

# Washington Law Review

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Volume 83 | Number 1

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2-1-2008

## The Evolution of Intellectual Infrastructure

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## THE EVOLUTION OF INTELLECTUAL INFRASTRUCTURE

Peter Lee\*

*Abstract.* This Article explores the concept of intellectual infrastructure in intellectual property law. It makes three principal contributions. First, it builds upon prior work to elaborate an infrastructure-based theory of productivity that encompasses trademark, copyright, and patent law. It is well-recognized that intellectual property law promotes productivity through allowing exclusive rights on refined intellectual creations such as source-identifying marks, particularized expressions, and specific inventions. Somewhat less appreciated, these bodies of law also promote productivity through ensuring wide access to productivity-enabling “intellectual infrastructure,” such as generic words, ideas, and natural principles, by making these assets ineligible for exclusive rights. This Article argues that this distinction between refined “applications,” which are eligible for exclusive rights, and foundational infrastructure, which remains subject to liberal access, is critical to promoting commercial, creative, and inventive activity throughout intellectual property law.

Second, this Article offers a social account of the definition and evolution of intellectual infrastructure. Infrastructure is a dynamic entity, and intellectual creations subject to exclusive rights can “evolve into” infrastructure through widespread social appropriation. For example, trademarks can evolve into generic words, particularized expressions can develop into stock literary devices, and inventions can become standard platforms for technological development. This Article argues that trademark and copyright law employ social feedback mechanisms to relax exclusive rights on assets that become intellectual infrastructure and further contends that the absence of such mechanisms in patent law may inhibit technological progress. Trademark and copyright doctrines such as genericide, the idea-expression dichotomy, and the scenes a faire doctrine dynamically relegate refined intellectual creations to the public domain as they achieve infrastructural status. Patent law lacks an analogous mechanism for liberalizing access to patented inventions that achieve this status, such as isolated, purified human embryonic stem cells and information technology standards. While patent law’s relatively short term of protection mitigates the harshness of exclusive rights on foundational technologies, this one-size-fits-all approach ignores the reality that certain inventions can become infrastructure well before expiration of the patent term, particularly in rapidly advancing industries such as biotechnology and information technology.

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\* Acting Professor of Law, U.C. Davis School of Law. I would like to thank Keith Aoki, Anupam Chander, Joel Dobris, Holly Doremus, Bob Hillman, Leslie Kurtz, Bobbi Kwall, Mark Lemley, Michael Risch, Kathy Strandburg, Madhavi Sunder, and Greg Vetter for their valuable insights on this project. Special thanks to Brett Frischmann for his extremely thorough input. This paper benefited substantially from presentations at the Chicago Intellectual Property Colloquium, U.C. Davis School of Law, and the 2007 Intellectual Property Scholars Conference hosted by DePaul University College of Law. I would also like to thank Dean Rex Perschbacher and Associate Dean Kevin Johnson for providing tremendous institutional support for this project. I am grateful to Cindy Dole, Nathan Jacobsen, and Ash Sahu for their research and editing assistance, as well as to the superlative staff of the U.C. Davis School of Law library. Finally, I would like to thank the excellent editorial staff of the Washington Law Review.

Third, this Article draws on the Supreme Court's recent decision in *eBay Inc. v. MercExchange, L.L.C.*<sup>1</sup> to propose a social feedback mechanism for liberalizing access to patented infrastructure. Specifically, it argues that courts in patent infringement cases should deny injunctions and allow liability rule protection for patented inventions used as infrastructure. Rather than simply relegating these foundational technologies to the public domain, this approach enhances access to patented infrastructure while maintaining incentives to invent.

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1. 547 U.S. \_\_\_, 126 S. Ct. 1837 (2006).

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## INTRODUCTION

In certain circumstances, a newly introduced technology can quickly achieve the status of basic infrastructure that critically enables wide arrays of subsequent innovation.<sup>2</sup> Patents, which confer exclusive rights for twenty years, on these foundational technologies may inhibit this subsequent innovation, particularly in rapidly advancing fields. For example, in biotechnology, patents on foundational resources such as human embryonic stem cells<sup>3</sup> and polymerase chain reaction,<sup>4</sup> a basic laboratory technique for copying DNA, have raised concerns that such “upstream” patents may inhibit “downstream” research and

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2. See *infra* Part I.A for an extended definition of infrastructure.

3. See Christopher D. Hazuka, *Supporting the Work of Lesser Geniuses: An Argument for Removing Obstructions to Human Embryonic Stem Cell Research*, 57 U. MIAMI L. REV. 157, 158 (2002); Emily Singer, *Stem Cells Stuck in Patent Quagmire*, TECH. REV. (Apr. 24, 2006), available at <http://www.technologyreview.com/biztech/16728> [hereinafter Singer, *Stem Cells Stuck*]; Jeanne F. Loring & Cathryn Campbell, *Intellectual Property and Human Embryonic Stem Cell Research*, 311 SCIENCE 1716, 1716 (2006).

4. See *Cetus To Exact Royalties from PCR Sales; Probe Absolves Convicted Rapist*, BIOTECH. NEWSWATCH, Sept. 5, 1988, at 7.

development.<sup>5</sup> In the information technology realm, patents on interoperability standards, such as the JPEG protocol for photographic compression<sup>6</sup> and the design of key memory chips,<sup>7</sup> have sparked similar concerns from software and hardware developers who build their own innovations based on this infrastructure. The problem of exclusive rights on upstream, infrastructural resources has informed recent Supreme Court pronouncements,<sup>8</sup> congressional patent reform proposals,<sup>9</sup> and academic commentary,<sup>10</sup> all of which suggest that the patent system may sometimes subvert, rather than advance, its constitutional objective to “promote the Progress of Science and useful Arts.”<sup>11</sup>

The evolution of a novel, singular innovation into broadly used infrastructure is a phenomenon endemic to many creative fields. Language is highly dynamic, with fabricated neologisms such as “yuppie” and “e-mail” quickly becoming indispensable means of general communication. In the musical realm, the twelve-bar blues form was once a novel innovation, but ultimately became the standard platform for almost every blues, rock and roll, and country song.<sup>12</sup> In the scientific

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5. Of course, some argue that upstream patents promote downstream productivity because these patents provide incentives to create the foundational technologies that enable subsequent innovation. *Compare* *Brenner v. Manson*, 383 U.S. 519, 534 (1966) (observing that upstream patents may inhibit scientific research) *with id.* at 538–39 (Harlan, J., concurring in part and dissenting in part) (noting that upstream patents encourage creating foundational technologies that enable downstream research).

6. See Michael Kannellos, *Forgent Settles JPEG Patent Cases*, CNET NEWS.COM, Nov. 1, 2006, [http://www.news.com/Forgent-settles-JPEG-patent-cases/2100-1014\\_3-6131574.html?tag=item](http://www.news.com/Forgent-settles-JPEG-patent-cases/2100-1014_3-6131574.html?tag=item).

7. See *In re Rambus Inc.*, No. 9302, Opinion of the Commission (F.T.C. Aug. 2, 2006); Pamela A. MacLean, ‘*Rambus*’ Ruling is a Standards Landmark, THE NAT’L L. J. (Oct. 23, 2006); Mark A. Lemley & Philip J. Weiser, *Should Property Rules or Liability Rules Govern Information?*, 85 TEX. L. REV. 783, 837–38 (2007).

8. *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. \_\_\_, 126 S. Ct. 2921, 2922 (2006) (per curiam) (Breyer, J., dissenting from the dismissal of certiorari) (“[S]ometimes *too much* patent protection can impede rather than ‘promote the Progress of Science and useful Arts’ . . .”).

9. See Patent Reform Act of 2006, S. 3818, 109th Cong. (2006); Patent Reform Act of 2005, H.R. 2795, 109th Cong. (2005).

10. See, e.g., Mark A. Lemley, *Property, Intellectual Property, and Free Riding*, 83 TEX. L. REV. 1031, 1032 (2005) [hereinafter Lemley, *Free Riding*]; Peter Yun-hyoung Lee, *Inverting the Logic of Scientific Discovery: Applying Common Law Patentable Subject Matter Doctrine to Constrain Patents on Biotechnology Research Tools*, 19 HARV. J.L. & TECH. 79, 81 (2005) [hereinafter Lee, *Inverting the Logic of Scientific Discovery*]; Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698, 698–701 (1998); Suzanne Scotchmer, *Standing on the Shoulders of Giants: Cumulative Research and the Patent Law*, 5 J. ECON. PERSP. 29, 37–38 (1991).

11. U.S. CONST. art. I, § 8, cl. 8.

12. Keith Aoki, *Distributive and Syncretic Motives in Intellectual Property Law (with Special*

realm, Thomas Kuhn has famously theorized that revolutionary scientific theories spark “paradigm shifts” that upset accepted worldviews—only to become dominant worldviews themselves that define the direction of “normal science.”<sup>13</sup> In all of these contexts, exclusive rights on the germinal resource—a word, musical form, or scientific theory—can inhibit widespread appropriation of that asset and significantly burden downstream productivity.

