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Beyond Incentives: Expanding the Theoretical Framework for Patent Law Analysis

Ofer Tur-Sinai

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BEYOND INCENTIVES: EXPANDING THE THEORETICAL FRAMEWORK FOR PATENT LAW ANALYSIS

*Ofer Tur-Sinai**

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I. INTRODUCTION

Economic considerations dominate the analysis of patent law.¹ The most often used theory for the justification of the patent system is the “incentive to invent” theory, which focuses on the role of patents in providing adequate economic incentives to invest in technological

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1. See generally A. Samuel Oddi, *Un-Unified Economic Theories of Patents—The Not-Quite-Holy Grail*, 71 NOTRE DAME L. REV. 267 (1996) (surveying many of the economic justifications for the patent system offered over the years).

research and development.² Pursuant to this theory, absent exclusive legal rights to use an invention, there would be no incentive to invent, as free riders may imitate the invention and drive down its market price to a level that would not allow the inventor to recoup her research and development costs and make a reasonable profit.³ By providing legal exclusivity, patents overcome this market failure and provide the missing incentive to engage in inventive activity, thus benefiting society. The “incentive to invent” theory has been complemented by other theories, including the “incentive to disclose” theory⁴ and the “prospect” theory,⁵ all of which set out to justify the need for a patent system from an economic point of view.⁶

The economic justifications for the patent system have not gone unchallenged. Over the years, the various purported economic benefits of the patent system have been called into question. A central argument criticizing the “incentive to invent” theory has been that government intervention is not necessary to secure incentives to invent. As the argument goes, inventions are developed, with or without patents, when

2. See generally Kenneth W. Dam, *The Economic Underpinnings of Patent Law*, 23 J. LEGAL STUD. 247, 247 (1994); Wendy J. Gordon, *Intellectual Property*, in THE OXFORD HANDBOOK OF LEGAL STUDIES 617, 632 (Peter Cane & Mark Tushnet eds., 2003), available at <http://www.ssrn.com/abstract=413001>; Yusing Ko, *An Economic Analysis of Biotechnology Patent Protection*, 102 YALE L.J. 777, 791-92 (1992). It should be noted that incentives (to create) play a very significant role in the analysis of copyright law as well. See generally Christina Bohannon, *Copyright Harm, Foreseeability, and Fair Use*, 85 WASH. U. L. REV. 969, 969 (2007); Shyamkrishna Balganesh, *Foreseeability and Copyright Incentives*, 122 HARV. L. REV. 1569, 1577 (2009). In fact, the incentive-based justification for patent law and for copyright law has roots in the U.S. Constitution, which empowers Congress to “promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Rights to their respective Writings and Discoveries”. See U.S. CONST. art. I, § 8, cl. 8.

3. See *infra* note 21 and accompanying text.

4. See *infra* notes 25-27 and accompanying text.

5. See *infra* notes 28-29 and accompanying text.

6. For additional economic theories, see, for example, F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697 (2001) (suggesting justification to the patent system, which is based on the need to provide “incentive to commercialize” the invention); Gordon, *supra* note 2, at 632 (listing various theoretical justifications for the patent system, including the “incentive to design around” theory); Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625 (2002) (formulating the “signaling” theory, which focuses on the role played by patents in spreading information about the firms holding them); Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1 (2005) (presenting the “patent portfolio” theory, pursuant to which the true value of patents does not lie in their individual worth but in their aggregation into a patent portfolio); and Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473 (2005) (suggesting a “transaction costs” theory, which focuses on the function performed by the patent system in reducing transaction costs compared to the available alternative system for protection, i.e., trade secrecy).

the state of the art and other relevant circumstances allow for it.⁷ There is, in fact, no conclusive empirical evidence establishing that patents are necessary to incentivize innovation.⁸

Even if the benefits of the patent system were unquestioned, they must be balanced against the costs associated with the patent system, which include, most significantly, the deadweight loss resulting from non-competitive pricing of patented inventions.⁹ Scholars analyzing patent law within an economic framework typically seek out a design of the relevant legal rules that will maximize the benefits while minimizing the costs of the patent system. This type of cost-benefit analysis, naturally, does not always lead to conclusive recommendations. Indeed, in some cases, such analysis may lead to a dead end.¹⁰ Measuring the costs and benefits associated with each existing or suggested legal rule affecting the patent system has proven to be particularly challenging.¹¹ Ultimately, it has been impossible to definitively determine whether current patent law, in the United States or elsewhere, reflects an optimal balancing of the multiple considerations at stake.¹²

Yet, economic rationales are not the only possible justifications for the patent system. The labor theory, pursuant to which every person has a right to the fruits of her labor,¹³ and the personality theory, which focuses on the function of private property as a means for developing and realizing one's personality,¹⁴ offer alternative justifications. Unlike the economic approach, which justifies individual rights by pointing at the benefits to society associated with their existence, the labor and

7. See, e.g., Ko, *supra* note 2, at 792. For a recent empirical study showing that the “orthodox” assumption that patents spur technological innovation is not necessarily true, see Andrew W. Torrance & Bill Tomlinson, *Patents and the Regress of Useful Arts*, 10 COLUM. SCI. & TECH. L. REV. 130, 166-67 (2009).

8. See STAFF OF S. COMM. ON THE JUDICIARY, 85TH CONG., AN ECONOMIC REVIEW OF THE PATENT SYSTEM, STUDY OF THE SUBCOMM. ON PATENTS, TRADEMARKS, AND COPYRIGHTS, STUDY NO. 15, at 80 (Comm. Print 1958) (written by Fritz Machlup) (stating that “[i]f we did not have a patent system, it would be irresponsible, on the basis of our present knowledge of its economic consequences, to recommend instituting one. But since we have had a patent system for a long time, it would be irresponsible, on the basis of our present knowledge, to recommend abolishing it”); see also John H. Barton, *Patents and Antitrust: A Rethinking in Light of Patent Breadth and Sequential Innovation*, 65 ANTITRUST L.J. 449, 453 (1996).

9. See generally *infra* notes 30-32 and accompanying text.

10. See Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1031 (1989) (noting that the incentive theories are “analytical dead ends for those seeking to fine tune the patent laws”).

11. See *infra* note 37 and accompanying text.

12. See, e.g., Eisenberg, *supra* note 10, at 1031-32 (noting the difficulty in determining whether the current level of incentives supplied by the patent system is too high or too low).

13. See *infra* Part III.

14. See *infra* Part IV.

personality theories view the interests of individuals in property as interests worthy of protection in themselves and not just as a means to the end of promoting the general welfare.¹⁵ While these theories are more commonly used in the analysis of property law or copyright law, they are not often relied upon in the context of patent law, where the analysis has been predominately governed by economic considerations. The potential applicability of these theories to rights in technological inventions has, in fact, been examined by certain scholars.¹⁶ However, the scholarly treatment of such theories has typically remained on a general philosophical level, while the actual use of non-utilitarian considerations to supplement economic theory in the analysis of current patent law cases and policy problems is not common.¹⁷ This Article challenges this one-dimensional approach and calls for a more frequent use of non-utilitarian considerations in discussions of the patent system.

To be sure, this Article does not call for the complete abolition of economic analysis of patent law, which, despite its shortcomings, remains the most important tool in the evaluation of legal rules in this arena, where the vast majority of the players are motivated primarily by economic considerations.¹⁸ However, it does call for a broader use of non-economic considerations, particularly those embedded in the labor theory and the personality theory, alongside the economic analysis. As will be shown in detail below, these non-utilitarian justifications for property rights are, to a great extent, applicable to rights in inventions. When a person develops a technological product, she invests her labor in the process and, according to the labor theory, she is therefore entitled to rights over the invention, subject to certain conditions that will be discussed below. At the same time, an invention often reflects the personality of its inventor, and thus, patents may be justified under the personality theory as well. This Article argues that an examination of patent law under the framework of these non-utilitarian theories may offer significant guidance for policymakers in certain instances where the economic analysis does not point to a definitive solution. Furthermore, according such theories greater weight in the analysis of patent law may ultimately result in a patent system that not only serves

15. See *infra* text accompanying note 62-63 (with respect to the labor theory) and notes 151-53 (with respect to the personality theory).

16. See *infra* note 88 (with respect to the labor theory) and note 166 (with respect to the personality theory).

17. See also *infra* text following note 93.

18. In fact, as mentioned before, the economic role of intellectual property law has a constitutional basis. See *supra* note 2.

its prescribed economic goals, but also promotes other important goals, such as providing just reward for labor and enabling individuals to develop their personality.

As a case in point, cumulative innovation will be used in this Article to highlight the ways in which the non-utilitarian theories referenced above can assist policymakers in areas where the economic analysis of patent law cannot provide conclusive answers. The term “cumulative innovation” refers to situations where an inventor uses a previously patented invention in order to develop her own invention. This setting poses a special challenge in the design of patent law, as the interests of more than one inventor must be given due consideration. While cumulative innovation is far from a new phenomenon,¹⁹ policymakers in the patent field are still in disagreement as to the proper way to approach it. The economic analysis of patent law, in particular, does not definitively resolve many of the issues raised in this setting. Cumulative innovation has not been analyzed from any perspective other than the economic one. This Article will show how the analysis under the labor and personality theories can add weight to certain conclusions arising out of the economic analysis, can lend support to an argument or a counter-argument in matters that are unresolved under the economic analysis, and in some contexts, shed light on important issues that do not arise under the economic analysis yet warrant the attention of policymakers. For example, one of the novel conclusions of the analysis under the personality theory is that inventors should be granted a right of attribution in connection with follow-on inventions.

The Article proceeds as follows: Part II provides the necessary background with respect to the economic analysis of patent law in general and the economic analysis of cumulative innovation in particular.²⁰ Part II also highlights the shortcomings of such analyses. Parts III and IV present the theories at the center of this Article—the labor theory and the personality theory, respectively—and analyze the case of cumulative innovation in light of each of these theories. Part V concludes with a summary and specific recommendations, including proposals to adopt a wide experimental use exception, to include the

19. As early as 1675, Sir Isaac Newton noted: “If I have seen further it is only by standing on the shoulders of giants.” Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 29 (Winter 1991) (quoting Letter from Isaac Newton to Robert Hooke (Feb. 5, 1675)).

20. See generally Ofer Tur-Sinai, *Cumulative Innovation in Patent Law: Making Sense of Incentives*, 50 IDEA 723 (2010) (analyzing cumulative innovation from the point of view of the “incentive to invent” theory).

exploitation of follow-on inventions within the scope of the original patent, and to apply liability rules in case the inventors fail to reach a voluntary agreement allowing such exploitation.

II. BACKGROUND: ECONOMIC ANALYSIS OF PATENT LAW

A. General

As mentioned above, the traditional analysis of patent law focuses on the economic benefits of the patent system. The most common justification for the patent system is the “incentive to invent” theory, according to which in a world without patents, inventors would lack an economic incentive to invest in research and development. This is so because of the “public good” characteristics of an invention: non-excludability (once competitors of the inventor have found out about an invention, it is difficult to prevent them from using it without paying) and non-rivalry (the use of the invention by one does not prevent simultaneous use by others).²¹ Thus, despite the potentially high social value of an invention, an inventor may lack adequate incentive to develop it, absent some type of protection against competition from free riders. Patent law provides such protection by granting the inventor exclusive rights to her invention for a limited period of time, during which she should be able to cover her research and development costs and make a reasonable profit in the market for her invention.

Over the years, the “incentive to invent” theory has been the subject of a variety of challenges. One line of criticism is that state intervention is not really necessary to secure an incentive to invent. Not all inventors are driven by economic motives.²² Even those who invent for purely

21. The combination of these characteristics creates the potential for sub-investment in the production of public goods in general and inventions in particular. *See generally* Daphna Lewinsohn-Zamir, *Consumer Preferences, Citizen Preferences, and the Provision of Public Goods*, 108 YALE L.J. 377 (1998) (discussing the provision of public goods). For the public goods nature of inventions, see, for example, Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1580 (2003).

22. Alternative motives to invent may be the prospect of gaining professional reputation and fame amongst colleagues or sheer intellectual curiosity. *See* Tur-Sinai, *supra* note 20, at 738; *see also* Gordon, *supra* note 2, at 632 (noting that the existence of reputational advantages might reduce the need for a patent system). *Cf., e.g.*, Diane Leenheer Zimmerman, *Copyrights as Incentives: Did We Just Imagine That?*, THEORETICAL INQUIRIES IN LAW (forthcoming), available at <http://www.ssrn.com/abstract=1515964> (challenging the traditional incentive justification for copyright law, while drawing on behavioral studies that suggest that intrinsic factors are much more important determinants of participation in creative work than such extrinsic ones as monetary reward); Rebecca Tushnet, *Economies of Desire: Fair Use and Marketplace Assumptions*, 51 WM.

economic reasons can be protected from competition by the existence of high production and imitation costs, which may deter free riders, or can at least be allowed to enjoy a head start in the market until such free riders reveal the workings of the invention.²³ This criticism cannot serve to completely negate justification for the patent system, as studies show that at least in some industries inventors do rely on patents to supply an incentive.²⁴ However, it certainly calls into question the ability to base the entire justification for the patent system, with its broad application to a vast array of technological fields, solely on the “incentive to invent” theory.

Two other theories of note which suggest economic justifications for the patent system are the “incentive to disclose” theory and the “prospect” theory. The *incentive to disclose theory* focuses on the role that patents purportedly play in promoting disclosure of the information underlying a new invention by its inventor.²⁵ The main criticism of this theory is that in many cases, an invention’s working cannot be kept secret once it has been commercialized.²⁶ In the few cases where secrecy is feasible, the inventor would typically avoid registering a patent for her invention because she would rather keep it secret to enjoy trade secret protection, which may last for an indefinite period of time.²⁷ The *prospect theory*, formulated by Kitch, posits that the main justification for the patent system is that it increases the efficiency in allocation of resources for technological development by granting ownership to the inventor in the technological prospect derived from her

& MARY L. REV. 513 (2009) (exploring the ways in which the desire to create can be free from the need for economic incentive).

