exploitation of that fragment in recognition of Breeder A's real costs of R&D. But given the preponderant weight of the public-domain layer in all small-scale applications of know-how to industry, we do not want the compensatory mechanism to undervalue the technical community's own contribution to every follow-on innovation. From this angle, a sliding scale of relatively modest percentage royalties expresses the concept of floating, *de facto* "partnerships" that arise within the framework of a compensatory liability rule, while respecting the shared ownership of the commons that unites all those engaged in technical and scientific pursuits.¹⁵⁵

The small scale of allowable percentages would also discourage resort to arbitration or appeal of the results of arbitration to the courts. Moreover, because most of the relevant players in the different sectors of industry are likely to alternate as both borrowers and lenders of subpatentable innovation over time, their mutual self interest pushes toward accommodations that both lenders and borrowers can live with at any time.¹⁵⁶

Finally, a preference for a set of modest percentage royalties over other more aggressive valuation methods harmonizes with the principle that the period during which any borrower remains liable for equitable contributions to the costs of R&D should be short in an absolute sense. This follows because the primary purpose of the

155. Such percentages, though sometimes yielding lower returns than what might be gained under exclusive property rights, *see infra* text accompanying notes 182-86, are thus in no sense "suboptimal" from the perspective of either the technical community or that of the public at large. Because the only innovation at issue is small grain-sized and subpatentable by definition, these are the only perspectives that count under the circumstances.

156. *See* Reichman, *Legal Hybrids*, *supra* note 7, at 2535-36; *cf.* William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325 (1989).

proposed default rules is to overcome the chronic shortage of natural lead time under present-day conditions, and not to create legal monopolies or other incentives to invest where none are needed.¹⁵⁷ One should also emphasize that the transaction costs of implementing the proposed set of default rules need not prove onerous or burdensome precisely because only a finite number of industry players are ever involved at any given time, and the system focuses mainly on payments and adjustments between players on given market segments.

d. Defenses

In practice, once a compensatory liability regime was legislatively set in motion, parties opting into the system would normally prefer to strike their own bargains while treating the baseline statutory entitlements as a point of reference for this and other purposes, including litigation. The ex-ante disclosure problem that hinders deal-making between Breeders A and B under present-day conditions, for example, would give way to an environment in which both parties (and all other industry players) knew that Breeders B and C could legally apply Breeder A's green tulip know-how to follow-on products so long as they paid their compensatory dues.

In many ways, this propensity to deal is a major benefit of the proposal. Experience suggests that industry-approved standard-form contracts, perhaps administered by a single authorized agent, may develop, and these would further tend to reduce overall transaction costs.¹⁵⁸ If public, such deals will also furnish data about the industry's own valuations of follow-on innovations, which arbitrators could use in contested cases. Actual experience could eventually lead legislatures to modify the initial statutory entitlements to more accurately reflect these bargained-for results.

Facilitating transactions among competitors also raises the danger of anticompetitive agreements, such as agreements that unduly benefited, say, Breeders A, B, and C at the expense of those who would buy their tulips or who would enter the market as their potential competitors. It seems advisable, therefore, to include in the statute a list of anticompetitive acts that would furnish a de-

157. Conceivably, a statutory set of default rules could establish both a minimum and a maximum period of liability, and allow different industries some flexibility in adopting or adjusting their own liability periods within the statutorily allowed range. Cf. Kingston, *Thesis Chapters*, *supra* note 3, at 1-87.

158. Cf. Merges, *supra* note 26; see *infra* text accompanying notes 187-88.

fense to infringement actions, along with codified standards of misuse that would further clarify the limits of privately negotiated contracts arising under the compensatory liability regime.¹⁵⁹ An accompanying series of safe harbors should likewise provide entrepreneurs with guidance about types of agreements that are considered to promote innovation and competition.¹⁶⁰

e. Relationship to Unfair Competition Laws

Although the proposed compensatory liability regime should obviate the need for other *sui generis* intellectual property rights to protect subpatentable innovation, some doctrines of unfair competition law should retain their vitality. The first is trade secret law: nothing should impede any entrepreneurs capable of keeping all or part of their subpatentable innovations secret from taking their chances under trade secret law. The innovators' lead-time calculus would then vary with the second comers' abilities to reverse engineer the process underlying the relevant products by honest means.¹⁶¹ If such an entrepreneur declined to use trade secret protection and opted into the compensatory liability system, he or she would be wagering that the potential returns accruing from its period of artificial lead time would exceed expected earnings under a variable (and disappearing) period of natural lead time.¹⁶² Of course, few investors will actually enjoy the luxury of such a choice, given that the impetus for this proposal was the chronic shortage of natural lead time that afflicts investments in so many of today's most commercially valuable applications of know-how to industry.