This Article explores this phenomenon throughout intellectual property law, focusing particularly on patent law. In so doing, it examines how trademark and copyright law deal with innovations that evolve into widely needed infrastructure. Intellectual property law is premised on the idea that granting exclusive rights to specific creations, such as particular brand names, expressions, or technical designs, will promote progress.<sup>14</sup> However, these specific creations can quickly evolve into general infrastructure, such as when a trademark becomes a generic word, an expression develops into a stock literary device, or an invention emerges as a standard platform for technological development. As we will see, trademark and copyright law possess socially attentive mechanisms to relax protection on assets that evolve into widely needed infrastructure; patent law, as conventionally conceived, lacks this capability. This Article proposes such a mechanism that is specifically tailored to patent law.

This Article makes three principal contributions. First, it extends previous work to elaborate an infrastructure-based theory of productivity that spans trademark, copyright, and patent law. In so doing, it argues that infrastructure plays a critical role in delineating the appropriate boundary between protectable and nonprotectable subject matter throughout intellectual property law. In trademark, copyright, and patent

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*Reference to Coercion, Agency, and Development*), 40 U.C. DAVIS L. REV. 717, 766–67 (2007).

13. THOMAS S. KUHN, *THE STRUCTURE OF SCIENTIFIC REVOLUTIONS* 10–22 (3d ed. 1996).

14. Of course, “progress” is a highly contested concept. This Article focuses on the objective of promoting economic, creative, and inventive productivity that has long been central to intellectual property law. By focusing on progress as productivity, this inquiry avoids intractable problems such as evaluating whether contemporary artistic works represent aesthetic “progress” over classic works. This originalist, economic paradigm, however, leaves important issues of distributive justice and cultural recognition unresolved. *See generally* Symposium, *Intellectual Property and Social Justice*, 40 U.C. DAVIS L. REV. 559 (2006). While this Article does not directly address these concerns, it integrates cultural considerations with economic theory to show that even within the originalist paradigm, intellectual property must accommodate social and cultural evolution to effectively promote productivity. *See* Madhavi Sunder, *IP<sup>2</sup>*, 59 STAN. L. REV. 257, 264 (2006) [hereinafter Sunder, *IP<sup>2</sup>*].

law, raw materials such as generic words, abstract ideas, and natural principles constitute “intellectual infrastructure” that is not eligible for individual ownership.<sup>15</sup> Open access to these foundational assets facilitates their broad exploitation by the public at large, thus promoting productivity. Conversely, trademark, copyright, and patent law only allow exclusive rights on particularized *applications* derived from this infrastructure: source-identifying marks, expressions, and inventions. The process of drawing from “raw” infrastructure to produce refined applications can be analogized to “cooking”—value enhancement through human manipulation.<sup>16</sup> While open access is the appropriate productivity-enhancing property regime for infrastructure, exclusivity represents the appropriate productivity-enhancing property regime for applications: proprietary trademarks reduce search costs for consumers and enable fair competition, and exclusive rights in the patent and copyright contexts provide incentives to create. Applying opposite property regimes to infrastructure and application thus helps trademark, copyright, and patent law achieve their utilitarian ends. Accordingly, all three disciplines have developed doctrines to distinguish these two classes of intellectual assets.

Second, this Article provides a social account of the evolution of intellectual infrastructure, and it reveals how trademark and copyright law dynamically accommodate this evolution while patent law does not. Through a different process of value enhancement—widespread social adoption and reliance—certain applications can become so indispensable to a broad range of downstream uses that they become infrastructure. For example, trademarked terms can enter the vernacular as generic words such as “aspirin” or “thermos.” Particularized expressions can become stock literary elements, such as the Swiss bank account that has become a standard plot device in international espionage stories. Inventions can

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15. See Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 MINN. L. REV. 917, 928 (2005) (describing several examples of intellectual infrastructure in copyright and patent law) [hereinafter Frischmann, *Economic Theory*].

16. I use the terms “raw” and “cooked” differently than Claude Levi-Strauss, for whom they generally signify “natural” and “cultural” elements, respectively. See generally CLAUDE LEVI-STRAUSS, *THE RAW AND THE COOKED* (John Weightman & Doreen Weightman trans., Harper & Row 1969); see also Bradford S. Simon, *Intellectual Property and Traditional Knowledge: A Psychological Approach to Conflicting Claims of Creativity in International Law*, 20 BERKELEY TECH. L.J. 1613, 1618 (2005). For my purposes, generally speaking, “raw” assets represent infrastructural building blocks for which enhanced access is appropriate while “cooked” assets are refined, particularized, and properly subject to exclusive rights. However, as I explore at length, this paradigm is complicated when a “cooked” asset achieves the status of infrastructure.

quickly become standard platforms for technological development, such as the technique for gene splicing, a fundamental innovation around which a significant portion of the biotechnology industry has coalesced. Through widespread adoption and reliance, applications can evolve into infrastructure. This in turn complicates the familiar productivity model wherein intellectual property law grants exclusive rights to applications while ensuring wide access to infrastructure.

As this Article demonstrates, trademark and copyright law use social-feedback mechanisms to relax exclusive rights on applications that have become infrastructure; patent law lacks such a mechanism, thus potentially inhibiting technological development. In trademark and copyright law, doctrines such as genericide, the idea-expression dichotomy, and the scenes a faire doctrine<sup>17</sup> allow courts to consider social practice and norms in eliminating exclusive rights on applications that society has come to regard as infrastructural. Trademarks that become generic words lose their trademark status. Similarly, expressions that become stock literary devices are no longer eligible for copyright protection. “Retiring” exclusive rights on these infrastructural resources facilitates their unfettered use by the community at large. Patent law has no analogous, dynamic mechanism for liberalizing access to patented inventions that have achieved the status of infrastructure. Instead, it relies on a relatively short term of protection (twenty years) to provide “timely” access to foundational technologies. However, in fast-moving industries, patented inventions can become infrastructure well before the patent expires. Patent law’s rigidity is not only out of step with its intellectual property siblings, but it is also inconsistent with myriad real property doctrines that enhance access to proprietary infrastructure in response to evolving social needs.

Third, having identified this deficiency in patent law, this Article offers a solution. Specifically, it draws from the Supreme Court’s recent decision in *eBay Inc. v. MercExchange, L.L.C.*<sup>18</sup> to propose a case-

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17. In brief, the doctrine of genericity prohibits trademarks on generic words that signify entire product classes, such as “car” or “computer.” See, e.g., *Abercrombie & Fitch Co. v. Hunting World, Inc.*, 537 F.2d 4, 9 (2d Cir. 1976). The idea-expression dichotomy allows copyrights on particularized expressions, such as the text of a book and close paraphrasings, but not on general ideas, such as “boy meets girl.” See, e.g., *Nichols v. Universal Pictures Corp.*, 45 F.2d 119, 121 (2d Cir. 1930). The scenes a faire doctrine prohibits copyright protection on standard, stock, or necessary expressions, such as the hackneyed Swiss bank account of the international spy genre. See, e.g., *Walker v. Time Life Films, Inc.*, 784 F.2d 44, 50 (2d Cir. 1986). (This Article adopts the Anglicized version of “scenes a faire,” which courts also refer to as “scènes à faire.”)

18. 547 U.S. \_\_\_, 126 S. Ct. 1837 (2006).



specific social feedback mechanism for liberalizing access to patented infrastructure. *eBay* replaces the Federal Circuit's per se rule under which courts virtually automatically granted motions for injunctive relief upon a finding of patent infringement.<sup>19</sup> Instead, courts must now apply the traditional, multi-factor equitable framework long used in non-patent cases to determine the appropriateness of injunctions.<sup>20</sup>

This Article argues that courts should consider the infrastructural use of a patented invention when determining infringement remedies and, in certain circumstances, allow such use to continue by a downstream user contingent upon providing compensation to the patentee. This Article proposes a two-tiered system in which courts would continue to protect ordinary inventions not serving as infrastructure with a property rule (via injunctive relief) but would have the flexibility to protect patented inventions serving as infrastructure with a liability rule<sup>21</sup> (via royalties). Inventions that would be eligible for liability rule treatment would satisfy three criteria: (1) they would constitute infrastructure, a concept I discuss at length in Part I.A; (2) the alleged infringer would be using the invention in an infrastructural manner; and (3) the invention would not be reasonably available through ordinary licensing. To be effective, liability rule protection would extend both to inventions that have clearly achieved infrastructural status, such as widely used, patented information technology standards, as well as to inventions whose limited availability demonstrates significant potential for infrastructural use, such as patented human embryonic stem cells. Although this proposal allows courts to determine an ongoing royalty for continued infringement of infrastructural inventions, a court-determined royalty would only represent a last resort if parties could not voluntarily negotiate a license.

This proposal offers several significant advantages. First, it enhances patent law's responsiveness to productivity dynamics in particular technological fields by relaxing exclusive rights on inventions as they become critical platforms for downstream development. This proposal mitigates the possibility that exclusive rights on infrastructural

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19. *Id.* at 1839 (quoting *MercExchange, L.L.C. v. eBay, Inc.*, 401 F.3d 1323, 1339 (Fed. Cir. 2005)).