23. See, e.g., Eisenberg, *supra* note 10, at 1026; Ko, *supra* note 2, at 794.

24. For recent empirical evidence of the role that patents play in the biotechnology industry, see Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 4 (2009). As to the importance of patents in the pharmaceutical industry, see, for example, Benjamin N. Roin, *Unpatentable Drugs and the Standards of Patentability*, 87 TEX. L. REV. 503, 569 (2009). For studies comparing the value of patents in different industries, see, for example, John R. Allison & Mark A. Lemley, *Who’s Patenting What? An Empirical Exploration of Patent Prosecution*, 53 VAND. L. REV. 2099, 2125 (2000) (suggesting a possibility that patents are considered more important in the chemical, pharmaceutical and biotechnological fields than in other fields); John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 471-76 (2004) (discussing differences in patent litigation patterns between various industries and concluding that patents in some industries are more likely to be valuable than patents in other industries).

25. See generally Gordon, *supra* note 2, at 632; Eisenberg, *supra* note 10, at 1028-29; Julie S. Turner, *The Nonmanufacturing Patent Owner: Toward a Theory of Efficient Infringement*, 86 CAL. L. REV. 179, 189-90 (1998).

26. See Eisenberg, *supra* note 10, at 1028-29.

27. James Bessen & Eric Maskin, *Sequential Innovation, Patents, and Imitation*, 40 RAND J. ECON. 611, 620 n.31 (2009), available at <http://www.researchoninnovation.org/patrev.pdf>.

invention.²⁸ This theory has never gained wide support amongst scholars analyzing the patent system and it has been the subject of criticism, doubting particularly the ability and motivation of an inventor to engage in further development of the prospect derived from her original invention.²⁹

Alongside the purported benefits of patents outlined above, economic discussion of patent law has also highlighted certain costs associated with the patent system, including the deadweight loss resulting from non-competitive pricing of the patented invention,³⁰ the waste caused by the rent-seeking behavior of inventors engaging in a race to the patent office,³¹ and the potential chilling effect of patents on follow-on research, which is manifested in the cumulative innovation setting.³² Any attempt to design patent law based on economic theory must confront the trade-off between the desire to maximize incentives—to invent, disclose, or develop the “prospect”—and the need to minimize costs.³³ For example, it could be suggested that in order to supply incentives in the maximum amount of cases, the exclusivity period provided by patents should be indefinite.³⁴ Yet, this solution also maximizes patent costs. The larger the economic reward, the more

28. Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977).

29. See, e.g., Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 871-79 (1990); John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439 (2004) (critically examining the “prospect” theory).

30. See, e.g., Dam, *supra* note 2, at 249-51; Kitch, *supra* note 28, at 266-67; Merges & Nelson, *supra* note 29, at 871; Richard R. Nelson, *Intellectual Property Protection for Cumulative Systems Technology*, 94 COLUM. L. REV. 2674, 2676 (1994).

31. See, e.g., Michelle Armond, *Introducing the Defense of Independent Invention to Motions for Preliminary Injunctions in Patent Infringement Lawsuits*, 91 CAL. L. REV. 117, 142-43 (2003); Dam, *supra* note 2, at 251-52; Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 VA. L. REV. 305, 308 (1992).

32. For a more comprehensive list of costs, see Tur-Sinai, *supra* note 20, at 737.

33. See WILLIAM D. NORDHAUS, *INVENTION, GROWTH AND WELFARE: A THEORETICAL TREATMENT OF TECHNOLOGICAL CHANGE* (1969), for one of the most influential studies of the patent system, which discusses the basic trade-off between the desire to provide an incentive to invent and the social loss resulting from the monopolistic pricing by the patent owner, in an attempt to figure out optimal patent length. This article has served as the basis for many other studies of the patent system focusing on the above-mentioned trade-off. See, e.g., Richard Gilbert & Carl Shapiro, *Optimum Patent Length and Breadth*, 21 RAND J. ECON. 106 (1990); Paul Klemperer, *How Broad Should the Scope of Patent Protection Be?*, 21 RAND J. ECON. 113 (1990) (attempting to find the combination of patent length and patent scope that would ensure a given amount of profit to the inventor while minimizing monopolistic cost).

34. Cf. Scotchmer, *supra* note 19, at 31 (arguing that “the only way to ensure that firms undertake every research project that is efficient is to let the firms collect as revenue all the social value they create”). But see Gordon, *supra* note 2, at 622 (claiming that “no one would suggest that IP should internalize *all* the benefits that flow from an intangible”).

inventions will supposedly be developed, but the costs associated with patents will also increase unnecessarily with respect to inventions that would have been developed otherwise.³⁵

Reaching definitive conclusions regarding the optimal design of patent law based on economic analysis is, thus, a difficult task.³⁶ What complicates things even further is that the current level of incentives created by the patent system, as well as the effect of any suggested change in the laws on such incentives and on the costs associated with the system, is very difficult to measure, as policymakers lack accurate information with respect to the relevant parameters, such as the research and development costs associated with the development of various inventions.³⁷ The fact that the patent system, with its “one-size-fits-all” approach, applies to various technological fields, which broadly differ from one another with respect to various relevant parameters, complicates things even further.³⁸ To be sure, even if economic analysis could be used to clearly point out the direction that needs to be taken by policymakers—increasing or decreasing the strength of patents—it generally offers no guidance “in evaluating the relevant merits of different packages of patent rights” that may achieve such an overall effect.³⁹ For all these reasons, it is not possible to reach accurate recommendations with respect to the optimal design of patent law based on economic analysis alone.

B. *Economic Analysis of Cumulative Innovation*

As explained above, the term “cumulative innovation” refers to situations where an inventor uses a previously patented invention in the development process of her own invention.⁴⁰ Cumulative innovation cases can be roughly classified into a few categories, including, most

35. See, e.g., SUZANNE SCOTCHMER, *INNOVATION AND INCENTIVES* 98 (2006); Gordon, *supra* note 2, at 632; Scotchmer, *supra* note 19, at 31.

36. Cf. Rebecca S. Eisenberg, *Analyze This: A Law and Economics Agenda for the Patent System*, 53 *VAND. L. REV.* 2081, 2081-82 (2000) (noting the “indeterminacy of economic analysis in evaluating the patent system”).

37. Surely, policymakers cannot rely in this respect on information submitted by the inventors. See Tur-Sinai, *supra* note 20, at 740 n.66. See generally Eisenberg, *supra* note 10, at 1030-31 (pointing out that the economic theories do not supply an answer to the empirical question of how much incentive is necessary).

38. See generally Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 *BERKELEY TECH. L.J.* 1155, 1155 (2002) (describing the one-size-fits-all nature of the patent system).

39. See Eisenberg, *supra* note 10, at 1030-31.

40. See Tur-Sinai, *supra* note 20, at 731.

importantly,⁴¹ (1) the basic technology-applications category,⁴² (2) the improvements category,⁴³ and (3) the research tools category.⁴⁴ In all these situations, there is concern that the patent for the first invention will delay or even prohibit the activity of the second inventor. This is not just a theoretical concern and there are numerous examples—from the early days of the radio industry to modern day—of cases in which a patent had a chilling effect on follow-on research and development in the relevant field.⁴⁵

The economic analysis of patent law has traditionally focused on the process leading to the development of an isolated invention and on the costs associated with the grant of exclusive rights in such invention, while ignoring the possibility that an invention can also serve as an input in the development process of follow-on inventions.⁴⁶ Cumulative innovation places an additional burden on the patent system as the interests of more than one inventor must be taken into account and weighed against each other.⁴⁷ From the perspective of the “incentive to invent” theory, the challenge is to design patent law in a manner ensuring a division of profits between the inventors that allows each one to cover her costs and make a sufficient profit.⁴⁸ Policymakers are thus

41. The following list is not exhaustive. For a more comprehensive list of scenarios, see *id.* at 731-32. See also SCOTCHMER, *supra* note 35, at 132 (2006); Oren Bar-Gill & Gideon Parchomovsky, *The Value of Giving Away Secrets*, 89 VA. L. REV. 1857, 1868 (2003).

42. In this scenario, the patented invention is a basic technology—such as laser technology—which forms the basis for a variety of applications in multiple technological fields. For additional examples, see Tur-Sinai, *supra* note 20, 731 n.22.

43. In this category, the follow-on invention is an improvement of the patented invention. Improvements are common in many industries. For various examples, see *id.* at 731 n.23.

44. In this scenario, the patented invention serves as a research tool in the development process of the follow-on invention, though ultimately, it is not embedded in it. There are many patented inventions whose sole purpose is to serve as a research tool. For various examples from the biotechnology and nanotechnology fields, see *id.* at 732.

45. *Id.* at 732-33. For a thorough study of the history of science in this respect, see Merges & Nelson, *supra* note 29, at 884-908.

46. See, e.g., Merges & Nelson, *supra* note 29, at 868 (claiming that in most discussions of the patent system, emphasis is placed on the basic trade-off between incentives to the inventor and sub-use of her invention as a result of monopolistic rights granted to her); Nelson, *supra* note 30, at 2676 (arguing that the problems associated with the grant of strong patent rights in cumulative technologies are not adequately dealt with in the standard isolated invention model).

47. Cf. Scotchmer, *supra* note 19, at 30 (“The challenge is to reward early innovators fully for the technological foundation they provide to later innovators, but to reward later innovators adequately for their improvements and new products as well”).

48. Cf. SCOTCHMER, *supra* note 35, at 135; Suzanne Scotchmer, *Protecting Early Innovators: Should Second-Generation Products Be Patentable?*, 27 RAND J. ECON. 322, 322 (1996) (“The possible division of R&D effort among many firms places an additional burden on the patent system. Not only must it try to ensure that research firms earn enough profit in total to cover the

confronted with a new trade-off on top of the basic trade-off between incentives and costs.⁴⁹ The more we strengthen the rights of the original inventor in order to increase her incentive to invent—i.e., by increasing her control over the development and use of follow-on inventions—the more we hurt the incentives of others to develop follow-on inventions. Yet, the more we strengthen the rights of follow-on inventors—i.e., by broadening their freedom to develop and commercialize their inventions—the more we hurt the incentive of the original inventor. Confronted with such a complicated challenge and considering the general shortcomings of the economic analysis described above, it is not surprising that scholars and policymakers in the patent arena are still in disagreement as to the proper means to deal with cumulative innovation.

Admittedly, there are certain principles which are widely agreed upon by scholars dealing with cumulative innovation. First, it is agreed by most scholars that at least a certain degree of freedom to engage in cumulative research and development must be ensured.⁵⁰ Second, it is generally assumed that a follow-on inventor who has managed to develop an invention that meets the general criteria for patent eligibility should be able to register a patent for it.⁵¹ Third, it is generally acknowledged that the original patentee has to be compensated somehow for the use of her invention.⁵²

total costs of R&D, but in addition the profit must be divided among them such that each firm covers its costs”).

49. For a presentation of the matter as a trade-off, see for example ADAM B. JAFFE & JOSH LERNER, *INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT* 48–49 (2004); Dam, *supra* note 2, at 253, 266–67; Howard F. Chang, *Patent Scope, Antitrust Policy, and Cumulative Innovation*, 26 *RAND J. ECON.* 34, 35 (1995).

50. See, e.g., Eisenberg, *supra* note 10, at 1078; Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 *YALE L.J.* 177, 224–26 (1987); Irving N. Feit, *Biotechnology Research and the Experimental Use Exception to Patent Infringement*, 71 *J. PAT. & TRADEMARK OFF. SOC’Y* 819, 839–41 (1989); Janice M. Mueller, *No “Dilettante Affair”:* *Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools*, 76 *WASH. L. REV.* 1, 66 (2001); Tom Saunders, Case Comment, *Renting Space on the Shoulders of Giants: Madey and the Future of the Experimental Use Doctrine*, 113 *YALE L.J.* 261, 268 (2003); Katherine J. Strandburg, *What Does the Public Get?: Experimental Use and the Patent Bargain*, 2004 *WIS. L. REV.* 81, 119–52 (2004); Wendy Thai, *Toward Facilitating Access to Patented Research Tools*, 6 *MINN. J. L. SCI. & TECH.* 373, 390–97 (2004). *But see* Jordan P. Karp, *Experimental Use as Patent Infringement: The Impropriety of a Broad Exception*, 100 *YALE L.J.* 2169, 2188 (1991) (arguing against a broad experimental use exception).

51. This is, in fact, so widely agreed upon, that there are hardly any discussions in the literature with respect to this matter. For an exception, see Scotchmer, *supra* note 48.

52. See, e.g., Eisenberg, *supra* note 10, at 1077–78; Donna M. Gitter, *International Conflicts over Patenting Human DNA Sequences in the United States and the European Union: An Argument*

However, there are many questions related to the matter that do not enjoy consensus among scholars, and economic theory does not provide definitive answers to these questions. Some of these questions are fundamental in nature. For example, there is no consensus among scholars as to the principal question of which regime—one that allows for competition in the market for follow-on inventions or one that places exclusive control of the technological prospect derived from the original invention at the hands of its inventor—is a more efficient environment for technology development.⁵³ Another key matter which is disputed among scholars is the extent to which it is reasonable to expect inventors in a cumulative innovation setting to come to a voluntary agreement allowing for the development and/or commercialization of a follow-on invention while dividing the profits in a manner preserving their respective incentives to invent.⁵⁴ The lack of conclusive evidence on

for *Compulsory Licensing and a Fair-Use Exemption*, 76 N.Y.U. L. REV. 1623, 1679, 1683 (2001); Mueller, *supra* note 50, at 9-10.

53. Compare Kitch, *supra* note 28 (supporting a wide patent to the original patentee, granting her control over the prospect derived from her invention), with Merges & Nelson, *supra* note 29 (arguing that the grant of exclusive control of the prospect to the original patentee may actually stifle technological development in the field). See also Tur-Sinai, *supra* note 20, at 734-35 (pointing out that the original inventor may not always possess the requisite incentive and ability to develop follow-on inventions, and hence, competition must be allowed).