General norms of unfair competition law that, in some countries, prompt courts to take action against "slavish imitation" or "parasitical copying" are a different matter,¹⁶³ and they should lose

159. Cf. H.R. 1858, 106th Cong. § 106 (1999); H.R. REP. No. 106-350, pt. 1 (1999) (proposing database protection law on unfair competition principles and setting out detailed standards for application of a misuse defense).

160. The misuse provision could itself codify a "sword of Damocles" clause, which would intrinsically validate the bulk of contractual transactions while establishing heavier burdens of justification on rights holders who forced competitors into potentially unreasonable terms and conditions. See generally Reichman & Franklin, *supra* note 121, at 929-38 (proposing public-interest unconscionability doctrine that would "validate non-negotiable terms that respect the balance of public and private interests"); see also *id.* at 951-70 ("A Non-Assent Driven Paradigm of Contract Formation for the Digital Age").

161. See, e.g., UNIFORM TRADE SECRETS ACT § 1(4), 14 U.L.A. 438 (1985); RESTATEMENT (THIRD) OF UNFAIR COMPETITION, *supra* note 17, §§ 39-45.

162. See, e.g., John C. Stedman, *Trade Secrets*, 23 OHIO ST. L.J. 4, 21 (1962) (characterizing trade secret rights as a "disappearing right").

163. See KAMPERMAN SANDERS, *supra* note 17, at 24-78; *supra* note 82.

much of their appeal with the enactment of a compensatory liability regime. The notion that unfair competition law constitutes "a third intellectual property paradigm"¹⁶⁴ that can itself alleviate the investment dilemmas attributed to the phenomenon of incremental innovation bearing know-how on its face is historically anachronistic and empirically untenable.

Historically, unfair competition law constitutes an amorphous "urground," or basic set of principles that identify and try to rectify recurring patterns of market-destructive behavior. These very principles led to the codification of patent and copyright laws, but they also led to the epicycles of the hybrid regimes. These regimes are enacted precisely because unfair competition norms provide no firm ground for resolving the tensions between the need for incentives to create and the realities of competition with respect to small-scale innovations.¹⁶⁵

Empirically, unfair competition norms enable courts to adopt temporary measures to alleviate the tensions that arise from gaps in the domestic systems of innovation. Over time, however, when legislatures fail to intervene (or when they choose to intervene inopportunistically), courts applying these amorphous principles of unfair competition law to deep-rooted problems of small-scale innovation tend to become part of the problem rather than agents of any real solution.¹⁶⁶

164. Dennis S. Karjala, *Misappropriation as a Third Intellectual Property Paradigm*, 94 COLUM. L. REV. 2594 (1994); see also KAMPERMAN SANDERS, *supra* note 17, at 113-15.

165. Principles sounding in pure misappropriation doctrines paper over an inherent contradiction between nineteenth century tenets of free competition, which treat product simulation as an unmitigated blessing, and the chronic shortage of natural lead time under late twentieth century competitive conditions, which goad courts into treating product simulation as "parasitical copying." Between these two extremes, neither ethical homilies about "reaping where one has not sown" or the helpful economic literature concerning market failure, see Gordon, *supra* note 2; C. Owen Paepke, *An Economic Interpretation of the Misappropriation Doctrine: Common Law Protection for Investments in Innovation*, 2 HIGH TECH L.J. 55 (1987), supplies a valid and workable solution. See Leo J. Raskind, *The Misappropriation Doctrine as a Competitive Norm of Intellectual Property Law*, 75 MINN. L. REV. 875, 896-905 (1991).