20. *Id.*

21. See Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092 (1972). While Calabresi and Melamed primarily discuss liability rules in the context of awarding one-time damages, I extend their framework to also include awarding ongoing royalties.

inventions will serve as a bottleneck that inhibits downstream productivity. Analyzing infrastructural status at the time of infringement, rather than upon patent issuance, allows courts to consider an invention's social history and specific exploitation on a case-by-case basis when determining the appropriateness of enjoining infringement.

Second, this proposal moves beyond the trademark and copyright contexts where a binary choice between open access and exclusive rights is adequate. Through applying liability rules, this Article offers a nuanced guide to use-specific, compensation-dependent access to patented infrastructural technologies. This approach enhances access to proprietary infrastructure while still maintaining incentives to invent.

Third, while liability rules may serve as a useful judicial backstop to enhance access to patented infrastructure, this proposal maintains numerous opportunities for parties to voluntarily negotiate licenses. Furthermore, by changing the baseline conditions of these negotiations, this proposal may help reduce the transaction costs that often undermine private ordering.

In addition to offering a concrete proposal for patent law, this inquiry holds implications that extend far beyond that single field. First, it highlights the methodological value of intradisciplinary comparison within intellectual property law in general.<sup>22</sup> Although analogies are rarely perfect, and although trademark, copyright, and patent law exhibit significant theoretical and doctrinal differences, these fields can still borrow fruitfully from each other when solving certain shared problems. Second, this intradisciplinary comparison reveals a natural limitation on intellectual property rights, which are structured to maintain access to infrastructure and prevent pernicious intellectual monopolies.<sup>23</sup> Finally,

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22. See generally WILLIAM M. LANDES & RICHARD A. POSNER, *THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW* 205 (2003) (noting similarities between patent law's exclusion of scientific and mathematical principles and copyright's exclusion of ideas); Mark Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 *TEX. L. REV.* 989 (1997) (suggesting a copyright analog for "blocking patents") [hereinafter Lemley, *Economics of Improvement*]; Oskar Liivak, *Maintaining Competition in Copying: Narrowing the Scope of Gene Patents*, 41 *U.C. DAVIS L. REV.* 177 (2007) (applying the originality requirement to constrain gene patents); Oskar Liivak, *The Forgotten Originality Requirement: A Constitutional Hurdle for Gene Patents*, 87 *J. PAT. & TRADEMARK OFF. SOC'Y* 261 (2005) (applying the originality requirement, commonly associated with copyrights, to patent law); Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 *COLUM. L. REV.* 1177 (2000) (proposing an analog of copyright's fair use doctrine for patent law); John Shepard Wiley, Jr., *Copyright at the School of Patent*, 58 *U. CHI. L. REV.* 119 (1991) (proposing reforms to the idea-expression dichotomy based on analogous concepts in patent law).

23. This infrastructural insight bolsters criticisms of the ever-expanding nature of intellectual

this Article begins to reconcile progressive calls to enhance intellectual property law's attentiveness to social context with this legal field's traditional economic objective of promoting productivity.<sup>24</sup> This Article shows that intellectual property law can only achieve its originalist goal of promoting productivity if it is sensitive to the evolving infrastructural needs of creative communities.<sup>25</sup>

Part I argues that differential treatment of intellectual infrastructure and application is essential to promoting productivity in trademark, copyright, and patent law. Extending previous work,<sup>26</sup> Part I provides a comprehensive account of intellectual property doctrines that distinguish nonprotectable infrastructure from protectable application: trademark's doctrine of genericity; copyright's idea-expression dichotomy and scenes a faire doctrine; and patent law's prohibition against patenting natural laws, physical phenomena, and abstract ideas.<sup>27</sup>

Part II turns to real property to show both that infrastructure evolves and that legal doctrines respond to this evolution by liberalizing access to assets that *become* infrastructure. Society's widespread use and reliance on productivity-enabling resources can transform them into infrastructure. Analogously, trademarked terms, particularized expressions, and specific inventions can "evolve" into infrastructure through society's widespread use and reliance upon them as basic building blocks of communication and creation. Drawing from Professor Carol Rose's concept of "inherently public property," Part II shows how

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property rights. See, e.g., James Boyle, *The Second Enclosure Movement and the Construction of the Public Domain*, 66 LAW & CONTEMP. PROBS. 33, 37–40 (2003).

24. See Sunder, *IP<sup>3</sup>*, *supra* note 14, at 264 (urging scholars to integrate economic and cultural accounts of intellectual property).

25. This analysis draws much from the "social relations" view of property rights associated with Joseph Singer. See Joseph William Singer, *The Reliance Interest in Property*, 40 STAN. L. REV. 611, 663 (1988) [hereinafter Singer, *The Reliance Interest*]. Ultimately, this Article suggests a more productive way for patents to mediate the relationship between upstream inventors and downstream users and society at large.

26. See Frischmann, *Economic Theory*, *supra* note 15; Brett M. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257 (2007).

27. See *supra* note 17. The prohibition against patenting natural laws, physical phenomena, and abstract ideas excludes these entities from patentable subject matter, reserving exclusive rights only for particularized inventions. Related, though not identical, concerns over distinguishing nonprotectable infrastructure from protectable application also apply to the right of publicity. See *White v. Samsung Elecs. Am., Inc.*, 989 F.2d 1512, 1512–23 (9th Cir. 1993) (Kozinski, J., dissenting from denial of rehearing en banc) (arguing that an expansive right of publicity can inhibit subsequent creative expression). I here focus on the "core" intellectual property disciplines of trademark, copyright, and patent law. See James Gibson, *Risk Aversion and Rights Accretion in Intellectual Property Law*, 116 YALE L.J. 882, 885 (2007).

certain real property doctrines, such as eminent domain, public prescription, the public trust doctrine, and custom, relax exclusive rights on resources that are widely needed to promote productivity.<sup>28</sup> Applied to intellectual property, these doctrines provide a model for liberalizing access to trademarks, expressions, and inventions that evolve into intellectual infrastructure.

Part III then examines the extent to which various intellectual property doctrines accommodate the evolution of intellectual infrastructure. A striking continuum emerges. Trademark's doctrine of genericity is highly attentive to evolving social meanings in determining when a trademarked term has become generic, thus warranting its preservation in the public domain as intellectual infrastructure. Copyright law occupies an intermediate position by ensuring access to expressive elements that society has come to recognize as "stock" or "standard" as nonprotectable infrastructure. At the far end of the continuum, patent law has no such social feedback mechanism. It is insensitive to demand-side<sup>29</sup> considerations favoring broad access to patented inventions, such as isolated, purified human embryonic stem cells and information technology standards, that fundamentally enable downstream research and development. Part III acknowledges patent law's differences from trademark and copyright law, but concludes that these differences do not fully justify patent law's rigid approach. Among other considerations, it explains how patent law's relatively short term of protection does not provide adequate access to foundational technologies that became infrastructure within a short time after patenting.

Part IV presents a remedy. Moving beyond the all-or-nothing choice between open access and strict exclusive rights, Part IV proposes a workable model for use-specific, compensation-dependent access to patented infrastructure. This solution arises organically from the Supreme Court's recent decision in *eBay Inc. v. MercExchange, L.L.C.*, which provides courts greater latitude to deny injunctions in patent infringement suits and to protect patents with a liability rule.<sup>30</sup> I advocate

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28. See Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 714, 720 (1986) [hereinafter Rose, *The Comedy of the Commons*].

29. In economic terms, demand-side considerations relate to the interests of consumers while supply-side considerations relate to the interests of producers. For patented infrastructure, such as isolated, purified human embryonic stem cells, demand-side considerations favor free access to these cells to facilitate their downstream exploitation by users. However, such open access would undermine producers' supply-side incentives to invest in developing such cells in the first place.

30. 547 U.S. \_\_\_, 126 S. Ct. 1837 (2006).

a two-tiered system in which inventions used in a non-infrastructure capacity would continue to receive property rule protection, but infrastructure use of a patented technology would weigh in favor of denying an injunction and protecting the patent with a liability rule. In the context of a particular infringement suit, courts would extend liability rule protection to a patented invention that: (1) comprises productivity-enhancing infrastructure, (2) was actually used by an alleged infringer in an infrastructure capacity, and (3) was not reasonably available through ordinary licensing. This approach would enhance access to patented infrastructure while still maintaining incentives to invent.

## I. PROMOTING PRODUCTIVITY THROUGH LIBERAL ACCESS TO INTELLECTUAL INFRASTRUCTURE

Trademark, copyright, and patent law all promote productivity by applying opposing property regimes to intellectual infrastructure and application. This Article uses analogy to identify shared principles among these three fields,<sup>31</sup> a method that courts and commentators have found fruitful.<sup>32</sup> While one must acknowledge significant differences among these disciplines,<sup>33</sup> these differences should not obscure significant conceptual and doctrinal similarities. Subject matter is the

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31. See Anupam Chander, *Minorities, Shareholder and Otherwise*, 113 YALE L.J. 119, 152 (2003) (comparing minorities in the shareholder and constitutional contexts and noting that “[s]uch intradisciplinarity seems especially appropriate to law, a discipline that relies on analogical reasoning”).