54. Many scholars have expressed pessimism as to the efficiency of the market for licenses, while pointing at the particularly high transaction costs and other factors that make it difficult for the parties to come to an agreement in this setting. See, e.g., Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1052-65 (1997); Merges & Nelson, *supra* note 29, at 874-75; Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177, 1179 (2000); see also Jay Dratler, Jr., *Invention is a Process, or Why the Electronics and Pharmaceutical Industries are at Loggerheads over Patents* 26 (U. of Akron Legal Studies Research, Paper No. 06-13, July 2006), available at <http://www.ssrn.com/abstract=899924>; Jay Dratler, Jr., *Combinatorial Mathematics and the Problem of Early-Stage Patents in Biotechnology* 1 (U. of Akron Legal Studies Research, Paper No. 07-02, Jan. 2007), available at <http://www.ssrn.com/abstract=959462>; Jay Dratler, Jr., *Fixing Our Broken Patent System*, 14 MARQ. INTELL. PROP. L. REV. 47, 56 (2010) (noting the high transaction costs associated with the need to secure consent of early stage patentees for a follow-on project, which rise significantly as the number of such early patents increases). However, certain recent empirical studies suggest that these concerns may be more theoretical than practical. See, e.g., John P. Walsh et al., *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, in PATENTS IN THE KNOWLEDGE-BASED ECONOMY 285 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) (providing survey results indicating that the patenting of research tools in the biomedical industry has generally not been viewed as having a substantial negative effect on further research in the field). The main explanation for the results supplied in Walsh's study is that firms and universities have been able to develop "working solutions" that allow their research to proceed, including the emergence of a licensing practice. *Id.* at 286. The authors state their opinion that "it is typically not that difficult to contract" and state that licensing is routine in the drug industry. *Id.* at 322.

such fundamental matters underlies some of the disagreements among scholars as to the proper way to design patent law in this context.⁵⁵

Alongside such principal matters, there are also many unresolved questions that relate to the finer details of the optimal legal regime.⁵⁶ For example, even among scholars who are in support of a relatively wide experimental use exception in patent law, which allows for certain experimental uses of the invention to take place during the patent period without the patentee's advance permission, there is no agreement as to whether and how such an exception should be qualified to distinguish between permissible and non-permissible activities.⁵⁷ Another unresolved matter is the appropriate manner for compensating the

55. For a "battle" of scholars that seems to stem from the basic disagreement on the efficiency level of the market for licenses, see for example Arti Kaur Rai, *Regulating Scientific Research: Intellectual Property Rights and the Norms of Science*, 94 NW. U. L. REV. 77 (1999); F. Scott Kieff, *Facilitating Scientific Research: Intellectual Property Rights and the Norms of Science—A Response to Rai and Eisenberg*, 95 NW. U. L. REV. 691 (2001); Arti Kaur Rai, *Evolving Scientific Norms and Intellectual Property Rights: A Reply to Kieff*, 95 NW. U. L. REV. 707 (2001). Whereas Rai argues that in light of high transaction costs, property protection for upstream research results should be weakened, Kieff supports the patenting of basic research while relying on the ability of the market to ensure efficient utilization of the patented inventions.

56. The following list of unresolved questions is not meant to be exhaustive.

57. One suggestion that has been made in the literature is to make a distinction based on whether the research user is motivated by profit or not. See, e.g., Richard E. Bee, *Experimental Use as an Act of Patent Infringement*, 39 J. PAT. OFF. SOC'Y 357, 377 (1957); cf. Gitter, *supra* note 52, at 1628, 1679 (suggesting that different rules are to be applied with respect to commercially driven research and other research). This is, in fact, the position taken by the U.S. judiciary. See, e.g., *Embrex, Inc. v. Serv. Eng'g Corp.*, 216 F.3d 1343, 1349 (Fed. Cir. 2000) (stating the narrow construction of the experimental use exception); *Roche Prods., Inc. v. Bolar Pharm. Co.*, 733 F.2d 858, 863 (Fed. Cir. 1984), *superseded by statute* 35 U.S.C. § 271(e) (1994) (holding the experimental use exception to be truly narrow and not applicable when the allegedly infringing use has "definite, cognizable, and not insubstantial commercial purposes"); *Ares-Serono, Inc. v. Organon Int'l B.V.*, 862 F. Supp. 603, 608 (Mass. Dist. Ct. 1994) (clarifying that "[t]he experimental use exception does not protect experiments or tests which have a commercial purpose"); *Pfizer, Inc. v. Int'l Rectifier Corp.*, No. 73-58, 1982 U.S. Dist. LEXIS 17411, at *12 (C.D. Cal. July 20, 1982) (holding that experimental use "cannot be invoked for the protection of one who uses a patented invention commercially"). For criticism of this position, see, for example, Eisenberg, *supra* note 10, at 1023-24, 1035. Another distinction suggested in the literature is between research users who compete with the patent owner in the same market and research users who are "regular consumers" of the invention, as in the research tools scenario. See, e.g., Eisenberg, *supra* note 10, at 1074-78; Eisenberg, *supra* note 50, at 225; DAVID GILAT, II STUDIES, EXPERIMENTAL USE AND PATENTS 44 (1995); Ronald D. Hantman, *Experimental Use as an Exception to Patent Infringement*, 67 J. PAT. & TRADEMARK OFF. SOC'Y 617, 638-41 (1985). Yet, this suggestion as well has not been unanimously agreed to by scholars attending to the matter. See, e.g., Gitter, *supra* note 52, at 1684-85 (proposing the application of the experimental use exception with respect to noncommercial research in DNA sequences); Thai, *supra* note 50, at 393-97 (suggesting the exemption of certain uses of research tools in university research); Tur-Sinai, *supra* note 20, at 756-57 (supporting a broad application of the experimental use exception with respect to research tools).

original inventor for the use of her invention. Should such compensation be limited to cases where a successful follow-on invention was developed and be based on the actual level of market profits, or should compensation be given for the mere use of the original invention even where such use did not result in the successful development of a follow-on invention?⁵⁸ Should there be cases where a complete exemption—i.e., an exception covering the commercialization stage, and not only the development stage—is granted to the follow-on inventor, and what should be the grounds for such exemption?⁵⁹ In cases that do not fall under such exemption, should the consent of the original patentee for the commercialization of a follow-on invention always be required, or is it more efficient to apply liability rule doctrines in this context, at least under certain circumstances, allowing the follow-on inventor to exploit her invention even without permission in return for an appropriate royalty to be determined by the United States Patent and Trademark Office or by the courts?⁶⁰ How should such royalty be calculated?⁶¹

58. Compare Mueller, *supra* note 50, at 62 (supporting compensation even when the research use does not result in a commercial product), with Tur-Sinai, *supra* note 20, at 756 (justifying a regime where compensation is not given for the mere research use of the original invention).

59. For support of such an exemption doctrine, see, for example, Chang, *supra* note 49, at 42-49 (arguing that fewer exemptions should be granted when the standalone value of the original invention is particularly low or particularly high); Merges & Nelson, *supra* note 29, at 865-67 (arguing that an exemption is warranted particularly when the marginal value of the second invention is higher than the standalone value of the original invention). *But see* Tur-Sinai, *supra* note 20, at 759-60 (arguing that, in light of the potential damage to the original inventor's incentive as a result of such exemption doctrine, its application should be primarily restricted to cases where the original inventor could not have reasonably expected the development of the follow-on invention). For a limited exemption doctrine adopted by the U.S. judiciary—the so-called “reverse doctrine of equivalents”—see Tur-Sinai, *supra* note 20, at 770.

60. For a suggestion to apply liability rules in a sweeping manner whenever negotiations between the inventors fail, see Tur-Sinai, *supra* note 20, at 761. In practice, even countries that have enacted a liability rule in this context in the form of a compulsory license have conditioned it upon the follow-on invention involving “an important technical advance of considerable economic significance in relation to the invention claimed in the first patent.” Richard T. Jackson, *A Lockean Approach to the Compulsory Patent Licensing Controversy*, 9 J. TECH. L. & POL'Y 117, 120 (2004). This limitation originated in the Marrakesh Agreement establishing the World Trade Organization, Annex 1C, Agreement on Trade Related Aspects of Intellectual Property Rights art. 31(1)(i), Apr. 15, 1994, 33 I.L.M. 1210 (1994) [hereinafter “the TRIPS Agreement”], which sets up mandatory conditions in this regard. It should be noted that in the United States, which is known for its general hostility towards compulsory licenses in patent law, no such provision has been enacted. See Tur-Sinai, *supra* note 20, at 773.

61. For relevant discussions in the literature, see for example Jerome H. Reichman, *Of Green Tulips and Legal Kudzu: Repackaging Rights in Subpatentable Innovation*, in EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 23, 44 (Rochelle Cooper Dreyfuss et al. eds., 2001); Mueller, *supra* note 50, at 64-65; Tur-Sinai, *supra* note 20, at 765-66.

Against this background, this Article will now turn to examine the potential contribution of integrating non-utilitarian theories into the analysis of patent law, in general, and in connection with the search for an optimal solution to the perplexing case of cumulative innovation, in particular.

III. THE LABOR THEORY

A. General

One of the principal theories used in support of property rights is the labor theory, based on the work of John Locke, who argued that every person has a right to the fruits of her labor.⁶² This is a theory of natural law, which views property rights as pre-existing in the state of nature.⁶³ According to Locke, God gave the world to men in common,⁶⁴ yet “every man has a property [right] in his own person”⁶⁵ and from such right follows also his right to “[t]he Labour of his Body, and the Work of his Hands.”⁶⁶ Therefore, whatever a person has removed out of its natural state and mixed her labor therewith belongs to her.⁶⁷ One fundamental condition to the acquisition of property, according to the labor theory, is that the resources that labor is mixed with have been initially in the “common state,” i.e., in the public domain.⁶⁸ Beyond that, Locke described two main limitations to the scope of property rights that a person may acquire in the fruits of her labor⁶⁹: (1) “there is

62. JOHN LOCKE, TWO TREATISES OF GOVERNMENT 290-91 (Peter Laslett ed., Cambridge Univ. Press 1988) (1690).

63. See, e.g., JEREMY WALDRON, THE RIGHT TO PRIVATE PROPERTY 19 (Brotherhood eds., Jerusalem 1988); Daphna Lewinsohn-Zamir, *Compensation for Injuries to Land Caused by Planning Authorities: Towards a Comprehensive Theory*, 46 U. TORONTO L.J. 47, 50 (1996).

64. LOCKE, *supra* note 62, at 286.

65. *Id.* at 287.

66. *Id.* at 287-88.

67. *Id.* at 288.

68. *Id.* See also Benjamin G. Damstedt, *Limiting Locke: A Natural Law Justification for the Fair Use Doctrine*, 112 YALE L.J. 1179, 1181 (2003).

69. In addition to these two limitations, it can be argued that the acquisition of property should also be limited by the general principle of natural law, pursuant to which one should not cause damage to another, other than in certain instances of extreme necessity. See LOCKE, *supra* note 62, at 271 (“no one ought to harm another in his Life, Health, Liberty, or Possessions”). However, this principle may not be necessary as a separate limitation on the ability to acquire property as it seems that Locke took it into account while designing the specific rules governing the acquisition of property. First, the principal rule itself, assigning property rights to the laborer, can be justified by the no-harm principle, assuming that taking the fruits of her labor away would cause the laborer harm. See, e.g., Wendy J. Gordon, *A Property Right in Self Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 YALE L.J. 1533, 1544-45, 1561

enough, and as good left in common for others”,⁷⁰ and (2) the laborer does not waste resources by taking more than she needs for her own use, including use by means of exchange with others.⁷¹

As explained above, Locke’s conclusion that a person has a property right in the fruits of her labor follows from his argument that a person owns a right to her own body, hence to the labor of her body, and therefore to anything that results from mixing her labor with common resources.⁷² This may be considered an adequate justification for the existence of property rights under the theory.⁷³ However, among those who studied and analyzed Locke’s theory, some consider such conclusion as warranting a separate justification, which they have looked for in other places in Locke’s writings or elsewhere.⁷⁴ One possible justification for recognizing property rights in the fruits of one’s labor is that when labor results in something valuable for society then the laborer is morally entitled to a just reward in consideration for such value.⁷⁵ It should be noted that if, indeed, the justification for the laborer’s right is her contribution to society, then the scope of such right should arguably be limited to the added value derived from the labor and should not include the original resource that the labor was invested in.⁷⁶ Another

(1993); Damstedt, *supra* note 68, at 1185-86. Second, in order to ensure that no harm is caused to others as a result of the grant of property right to the laborer, Locke set the two specific limitations discussed in the text. See, e.g., Gordon, *supra*, at 1562; Damstedt, *supra* note 68, at 1185.

70. LOCKE, *supra* note 62, at 288. This limitation can be interpreted broadly—a requirement to leave enough resources from the exact same type and quality—but such interpretation may completely negate the possibility to attain rights in objects, at least when it comes to tangibles. Therefore, scholars analyzing Locke’s theory tended to interpret this requirement in a narrower manner, i.e., as a requirement to leave enough resources of any type that would enable others to work and earn sustenance. See Damstedt, *supra* note 68, at 1187.

71. LOCKE, *supra* note 62, at 290 (“[a]s much as any one can make use of any advantage of life before it spoils; so much he may by his Labour fix a Property in. Whatever is beyond this, is more than his share, and belongs to others. Nothing was made by God for Man to spoil or destroy”); *id.* at 295 (“[b]ut if they perished, in his Possession, without their due use; if the Fruits rotted, or the Venison putrified, before he could spend it, he offended against the common Law of Nature, and was liable to be punished; he invaded his Neighbour’s share, for he had no Right, farther than his Use called for any of them, and they might serve to afford him Conveniences of Life”); *id.* at 300 (discussing the possibility of exchange).

72. For a description of the labor theory along similar lines, see Damstedt, *supra* note 68, at 1181, 1184.

73. According to this interpretation of the theory, the justification for private property is based on the property right that a person has in her body, which attaches to the product of her labor.

74. See, e.g., Wendy Lim, *Towards Developing a Natural Law Jurisprudence in the U.S. Patent System*, 19 SANTA CLARA COMPUTER & HIGH TECH. L.J. 561, 579 (2003).

75. See, e.g., Lawrence C. Becker, *Deserving to Own Intellectual Property*, 68 CHI.-KENT L. REV. 609, 624 (1993); Justin Hughes, *The Philosophy of Intellectual Property*, 77 GEO. L.J. 287, 305 (1988). See, with respect to the value of labor, *infra* note 78.

76. See Hughes, *supra* note 75, at 305.

reward-type justification is based on the assumption that human beings would rather avoid labor and that compensation for the inconvenience of the laborer should be given to her in the form of a right in the fruits of her labor.⁷⁷ The above arguments may also serve as a basis for a utilitarian interpretation of Locke's theory. If people's natural tendency is to avoid labor, then in light of labor's importance to society,⁷⁸ human beings should be given an incentive to labor, which is what property rights are meant to provide.⁷⁹ An alternative justification for granting a property right to the laborer is that a person needs a means of sustenance, and as work is the main way of attaining this, there is a need to recognize a laborer's right to the means of sustenance she acquired through work.⁸⁰ Finally, labor theory can be tied to the general principles of unjust enrichment, which are based on notions of corrective justice because absent protection for the right of a person to exclusively enjoy the fruits of her labor, others may be unjustly enriched at her expense.⁸¹

The labor theory can be criticized on various grounds. One critical argument that can be made against the theory is that there is a wide gap between the theory and the real state of affairs as a result of the theory's focus on merely one mechanism for attaining private property while ignoring other mechanisms, such as inheritance. The economic disparity between individuals in society is wide, and there is not necessarily a correlation between the amount of work done by each individual and her level of wealth.⁸² A different argument notes that a theory based on an

77. *Id.* at 303.