166. At least one heroic effort was made in the Swiss unfair competition law of 1985 to establish a basis for prohibiting slavish imitation of new technologies until the investor had a reasonable chance to recoup his or her investment, but courts have balked at applying these provisions. KAMPERMAN SANDERS, *supra* note 17, at 65; Reichman, *Legal Hybrids*, *supra* note 7, at 2474-76. The belief that murky notions of "unjust enrichment" and restitution theory will solve the deep-rooted problems of small-scale innovation better than the Swiss unfair competition law (codifying a well-meaning and well-thought out proposal of the late Professor Alois Troller) is misguided. But see KAMPERMAN SANDERS, *supra* note 17, at 121-54 (extolling virtues of unjust enrichment theory and "shaping a new action of malign competition"); Gordon, *supra* note 2; Karjala, *supra* note 164. Worse yet, the failure of general principles of unfair competition law to solve these deep-rooted problems makes it easier for special interest lobbies to convert well-grounded fears of market failure into ill-conceived hybrid exclusive property rights that gradu-

Inevitably, judicial decisions about slavish imitation are ad hoc and prompted by the judges' own views about the morality of copying and the importance of free competition. As contradictory, zig-zag decisions pile up, the cyclical tensions between over- and underprotection in unfair competition law itself become a tell-tale sign that the prevailing intellectual property system has once again failed to come to grips with the real problems afflicting investment in small grain-sized applications of know-how to industry.¹⁶⁷ The persistence of these problems, in turn, sets the stage for yet another round of legislative experiments with *sui generis* regimes of exclusive property rights, which are likely to repeat the cycle of under- and overprotection with even greater anti-competitive effects along the way.¹⁶⁸ The compensatory liability regime explored in this Article aims to improve upon the historical failure of unfair competition laws to solve the puzzle of small-scale innovation while avoiding recourse to hybrid exclusive property rights that seldom do better than unfair competition laws and that cumulatively undermine the competitive ethos.

There is, nonetheless, at least one point where the principles of both approaches—unfair competition and compensatory liability—properly converge. Here I refer to the situation in which the second comer rapidly appropriates the innovator's small grain-sized technical contribution in order to compete head to head in the same market segment, without producing any value-adding product. In

ally suffocate competition. The legislative history of the E.C. Directive on Databases is especially instructive in this regard. See Reichman & Samuelson, *supra* note 24, at 80-95.

167. The most recent example of this phenomenon in United States law occurred after 1976, when Congress failed to enact a *sui generis* design law and the federal appellate courts began religiously to protect three-dimensional product configurations as unregistered marks (in perpetuity) under section 43(a) of the Lanham Act. By the 1990s, the cumulative anti-competitive weight of this "most protectionist design law of them all," Reichman, *Design Protection*, *supra* note 33, at 100-23, had induced the same federal appellate courts to reverse direction by overruling these precedents and thus to reestablish the chronic state of underprotection that had previously prevailed, see, e.g., *id.*

168. A recent example is design protection laws for boat hulls, which were enacted by state legislatures, struck down by the Supreme Court, and then reenacted (in even stronger form) by the federal government, see 17 U.S.C. §§ 1301-32 (1994); *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141 (1989). The bankruptcy of these solutions is shown in the fact that the so-called "harmonized" European Community design proposals could allow overlapping protection among nine or more different regimes, viz, unregistered Community design right; registered Community design right; national registered design rights; national copyright protection (France, Benelux); U.K. unregistered design right; Community trade mark protection; national trade mark protection; national unfair competitions laws; and the proposed Community Directive on Utility Models. See SUTHERSANEN, *supra* note 16, at 80; cf. THOMAS S. KUHN, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* (2d ed. 1962) (explaining the role of pre-Copernican epicycles)

terms of the green tulip exercise, this presupposes the situation in which Breeder A's green tulip would actually have scored a commercial success and, by appropriating the relevant technical know-how without incurring the costs of R&D, Breeder B undersells Breeder A and captures the market for green tulips as such (as well as adjacent market segments for follow-on varieties).

This is the one situation in which it makes sense for a compensatory liability regime to undertake a more aggressive calculus of the real value added to Breeder B's product by his rapid duplication of Breeder A's technical contribution. Even here, however, there are other ways of addressing the underlying threat of market failure from a compensatory liability angle that may better respect the common public-domain denominator of both products and that may better preserve the benefits of competition than would a resort to murky principles of unjust enrichment.