32. See *supra*, note 22; *eBay Inc.*, 547 U.S. at \_\_\_, 126 S. Ct. at 1840 (harmonizing patent law with traditional injunction practice applying to copyright law); *Lab. Corp. of Am. Holdings v. Metabolite Labs., Inc.*, 548 U.S. \_\_\_, 126 S. Ct. 2921, 2922–23 (2006) (per curiam) (Breyer, J., dissenting from denial of certiorari) (noting the similarity of patent law’s exclusion of scientific principles and copyright’s exclusion of ideas from protectable subject matter); *Eldred v. Ashcroft*, 537 U.S. 186, 201 (2003) (“Because the [constitutional] Clause empowering Congress to confer copyrights also authorizes patents, congressional practice with respect to patents informs our inquiry.”); *Sony Corp. v. Universal City Studios, Inc.*, 464 U.S. 417, 439 (1984) (noting the “historic kinship” of copyright and patent law); *United States ex rel. The Baldwin Co. v. Robertson*, 265 U.S. 168, 180 (1924) (recognizing that Congress intended early trademark legislation to afford applicants the same equitable remedies available to patent applicants); *Jeffrey Milstein, Inc. v. Greger, Lawlor, Roth, Inc.*, 58 F.3d 27, 32 (2d Cir. 1995) (“[J]ust as copyright law does not protect ideas . . . neither does trade dress law protect an idea, a concept, or a generalized type of appearance.”).

33. Cf. *Baker v. Selden*, 101 U.S. 99, 102 (1879) (noting that patent law extends further than copyright law in allowing exclusive rights on technical ideas); *Canal Co. v. Clark*, 80 U.S. 311, 322 (1871) (observing that trademarks, unlike copyrighted or patented works, need not be original to the creator). My arguments are based on functional analogies among these doctrines, not analytical identity.

most obvious point of convergence: intellectual property deals with exclusive rights in intangible assets. Broadly speaking, promoting progress through enhancing productivity is another commonality.<sup>34</sup> Accordingly, this Part first situates intellectual infrastructure in the shared utilitarian objectives of trademark, copyright, and patent law. It then presents an economic definition of infrastructure that helps explain why open access to this type of resource is critical to promoting productivity. Finally, this Part explores various doctrines that distinguish intellectual infrastructure from application: trademark's genericity doctrine; copyright's idea-expression dichotomy and scenes a faire doctrine; and patent law's prohibition against patenting natural laws, physical phenomena, and abstract ideas.

### A. *The Utilitarian Foundations of Intellectual Infrastructure*

At a general level, trademark, copyright, and patent law all aim to promote some type of progress, whether commercial, creative, or technological. As we will see, while granting exclusive rights on some kinds of intangible assets can promote progress, exclusive rights on other kinds can actually inhibit it. Of course, "progress" is a highly contested concept.<sup>35</sup> In my analysis, I focus on traditional interpretations of progress in the intellectual property context that relate economic, creative, and inventive productivity to aggregate social welfare. Although this economic focus on ensuring marketplace efficiency and producing cultural and technological goods does not directly address questions such as whether some goods are aesthetically "better" than others,<sup>36</sup> or whether they are equitably distributed,<sup>37</sup> it holds great currency in intellectual property doctrine. As others have argued, economic, cultural, and other theories all have roles to play in explaining

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34. Lemley, *Free Riding*, *supra* note 10, at 1031 ("Intellectual property protection in the United States has always been about generating incentives to create.").

35. See Sunder, *IP*<sup>3</sup>, *supra* note 14, at 284 ("The utilitarian approach to intellectual property does not ask: Who makes the goods? Who profits, and at whose expense?"); Anupam Chander & Madhavi Sunder, *The Romance of the Public Domain*, 92 CAL. L. REV. 1331, 1332 (2004) (emphasizing distributional concerns in intellectual property law); Julie E. Cohen, *Creativity and Culture in Copyright Theory*, 40 U.C. DAVIS L. REV. 1151, 1162–70 (2007) [hereinafter Cohen, *Creativity and Culture*]; Brett Frischmann, *Cultural Environmentalism and the Wealth of Networks*, 74 U. CHI. L. REV. 1083, 1096 (2007) (noting multiple conceptions of "progress," one of which involves promoting widespread participation in creative activities).

36. See *Bleistein v. Donaldson Lithographing Co.*, 188 U.S. 239, 251–52 (1903) (cautioning against judicial evaluations of artistic merit in copyright cases).

37. See Sunder, *IP*<sup>3</sup>, *supra* note 14, at 284.

and critiquing intellectual property.<sup>38</sup> Indeed, as I hope to show, attentiveness to the evolving needs of creative communities is essential for intellectual property to achieve its traditional economic objectives.

Trademark, copyright, and patent law all exhibit a strongly utilitarian character. Trademarks confer exclusive rights to “marks,” such as brand names, logos, and even distinctive product designs, which firms can use to identify their particular goods and services in the marketplace. Although trademarks, unlike copyrights and patents, do not provide direct incentives to create,<sup>39</sup> they ultimately aim to promote productivity.<sup>40</sup> In enacting the Lanham Act,<sup>41</sup> the framework for federal trademark law, Congress intended to foster competition and enhance general consumer welfare.<sup>42</sup> Trademarks reduce search costs for consumers,<sup>43</sup> prevent public deception,<sup>44</sup> and mitigate free-riding by imitators.<sup>45</sup> While protecting reputable firms suggests a moral desert basis for trademark law, this theory falters given that despite a trademark owner’s well-established reputation and substantial marketing efforts, any trademark that becomes generic is subject to cancellation.<sup>46</sup> While traditional notions of commercial morality and unfair competition inform trademark doctrine, its modern formulation features a strong utilitarian emphasis on streamlining market transactions.

The utilitarian character of copyright and patent law arises most clearly from their constitutional objective “[t]o promote the Progress of Science and useful Arts.”<sup>47</sup> While copyright offers some protection for

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38. *Id.* at 264; see Cohen, *Creativity and Culture*, *supra* note 35, at 1155–62.

39. See Mark A. Lemley, *The Modern Lanham Act and the Death of Common Sense*, 108 YALE L.J. 1687, 1695 (1999) [hereinafter Lemley, *Lanham Act*].

40. See LANDES & POSNER, *supra* note 22, at 166.

41. Trademark Act of 1946, Pub. L. No. 79-489, 60 Stat. 427 (codified as amended at 15 U.S.C. §§ 1051–1141 (2000 & Supp. V 2005)).

42. S. REP. NO. 1333, at 3–5 (1946); see *Park 'N Fly, Inc. v. Dollar Park & Fly, Inc.*, 469 U.S. 189, 198 (1985); Ralph S. Brown, *Advertising and the Public Interest: Legal Protection of Trade Symbols*, 57 YALE L.J. 1165, 1167 (1948) (describing how trademarks serve both private and public interests).

43. Lemley, *Lanham Act*, *supra* note 39, at 1690.

44. *Canal Co. v. Clark*, 80 U.S. 311, 323 (1871); see *Kidd v. Johnson*, 100 U.S. 617, 620 (1879); *Two Pesos, Inc. v. Taco Cabana, Inc.*, 505 U.S. 763, 767–78 (1992) (noting that the Lanham Act seeks to prevent deceptive marks and protect firms against unfair competition). *But see* Mark P. McKenna, *The Normative Foundations of Trademark Law*, 82 NOTRE DAME L. REV. 1839, 1841 (2007) (emphasizing that early trademark law sought to protect producers, not consumers).

45. See *Mattel, Inc. v. MCA Records, Inc.*, 296 F.3d 894, 903 (9th Cir. 2002).

46. See *infra* Part I.B.1.

47. U.S. CONST. art. I, § 8, cl. 8. By comparison, federal trademark law relies on the Commerce

authors’ “moral rights,”<sup>48</sup> its doctrinal basis has traditionally been understood as utilitarian.<sup>49</sup> Although the “immediate effect” of copyright law “is to secure a fair return for an ‘author’s’ creative labor,” the “ultimate aim is, by this incentive, to stimulate artistic creativity for the general public good.”<sup>50</sup>

Patent law is similarly instrumental, with the constitutional objective of promoting technological progress<sup>51</sup> acting as a limiting condition on Congress’s power over the patent system.<sup>52</sup> The Supreme Court has recognized that the “ultimate goal of the patent system is to bring new designs and technologies into the public domain through disclosure.”<sup>53</sup>

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Clause for constitutional authorization. *See In re Trade-Mark Cases*, 100 U.S. 82 (1879).