78. See, with respect to the importance of labor, LOCKE, *supra* note 62, at 297. Locke notes that granting property rights to individuals in assets that they created through their labor increases the pool of assets that stands to serve society. *Id.* at 294. A possible argument is that if the new assets created by labor remain the property of the laborer, then society's wealth does not increase, though Locke emphasizes that such new assets can potentially serve other members of society through exchange transactions. *Id.* at 300. For discussion, see also Hughes, *supra* note 75, at 299.

79. For an interpretation of the labor theory along similar lines, see, for example, Hughes, *supra* note 75, at 296; David W. Opperbeck, *Symposium: Closing In on Open Science: Trends in Intellectual Property & Scientific Research: A Virtue-Centered Approach to the Biotechnology Commons (or, the Virtuous Penguin)*, 59 ME. L. REV. 315, 317 (2007).

80. This is implied by Locke himself. See LOCKE, *supra* note 62, at 288-89; cf. Becker, *supra* note 75, at 626-28 (discussing psychological needs of the laborer "that can appropriately be met by the award of property rights").

81. See LOCKE, *supra* note 62, at 291 ("He that had as good left for his Improvement, as was already taken up, needed not complain, ought not to meddle with what was already improved by another's Labour: If he did, 'tis plain he desired the benefit of another's Pains, which he had no right to").

82. See DAPHNA LEWINSOHN-ZAMIR, *INJURIES TO LAND CAUSED BY PLANNING AUTHORITIES* 63 (1994) (in Hebrew).

assumption that labor can be attributed exclusively to a single individual is unrealistic, as work in modern day is typically done in teams comprised of numerous individuals in an environment that provides the laborer with the necessary tools and opportunity to work. This makes it difficult to justify the grant of exclusive rights in an asset to an individual based on the argument that such asset is the product of her labor.⁸³ A related criticism may be that, inasmuch as the labor theory is based on the argument that the laborer is entitled to a reward for her contribution to society, the theory cannot justify full property rights in assets with a value exceeding such contribution. Beyond that, one may criticize the religious notions underlying the theory, the initial claim that a person has a property-like right over her body, and the implicit assumptions that the theory is based upon, such as the assumption that there is an indefinite amount of resources in the public domain.⁸⁴ Finally, it can be argued that, even if the laborer deserves to be rewarded for her work, this does not necessarily mean that such reward should be in the form of a property right in the fruits of her labor, as it is seemingly sufficient to award her money damages, at least according to some of the aforementioned justifications to the theory.⁸⁵

Ultimately, despite these and other critical arguments, the labor theory has become over the years one of the main theories for justifying rights in private property.⁸⁶ Even though the theory originally focused on property rights in physical assets,⁸⁷ it has been used for the justification and analysis of intellectual property rights as well.⁸⁸

83. See MORRIS R. COHEN, *Property and Sovereignty*, in *LAW AND THE SOCIAL ORDER* 41, 51 (1933) (noting that “economic goods are never the result of any one man’s unaided labour”).

84. If natural resources were limited, then at some point it would become impossible to meet the theory’s requirement that enough is left for others. Cf. Damstedt, *supra* note 68, at 1181, 1187 (arguing that if the duty to leave enough to others is interpreted broadly (see *supra* note 70), the theory fails). This is exactly the reason why some argue that the theory is more applicable to intangibles. See *infra* note 112 and accompanying text.

85. See generally J. W. HARRIS, *PROPERTY AND JUSTICE* 209 (1996) (noting that “[c]laims to property based on labour-desert are dependent on social convention”).

86. See, e.g., *id.* at 182-212; STEPHEN R. MUNZER, *A THEORY OF PROPERTY* 254-91 (1990); WALDRON, *supra* note 63, at 137-252.

87. For an argument that a more thorough examination of Locke’s writings reveals that he actually had a solid point of view with respect to rights in intangibles as well, see generally Lior Zemer, *The Making of a New Copyright Lockean*, 29 *HARV. J.L. & PUB. POL’Y* 891 (2006).

88. See, e.g., Becker, *supra* note 75; Hughes, *supra* note 75; Damstedt, *supra* note 68; Gordon, *supra* note 69; Zemer, *supra* note 87; Lim, *supra* note 74, at 579; Stephen M. McJohn, *The Paradoxes of Free Software*, 9 *GEO. MASON L. REV.* 25, 44 (2000); Caroline Nguyen, *Toward an Incentivized But Just Intellectual Property Practice: The Compensated IP Proposal*, 14 *CORNELL J.L. & PUB. POL’Y* 113, 119-26 (2004); Molly A. Holman & Stephen R. Munzer, *Intellectual Property Rights in Genes and Gene Fragments: A Registration Solution for Expressed Sequence Tags*, 85 *IOWA L. REV.* 735, 832-35 (2000). See generally Andrew R. Sommer, *Trouble on the*

Although there are various challenges associated with applying the theory to intangibles, it is generally agreed that to the extent that it is possible to justify property in tangibles based on the labor theory, it is also possible to use it for the justification of intellectual property rights,⁸⁹ and in a way, it is even easier to do so.⁹⁰ When a person creates a work of authorship or develops a technological invention, she invests her labor in the process,⁹¹ and therefore, according to the labor theory, is entitled to rights over the product resulting from such process, provided only that the conditions for the acquisition of property set forth by Locke are met: there is enough left for others, and there is no waste of resources.⁹² Some scholars who dealt with the application of the labor theory to intellectual property rights examined the extent to which intellectual property law is consistent with these principles and suggested various revisions in the law in order to increase its correlation

Commons: A Lockean Justification for Patent Law Harmonization, 87 J. PAT. & TRADEMARK OFF. SOC'Y 141 (2005); Adam D. Moore, *A Lockean Theory of Intellectual Property*, 21 HAMLINE L. REV. 65 (1997); Richard T. Jackson, *A Lockean Approach to the Compulsory Patent Licensing Controversy*, 9 J. TECH. L. & POL'Y 117 (2004); Kurt L. Glitzenstein, *A Normative and Positive Analysis of the Scope of the Doctrine of Equivalents*, 7 HARV. J.L. & TECH. 281 (1994).

89. See, e.g., Becker, *supra* note 75, at 609-10; Glitzenstein, *supra* note 88, at 314; Hughes, *supra* note 75, at 297. A separate examination could be held under each possible justification for the labor theory in order to evaluate whether it is justified, pursuant thereto, to grant property rights in intangibles. Thus, for example, if the justification is the added value created by labor (see *supra* notes 75-76 and accompanying text), then—assuming that the intangible products protected by intellectual property law are valuable to society—intellectual property rights are justified. See with respect to patent law, Hughes, *supra* note 75, at 307 (explaining why the current standards used to measure patent eligibility are in accordance with an added value justification). If the justification is not the added value created by labor but rather the need of the laborer herself for the fruits of her labor (see *supra* note 80 and accompanying text), it can be argued that the labor theory does not apply with respect to intellectual products, as the laborer does not need them as much as she needs the physical means of sustenance dealt with directly by Locke. However, the laborer's needs can be said to include not only the need for means of physical sustenance but also artistic and intellectual needs, the need of an individual to express herself, etc. See Gordon, *supra* note 69, at 1555. Beyond that, it can be argued that property right in intellectual assets is what allows authors of copyrightable works and inventors of patentable inventions to earn money and use it to purchase whatever they need to sustain themselves physically.

90. See *infra* note 112 and accompanying text, for the proposition that the Lockean proviso that “there is enough, and as good left in common for others” can be satisfied more easily with respect to intangibles, due to their non-rival nature.

91. One question that arises, in this context, is whether intellectual labor is equivalent to the physical labor discussed by Locke. The common answer is yes. See, e.g., Zemer, *supra* note 87, at 911; McJohn, *supra* note 88, at 44; Hughes, *supra* note 75, at 301, 304-05 (noting that the large scope of activities associated with most research projects nowadays strengthens the conclusion that research and development activities can be classified as labor).

92. For a discussion of these conditions in connection with intellectual property protection, see generally Hughes, *supra* note 75, at 315-29; Nguyen, *supra* note 88, at 119-26.

with the theory.⁹³ However, the theory has never been accepted by scholars or policymakers in the patent arena as a standard tool for the evaluation of the patent system, which can supplement and enhance the economic analysis in discussions with respect to the optimal design of patent law. In the next section, this potential role of the labor theory will be demonstrated in connection with the case of cumulative innovation.

B. *Cumulative Innovation in light of the Labor Theory*

Assuming that the labor theory provides a valid justification for granting property rights in technological inventions—i.e., for the patent system—then in a cumulative innovation setting, this justification clearly supports the grant of a patent for the first invention in a sequence of inventions, as it is the fruit of its inventor’s labor. The interesting question, though, is whether the theory can provide some guidance as to the scope of such a patent. According to the theory, the right of a laborer applies to all the assets produced by her work, subject only to the external limitations on the acquisition of property (the condition that enough is left for others and the no-waste prohibition), which will be discussed separately below. Arguably, a follow-on invention should be considered to be derived from the original inventor’s labor, at least in instances where it would not have been developed otherwise (i.e., when the first invention served as a but-for cause in its development process).⁹⁴ A possible conclusion is that property rights over follow-on inventions should be allocated to the original inventor.

Yet, labor theory, as originally crafted, only applies to direct products of a person’s labor and does not address a situation where, based on such products, another person’s labor leads to entirely different products. As follow-on inventions, by definition, are not the direct products of the original inventor’s labor, labor theory does not mandate that she owns the patents for such inventions on top of the patent for her original invention.

This conclusion can be further supported by reverting to the various explanations outlined above for the justification of the labor theory.

93. Thus, for example, scholars opined that the labor theory supports adopting an independent development defense in patent law. See *infra* note 118 and accompanying text. For a different example, see Sommer, *supra* note 88 (arguing that patent laws around the world should be harmonized because only then would the patentee be able to get a full reward for her contribution to society, as the labor theory mandates).

94. In other instances, the first invention may merely lower the cost of developing the second invention or may allow for its more rapid development. See SCOTCHMER, *supra* note 35, at 127; Scotchmer, *supra* note 19, at 31.

According to the “added value approach,”⁹⁵ the first inventor is not the one who solely produced the social value embodied in a follow-on invention, and therefore, she does not deserve a reward for such value in the form of a property right in such invention. However, as she contributed to this value,⁹⁶ she should earn a portion of it, as a reward for her contribution.⁹⁷ According to the “compensation for the inconvenience” approach,⁹⁸ the first inventor is not the one who has suffered the inconvenience associated with the labor invested in the development of the follow-on invention. Nevertheless, she may have a just claim to a portion of the profits from such invention as compensation for the inconvenience associated with the development of the original invention, which served as a basis for the follow-on invention and, while doing so, presumably lowered the amount of labor required to develop it and the associated level of the follow-on inventor’s inconvenience associated with her labor. Under the “necessity” approach,⁹⁹ as a follow-on invention was not developed by the original inventor, it cannot be considered to be directly related to her effort to secure means of sustenance. However, it might be the case that, in order to allow the original inventor to earn enough money, she should be entitled to a portion of the profits in the markets for follow-on inventions.¹⁰⁰ Finally, under the “unjust enrichment” approach,¹⁰¹ as long as the original inventor is compensated for her contribution to the development of a follow-on invention, there is no need to grant her a patent for such invention in order to avoid unjust enrichment. In fact, such patent would unjustly enrich her at the expense of the follow-on inventor.

95. See *supra* notes 75-76 and accompanying text.

96. This is not only in cases where the original invention served as a but-for cause in the development process of the follow-on invention but also in cases where it merely lowered the cost of its development or accelerated it. Therefore, and due to the difficulty in proving causation, it seems that the same principal solution should be applied with respect to all these cases.

97. Such conclusion is also supported by the approach according to which a property right should be limited to the value added by the laborer. See *supra* note 76 and accompanying text. The value added by the original inventor includes the potential uses of her invention by others as an inventive input, and thus, a portion of the value of the resulting follow-on invention, which reflects such input, should be attributed to the original inventor’s labor, which must be rewarded accordingly.

98. See *supra* note 77 and accompanying text.

99. See *supra* note 80 and accompanying text.

100. This may be particularly so in connection with research tools or other basic inventions which do not have a stand-alone commercial value.

101. See *supra* note 81 and accompanying text.

Ultimately, labor theory does not justify the grant of a patent for a follow-on invention to the original inventor, though it does call for compensating the original inventor for her contribution to the development of such invention by allowing her to win a portion of its value that would reflect such contribution.¹⁰² In order to ensure such compensation, the exploitation of follow-on inventions needs to be included in the scope of the original patent.¹⁰³ This conclusion correlates to the basic findings of the economic analysis,¹⁰⁴ though the need to take into account the magnitude of the original invention's contribution to the development of the follow-on invention in calculating the compensation due to the original inventor¹⁰⁵ is uniquely derived from the analysis under the labor theory.¹⁰⁶

As to the patent for the follow-on invention, it should be granted to the follow-on inventor, considering that she is the one who actually developed it. This invention is the fruit of her labor and according to all the justifications for the labor theory, she is entitled to a property right in it. She deserves a reward for the social value embedded in the invention,¹⁰⁷ is entitled to compensation for the inconvenience associated with her labor, should be able to attain means of sustenance through her labor, and should get protection against unjust enrichment. Admittedly, the labor theory deals directly only with situations in which the labor of one person is invested in common resources,¹⁰⁸ while in the

102. In general, there is no need to interpret Locke's theory as ruling in a dichotomist manner that the only right that a person can have with respect to an object is a complete property right. *See also infra* note 145 and accompanying text.

103. For a proposal, relying on economic analysis of the matter, to adopt an "Absolute Scope Principle" in patent law in order to ensure compensation to original inventors in cumulative innovation cases, see Tur-Sinai, *supra* note 20, at 742-44.

104. *See supra* note 52 and accompanying text.