A relatively simple solution, for example, is to codify measures that block Breeder B's ability to undertake this act of wholesale or slavish imitation in the same market segment for a fixed period of artificial lead time, after which head-to-head competition may be allowed without any further duty to make compensatory contributions to R&D. On this approach, Breeder B could not just duplicate the green tulip variety for, say, a period of three years,¹⁶⁹ even through his *value-adding* operations remained permissible but subject to compensatory liability payments.¹⁷⁰

The advantages of this solution are its low transaction costs and its neutral impact on follow-on innovation. However, it tends to slow the pace of direct competition and further to skew the benefits of such competition by imposing a relatively long blocking period that lacks any firm empirical foundation. Another, more refined way to address the problem is to reduce the prohibition against wholesale duplication for purposes of head-to-head competition to such a short blocking period that it could withstand any critical economic evaluation, while requiring the second comer to pay compensatory contributions to the costs of R&D for the remainder of a specified period of artificial lead time. For example, if the statute

169. Cf. Japanese Unfair Competition Act, Law No. 47/1993, May 19, 1993, § 2(3) (codifying such a bright-line approach); Reichman, *Legal Hybrids*, *supra* note 7, at 2475. The Italian design law of 1941, *supra* note 149, first recognized a three-year lead-time period of exclusive protection, which gave way to a fifteen-year term in 1977.

170. In other words, there could be an exception to the liability regime that permits an injunction against parasitical copying. This contrasts with the property rules used to protect large-grain-sized creations, which sometimes give way to exceptions. See *supra* notes 179-82 and accompanying text.

blocked Breeder B's wholesale duplication of the green tulip for, say, one year, his delayed entry into that market segment by such means could be followed by a subsequent period of, let us say, two years, in which compensatory liability payments remained obligatory.

Here, moreover, the calculus of those contributions could arguably have still more bite, to reflect the fact that there is no value-adding operation that redounds to the benefit of the technical community as a whole. This can be achieved either by imposing a higher percentage royalty than would ever apply in a case of follow-on innovation, by extending the period of compensatory liability beyond that applicable to follow-on innovation, or by some combination of the two.¹⁷¹ For example, after a one-year blocking period, Breeder B's wholesale duplication of Breeder A's green tulip might bear a higher percentage royalty than that applicable to follow-on innovation, and the duty to pay it might last for a longer term than that governing the case of follow-on applications (say, four years rather than three). In any event, the mere threat of such regulatory sanctions should encourage greater reliance on negotiated transactions to resolve conflicts over acts of slavish imitation, like those envisioned earlier for follow-on innovations.

B. Implications of a Compensatory Liability Regime

I believe that the compensatory liability regime outlined above would solve the "green tulip" problem and make it unnecessary to enact more hybrid exclusive property rights to address the problem of market failure in the technology-specific fashion of the past. However, one could conceivably achieve similar results outside of the intellectual property system as such, for example, by rooting the proposed default rules in contract law or in trade regulation law.¹⁷² What matters is not the specific legal regime chosen to implement the proposal, but rather the end result: namely, a set of off-the-rack liability rules allocating contributions to the costs of R&D for unauthorized uses of subpatentable innovations within a specified period of time.

In this context, a paramount consideration is that any new approach to the puzzle of small-scale innovation should focus on the relevant technical community as a whole and not on the individual innovator, whose inducement to invest hinges on market-

171. Cf. Reichman & Samuelson, *supra* note 24, at 145-47.

172. Cf., e.g., Mackaay, *supra* note 43.

determined variables rather than on the need to overcome exceptionally high technical barriers.¹⁷³ If the risk of market failure that collectively discouraged investment in small-scale innovation were otherwise attenuated, it should suffice to free individual entrepreneurs operating within the relevant technical communities to follow their own business instincts—i.e., to make pro-competitive business decisions about the direction of such investments—without the spur of ad hoc legal monopolies. Conversely, the growth of any given technical community's store of shared know-how in the absence of balkanizing exclusive property rights depends on a continuing and adequate flow of investment across the given field of endeavor, which serves to nourish the innovative activities of single players as their needs arise.

This investment model differs from that applicable to large grain-sized innovation (especially patentable inventions), in which context a major technical advance by any single player tends to elevate the level of competition as a whole¹⁷⁴ and to redirect the flow of investment to new objectives¹⁷⁵ that ought to lie beyond the scope of the prior art.¹⁷⁶ In what follows, I will attempt to clarify the deeper implications of my approach to small-scale innovation in light of the findings derived from the green tulip exercise that were set out above.