48. Moral rights, which hold great currency in Continental copyright law, protect copyrighted works as extensions of an author’s persona and do not arise from an explicitly utilitarian aim to encourage production of such works. *See* Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957 (1982) (arguing that ownership of property is essential to realizing one’s individual potential, and laying the foundation for justifying copyright as protecting the integrity of the author’s persona); Neil Netanel, *Copyright Alienability Restrictions and the Enhancement of Author Autonomy: A Normative Evaluation*, 24 RUTGERS L.J. 347, 383–88 (1993) (discussing moral rights); *see* Douglas Y’Barbo, *The Heart of the Matter: The Property Right Conferred by Copyright*, 49 MERCER L. REV. 643, 659–60 (1998) (describing the incentives and personhood paradigms for copyright). United States copyright law does offer limited protection of moral rights for certain kinds of visual art. *See* 17 U.S.C. § 106A (2000) (codifying the Visual Artists Rights Act of 1990); Roberta Rosenthal Kwall, “*Author-Stories: Narrative’s Implications for Moral Rights and Copyright’s Joint Authorship Doctrine*,” 75 S. CAL. L. REV. 1, 5, 26 (2001).

49. *But see* Sunder, *IP<sup>3</sup>*, *supra* note 14, at 286–88 (noting that moral rather than efficiency concerns animated the Supreme Court’s ruling in *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 545 U.S. 913 (2005)).

50. *Twentieth Century Music Corp. v. Aiken*, 422 U.S. 151, 156 (1975); *see* H.R. REP. NO. 60-2222, at 7 (1909); *Eldred v. Ashcroft*, 537 U.S. 186, 212 (2003) (characterizing Congress’s “constitutional command” as creating “a ‘system’ that ‘promote[s] the Progress of Science’”); *Feist Publ’ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 349 (1991) (rejecting the so-called “sweat of the brow” theory of copyright); *United States v. Paramount Pictures*, 334 U.S. 131, 158 (1948) (“The copyright law, like the patent statutes, makes reward to the owner a secondary consideration.”); *Fox Film Corp. v. Doyal*, 286 U.S. 123, 127 (1932) (“The sole interest of the United States and the primary object in conferring the monopoly lie in the general benefits derived by the public from the labors of the authors.”); *see also* Leslie A. Kurtz, *Copyright: The Scenes a Faire Doctrine*, 41 FLA. L. REV. 79, 83 (1989) (“The function of copyright is to promote creativity and the dissemination of creative works, so that the public may benefit from the labor of authors.”) [hereinafter Kurtz, *The Scenes a Faire Doctrine*].

51. Some scholars debate the original meaning of “progress” in the Constitution. *See, e.g.*, Malla Pollack, *What Is Congress Supposed To Promote?: Defining “Progress” in Article I, Section 8, Clause 8 of the United States Constitution, or Introducing the Progress Clause*, 80 NEB. L. REV. 754, 755 (2001) (arguing that progress in this context means “diffusion”).

52. *See* *Graham v. John Deere*, 383 U.S. 1, 5 (1966).

53. *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 151 (1989). *But see* Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. REV. 123, 131–38 (2006) (arguing that the



While acknowledging the valuable contributions of inventors,<sup>54</sup> the Court has accordingly rejected any moral rights or Lockean labor theory justifications for granting patents.<sup>55</sup>

While exclusive rights on intangible assets can advance productivity, they can also inhibit it. In trademark, exclusive rights on brand names and logos lower transactions costs and enhance competition. In copyright and patent law, exclusive rights establish incentives to create expressive works and inventions. This model equates property rights with productivity.<sup>56</sup> However, ownership is not a natural right but is contingent on promoting productivity.<sup>57</sup> As such, all three disciplines must address a shared question: what happens when conferring exclusive rights actually *inhibits* progress?<sup>58</sup> After all, trademarks on generic words might hamper commerce, and copyrights and patents on ideas and natural principles might inhibit downstream productivity.

Accordingly, all three disciplines possess functional doctrines to limit exclusive rights to facilitate subsequent productivity. Specifically, all three disciplines distinguish nonprotectable intellectual *infrastructure* from protectable intellectual *application*.<sup>59</sup> Infrastructure includes generic words, creative ideas, stock literary devices, natural laws, physical phenomena, and abstract technical ideas. These basic building blocks of communication, expression, and invention reside in the public domain for all to use.<sup>60</sup> Infrastructure enables productivity, and its wide

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disclosure requirement is inconsistent with prevailing theories justifying the patent system).

54. See *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, 186 (1933) (“An inventor . . . gives something of value to the community by adding to the sum of human knowledge.”).

55. See *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 330–31 (1945) (“The primary purpose of our patent system is not reward of the individual but the advancement of the arts and sciences.”); *id.* at 331 n.1 (noting that the purpose of patents is “much deeper and the effect much wider than individual gain”) (quoting TNEC Hearings, Part 3, p. 857).

56. See Cohen, *Creativity and Culture*, *supra* note 35, at 1170 (“A legal regime meant to promote progress requires a set of premises about the ways in which progress develops.”). See generally Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967) (arguing that property rights help internalize externalities and thus encourage efficient resource exploitation).

57. See *Graham*, 383 U.S. at 9.

58. Most commentators have focused on this shared concern between copyright and patent. See, e.g., O’Rourke, *supra* note 22, at 1180. However, productivity concerns also inform trademark’s doctrine of genericity. See Part I.B.1.

59. I make no claim to coining “intellectual infrastructure.” See Frischmann, *Economic Theory*, *supra* note 15, at 990–1003.

60. These assets occupy one region of the public domain, alongside creative works and inventions for which the protected terms have expired, assets dedicated to the public, and other resources

availability in the public domain allows for its broadest possible exploitation. Individuals work from these “raw” materials to produce “cooked” creations eligible for exclusive rights: source-identifying marks, particularized texts, and specific inventions.

In elaborating the concept of intellectual infrastructure, I extend the work of Professors Brett Frischmann and Mark Lemley.<sup>61</sup> Professor Frischmann presents a demand-side economic model that defines an infrastructural resource as satisfying three criteria: (1) the resource is at least partially nonrival; (2) it derives its primary social value from facilitating downstream productive activity; and (3) it serves as an input into a wide range of goods and services, including private, public, and nonmarket goods.<sup>62</sup> Extended to intellectual property, intangible resources satisfying these criteria qualify as intellectual infrastructure.<sup>63</sup> These resources facilitate broad arrays of downstream activity, thus creating a powerful demand-side argument for making them widely available in the public domain.<sup>64</sup>

The first criterion, nonrivalry, indicates that within certain limits, additional consumption of infrastructure does not diminish its availability for others to use. For example, subject to constraints of congestion, additional users in a telephone network do not diminish that network’s overall capacity to facilitate communication.<sup>65</sup> Intangible assets such as words, ideas, and natural principles exhibit perfect nonrivalry because additional “consumption” of these resources does not diminish their availability at all,<sup>66</sup> thus well-suited them for open access.

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ineligible for exclusive rights. See Pamela Samuelson, *Challenges in Mapping the Public Domain*, in *THE FUTURE OF THE PUBLIC DOMAIN: IDENTIFYING THE COMMONS IN INFORMATION LAW* 7–25 (Lucie Guibault & P. Bernt Hugenholtz eds., 2006). These other assets also function as infrastructural elements. See Frischmann & Lemley, *supra* note 26, at 291. However, I focus here on “pure” intellectual infrastructure that is never eligible for individual ownership, such as generic words, abstract ideas, and natural principles.

61. See Frischmann, *Economic Theory*, *supra* note 15; Frischmann & Lemley, *supra* note 26.

62. Frischmann, *Economic Theory*, *supra* note 15, at 956.

63. See *id.* at 990–1003.

64. See *id.* at 922–23; Frischmann & Lemley, *supra* note 26, at 282 (“Frischmann’s organizing heuristic is ‘if infrastructure, then commons.’”).

65. See Frischmann, *Economic Theory*, *supra* note 15, at 953–55.

66. See VI THE WRITINGS OF THOMAS JEFFERSON 180–81 (H.A. Washington ed., 1871) (describing ideas as “expansible over all space, without lessening their density in any point”).

The second criterion emphasizes that infrastructure is “intermediate”: its primary social value resides in enabling downstream productivity.<sup>67</sup> The value of words, ideas, and natural principles in the utilitarian context of the intellectual property system derives largely from their role as *means*—enablers of commercial transactions, creative expressions, and tangible inventions—rather than as ends in and of themselves.<sup>68</sup>

The third criterion reflects infrastructure’s ability to enable a wide array of downstream activities.<sup>69</sup> While many resources, from beakers to mechanical pencils, are inputs into downstream production chains, infrastructure is different. Intellectual infrastructure, such as words, ideas, and natural principles, contributes to an extremely wide range of downstream applications, as well as to many kinds of applications, including private, public, and nonmarket goods.<sup>70</sup>

As Frischmann and Lemley recognize, several intellectual property doctrines operate to keep intellectual infrastructure in the public domain. These include subject matter exclusions such as copyright’s idea-expression dichotomy and the nonpatentability of abstract ideas.<sup>71</sup> Additionally, use-specific exclusions such as the fair use defense also permit the infrastructural exploitation of certain copyrighted materials.<sup>72</sup>

I build upon Frischmann and Lemley’s work in several ways. Under the rubric of intellectual infrastructure, I include trademark’s doctrine of genericity,<sup>73</sup> copyright’s idea-expression dichotomy and scenes a faire doctrine,<sup>74</sup> and the prohibition against patenting natural laws, natural phenomena, and abstract ideas.<sup>75</sup> I therefore bring trademark into the fold and extend infrastructure theory to previously unexamined doctrines

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67. Frischmann, *Economic Theory*, *supra* note 15, at 957.