105. Admittedly, determining this parameter may prove difficult. The inventors themselves surely cannot be expected to agree upon it, as each one may have an inflated idea of her own contribution or not understand the other's contribution. *See, e.g.*, Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCI. 698, 701 (1998); Robert Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 89-91 (1994); Turner, *supra* note 25, at 183. *See generally* Linda Babcock & George Loewenstein, *Explaining Bargaining Impasse: The Role of Self-Serving Biases*, 11 J. ECON. PERSP. 109 (1997) (discussing the tendency of parties to arrive at judgments that reflect a self-serving bias: to conflate what is fair with what benefits oneself).

106. Under the economic analysis, the relevant parameters in determining an efficient division of profits among the inventors are different, and include most notably the respective costs associated with the development of each invention. *See, e.g.*, Tur-Sinai, *supra* note 20, at 750.

107. This is also true under the position that property should be limited to the value added by the laborer as the patent for the follow-on invention would be limited to the novel elements contributed by the follow-on inventor. *See supra* note 76 and accompanying text.

108. *See supra* note 68 and accompanying text.

cumulative innovation setting, the follow-on inventor also uses the product of someone else's labor as an input. However, as explained above, it seems that all the underlying justifications for granting a property right to the laborer apply with respect to a follow-on inventor as well, and thus, allowing her to register a patent for her invention seems supported by the theory.¹⁰⁹

As mentioned above, Locke specified two external limitations on the ability to acquire property, which will be discussed below.

1. The Duty to Leave Enough for Others

A condition for acquiring property, according to Locke, is that “there is enough, and as good left in common for others”.¹¹⁰ One may prevent others from using her work products only if there would remain sufficient resources in the public domain to allow others to labor and acquire property as well.¹¹¹ In theory, it is easier to meet this condition when the product is an intangible, in light of the non-rivalry characterizing it, i.e., the fact that the use of an intangible by one does not prevent simultaneous use of it (or the resources embedded in it) by others.¹¹² Yet, this conclusion could only hold if there were no property rights in intangibles.¹¹³ Once intellectual property protection is in force, there is an artificial want of the products covered by it, as others are no longer free to use them, even if such use is non-rival by its nature. Patent law is specifically designed to prevent competition by free riders, and there is essentially no freedom to use an invention covered by a

109. The difference between the basic setting of labor performed on common resources only, discussed by Locke, and the cumulative innovation setting, where the fruits of someone else's labor are used by the current laborer, should be given due account in requiring that a follow-on inventor compensates the original inventor, as discussed above.

110. See *supra* note 70 and accompanying text.

111. The resources of which a sufficient amount needs to be left for others are the raw materials to which labor can be applied (rather than the work products). See, e.g., Gordon, *supra* note 69, at 1562-64; Damstedt, *supra* note 68, at 1181; Zemer, *supra* note 87, at 928.

112. See, e.g., Hughes, *supra* note 75, at 315 (pointing out that every idea can be used by an unlimited number of individuals).

113. Hughes acknowledges the fact that property rights in intangibles may affect the possibilities of others, but he maintains that current intellectual property law does not provide absolute exclusivity to the owner of the right—inter alia, as third parties cannot be prevented from using in their thoughts ideas embedded in patents of others—and hence, it does not unduly limit the possibilities of future creators and inventors. On the contrary, his position is that as soon as a new idea has been commercialized and people know about it, it becomes easier for them to create and invent. See *id.* at 315-16. This position is problematic, as the ability to think is generally not sufficient to provide creators and inventors the freedom to continue being active in their field, in contrast to the ability to actually use the protected intellectual products and/or to embody them in the new product.

patent during the patent term.¹¹⁴ The relevant inquiry is whether, considering the exclusive rights provided by a patent, there is still enough left for others following the registration of a patent for an original invention.

As the condition that enough is left for others relates to the underlying raw materials, i.e., the inventive inputs, it does not seem to be affected by the patentee's right to prevent mere imitators from using her invention without permission.¹¹⁵ The requirement that enough be left for others is meant to allow others to labor in order to attain property and not to grant them permission to use the fruits of the original laborer's efforts. It seems that with respect to patent law, this limitation on the scope of property is particularly relevant to the cumulative innovation scenario, where the rights of the patentee need to be balanced with the interests of other potential inventors.

In order to continue the inquiry as to whether sufficient "raw materials" are left for the use of other potential inventors once a patent for an original invention was registered, such raw materials must be defined. The inventive inputs used in the development process of a new invention seem to include: (1) the pre-existing art, i.e., the information existing in the world pertaining to the subject matter of the invention¹¹⁶ and (2) a pool of raw ideas that have not yet been revealed by anyone.¹¹⁷

Arguably, when a person registers a patent, the pre-existing art underlying her invention still remains available to be used by anyone, and following the patent term, it is even expected to be widened by the information embedded in the new patent. The raw idea underlying the invention is arguably taken by the inventor, though as she was actually the one drawing it out of "darkness," it was not exactly withdrawn from the public domain, and in any case, it can be reasonably assumed that there are sufficient other raw ideas in the same imaginary pool waiting to be revealed by others. Yet, these arguments seem to ignore the dynamic

114. This is subject, of course, to certain limited exceptions, including an experimental use exception, to the extent it exists in various legal systems.

115. Cf. Gordon, *supra* note 69, at 1576 (focusing on copyright law and suggesting that the creator could bar a commercial user "who has been drawn to the work solely in order to save himself fungible resources such as money, effort, and time").

116. It should be noted that the term "pre-existing art" used herein, which encompasses every piece of information pre-existing in the world that may be used by the inventor, is not equivalent to the more limited technical term "prior art," which is used in connection with the examination of the novelty and non-obviousness requirements in patent law.

117. See Damstedt, *supra* note 68, at 1192-93. For the notion that ideas are pre-existing in an imaginary repository, see also Hughes, *supra* note 75, at 312 (discussing the view that new ideas are "plucked from some platonic common").

nature of technology development, as will be explained below, first with respect to the pre-existing art and thereafter with respect to the raw ideas pool.

As for the pre-existing art, following the development of a new invention and the registration of a patent for it, even though the information which the inventor relied upon remains in the public domain, the inventive uses that can be made with it are no longer the same, and therefore, it is not clear at all that under the current design of patent law a sufficient opportunity to invent is left for others. First, due to the “winner-take-all” characteristic of the patent system, under which a patentee can prevent even someone who independently developed the same invention from using it, the underlying information clearly can no longer be used for the same purpose for which it was used by the original inventor (i.e., to develop the exact same invention).¹¹⁸

Moreover, following the registration of a patent, it may even be difficult to develop *other* patent-eligible inventions based on the same information underlying the original invention. Let us consider the following scenario: Inventor *A* has just registered a patent for a cellular phone antenna and inventor *B* wishes to develop a different antenna based on the same prior art. This may not be feasible. The number of different inventions that can be made using the same inventive inputs is presumably limited, at least in some contexts. In addition, even if the same pre-existing art could lead inventor *B* to a different type of antenna, such new antenna may not be eligible for patent protection. To be eligible for a patent, an invention must be held novel and non-obvious against the prior art, which now includes, *inter alia*, the information embedded in the patent just registered by inventor *A*. Depending on the differences between the antennas, the new one may not be considered novel and non-obvious. The forefront of scientific research and technological development keeps moving on, and this is reflected in the continuously evolving composition of the prior art used by patent

118. It can be argued, then, that in order to satisfy the requirement that enough is left for others (particularly in its broad interpretation—*see supra* note 70), this fundamental patent law principle should be abandoned. *Cf.* Becker, *supra* note 75, at 629 (noting that whoever independently developed the invention labored as well and therefore is entitled to a property right exactly like the original inventor); Damstedt, *supra* note 68, at 1186 (recommending to adopt an independent development defense against infringement based on Locke’s theory); Moore, *supra* note 88, at 100 (emphasizing the need to not make the situation of the second inventor worse compared to his situation before the registration of the patent by the original inventor). It should be noted, however, that, even if we allow independent development, after the registration of a patent for the original invention and the public disclosure of the relevant information, the chance that other potential inventors in the same field will not be exposed to it (and are also able to prove it) is small.

examiners to evaluate patent applications. For these reasons, following the registration of a patent, the opportunity of others to use the same pre-existing art underlying it as the basis for further novel and non-obvious inventions is narrowed down. In order to increase the chances of future inventors to develop patentable inventions, it seems that they should be allowed to use or even incorporate previously patented inventions in their projects. In the example used above, such policy would allow inventor *B* to work on an *improvement* of inventor *A*'s antenna, rather than a mere version for such antenna developed based on the same pre-existing art.

Moreover, a new invention often changes the scientific and technological landscape, and by doing so, it affects opportunities for research and development by future inventors.¹¹⁹ For example, a new patented laboratory research tool in the biotechnology field may be radically more efficient and achieve far better results than previous technologies used for that purpose. If this is the case, then inventors forced to continue using such old technologies may quickly find themselves out of the game. This effect may be even stronger when the original invention is a pioneer invention, which can potentially serve as the basis for multiple applications in a variety of technological fields, or when it becomes a standard in the relevant industry.¹²⁰

For all these reasons, it seems fair to say that, at least in some instances, an inventor who registers a patent for her invention attaches her property right, indirectly, to the underlying materials as well, and thus, withdraws them from the public domain in terms of the practical ability to reuse them for the purpose of developing other patentable inventions. An argument can be made that while the inventor detracts something from the public domain, she also enriches it by disclosing the details of her invention in a manner that will allow the public to use it at the end of the patent term.¹²¹ Yet, timing matters. Technologies become obsolete rapidly, and at the end of the patent term, the ability to use the invention as the basis for the development of follow-on inventions may not be relevant anymore. Beyond that, as the issue at stake is an

119. A new invention may also cause a shift in consumer preferences, which then influences the demand for certain follow-on inventions. *Cf.* Gordon, *supra* note 69, at 1567-70 (discussing the effect of a new intellectual product on the "stream of culture and events").

120. *Cf.* Gordon, *supra* note 69, at 1600 (pointing out that giving ownership in a work that has come to serve as standard may not leave enough opportunities for others).

121. *See* 35 U.S.C. § 112 (2006) (setting forth the requirement that as part of the patent application, a written description of the invention shall be made, "in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same").

opportunity to work and acquire property, having “enough for others” in twenty years cannot be considered satisfactory. Thus, in order to provide other inventors with a real opportunity to engage in research and development and to attain property rights in inventions, it seems that they should be allowed to use the information located at the forefront of the relevant technological field immediately—i.e., not only the public domain information underlying the original invention but the proprietary information embedded in it as well.

As for the raw idea at the basis of the invention, the more we treat it as if it was drawn out of a pool that was originally free for use by every member of society,¹²² the more it can be said that when registering a patent for her invention, the inventor impoverished the public domain by depleting it of something that others might have discovered more or less at the same time.¹²³ In any case, the question is whether, once the inventor acquired property rights over her idea, there are enough such ideas left for others. Even under an assumption that the amount of ideas in such imaginary pool is infinite,¹²⁴ human history tells that such ideas are bound to be revealed in a gradual manner, depending, *inter alia*, on the state of knowledge at the relevant time. At any given period there are, on a practical level, only a limited number of potential paths for research and development.¹²⁵ Therefore, once the original inventor secured her exclusivity in her invention, she may have narrowed down the current possibilities available for others. This conclusion is even stronger when the inquiry is narrowed down to the specific technological field at stake.¹²⁶

A possible counterargument is that, as a patentable invention pushes forward the forefront of technological research and opens up new

122. See *supra* note 117 and accompanying text.

123. As to the likelihood that someone else would discover the same patented invention, see Moore, *supra* note 88, at 103; Jackson, *supra* note 88, at 127. What increases the likelihood of this occurring is the fact that an invention is often a solution to a current need.

124. This is a philosophical question without any clear answer. See, e.g., Damstedt, *supra* note 68, at 1191 n.57.

125. Cf. Nguyen, *supra* note 88, at 122 (noting that “while ideas are technically limitless, the realm of useful and worthwhile ideas is much more focused and accessible only to those who have access to previous intellectual products”); PETER DRAHOS, A PHILOSOPHY OF INTELLECTUAL PROPERTY 51 (1995) (pointing out that “[e]ven where the stock of abstract objects is infinite, the human capacity to exploit that stock at any given moment is conditioned by the state of cultural and scientific knowledge which exists at that historical moment”).

126. This is related to the way this Lockean proviso is interpreted in general. See *supra* note 70. In the specific context dealt with herein, the question is whether it is enough that a general opportunity to work (or invent) is left open or whether it is specifically required that an opportunity to develop further inventions in the same technological field remain open.

avenues for further development, it can increase the chances that future inventors will be able to pull new ideas from the common pool.¹²⁷ However, this is generally true only inasmuch as uses of the patented invention by follow-on inventors are permitted.¹²⁸ A breakthrough invention in the field of nanotechnology does not broaden research and development opportunities in the field, unless other inventors are allowed to use it, improve upon it, or incorporate it in their own invention. In other words, in order to be able to reveal the next-in-turn idea, which is situated deeper in the “pool,” the current inventor must be allowed to “stand on the shoulders” of her predecessor.¹²⁹ This conclusion is derived directly from the cumulative nature of scientific research and technological development. If an inventor who registers a patent for an original invention is allowed control over the entire “prospect”¹³⁰ marked by her invention and if other inventors are not allowed to use the patented invention for the purpose of developing follow-on inventions, then such other inventors’ opportunity to engage in research and development is narrowed down, and thus again, not enough is left for others.¹³¹

To summarize, the development of a new invention and the registration of a patent for it may affect opportunities to engage in research and development. In many cases, in order to allow inventors a real opportunity to participate in the game, they should be allowed to make use of prior inventions. The first Lockean proviso for the acquisition of property, thus, supports the adoption of an experimental use exception in patent law.¹³²

2. The No Waste Prohibition

As mentioned earlier, the second Lockean condition for the acquisition of property is that there is no waste of work products. Scholars analyzing the labor theory have suggested a few possible

127. *Cf.* Hughes, *supra* note 75, at 316; Sommer, *supra* note 88, at 159.

128. *Cf.* *supra* note 113 and accompanying text.

129. See *supra* note 19, for Newton’s famous quote.

130. See, with respect to the “prospect” theory, *supra* notes 28-29 and accompanying text.

131. *Cf.* Jackson, *supra* note 88, at 135 (noting that “even if the commons is not affected by removing from it the information found in the patent, the state of the art that lies just beyond the patent itself cannot be explored without fear that the pioneer will refuse to grant a license”).