173. If the technical community required the solution of an exceptionally hard problem in order to progressively develop the prevailing technical trajectories, that would justify awarding full patent protection to the individual inventor who solved the problem, according to the traditional rationales for a patent system. See, e.g., Kitch, *supra* note 52; Oddi, *supra* note 52. While the difficulty of the problem to be solved could thus, in principle, also justify a reward cast in terms of hybrid exclusive property rights (e.g. a utility model law), I remain skeptical of attempts to parse innovation qualitatively below the line of demarcation with nonobviousness. The point of this and related articles is to show the need for a different kind of approach. Accord Janis, *supra* note 12, at 71-76. So long as what is at issue is minimally novel, but less so than a judge requires of a patentable invention, my regime saves it from free-riding with less than patent remedies. Cf. Dreyfuss, *supra* note 31 (criticizing use of patent remedies to protect business-method software).

174. See Lehmann, *The Theory of Property Rights*, *supra* note 17; Lehmann, *Property and Intellectual Property*, *supra* note 17; see also Merges & Nelson, *supra* note 26.

175. See generally Kitch, *supra* note 52 (stressing importance of recognizing the role of the individual in patent law).

176. In practice, the level of nonobviousness drops lower and lower, and has perhaps touched bottom in recent patents on business methods. See, e.g., *State Street Bank and Trust Co. v. Signature Fin. Group, Inc.*, 149 F.3d 1368 (Fed. Cir. 1998); Merges, *supra* note 31; Dreyfuss, *supra* note 31; cf. James Gleick, *Patently Absurd*, N.Y. TIMES MAG., Mar. 12, 2000, at 44. The establishment of the proposed compensatory liability regime ought quickly to enable courts concerned about free-riders to restore the nonobviousness standard to more traditional levels. See also *infra* text accompanying notes 187-88.

1. Amplifying Investment without Impoverishing the Public Domain

Within the relevant community of small grain-sized innovators at work on a common technical trajectory,¹⁷⁷ all the players can add to the cumulative stock of know-how at different times by dint of their individual business decisions, and each is likely to operate as either a lender or a borrower of incremental innovation at different times or intervals. So long as the stock of shared know-how continues to grow, today's innovator who borrows another's subpatentable technical innovation tomorrow in order to meet and trump the evolving state of competition periodically injects both investment and knowledge into an ongoing community-wide enterprise.¹⁷⁸ The proper goal of a reformed intellectual property system is mainly to inhibit second comers operating within the confines of given technical trajectories from free-riding by obliging them to contribute, directly or indirectly, to the first comers' costs of R&D. These costs have facilitated the second comers' specific follow-on innovation and have also produced a small, incremental addition to the cumulative stock of shared technical know-how, which potentially benefits all firms operating in the same market segment.

However, one should not confuse the second comers' duty to pay compensation under this approach with the compensatory duties that arise when compulsory licenses derogate from the patentee's (or the copyright owner's) legal monopoly under existing intellectual property systems.¹⁷⁹ Compulsory licenses cut back on proprietary control in order to promote certain overriding public interest goals, and the rationale for imposing them remains inherently controversial.¹⁸⁰ In contrast, the "automatic license" that, under my proposal,¹⁸¹ entitles an investor to compensatory liability for follow-on applications by second comers during a specified period of time

177. See *supra* note 1.

178. See Reichman, *Legal Hybrids*, *supra* note 7, at 2544.

179. See TRIPS Agreement, *supra* note 6, art. 31 (universal rules for compulsory licenses on patents); cf. Berne Convention, *supra* note 19, arts. 11*bis*, 14*bis*, Appendix, incorporated by reference into TRIPS Agreement, art. 9 (universal rules for compulsory licenses on certain literary and artistic works).

180. See, e.g., Merges, *supra* note 9 (preferring not to weaken strong property rules, even in the face of high transaction costs). However, Merges later extols the Harry Fox licensing solution, see Merges, *supra* note 26, which to my mind, arose precisely to facilitate bargaining around a liability rule that was subsequently engrafted onto an exclusive property right. To set the record straight once again, this Article takes no position on the desirability (or lack of it) of superimposing liability rules onto the patent and copyright subsystems as such.

181. Cf. Samuelson et al., *Manifesto*, *supra* note 3, at 2414-15.

fully expresses the entitlement in question and does not constitute an artificial limitation upon an exclusive property right.