68. COMM. ON MEASURING & IMPROVING INFRASTRUCTURE PERFORMANCE, NAT’L RESEARCH COUNCIL, MEASURING AND IMPROVING INFRASTRUCTURE PERFORMANCE 5 (1995) (“Infrastructure is a means to other ends, and the effectiveness, efficiency, and reliability of its contribution to these other ends must ultimately be the measures of infrastructure performance.”).

69. Frischmann, *Economic Theory*, *supra* note 15, at 957–58.

70. *Id.* Given the functional definition of infrastructure, the line separating infrastructure from application may not always be clear. Furthermore, the same asset may constitute infrastructure in one context and non-infrastructural application in another. *See infra* Part IV.D.

71. Frischmann, *Economic Theory*, *supra* note 15, at 1003; Frischmann & Lemley, *supra* note 26, at 284–92.

72. *See* Frischmann, *Economic Theory*, *supra* note 15, at 1002–03; Frischmann & Lemley, *supra* note 26, at 286–90.

73. *See infra* Part I.B.1.

74. *See infra* Part I.B.2.

75. *See infra* Part I.B.3. *See supra* notes 17, 27.

in copyright and patent law. This comprehensive analysis shows that maintaining wide access to infrastructure is essential to advancing productivity throughout intellectual property law. Conversely, it highlights the significant productivity losses that can result from exclusive rights on intellectual infrastructure.<sup>76</sup>

### *B. The Doctrinal Framework for Intellectual Infrastructure*

#### *1. Trademarks: Genericity*

Through the doctrine of genericity, trademark law maintains the intellectual infrastructure of generic words in the public domain.<sup>77</sup> Taco Bell cannot trademark the term “quesadilla,” which is a generic word signifying a general class of products.<sup>78</sup> However, it can trademark “Crunchwrap Supreme” because this distinctive term signifies a single product unique to that firm.

Importantly, genericity operates in a dynamic fashion over time. Ex ante, terms that already represent the “common descriptive name” of a product category, such as “car” or “computer,” are not eligible for trademark protection.<sup>79</sup> Ex post, even fabricated terms such as “aspirin” and “cellophane,” which originated as trademarks, can lose their protected status if they become the generic signifiers of entire classes of products.<sup>80</sup> Thus, a registered mark is subject to cancellation if it *becomes* the generic name for the good or service for which it is registered.<sup>81</sup> This illustrates the phenomenon of genericide, which also

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76. For a related argument for liberalizing access to infrastructure in the antitrust context, see Brett Frischmann & Spencer Weber Waller, *Essential Facilities, Infrastructure, and Open Access* (Nov. 2, 2006), available at [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=942074](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=942074).

77. Trademarks are distinctive words, phrases, designs, or logos used by individuals and firms to uniquely identify their products and services to consumers. The Lanham Act protects both “registered” and “unregistered” marks. See 15 U.S.C. § 1051 (2000) (describing rules for registering trademarks); 15 U.S.C. § 1125 (2000) (establishing so-called “federal common law protection” for unregistered marks). Under both systems, generic terms are not protectable.

78. See *Abercrombie & Fitch Co. v. Hunting World, Inc.*, 537 F.2d 4, 9 (2d Cir. 1976).

79. See *Murphy Door Bed Co. v. Interior Sleep Sys., Inc.*, 874 F.2d 95, 100–01 (2d Cir. 1989); Hans Zeisel, *The Surveys that Broke Monopoly*, 50 U. CHI. L. REV. 896, 896 (1983).

80. *DuPont Cellophane Co. v. Waxed Prods. Co.*, 85 F.2d 75, 82 (2d Cir. 1936) (invalidating the trademark on “cellophane” in certain contexts); *Bayer Co. v. United Drug Co.*, 272 F. 505, 515–16 (S.D.N.Y. 1921) (holding similarly for “aspirin”).

81. See 15 U.S.C. § 1064(3) (2000). Genericity has its roots in the common law of trademarks. See RESTATEMENT (THIRD) OF UNFAIR COMPETITION § 13 (1995).

applies to trampoline, yo-yo, brassiere, escalator, thermos,<sup>82</sup> and “You Have Mail,”<sup>83</sup> all of which lost trademark status upon entering the vernacular as generic words. Ultimately, keeping generic words—a species of intellectual infrastructure—in the public domain helps promote commercial transactions and prevents firms from leveraging trademarks into economic monopolies.

Generic words satisfy the three criteria for infrastructure because they are: (1) nonrival assets that are (2) valuable as inputs (3) into a wide array of downstream uses.<sup>84</sup> While trademarks such as “IBM” share these attributes to a certain degree, the social value and potential uses of a generic word such as “computer” far outstrip that of any particular trademark, thus rendering exclusive rights on generic words inherently problematic.<sup>85</sup> As the Fifth Circuit has observed, “[a] generic term connotes the ‘basic nature of articles or services’ rather than the more individualized characteristics of a particular product.”<sup>86</sup> In a sense, generic language is the ultimate infrastructure because it is the essential foundation for all communication.<sup>87</sup>

Keeping generic words in the public domain serves trademark’s utilitarian objectives in several ways. First, generic words such as “hamburger” cannot fulfill the source-identifying function of trademarks because they describe general product classes, not particular products.<sup>88</sup> Thus, their use as trademarks would be unhelpful and potentially confusing to consumers seeking particular goods and services. Second, at a broader level, limiting exclusive rights through genericide prevents

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82. John Dwight Ingram, *The Genericide of Trademarks*, 2 BUFF. INTELL. PROP. L.J. 154, 154 (2004).

83. *Am. Online, Inc. v. AT&T Corp.*, 243 F.3d 812, 818–23 (4th Cir. 2001).

84. See Frischmann, *Economic Theory*, *supra* note 15, at 956–58.

85. Cf. Ralph H. Folsom & Larry L. Teply, *Trademarked Generic Words*, 89 YALE L.J. 1323, 1324 (1980) (“[C]ourts have assumed that granting or maintaining exclusive rights to generic words would unfairly and injuriously deprive competing manufacturers, consumers, and the public of the right to call an article by its name.”).

86. *Zatarain’s, Inc. v. Oak Grove Smokehouse, Inc.*, 698 F.2d 786, 790 (5th Cir. 1983) (quoting *Am. Heritage Life Ins. Co. v. Heritage Life Ins. Co.*, 494 F.2d 3, 11 (5th Cir. 1974)).

87. Accordingly, scholars have recognized a First Amendment basis for preventing exclusive rights over generic words. See Rochelle Cooper Dreyfuss, *Expressive Genericity: Trademarks as Language in the Pepsi Generation*, 65 NOTRE DAME L. REV. 397 (1990) [hereinafter Dreyfuss, *Expressive Genericity*].

88. See Lemley, *Lanham Act*, *supra* note 39, at 1695 (“[T]he economic case for brands and advertising is undone to the extent that trademarks are used in ways that affirmatively confuse consumers.”).

unfair competition.<sup>89</sup> If Gatorade trademarked the generic term “sports drink,” then POWERade and All Sport would be liable for infringement if they sold their products using the same name.<sup>90</sup> Consumers might eventually believe that only Gatorade produced “sports drinks.” Extrapolating beyond the single confused consumer, a firm could leverage a linguistic monopoly over a generic term into an economic monopoly, a possibility that the genericity doctrine seeks to foreclose.<sup>91</sup>

Accordingly, genericity ensures open access to a shared linguistic infrastructure, thus permitting consumers and firms to communicate effectively.<sup>92</sup> Conversely, it reserves exclusive rights for terms that are inherently distinctive or have achieved secondary meaning in the minds of consumers and that can effectively function as market signaling devices. In tandem, this differential treatment of infrastructure and application helps trademark law enhance competition and prevent consumer deception.

## 2. *Copyrights: The Idea-Expression Dichotomy and Scenes a Faire Doctrine*

Copyright law, like trademark law, distinguishes between nonprotectable intellectual infrastructure and protectable intellectual application.<sup>93</sup> However, the reason for this distinction is different:

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89. Conversely, the legislative history of the Lanham Act states that “[t]rade-marks, indeed, are the very essence of competition, because they make possible a choice between competing articles. . . .” S. REP. NO. 79-1333, at 4 (1946); H.R. REP. NO. 79-219, at 3 (1945).

90. Trademark law allows competitors to make “fair use” of a descriptive mark held by another firm for the purpose of describing their products. Analogizing to our hypothetical example in which trademark law allowed marks on generic terms, a similar fair use exception might allow firms to use “sports drink” in a descriptive sense. However, Gatorade’s exclusive right to use that term in a *trademark* fashion would still confer a significant competitive advantage. See *Zatarain’s, Inc.*, 698 F.2d at 701 (describing the fair use exception for descriptive uses of marks).