132. The arguments leading to this conclusion seem to apply, in equal force, to all scenarios of cumulative innovation, including the research tools scenario. *Cf.* *supra* note 57 and accompanying text (describing various approaches taken by scholars analyzing the question of how wide the experimental use exception should be from an economic perspective).

explanations for the rationale behind the no waste prohibition¹³³: (1) there might be a shortage as a result of the waste of products; (2) labor itself would be wasted without bringing any benefit to the laborer; and (3) “[n]othing was made by God for Man to spoil or destroy.”¹³⁴

While this prohibition may not be significant in connection with tangible objects,¹³⁵ it can be very important in connection with intellectual property in light of the non-rival nature of intangibles.¹³⁶ An intellectual product can serve as the basis for numerous tangible copies embedding it¹³⁷ so that an unlimited number of individuals can use it simultaneously. Accordingly, waste seemingly occurs every time a certain potential use of an intellectual product that could have brought benefit to the user does not materialize such that the social value of the product is not fully realized.¹³⁸

This means that the no waste prohibition is relevant not only with respect to the relationship of the intellectual property owner with future inventors and creators (as the previous Lockean proviso)¹³⁹ but also with respect to her relationship with potential end users of the product. For example, if a person developing a certain invention refuses to commercialize it, she is arguably wasting it because there are users that could have benefitted from using it. Waste also occurs when a person sells the product at such a high price that its potential consumers cannot purchase it.¹⁴⁰

133. See Hughes, *supra* note 75, at 327-39; Damstedt, *supra* note 68, at 1193-94.

134. LOCKE, *supra* note 62, at 290.

135. This is in light of the fact that Locke acknowledges the legitimacy of exchange so it is possible to avoid wasting an asset not only by privately using it but also by selling it. See *supra* note 71 and accompanying text.

136. See text accompanying *supra* note 21.

137. When the invention is a process invention, as opposed to a product invention, there is not even a need for duplicating a physical artifact.

138. See Damstedt, *supra* note 68, at 1196-97; Nguyen, *supra* note 88, at 121.

139. See *supra* note 115 and accompanying text.

140. This is the principal argument of Damstedt, *supra* note 68, who maintains that a refusal to sell units of an intangible violates the no waste prohibition and that such violation should lead to the deprivation of a property right with respect to such units. Hence, his conclusion is that pricing an intangible at a price higher than zero creates a right of fair use to all the ones evaluating the asset at a price higher than zero but lower than the price set by the laborer. According to his approach, the laborer has no right to prevent individuals from using units of the product that are not already being used by others. See *supra* note 68, at 1201-02. Damstedt emphasizes that a fair use right of this type is much wider than the fair use doctrine currently in force under copyright law in various legal systems (*id.* at 1215), while in patent law there is no such doctrine at all (Damstedt, *supra* note 68, at 1183). This broad argument is outside the scope of the discussion. It should be noted, though, that there seems to be a great difficulty in receiving reliable information from potential users about the value of the product for them, considering that they would be able to enjoy free use of it if they declared a value lower than the price set for the product. See Damstedt, *supra* note 68, at 1201 n.91.

In the cumulative innovation context, it seems that the no waste prohibition strengthens the conclusion that the use of a patented invention for research and development purposes should be allowed even without the patentee's consent, otherwise, there shall be waste.¹⁴¹ Furthermore, even after the development of a follow-on invention, legal intervention may still be warranted under the no waste prohibition if a license to *commercialize* such invention cannot be secured voluntarily from the original inventor.¹⁴² In such case, the potential waste would relate to uses of the follow-on invention rather than uses of the original invention. One position taken in the literature dealing with labor theory states that waste should result in a complete loss of the property right with respect to the wasted portion.¹⁴³ The application of this position, in the context discussed herein, would supposedly lead to a rule allowing a follow-on inventor, who has not received permission from the original inventor to commercialize her invention, to nevertheless do so free of charge.¹⁴⁴ Yet, this is an extreme position not mandated by the labor theory.¹⁴⁵ If it is possible to find a less extreme way, in terms of its effects on the interests of the original inventor, to avoid the potential waste resulting from the lack of agreement between the inventors with respect to the commercialization of the follow-on invention, it is preferable. And indeed, it is possible to adopt liability rule doctrines that would allow the follow-on inventor to commercialize her invention in return for an appropriate royalty payable to the original inventor.¹⁴⁶ Such royalty would minimize the damage to the original inventor's interests.

Beyond that, it is not necessarily true that waste should result in a complete loss of the property right. *See infra* note 145 and accompanying text.

141. The original patentee herself cannot be expected to develop on her own all potential follow-on inventions, as she may lack the requisite incentive and ability to do so. *See Tur-Sinai, supra* note 20, at 734-35.

142. Clearly, such license would only be required when commercialization of the follow-on invention is considered within the scope of the original patent. This would be the case if an "Absolute Scope Principle" in patent law is embraced. *See supra* note 103 and accompanying text.

143. *See Damstedt, supra* note 68, at 1182, 1214. As a result, Damstedt argues, as explained above, that a broad fair use right should be acknowledged in intellectual property law. *See supra* note 140.

144. According to this position, then, a complete exemption should be granted to follow-on inventors. *Cf. supra* note 59 and accompanying text (describing the relevant discussion under the economic theory).

145. *Cf. Gordon, supra* note 69, at 1538 (noting, with respect to the first Lockean proviso, that it "can yield outcomes other than the elimination of all claims by the laborer").

146. *Cf. supra* note 60 and accompanying text (describing the relevant discussion under the economic theory).

3. Summary

The analysis of cumulative innovation under labor theory leads to the following conclusions. With respect to the development stage, the labor theory supports the adoption of a wide experimental use exception, ensuring freedom to engage in follow-on research and development in a variety of circumstances.¹⁴⁷ Following the development of a follow-on invention, the theory supports allowing the inventor to register a patent for it. The original inventor should be allowed to earn a portion of the profits from follow-on inventions, in light of her contribution to their development. Therefore, the commercial exploitation of follow-on inventions should be considered within the scope of the original patent. Where the inventors cannot reach a voluntary agreement with respect to the exploitation of the follow-on invention, the labor theory supports the application of liability rule doctrines (rather than an exemption doctrine), allowing non-consented exploitation in return for a reasonable royalty. The division of profits among the inventors, in cases where it is not agreed upon between them, should reflect as much as possible their respective contributions to the development of the follow-on invention. Notably, this last conclusion is uniquely based on the analysis under the labor theory.¹⁴⁸

The fact that the analysis under the labor theory results in the foregoing conclusions may surprise those who believe that natural rights theories necessarily support the strengthening of property rights. Such theories, as a general matter, also take into account the interests of the public.¹⁴⁹ Beyond that, in the particular situation at hand, as there is more than one property owner, the conclusions reflect the special need for a balancing solution.

147. For a comparison of this conclusion with the results of the economic analysis, see *supra* note 132.

148. See *supra* note 106 and accompanying text.

149. Cf. Lim, *supra* note 74, at 563 (examining potential application of classical theories of natural law to patent law and noting that an approach based on natural law would try to achieve a balance between acknowledging the rights of the inventor and her duties to the community).

IV. THE PERSONALITY THEORY

A. *General*

Another theory that is often used to justify property rights is Hegel's personality theory,¹⁵⁰ as refined by Professor Radin.¹⁵¹ According to the personality theory, private property is necessary as a means for developing and realizing one's personality. Pursuant to Hegel, a person cannot begin to realize her self-identity until she is given an opportunity to exercise her will on external objects in her surroundings.¹⁵² In order for a person to enjoy freedom of action with respect to assets and a sense of security with respect to the continuity of her relationship with them, and in order for her to be able to uniquely identify herself based on her relationship with such assets, she should be provided a certain level of control over the assets, which is the reason that the institution of private property is necessary.¹⁵³

A direct conclusion of these basic insights is that every person should be provided a threshold amount of property that would enable her to function as a free individual and develop her personality. Yet, Professor Radin has gone a step further in her attempt to use the personality theory as the basis for detailed recommendations with respect to the appropriate design of property protection. According to Radin, a distinction should be made between various types of objects based on how closely they are bound up with personhood. At one end of the spectrum, there are certain objects that are often part of the way human beings constitute themselves as continuing personal entities in the world ("personal property")—a wedding ring, a portrait, an heirloom, or a house. At the other end of the spectrum, there are objects held for purely instrumental reasons ("fungible property")—money, a share certificate, an automobile in the hands of a dealer, or an

150. G.W.F. HEGEL, *PHILOSOPHY OF RIGHT* (S.W. Dyde trans., Prometheus Books ed. 1996) (1821).

151. Margaret Jane Radin, *Property and Personhood*, 34 *STAN. L. REV.* 957 (1982) [hereinafter Radin, *Personhood*]. See also Margaret Jane Radin, *Market-Inalienability*, 100 *HARV. L. REV.* 1849 (1987). For a recent criticism of Radin's version of the personality theory, see Jeanne L. Schroeder, *Unnatural Rights: Hegel and Intellectual Property*, 60 *U. MIAMI L. REV.* 453 (2006) (claiming that Radin's version is too remote from the original Hegelian theory to be considered derived from it). For Radin's treatment of the differences between her thesis and Hegel's theory, see Radin, *Personhood*, at 977-78.

152. HEGEL, *supra* note 150, at 51-52.

153. *Id.* See also Radin, *Personhood*, *supra* note 151, at 957, 972-73; Lim, *supra* note 74, at 579; Hughes, *supra* note 75, at 330; Brian M. Hoffstadt, *Dispossession, Intellectual Property, and the Sin of Theoretical Homogeneity*, 80 *S. CAL. L. REV.* 909, 934, 948 (2007).

undeveloped tract of land in the hands of a contractor.¹⁵⁴ An indicator of an object being “personal” is that its loss cannot be compensated through payment or replacement with another object of a similar market value due to its unique value to its owner; whereas, a “fungible” object, by definition, is perfectly replaceable with other goods of equal market value.¹⁵⁵ Radin does not focus on the development process of an object but rather on the relationship formed between the object and whoever holds it. Accordingly, the same object can be considered personal or fungible, depending on the identity of its current holder.¹⁵⁶ Radin acknowledges that in certain cases, a person’s attachment to an object may not be vital to her healthy self-constitution but rather fetishistic in its nature. In such cases, she maintains that the object should not be classified as personal property.¹⁵⁷

Radin’s basic argument, on the normative level, is that legal rules should be designed with sensitivity to the abovementioned distinction. In general, the more a relationship to an object is located toward the personal end of the continuum, the more the entitlement should be protected.¹⁵⁸ Radin suggests that, at least in certain cases, interests in personal property should be protected against invasion by the government and against cancellation by conflicting fungible property claims of other people by property rules, as no compensation for their taking could be just.¹⁵⁹ On the contrary, where an entitlement is fungible, its protection by liability rules would generally be sufficient, while sometimes it may even be justified to allow the taking of fungible property without any compensation at all.¹⁶⁰ Radin also maintains that

154. Radin, *Personhood*, *supra* note 151, at 959-60.

155. For a description of Radin’s insight with respect to the distinction between personal objects and fungible objects as part of a broader phenomenon, the existence of a gap between the price in which the holder of an object is willing to sell it and the price which buyers are willing to pay for the same object in the market, see Abraham Bell & Gideon Parchomovsky, *A Theory of Property*, 90 CORNELL L. REV. 531, 568 (2005). The gap might be due to sentimental causes as Radin points out, but it might also be caused by a variety of other reasons, some rational and others affected by cognitive biases, such as the “endowment effect”. *Id.*

156. Radin, *Personhood*, *supra* note 151, at 987. See also Steven Cherenksy, *A Penny for Their Thoughts: Employee-Inventors, Preinvention Assignment Agreements, Property, and Personhood*, 81 CAL. L. REV. 595, 645 (1993).

157. Radin, *Personhood*, *supra* note 151, at 968-70. The judgment that a certain relationship between a person and an object is non-healthy should be based, according to Radin, on an objective moral consensus. *Id.* For an argument that this may result in conservatism and in perpetuation of the status quo, see Stephen J. Schnably, *Property and Pragmatism: A Critique of Radin’s Theory of Property and Personhood*, 45 STAN. L. REV. 347, 355, 361, 404 (1993).

158. Radin, *Personhood*, *supra* note 151, at 986.

159. *Id.* at 988, 1005, 1014-15.

160. *Id.*

in case of a conflict between fungible property rights and non-property interests in personhood, such as free speech rights, it would sometimes be appropriate to allow the latter interests to take precedence.¹⁶¹

Radin's personality theory has been criticized from various angles. One argument is that there is no basis for Radin's thesis in Hegel's work, where property plays a very formal role—it allows people to create legal relationships with each other and thus turn from abstract entities into individuals with a concrete existence.¹⁶² A different criticism of Radin turns against the sweeping classification of objects used for business purposes as fungible property, implied from her writing. An individual may spend most of her time in the business, upon which her current welfare and future plans are dependent. Sometimes it is exactly through the business that an individual realizes her personal talents and qualities.¹⁶³ Radin's theory can also be criticized for necessitating classifications and tests in order to assess the level of existence of a personhood interest in individual cases.¹⁶⁴ Radin's normative conclusions can be criticized as well. For example, even if protection of fungible property through liability rules (as opposed to property rules) can be justified, it is not clear why it is justified to weaken protection for such property even more by allowing for its non-compensated taking in certain cases.¹⁶⁵

161. *Id.* at 1008-13.

162. Schroeder, *supra* note 151, at 454-55, 464, 466-69, 473, 476. Schroeder emphasizes that the analysis of property by Hegel does not address all aspects of personality but only addresses the formal role described above. Therefore, Hegel's theory can be used in support of a proposition whereby a modern state should establish a minimal level of private property, allowing the formation of legal relationships between individuals. However, it does not flow from the theory that society has to respect this or another type of property or has to provide a certain degree of protection to a certain group of assets, and the theory certainly does not provide any concrete guidance on whether any property (or intellectual property) doctrine is appropriate or not.

163. See LEWINSOHN-ZAMIR, *supra* note 82, at 79. See also Mary L. Clark, *Reconstructing the World Trade Center: An Argument for the Applicability of Personhood Theory to Commercial Property Ownership and Use*, 109 PENN ST. L. REV. 815, 815-16, 818-19, 821 (2005) (noting that ownership and use of commercial property may have a significant impact on self-identity of individuals and criticizing Radin for failing to take it into account).