As I conceive it, the power to *control* follow-on applications of subpatentable innovation (as distinct from an entitlement to equitable compensation for certain uses) is simply not a constituent feature of an intellectual property regime based on modified liability principles. I stress, nonetheless, that the first comer's entitlement to compensation, although weaker than the corresponding exclusive property rights that the patent and copyright paradigms afford, remains an *entitlement*: correctly perceived, it is *an entitlement that takes the form of an automatic license without the power to exclude*.¹⁸²

One should not assume that, despite the comparative weakness of the proposed liability regime, a right holder would necessarily collect a lesser stream of revenue from follow-on applications of protected small-scale innovation than that right holder would obtain if some hybrid exclusive property right covered the same innovation. The very power to exclude unlicensed follow-on applications often pits the first comer's interest in preserving a legal or factual monopoly against the second comer's business instincts regarding potentially profitable applications.¹⁸³ As the "green tulip" problem illustrates, an aggressive second comer's applications—if freely allowed subject to a compensatory liability rule—might yield far more in overall income than the first comer would have obtained if he or she had denied the license or granted it exclusively to a more congenial licensee.¹⁸⁴ This possibility of unexpected returns arises especially when several second comers become interested in multiple follow-on applications that could produce a cumulative "lottery effect" well in excess of what the first comer's own business plan might otherwise have yielded. In the green tulip exercise, for example, a potential lottery payout was portrayed when other breeders (Breeders B and C), having incorporated the first breeder's (Breeder A's) technical innovation into novel tulips with multiple color combinations, became subject to compensatory royalties.¹⁸⁵

182. I am indebted to Professor James Blumstein for this insight.

183. Cf. Reichman & Uhler, *supra* note 24 (discussing the problem of follow-on applications of collections of data under proposed database protection laws).

184. Experience with Harry Fox licenses for mechanical rights in musical works protected under 17 U.S.C. § 115 also demonstrates a potential lottery effect. See Merges, *supra* note 26.

185. Anyone who has followed me this far should now see why Breeder A would not often get the chance to license such uses under either a copyright-like or patent-like hybrid regime, see *supra* text accompanying notes 80-81, as distinct from what happens under the patent and copyright systems. Even where my scenarios tell only part of the story, moreover, and there is a

I do not mean to imply that Breeder A, as a single enterprise, is better off under a liability rule than he or she would have been under an exclusive right. The point of the whole exercise is rather that members of the relevant technical community (and society as a whole) are cumulatively better off under such a regime, while Breeder A is not always or necessarily worse off. At the same time, Breeder B, pushed by his own business instincts and pulled by the compensatory liability regime that protects his own follow-on innovation, retains sufficient incentives to play the game. In other words, once Breeder B opts to make equitable contributions to Breeder A's costs of R&D, he puts himself in a position to collect similar contributions not only from Breeders C, but even from Breeder A, who will often want to exploit the second comer's follow-on innovation quickly in order to keep up with the state of the art or move it forward.¹⁸⁶

The automatic license that characterizes the proposed compensatory liability regime thus eliminates the economically unjustifiable tendency of hybrid regimes of exclusive property rights to allocate ownership of follow-on applications to either the first comer (at the expense of others) or to second comers (at the expense of the initial innovator). Instead, first comers will have to calculate their business strategies knowing that second comers must pay compensation for follow-on applications of the small-scale innovation in which they plan to invest (within a specified period of time) and knowing also that they themselves are entitled to borrow back any such follow-on applications in return for compensatory dues.

At the same time, the second comer's legal ability freely to borrow the first comer's subpatentable innovation within specified periods of time is limited in practice by the need to calculate the impact on profitability of his contributions to the first comer's costs of R&D. Within the specified time limits of the applicable regime, this automatic license should empower all the relevant players at

stampede to license a small-scale innovation held under a *sui generis* right, there are obstacles. Cf. Eisenberg, *supra* note 12 (discussing why transactions in the biotech field may not go forward even when they are in the licensor's interest). On balance, the green tulip exercise as a whole shows why, in the case of small-scale innovations, a lottery effect at acceptable social costs is possible only under a liability rule.

186. In that event, of course, Breeder A must himself contribute to the R&D costs of Breeders B and C by paying compensatory royalties (in lieu of any negotiated royalty that should in fact become a commonplace industry practice). See *supra* text accompanying notes 151-56. By borrowing back the features that Breeders B and C added to their own small-scale innovations, indeed, Breeder A positions himself to compete with them on related or potential market segments without, however, either suffering or causing others to suffer the disadvantages of having to compete against firms that free-ride on the costs of R&D.

work on the shared technical trajectory to move back and forth between the status of lenders and that of borrowers as their business instincts dictate, unimpeded by artificial legal barriers encumbering access to subpatentable innovation.