91. *Canal Co. v. Clark*, 80 U.S. 311, 323 (1871) (holding that no one can claim “exclusive use of a trade-mark or trade-name which would practically give him a monopoly in the sale of any goods other than those produced or made by himself”); see *Star Indus., Inc. v. Bacardi & Co.*, 412 F.3d 373, 382 (2d Cir. 2005) (holding that preventing monopolies represents “[t]he ‘guiding principle’ in distinguishing protectable from non-protectable marks”); cf. *Virgin Enters. Ltd. v. Nawab*, 335 F.3d 141, 147 (2d Cir. 2003).

92. Cf. Lon L. Fuller, *Consideration and Form*, 41 COLUM. L. REV. 799, 802 (1941) (“One who wishes to communicate his thoughts to others must force the raw material of meaning into defined and recognizable channels.”).

93. In general, copyrights confer a set of time-limited exclusive rights over original literary, expressive, musical, and aesthetic works, including computer software, that are fixed in a tangible medium of expression.

copyright law draws this distinction not to enhance communication between firms and consumers but to maintain creative infrastructure in the public domain as the raw building blocks of expression. Copyright possesses several doctrines to draw this distinction,<sup>94</sup> all of which are conceptually related to the idea-expression dichotomy. As elaborated in precedent and statute,<sup>95</sup> copyright protection extends only to the particularized expression of a work (and minor deviations from this expression)<sup>96</sup> and not to a work's general ideas. Distinguishing between ideas and expressions promotes productivity by keeping infrastructural raw materials freely available to all authors while maintaining incentives to create particularized expressions.<sup>97</sup>

The idea-expression dichotomy keeps a certain type of intellectual infrastructure—ideas—in the public domain. Applying Frischmann's criteria,<sup>98</sup> ideas are: (1) nonrival, (2) valuable as means to creative expression, and (3) inputs into a wide range of ends (consider how many stories can arise from ideas such as “love story” and “alien invasion”).<sup>99</sup> While the idea-expression dichotomy applies to ideas that are inherently nonprotectable from their inception (such as “love story”), I will later show that it also renders nonprotectable certain intellectual creations that *become* “ideas” through common use.<sup>100</sup> Ultimately, relegating these infrastructural resources to the public domain helps facilitate creative productivity.

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94. These include the fact-expression dichotomy, functionality doctrine, scenes a faire doctrine, and merger doctrine. *See generally* Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340 (1991) (explaining the fact-expression dichotomy); *Brandir Int'l, Inc. v. Cascade Pac. Lumber Co.*, 834 F.2d 1142 (2d Cir. 1987) (addressing the functionality doctrine); *Litchfield v. Spielberg*, 736 F.2d 1352 (9th Cir. 1984) (discussing the scenes a faire doctrine); *Morrissey v. Procter & Gamble Co.*, 379 F.2d 675 (1st Cir. 1967) (describing the merger doctrine).

95. 17 U.S.C. § 102(b) (2000) (excluding from protection “any idea, procedure, process, system, method of operation, concept, principle, or discovery”). The idea-expression dichotomy applies not only to literary ideas but also to the technical ideas embodied in functional works. *See Baker v. Selden*, 101 U.S. 99 (1879) (holding that copyright protection, which is easy to obtain and relatively lengthy, is inappropriate for technical ideas, which should only be eligible for protection based on patent law's more rigorous examination standards). *See generally* Pamela Samuelson, *Why Copyright Law Excludes Systems and Processes from the Scope of Its Protection*, 85 TEX. L. REV. 1921 (2007).

96. *See Nichols v. Universal Pictures Corp.*, 45 F.2d 119, 121 (2d Cir. 1930).

97. *See* Leslie A. Kurtz, *Speaking to the Ghost: Idea and Expression in Copyright*, 47 U. MIAMI L. REV. 1221, 1224 (1993) [hereinafter Kurtz, *Speaking to the Ghost*].

98. Frischmann, *Economic Theory*, *supra* note 15, at 956–58

99. *See id.* at 957–58

100. *See infra* Part III.B.1.

Related to the idea-expression dichotomy is the “scenes a faire” doctrine, which similarly maintains intellectual infrastructure in the public domain. Relative to the idea-expression dichotomy, the scenes a faire doctrine is even more explicitly dynamic: it relegates items to the public domain as they *become* stock and standard infrastructure.<sup>101</sup> While courts vary in precisely how they define a scene a faire<sup>102</sup> and in how they apply this doctrine,<sup>103</sup> the doctrine generally excludes from copyright protection certain “incidents, characters or settings which are as a practical matter indispensable, or at least standard, in the treatment of a given topic.”<sup>104</sup> For example, in international espionage stories, copyright protection will not attach to the inclusion of Swiss bank accounts and femme fatales unless those elements are somehow particularized beyond their standard treatments.<sup>105</sup> Like ideas, scenes a faire are also infrastructural, for they constitute the “elements of creation, a vocabulary needed to create a work.”<sup>106</sup> These stock elements flow necessarily from common nonprotectable ideas<sup>107</sup> and represent the raw materials of expression. Accordingly, the scenes a faire doctrine ensures that this creative vocabulary is freely available to all authors.

Differential treatment of infrastructure and application by both the idea-expression dichotomy and the scenes a faire doctrine promotes creative productivity. As Professor Leslie Kurtz observes, “[t]he idea/expression dichotomy helps copyright strike a balance between providing incentives to create and maintaining the store of raw materials needed for new creations.”<sup>108</sup> This concern with preventing exclusive rights on ideas also informs the merger doctrine, which provides that “[w]hen there is essentially only one way to express an idea, the idea and its expression are inseparable and copyright is no bar to copying that expression.”<sup>109</sup> While expressions are the traditional subjects of

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101. *See infra* Part III.B.2.

102. *See* Kurtz, *The Scenes a Faire Doctrine*, *supra* note 50, at 82.

103. Michael D. Murray, *Copyright, Originality, and the End of the Scènes à Faire and Merger Doctrines for Visual Works*, 58 BAYLOR L. REV. 779, 799–848 (2006).

104. *Atari, Inc. v. N. Am. Philips Consumer Elecs. Corp.*, 672 F.2d 607, 616 (7th Cir. 1982) (quoting *Alexander v. Haley*, 460 F. Supp. 40, 45 (S.D.N.Y. 1978)).

105. *See, e.g., Walker v. Time Life Films, Inc.*, 784 F.2d 44, 50 (2d Cir. 1986).

106. Kurtz, *The Scenes a Faire Doctrine*, *supra* note 50, at 114.

107. *Landsberg v. Scrabble Crossword Game Players, Inc.*, 736 F.2d 485, 489 (9th Cir. 1984) (quoting *See v. Durang*, 711 F.2d 141, 143 (9th Cir. 1983)).

108. Kurtz, *The Scenes a Faire Doctrine*, *supra* note 50, at 83–84.

109. *Concrete Mach. Co. v. Classic Lawn Ornaments, Inc.*, 843 F.2d 600, 606 (1st Cir. 1988).



copyright protection, no expression may be copyrighted if so doing would enable one to appropriate an idea.<sup>110</sup> Underpinning the idea-expression dichotomy, as well as the merger doctrine, is the objective of keeping productivity-enabling ideas in the public domain.<sup>111</sup> In tandem, providing incentives to create particularized expressions while maintaining the free availability of the intellectual infrastructure needed to create them ensures that copyright operates as “the engine of free expression.”<sup>112</sup>

Similar productivity-enhancing concerns apply to the scenes a faire doctrine, which dynamically relegates expressions to the public domain as society comes to perceive them as stock or standard. Maintaining these expressive building blocks in the public domain allows authors to freely appropriate them when creating new stories. Moving beyond the literary realm, courts in software cases have recognized the scenes a faire doctrine’s productivity-enhancing character.<sup>113</sup> In analyzing computer programs, the Second Circuit has invoked the scenes a faire doctrine to ensure that “non-protectable technical expression remains in the public domain for others to use freely as building blocks in their own work.”<sup>114</sup>

It is important to note other copyright doctrines that can liberalize access to protected material, thus enhancing its productive downstream exploitation.<sup>115</sup> The fair use defense exempts qualified uses of copyrighted material from infringement, such as for news reporting, teaching, or parody.<sup>116</sup> Additionally, in certain cases courts have relaxed exclusive rights on copyrighted material by protecting it with a liability

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110. *See Morrissey v. Procter & Gamble Co.*, 379 F.2d 675, 678–79 (1st Cir. 1967) (holding that copyright does not inhere in the written rules of a sweepstakes contest because such expression is inseparable from the idea of the contest itself); *Landsberg*, 736 F.2d at 489. For a discussion of merger in the computer science context, see *Apple Computer, Inc. v. Franklin Computer Corp.*, 714 F.2d 1240, 1253 (3d Cir. 1983).

111. While licensing could theoretically enable many downstream elaborations of a copyrighted idea, high transaction costs, bounded rationality, and imperfect information prevent optimal licensing. *See Frischmann & Lemley*, *supra* note 26, at 278.

112. *Harper & Row, Publishers, Inc. v. Nation Enters.*, 471 U.S. 539, 558 (1985).