164. For an argument that Radin's analysis complicated the notion of property, see generally Bell & Parchomovsky, *supra* note 155, at 551 (pointing out that property, under Radin's analysis, can no longer be treated as a generic relationship between people with respect to objects because her analysis demands an inquiry as to the type of object at stake and as to the role that such object plays in the development of the personality of the individual claiming rights in it); Hughes, *supra* note 75, at 339 (arguing that a property system protecting personality would encounter difficulties in finding reliable indicators with respect to the question of whether people have a personality interest in specific objects or not).

165. See LEWINSOHN-ZAMIR, *supra* note 82, at 78-79.

B. *Technological Innovation and the Personality Theory*

The personality theory has been used, not infrequently, in scholarly discussions of intellectual property law in general and copyright law in particular.¹⁶⁶ The common position in the literature is that intellectual products are closer to the personal end of Radin's continuum of objects. Such assets are not only held by an individual but are also her creation, and thus, reflect her personality. As a result, the personal bond between the individual and such assets is particularly strong.¹⁶⁷ Accordingly, various scholars used the personality theory in support of arguments calling for the strengthening of authors' rights and, in particular, her moral rights, including the right of attribution and the right of integrity.¹⁶⁸ It should be noted that this approach, according to which a personhood interest—justifying an increased level of protection—can result from the fact that an object was created by someone whose personality is embedded in it,¹⁶⁹ deviates from Radin's version of the personality theory, which focuses on the attachment created between an object and its holder, while attributing no significance to the development process of the object.¹⁷⁰

166. See generally Becker, *supra* note 75; Amie N. Broder, *Comparing Apples to APPLs: Importing the Doctrine of Adverse Possession in Real Property to Patent Law*, 2 N.Y.U. J.L. & LIBERTY 557, 573 (2007); Cherensky, *supra* note 156; Glitzenstein, *supra* note 88, at 319-22; Hoffstadt, *supra* note 153; Hughes, *supra* note 75; Justin Hughes, *The Personality Interest of Artists and Inventors in Intellectual Property*, 16 CARDOZO ARTS & ENT. L.J. 81 (1998); Lim, *supra* note 74; McJohn, *supra* note 88, at 45; Nguyen, *supra* note 88, at 126-30; Opderbeck, *supra* note 79.

167. See Hughes, *supra* note 75, at 330, 365; Becker, *supra* note 75, at 610; Hoffstadt, *supra* note 153, at 935; McJohn, *supra* note 88, at 45; Opderbeck, *supra* note 79, at 319.

168. See, e.g., Hughes, *supra* note 166, at 165 (as to the right of attribution); Edward J. Damich, *The Right of Personality: A Common-Law Basis for the Protection of the Moral Rights of Authors*, 23 GA. L. REV. 1, 4 (1988) (as to the right of integrity; though not explicitly mentioning the personality theory as such, the article's thesis is grounded in the notion that artistic works reflect the creative personalities of their authors).

169. For a discussion of various personality aspects that may come into effect in the process of creating an intellectual product, see Hughes, *supra* note 166, at 82.

170. See *supra* note 156 and accompanying text. This approach is certainly remote from Hegel's original theory. See *supra* note 162 for Schroeder's position that Hegel's theory does not mandate recognition of specific rights in assets. Schroeder specifically points out that Hegel's theory cannot be legitimately used to justify moral rights or other increased rights with respect to intellectual property. According to her, any other interpretation, representing a romantic conception of personality, would be completely rejected by Hegel. Works of authorship should be considered external to personality just like any other object of property. See Schroeder, *supra* note 151, at 457, 498-99. Interestingly, the approach described in the text has early roots in the writings of Kant and Fichte, who viewed literary works as external expressions of their authors' personalities. See generally DRAHOS, *supra* note 125, at 80-81; DAVID SAUNDERS, *AUTHORSHIP AND COPYRIGHT* 106-15 (1992).

Seemingly such an approach, which relies on the great extent to which an intellectual product reflects the personality of its creator, is less applicable with respect to technological inventions, the subject matter of patent protection, than with respect to creative works of authorship, the subject matter of copyright protection. While searching for a technological solution for a given problem, e.g., a cure for a certain disease, an inventor is guided by the existing knowledge in the relevant field and is limited by various constraints—scientific, technological and commercial—and thus, has much less room to express her personality.¹⁷¹ The fact that inventions are often being conceived simultaneously by various individuals¹⁷² also suggests that technological properties do not necessarily reflect the personality of their creators but rather some more generic notions. Nevertheless, it seems that there is still an opportunity for an inventor to express her unique personality in a new invention, if only the more subtle aspects of her personality, observable perhaps by professionals in the relevant field.¹⁷³ For example, it may be possible, within the efficiency constraints faced by computer hardware engineers, to design a specific hardware device in various ways, each one representing a different personal style for accomplishing the task.¹⁷⁴ Moreover, the argument that an inventor cannot bring her unique personality into effect in her work seems to be based on a very narrow construction of the notion of personality. Even if it is true that in the development process of an invention there is generally no room for nuances reflecting the inventor's emotional composition or her aesthetic preferences as might commonly be the case in artistic works, a technological invention is still a unique intellectual product where the inventor's education, intellectual skills, professional experience, vision, and imagination all come into play.¹⁷⁵ At the same time, it should be noted that not all copyright-protected works strongly reflect the personality of their authors. Copyright law protects, *inter alia*, certain

171. See Hughes, *supra* note 75, at 341 (noting, for example, that “[i]n inventing the light bulb, Edison searched for the filament material that would burn the longest, not a filament that would reflect his personality”). See also Lim, *supra* note 74, at 579 (pointing out that inventions are generally a solution to a specific problem and not a reflection of the personality of an individual).

172. See *supra* note 123.

173. See generally Lim, *supra* note 74, at 580; Hughes, *supra* note 75, at 342-43; Cherenksy, *supra* note 156, at 649-52.

174. Cf. Lim, *supra* note 74, at 580.

175. Cf. Cherenksy, *supra* note 156, at 598 (noting that the interest of the employee in an intellectual product developed by her may be based on investment of personal capital: “training and education, personality, individual genius, extraordinary effort, creative spark, and even divine revelation”).

“works of low authorship, such as maps, nautical charts, and factual compilations,”¹⁷⁶ the content of which is dictated to a large extent by their practical purpose. Copyright protection also applies with respect to an important class of technological works, i.e., computer software. In fact, even in the more traditional categories of artistic works, creative authorship is subject to certain constraints that limit one’s freedom to artistically express herself. For example, in the creation of a movie, due consideration must be given to the expected attention span of the audience, to the budget constraints, and to the characteristics of the relevant genre.¹⁷⁷ To summarize, even if there is some difference between technological inventions and copyright-protected works with respect to the possibility of expressing one’s personality in the product, it is not a vast difference. It seems that at least in certain cases there may be a personhood interest in a technological invention, resulting from the fact that the product reflects the personality of the individual who developed it.¹⁷⁸

Moreover, it seems that a personality bond in the original sense discussed by Radin—i.e., a bond created between the object and its holder, regardless of the development process of the object,¹⁷⁹ may exist as well with respect to technological inventions. Indeed, in contrast to a wedding ring or a family portrait, which is closely guarded by its owner, technological inventions are often not only used by their owners in the business sphere of their lives (as opposed to the private sphere),¹⁸⁰ but are also commercialized by them. Arguably, if a person commercializes an object, she cannot have a personality interest in it. However, intellectual products are non-rival by their nature, so the owner of an invention can commercialize it (i.e., sell physical embodiments of it and/or grant licenses to use it) without abandoning her ownership of it.¹⁸¹ One of the basic principles of intellectual property law is the

176. Oskar Liivak, *Maintaining Competition in Copying: Narrowing the Scope of Gene Patents*, 41 U.C. DAVIS L. REV. 177, 184 (2007).

177. See generally Michal Shur-Ofry, *The (Copyright) Law of Genre: A Network Perspective on Copyright Protection of Cultural Genres*, 2 FLA. ENT. L. REV. 60 (2008) (noting the important role of genres in various artistic and cultural fields).

178. Cf. Hughes, *supra* note 166, at 143-44 (pointing out that, even if there is no personal expression in an invention, a personal intention is invested in its creation, and therefore, the personality of the inventor is uniquely reflected in it).

179. See *supra* note 156.

180. But see *supra* note 163 and accompanying text (criticizing this distinction).

181. Cf. Hughes, *supra* note 166, at 86; Opderbeck, *supra* note 79, at 319. Clearly, when it comes to a complete assignment of intellectual property rights, the personality theory runs into a paradox. The transfer indicates that the individual no longer has a personality interest in the product, so the justification for allowing her to dictate the terms of the transfer is unclear. See

separation between the intellectual work itself and its physical embodiments; the sale of a physical artifact that embodies a protected intellectual product is not equivalent to a transfer of ownership in such underlying intellectual product. The commercialization of intellectual property (except when an exclusive license is granted) does not damage the ability of its owner to keep on using it on her own,¹⁸² or even, to continue commercializing it. Therefore, the fact that technological inventions are often commercialized by their owners does not necessarily place them at the fungible end of Radin's continuum of objects. In fact, commercialization of an intellectual product may contribute to the development of its owner's personality. By commercializing an intellectual product, the inventor or author reveals herself to other individuals, and the payment she receives for the opportunity to use her product constitutes an act of recognition of her by such individuals.¹⁸³

In fact, the personality interest in technological inventions may be particularly strong. An inventor is often identified with her inventions—Thomas Edison is recognized first and foremost as the inventor of the light bulb—and such inventions become the basis for her business and commercial activity, i.e., for her connections with other individuals through which she defines herself. Based on the commercial activity involving her inventions, the inventor acquires recognition, respect, and appreciation by others. The invention becomes part of the public persona of the inventor.¹⁸⁴ The fact that the inventor is the one who developed the invention surely plays an important role in the formation of others' evaluation of her, especially when it comes to the relevant research community.¹⁸⁵ Yet, it is possible that even an owner by assignment of an invention would develop, as time goes by, a personality interest in it, as a result of her business and commercial uses of it, while the public learns to recognize her as a unique subject—the

Hughes, *supra* note 75, at 346-47. *But see* Schroeder, *supra* note 151, at 484 (noting that there is no contradiction between the ability to transfer an asset and owning a personality interest in such asset, in the original meaning discussed by Hegel).

182. This is in contrast to the case of a physical object, which from the moment of its sale or lease can no longer be used by its owner (in the case of a lease, for a temporary period, and in the case of a sale, indefinitely).

183. *See* Hughes, *supra* note 75, at 349-51. Hughes adds that the money earned as a result of the commercialization of the asset encourages the creation of further works which reflect the personality of their creator. *Id.*

184. *Cf.* Hughes, *supra* note 75, at 343. For the status attached to success in technological development, see, for example, McJohn, *supra* note 88, at 42; Broder, *supra* note 166, at 573 n.59.

185. Interestingly, it is a prevalent practice among scientists and engineers to list patent applications in their resumes.

owner of said invention. The identification with an invention may be strong in comparison with the identification with other types of business assets in light of the inherent uniqueness of an invention.¹⁸⁶

All in all, it seems that in many cases a personhood interest may develop with respect to a technological invention. The personality theory thus provides an additional justification for the exclusive rights granted to an inventor under the patent system. Absent exclusivity, the inventor's competitors may freely use her invention. This would diminish her ability to uniquely identify herself with the invention and enjoy adequate recognition by others.

This, though, is only true with respect to the relationship between the inventor and free riders seeking to imitate her invention and use it free of charge. In the special context of cumulative innovation, where other researchers and inventors may also have a personality interest worthy of protection, the situation may become more complicated as will be explored next.

C. *Cumulative Innovation in light of the Personality Theory*

Entrusting control over research uses of an invention in the hands of the inventor would deny other potential inventors an opportunity to develop follow-on inventions based on such invention, narrowing their opportunities to engage in research and development activity and lowering their chances of expressing their personality through such activity. Thus, in the cumulative innovation scenario, there is seemingly a conflict between the personality interest of one individual and the opportunity of other individuals to develop their own personality interests.¹⁸⁷ In order to allow potential inventors a real chance to develop inventions in which they may hold a personhood interest in the future and given that technology often develops in a cumulative manner, it seems that inventors should be allowed to use patented inventions developed by their predecessors in the course of their own research and development.¹⁸⁸ The personality theory, then, seems to support the

186. The patent-eligibility criteria, including the novelty and non-obviousness requirements, ensure the uniqueness of an invention. See, as to the tendency of inventors to strongly identify with their inventions, Merges, *supra* note 105, at 90 n.61.

187. *Cf.* Hughes, *supra* note 166, at 81-82 (noting that the personality theory mandates a balance between the personality theory of the creator in her work and the personality interest of consumers who will use her work in their own future acts of creation).

188. It could theoretically be argued that there are enough opportunities to engage in research and development even without using patented inventions. *But see* discussion *supra* Part III.B.1 (with respect to the Lockean proviso that enough is left for others).

argument that there is a need to adopt an experimental use exception in patent law, allowing the use of an invention for research and development purposes even without the original inventor's permission.¹⁸⁹ This conclusion is not limited to a specific scenario of cumulative innovation.¹⁹⁰ If, alongside such exception, there would be a rule ensuring that the original inventor is compensated for the use of her invention, at least in cases where such use has resulted in the development of a successful follow-on invention, then the damage to the personality interest of the first inventor resulting from the adoption of an experimental use exception would be mitigated.¹⁹¹

To be sure, after the development of a follow-on invention, the follow-on inventor may have a personality interest in it. In order to protect her personality interest, the follow-on inventor should be allowed to register a patent, provided that her invention meets the general criteria for patent-eligibility. The personality theory, then, supports the conclusion that the registration of a patent for a follow-on invention should be allowed.¹⁹²

The realization that each inventor has a personality interest in her invention supports the conclusion that each inventor should be allowed to commercially exploit her patent and, while doing so, develop a unique identity and earn recognition from others, as explained above. The original inventor may, in most cases, continue exploiting her patent even after the development of a follow-on invention and the registration of a patent for it.¹⁹³ However, in order to ensure the ability of the second inventor to do so as well, assuming that the exploitation of the follow-on invention is considered within the scope of the original invention,¹⁹⁴

189. Cf. William W. Fisher III, *Symposium Cyberspace & The Law: Privacy, Property, and Crime in the Virtual Frontier: The Implications for Law of User Innovation*, 94 MINN. L. REV. 1417, 1471-72 (2010) (maintaining that user innovation offers opportunities for self-fulfillment and recommending that “[t]he government, through law, should therefore strive to open more opportunities for user innovation than manufacturers and the current population of users, left to their own devices, would create”).