2. Other Applications

The proposed compensatory liability regime was articulated with the historical problems of the developed industrial world in mind, but it will prove beneficial in other contexts as well. For example, the development of the Internet, digitization, and electronic commerce pose new challenges to small scale innovation. These advances reduce the cost of copying, shrink lead time, and increase the risk that small-scale innovators will take matters into their own hands and create totally unregulated states of artificial lead time through encryption and adhesion contracts. If enforceable, these electronically imposed standard form contracts could degenerate into a basis for asserting private intellectual property rights that override all the public-interest safeguards that had ensured access to the public domain under traditional intellectual property laws.¹⁸⁷ There are serious risks that these standard-form adhesion contracts could thus balkanize the information commons and reintroduce conditions that impede the flow of information.

However, the enactment of a general purpose innovation law on modified liability principles would lessen these risks because it would offer those who innovate in this environment a way to alleviate market failure without impoverishing the public domain. Indeed, the convergence of telecommunications and digital technologies may itself contribute to the operation of the liability regime. Online communication will expedite claim registration, help innovators find the know-how they need, facilitate negotiations, and promote the use of standardized terms. Monitoring use and collecting royalties will likewise prove easier to organize and less costly to implement online.

The compensatory liability regime proposed in this Article would also help to cure some of the major problems afflicting the

187. See Reichman & Franklin, *supra* note 121, at 914-51. See generally Symposium, *Intellectual Property and Contract Law for the Information Age: The Impact of Article 2B of the Uniform Commercial Code on the Future of Information and Commerce, Part I*, 87 CAL. L. REV. 1 (1999); Symposium, *Intellectual Property and Contract Law for the Information Age: The Impact of Article 2B of the Uniform Commercial Code on the Future of Information and Commerce, Part II*, 13 BERKELEY TECH. L.J. 809 (1998).

domestic patent laws in certain developed countries. In particular, the mere existence of such a liability regime would alleviate pressures on the patent systems of countries where the level of nonobviousness has been pushed downwards in order to provide some refuge for commercially valuable, small-scale innovations of importance to local industries. A liability regime for small-scale applications of know-how to industry would allow the intellectual property authorities and the courts to restrict the dominant patent-copyright dichotomy to truly nonobvious inventions and original works of authorship.

Furthermore, the proposed compensatory liability regime would help to solve some pressing needs of the developing countries. In particular, such a regime would provide these countries with new means of stimulating local innovation that would avoid the pitfalls and contradictions of existing design protection laws and utility model laws, and it could prove especially beneficial to efforts to exploit their comparative advantages in certain cultural industries.¹⁸⁸ It could also be modified to enable developing countries suitably to protect the folklore and the traditional know-how of indigenous peoples. As with small-scale innovations, the goal is to reward both first comers (in this case, the relevant indigenous community) and second comers (those who build on the community's cultural heritage), without impeding access to the public domain or the flow of new products. With small amounts of tinkering, a compensatory liability regime could be adapted to encourage use of traditional knowledge without denying the relevant indigenous communities the right to a fair share of the proceeds.

V. CONCLUSION

The objective of the green tulip exercise was to expose the structural flaws underlying prior legal solutions to the problem of small-scale innovation. The analysis showed that property-based rules do not and cannot work in this environment. They return to the first comer too little or too much, they impede follow-on developments, ignore the significant contributions of the public domain, balkanize the knowledge base, and increase transaction costs.

A modified liability rule would resolve these difficulties. Within a designated period of artificial lead time, firms are permitted to borrow one another's subpatentable innovations, but only

188. See Reichman, *Free Riders*, *supra* note 47, at 58-74.

when they contribute to the costs of development. When this occurs, the short-term commercial success of any player in the relevant technical community should either have produced new investment in new innovation or a flow of contributions back to other members of the technical community in exchange for investment in follow-on applications of their own subpatentable know-how during the very recent past. The success of multiple players in the relevant technical universe should correspondingly augment the flow of investment and technical information to that universe as a whole, as players participate in the industry-wide virtual partnership that a liability rule supports.

As a result, the relevant R&D decisions are properly rooted in business judgements about the state of competition, the likelihood of commercial success, and the comparative economies that would result from expenditure in de novo costs of reverse engineering as compared with the payment of equitable compensation to other firms for the use of borrowed, small-scale innovation within relatively short periods of time. Such decisions would not be skewed by top-down legal monopolies that slowed the pace of competition and made the public pay more for technical advances that would have been achieved anyway in the absence of market-destructive appropriations.