190. For a similar conclusion under the labor theory, see *supra* note 132 and accompanying text. Cf. *supra* note 57 (describing various approaches taken by scholars analyzing the matter from an economic perspective to the question of how wide the experimental use exception should be).

191. See also *infra* note 197 and accompanying text.

192. For a similar conclusion under the labor theory, see *supra* notes 107-09 and accompanying text.

193. This would not be true in the case of an improvement that completely substitutes for the original invention. See *infra* notes 213-15 and accompanying text as to the improvements scenario.

194. This would be the case if an “Absolute Scope Principle” in patent law is embraced. See *supra* note 103 and accompanying text.

liability rule doctrines should be adopted.¹⁹⁵ The main effects of liability rule doctrines would likely be to influence the negotiating positions of the inventors and to increase the likelihood that they reach a voluntary agreement.¹⁹⁶ However, such a mechanism would also serve as a second-order solution for cases in which the parties do not reach an agreement. In order to minimize the damage to the personality interest of the first inventor, the second inventor should be required to demonstrate good faith efforts to secure the first inventor's consent as a condition for the activation of a liability rule.¹⁹⁷ This way, the first inventor would be able to enjoy direct recognition by the follow-on inventor as the owner of the original patent. Beyond that, the existence of an administrative or judicial proceeding to which the original inventor is a party and in which she is recognized as the owner of the original invention, alongside the fact that she is entitled to ongoing royalties for the non-permitted use of her invention, may lessen the damage to her personality interest.¹⁹⁸

Ultimately, there does not appear to be significant harm to the personality interest of the original inventor under the suggested regime. Notably, it is only proposed that the rights of the original inventor be curtailed in this narrow context of her relationship with other inventors, while with respect to her relationship with any other third party, she would continue to enjoy full property-like protection.

D. *Right of Attribution*

Inasmuch as the original inventor has a personality interest in her invention, the question arises whether the follow-on inventor should be required to give her credit in connection with the follow-on invention.

A right of attribution exists under copyright law in many legal systems.¹⁹⁹ Various scholars have noted the link between the personality justification and the right of attribution as well as other moral rights granted to the author of a copyrighted work in certain legal systems.²⁰⁰

195. For a discussion of liability rule doctrines under economic theory, see *supra* note 60 and accompanying text.

196. See Tur-Sinai, *supra* note 20, at 762-63.

197. *Cf. id.* at 763.

198. This is certainly the case in comparison with the alternative regime of exemption doctrine, allowing free commercialization of follow-on inventions without any compensation to the original inventor. For a discussion of such an alternative under the economic analysis, see *supra* note 59 and accompanying text.

199. See, in the United States, 17 U.S.C. § 106A (2006).

200. See, *e.g.*, sources cited *supra* note 168.

In fact, under the patent laws of various countries, including the United States, there is also a certain degree of protection on the right of an inventor to be identified in connection with her invention.²⁰¹ The obligation to credit the inventor seems to correlate with the notion that inventors have a personality interest in their inventions. Crediting the inventor may strengthen her identification with the invention and increase the chance that she enjoy the recognition of others in connection with it.²⁰² In the context of cumulative innovation, it seems that obligating the follow-on inventor to credit the original inventor can serve as another means to minimize the harm to the personality interest of the original inventor that may be caused by allowing others to use her invention for research and development purposes.²⁰³ This way, she would at least be able to receive public recognition as a contributor to the development of the follow-on invention.²⁰⁴

An important question arising in this context is whether credit should be given to the private individual who developed the original invention or to the owner of the patent when they differ, as in the case of employee inventions²⁰⁵ or in other cases where the patent has been

201. See 35 U.S.C. § 111(a)(1) (2006) (mandating that a patent application shall be made, or authorized to be made, by the inventor) and 35 U.S.C. § 115 (2006) (requiring the applicant to “make oath that he believes himself to be the original and first inventor”). The patent must be applied for by the inventor herself even if it is assigned immediately thereafter to her employer. See Catherine L. Fisk, *Credit Where It’s Due: The Law and Norms of Attribution*, 95 GEO. L.J. 49, 57 (2006) (stating that “American patent law has always required the true and original inventor to be identified in the patent application, even though patents are routinely issued to entities other than the inventor based on a pre-invention assignment agreement”).

202. An interesting example, showing how valuable attribution may be to developers of technological products, is the case of the open source software movement. See Fisk, *supra* note 201, at 88-89 (stating that open source software is “software for which the source code is freely available to the public.”). While seeking to minimize intellectual property rights with respect to the software in order to maintain a robust public domain, open source licenses still typically insist on attribution. Fisk, *supra* note 201, at 89-91.

203. The fine details of the suggested attribution right, including the exact means by which credit should be given, are yet to be conceived. Due consideration must be given, *inter alia*, to the need to avoid overly burdening the follow-on inventor, especially in cases where her invention relies on multiple previously patented inventions.

204. Inasmuch as the expected glory associated with being credited as someone who contributed to the development of a follow-on invention plays a part in the initial motivation to invent the original invention, such credit can be justified under the economic theory as well. See generally, as to the role that anticipated fame and reputation may have in the formation of an incentive to invent, *supra* note 22.

205. See generally Robert P. Merges, *The Law and Economics of Employee Inventions*, 13 HARV. J.L. & TECH. 1, 5 (1999).

assigned by the inventor to another person.²⁰⁶ As explained above, in certain cases an owner by assignment of a patent may develop a personality interest as a result of her identification with the invention and her recognition by others as the owner of the rights in it.²⁰⁷ However, to the extent that the personality interest in inventions is attributed to the fact that the personalities of inventors are embedded in their inventions,²⁰⁸ it seems more appropriate to require that the credit be given to the inventors themselves. It should be noted that when the owner of the rights in the invention is a corporation, rather than a private individual, the personality interest is irrelevant, as the personality theory deals exclusively with interests of human beings.²⁰⁹ Assuming that most owners by assignment of patents are corporate entities, this further supports a rule whereby the credit is required to be given to the original inventor herself and not to the patent owner, in the case of a split between them.²¹⁰

E. *Unique Scenarios*

Two unique situations warrant a special discussion with respect to the personality theory. The first occurs when an employee develops an

206. The currently existing attribution regime in patent law (*see supra* note 201) relates to the right of the inventor vis-à-vis the owner of the patent (rather than any third parties) and thus, naturally, awards the right to the inventor herself.

207. *See* text accompanying *supra* note 186.

208. *See supra* note 178 and accompanying text.

209. *Cf.* Cherensky, *supra* note 156, at 659-60 (pointing at the difficulties associated with a comparison between the personhood interests of humans and corporations). Admittedly, as a substantial share of research and development activities in modern day society takes place in the research laboratories of universities, giant corporations or start-up companies, which end up owning the patents for the resulting inventions, this could serve as a general argument against the application of the personality theory to patent law. However, to the extent that the theory is used to strengthen the rights of the individual inventor, as suggested herein with respect to the right of attribution, such critical argument is irrelevant. Besides, even in the present, many inventions are developed by so-called “garage inventors.” In fact, an increasingly common related phenomenon nowadays is the practice of “user innovation.” *Cf.* Robert P. Merges, *To Waive and Waive Not: Property and Flexibility in the Digital Era*, 23rd Annual Horace S. Manges Lecture, April 6, 2010, 34 COLUM. J.L. & ARTS 113, 113 (2011) (noting that even in an era when creative works can sometimes be made collectively, individual creative effort is still the crucial ingredient for many high quality works). *See generally* Fisher, *supra* note 189; Katherine J. Strandburg, *Users as Innovators: Implications for Patent Doctrine*, 79 U. COLO. L. REV. 467 (2008).

210. The concept of a split between ownership of economic rights and ownership of moral rights with respect to an intellectual product is not new. In legal systems that grant moral rights under copyright law, such rights are typically personal and they belong to the author even if she is not the owner of the economic rights. *See*, in the United States, 17 U.S.C. § 106A(b) (stating that “[o]nly the author of a work of visual art has the rights conferred by subsection (a) in that work, whether or not the author is the copyright owner”).

invention that is then owned by her employer.²¹¹ Such employee may have a personality interest in the invention deriving from the fact that she developed it. In order to preserve such interest and guarantee that the employee can continue realizing her personality, develop her identity, and receive recognition based on her relationship with the invention, it seems that she should be granted permission to develop follow-on inventions even after she has left her workplace without it being considered an infringement of the original patent.²¹²

The second unique scenario exists when the follow-on invention is an improvement of the original invention.²¹³ In general, the personality theory does not seem to justify a right of the original inventor to use the follow-on invention. The original inventor's personality is reflected in her own invention, which can be continued to be used by her even after the development of a follow-on invention by another inventor. Yet, in the improvement scenario, at least where the follow-on invention is a perfect substitute for the original invention, which completely drives it out of the market, the original inventor may no longer have an opportunity to continue basing her business and commercial activities upon her invention and may no longer be able to identify herself with it and acquire recognition from others based on her relationship to it. The damage to the personality interest of the original inventor in this situation can be minimized by allowing the original inventor to use the follow-on invention and, thus, continue identifying herself and enjoying recognition by others with respect to such improved version of her invention. Surely, if the original inventor gives her voluntary consent to the commercialization of the improvement, she can demand a cross-license to use it herself as part of such a deal. Yet, when the commercialization of the improvement is allowed only under a liability rule regime, such cross-license should be granted to the original inventor as part of the administrative or judicial decision to activate the liability rule.²¹⁴ The grant of such cross-license should be taken into account in setting the royalty rates payable to the original inventor in order to avoid

211. See generally, with respect to employee inventions, *Merges*, *supra* note 205.

212. *Cf.* *Hughes*, *supra* note 166, at 125; *Cherensky*, *supra* note 156, at 662-64 (suggesting a "reverse shop-right", allowing an employee to continue using an invention developed by her even after she leaves her workplace).

213. See generally *supra* note 43 and accompanying text.

214. A provision mandating the grant of a cross-license to the original inventor as part of the decision to grant a compulsory license to exploit a follow-on invention can be found in the TRIPS Agreement, *supra* note 60, at art. 31(l)(ii). This provision is general in its application and not limited to the improvements scenario.

her over-compensation to the detriment of the follow-on inventor.²¹⁵ As the justification for such cross-license to the original inventor is rooted in the personality theory, it should be non-assignable.

V. SUMMARY AND CONCLUSIONS

This Article calls for broader use of specific non-utilitarian considerations in the design of patent law beyond the commonly used economic theories. The discussion focuses on two well-known theories used for the justification of property rights: the labor theory, which maintains that every person has a right to the fruits of her labor, and the personality theory, which focuses on the role that property fulfills in allowing individuals to develop and realize their personalities. The Article shows that these theories are applicable, to a great extent, to rights in inventions, and thus, they should be taken into account by policymakers in the patent arena.

While the labor theory and the personality theory have their own shortcomings as analytical tools for the evaluation of legal rules, this Article demonstrates that they can often provide significant insights with respect to the optimal design of patent law. Such insights may, in certain cases, be consistent with the ones arising out of the economic analysis of patent law or may support one particular direction among several possibilities pointed to by economic analysis. Such considerations could also potentially point policymakers in a direction which is different or even contrary to the one suggested by economic analysis. In such cases, policymakers would have to give priority to one group of considerations—presumably, the economic considerations traditionally governing the analysis of patent law—unless it is possible to find a multi-layered solution that somehow accommodates all relevant considerations.²¹⁶ At times, the analysis in light of such non-utilitarian theories may even expose new issues that do not arise under economic analysis, yet warrant the attention of policymakers.

With respect to the specific test case examined in this Article—the case of cumulative innovation—both the labor theory and the personality theory support the adoption of a wide experimental use exception

215. One of the questions that needs to be thought of in connection with such arrangement is whether such cross-license should be given automatically to the original inventor or only upon her request, when her alternative is to give up such licenses in return for a higher monetary compensation.

216. *Cf. supra* note 210 (describing an arrangement in copyright law allowing for a split between the ownership of economic rights and moral rights with respect to the same intellectual product).

allowing free use of a patented invention in the development course of a follow-on invention in a variety of circumstances, thus adding to the force of certain economic considerations that point in this direction.²¹⁷ Other conclusions arising out of the analysis under these theories are: (1) the inventor of a follow-on invention should be entitled to register a patent for it,²¹⁸ (2) the original inventor should be entitled to a portion of the profits in the market for the follow-on invention, and,²¹⁹ (3) in case the inventors fail to reach a voluntary agreement allowing the commercialization of the follow-on invention, application of a liability rule is warranted.²²⁰ The fairness considerations underlying the labor theory guide policymakers to take into account, in calculating the royalties payable to the original inventor under a liability rule regime, the level of contribution of the original invention to the development of the follow-on invention.²²¹ Beyond that, the analysis under the personality theory raises the important issue of attribution and supports a rule requiring the follow-on inventor to give credit to the original inventor in connection with the follow-on invention.²²² Finally, the analysis under the personality theory supports the enactment of special rules, which would take into account the unique characteristics of two specific situations: the employee-inventor situation and the improvements scenario.²²³

This Article, thus, demonstrates the potential usefulness of integrating non-utilitarian considerations into the analysis of patent law. According due weight to such considerations would enhance the ability of scholars to recommend solutions to current policy problems. Beyond that, it may ultimately result in a patent system that not only serves its prescribed economic goals but also promotes other important goals such

217. See *supra* note 132 and accompanying text (under the labor theory); *supra* notes 188-90 and accompanying text (under the personality theory). See *supra* note 57 and accompanying text, as to the indecisiveness of economic analysis with respect to this matter. See also Eisenberg, *supra* note 10, at 1030 (pointing out that “[n]either the incentive to invent theory nor the incentive to disclose theory offers any clear guidance in formulating a research exemption from infringement liability”).

218. See *supra* notes 107-09 and accompanying text (under the labor theory); *supra* note 192 (under the personality theory).

219. See *supra* note 102 and accompanying text (under the labor theory); text accompanying *supra* note 191 (under the personality theory).

220. See *supra* note 146 and accompanying text (under the labor theory); *supra* note 195 and accompanying text (under the personality theory).

221. See *supra* note 106 and accompanying text.

222. See *supra* notes 203-04 and accompanying text.

223. See *supra* notes 211-15 and accompanying text.

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as providing just reward for labor and enabling individuals to develop their personality.