113. Again, not all circuits have adopted identical approaches to the scenes a faire doctrine in the context of computer works. *See Murray*, *supra* note 103.

114. *Computer Assocs., Int’l, Inc. v. Altai, Inc.*, 982 F.2d 693, 721 (2d Cir. 1992).

115. *See Frischmann & Lemley*, *supra* note 26, at 286–90.

116. 17 U.S.C. § 107 (2000). *See generally* *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569 (1994); *Harper & Rowe, Publishers*, 471 U.S. 539; *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417 (1984); *Am. Geophysical Union v. Texaco, Inc.*, 60 F.3d 913 (2d Cir. 1994).

rather than a property rule.<sup>117</sup> This has occurred most prominently in the context of derivative works, where a court will allow the author of an unauthorized derivative work to continue to promulgate it as long as he provides compensation to the underlying copyright owner.<sup>118</sup> As we will see, liability rules (including fair use, which one can liken to a zero-price liability rule) can play a very helpful role in allowing downstream users to access upstream protected material.<sup>119</sup>

However, liability rules as traditionally applied in the copyright context focus on liberalizing access to particular texts that may not necessarily be widely needed by the creative community as a whole. A court's decision to allow continued distribution of an unauthorized derivative work contingent on paying an ongoing royalty may be based more on a sense of doing justice between two disputing parties rather than because the underlying copyrighted work is truly infrastructural. On the contrary, the idea-expression dichotomy and the scenes a faire doctrine are more centrally "infrastructural" in their orientation because they liberalize access to general building blocks of creation, such as ideas and stock expressions.

As with genericide, concerns over productivity losses from intellectual monopolies inform the idea-expression dichotomy and the scenes a faire doctrine. Exclusive rights over abstract ideas, which seldom have adequate substitutes, cast a very long shadow.<sup>120</sup> The idea-expression dichotomy directly prohibits exclusive rights on ideas; the merger doctrine indirectly prevents such appropriation by denying copyright protection where idea and expression have merged. Similarly, the scenes a faire doctrine preserves stock or standard expressions in the

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117. See, e.g., *Campbell*, 510 U.S. at 578 n.10 ("[T]he goals of the copyright law, 'to stimulate the creation and publication of edifying matter,' are not always best served by automatically granting injunctive relief when parodists are found to have gone beyond the bounds of fair use.") (quoting Pierre N. Leval, *Toward a Fair Use Standard*, 103 HARV. L. REV. 1105, 1134 (1990)); *Christopher Phelps & Assocs., LLC v. Galloway*, 492 F.3d 532, 543–47 (4th Cir. 2007) (applying *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. \_\_\_, 126 S. Ct. 1837 (2006), in a copyright case); *New Era Publ'ns Int'l, APS v. Henry Holt, Co.*, 884 F. 2d 659, 663 (2d Cir. 1989) (Newman, J., dissenting from denial of rehearing en banc) (rejecting the contention that once copyright infringement is found, an injunction follows as a matter of course); *Abend v. MCA, Inc.*, 863 F.2d 1465, 1478–80 (9th Cir. 1988); Alex Kozinski & Christopher Newman, *What's So Fair About Fair Use?*, 46 J. COPYRIGHT SOC'Y 513, 525–30 (1999) (proposing eliminating fair use and injunctive relief in favor of fee-based liability rules); Pierre N. Leval, *Toward a Fair Use Standard*, 103 HARV. L. REV. 1105, 1130–35 (1990).

118. See *Abend*, 863 F.2d at 1478–80.

119. See *infra* Part IV.

120. See Kurtz, *Speaking to the Ghost*, *supra* note 97, at 1253–58.

public domain “because to hold otherwise would give the first author a monopoly on the commonplace ideas behind the *scenes a faire*.”<sup>121</sup> Open access to creative infrastructure facilitates downstream productivity while reserving exclusive rights only for literary “applications” maintains incentives to create.<sup>122</sup>

### 3. *Patents: The Prohibition Against Patenting Natural Laws, Physical Phenomena, and Abstract Ideas*

As with trademark and copyright law, patent law also distinguishes between intellectual infrastructure and application. Like the idea-expression dichotomy, patent law prohibits exclusive rights on certain “raw” ingredients of creation—natural laws, physical phenomena, and abstract ideas—and reserves patents only for specific inventions. As with its intellectual property siblings, this differential treatment of infrastructure and application helps patent law achieve its utilitarian objectives. As I will later show, however, patent law has a static conception of nonprotectable intellectual infrastructure and does not accommodate the reality that certain patented inventions can *become* infrastructure within their term of protection.<sup>123</sup>

Natural laws, physical phenomena, and abstract ideas may not be patented. The Patent Act defines patentable subject matter as “any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof,” but does not define that which is *not* patentable.<sup>124</sup> Subject matter exclusions thus arise from case law<sup>125</sup> and have been deeply influenced by the legislative history of the 1952 Patent Act, which expressed Congress’s intent that patentable inventions “may include anything under the sun that is made by man.”<sup>126</sup>

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121. *Landsberg v. Scrabble Crossword Game Players, Inc.*, 736 F.2d 485, 489 (9th Cir. 1984).

122. *Satava v. Lowry*, 323 F.3d 805, 813 (9th Cir. 2003) (“Only by vigorously policing the line between idea and expression can we ensure both that artists receive due reward for their original creations and that proper latitude is granted other artists to make use of ideas that properly belong to us all.”).

123. *See infra* Part III.C.

124. *Compare* 35 U.S.C. § 101 (2000) (defining patentable subject matter) *with* 17 U.S.C. § 102(b) (2000) (enumerating exclusions from copyrightable subject matter).

125. For a more thorough history, see Lee, *Inverting the Logic of Scientific Discovery*, *supra* note 10, at 92–98.

126. S. REP. NO. 82-1979, at 5 (1952), *as reprinted in* 1952 U.S.C.C.A.N. 2394, 2399.

However, as the Supreme Court held in *Diamond v. Chakrabarty*,<sup>127</sup> this expansive language does not

suggest that § 101 [of the Patent Act] has no limits or that it embraces every discovery. The laws of nature, physical phenomena, and abstract ideas have been held not patentable. Thus, a new mineral discovered in the earth or a new plant found in the wild is not patentable subject matter. Likewise, Einstein could not patent his celebrated law that  $E=mc^2$ ; nor could Newton have patented the law of gravity.<sup>128</sup>

This nonpatentable subject matter—natural laws, physical phenomena, and abstract ideas—comprises intellectual infrastructure. These entities are: (1) nonrival,<sup>129</sup> (2) valuable as enablers of subsequent inventions, and (3) inputs into a wide range of applications.<sup>130</sup> Accordingly, open access to this inventive infrastructure enhances downstream productivity.

A distinction between productivity-enabling infrastructure that resides in the public domain and refined, particularized inventions that are eligible for exclusive rights runs throughout patentable subject matter jurisprudence. On the infrastructure side, the Second Circuit has famously held that “[e]poch-making ‘discoveries’ of ‘mere’ general scientific ‘laws,’ without more, cannot be patented.”<sup>131</sup> Additionally, in computer sciences cases,<sup>132</sup> courts have struck down patents claiming algorithms as improperly attempting to claim abstract ideas.<sup>133</sup> Distinguishing between infrastructure and application, the Supreme Court has rejected a patent claiming a combination of various nitrogen-fixing bacteria, explaining that “[h]e who discovers a hitherto unknown phenomenon of nature has no claim to a monopoly of it which the law recognizes. If there is to be invention from such a discovery, it must

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127. 447 U.S. 303 (1980).

128. *Id.* at 309 (citations omitted).

129. Physical phenomena, such as all the members of an endangered species, are scarce and therefore rivalrous. However, any patent claiming physical phenomena does not claim the physical manifestations of these entities, but somewhat abstracted blueprints of them, which are nonrival.

130. Frischmann, *Economic Theory*, *supra* note 15, at 956.

131. *Katz v. Horni Signal Mfg. Corp.*, 145 F.2d 961, 961 (2d Cir. 1944).

132. *See* Julie E. Cohen & Mark A. Lemley, *Patent Scope and Innovation in the Software Industry*, 89 CAL. L. REV. 1, 7–13 (2001).

133. *Cf.* *Rubber-Tip Pencil Co. v. Howard*, 20 Wall. (87 U.S.) 498, 507 (1874) (holding that abstract ideas are not patentable); *see also* *Le Roy v. Tatham*, 55 U.S. 155 (1852) (upholding a patent on a process for manufacturing lead pipes, but refusing to construe the patent as covering the *principle* of manufacturing such pipes).

come from the *application* of the law of nature to a new and useful end.”<sup>134</sup> While sufficient human manipulation of a natural substance may yield a patentable invention,<sup>135</sup> the underlying substance in its natural state is not patentable. Analogously, while an abstract algorithm cannot be patented,<sup>136</sup> applying that algorithm in the context of a broader process or machine may produce a patentable invention.<sup>137</sup>

Maintaining intellectual infrastructure in the public domain promotes inventive activity.<sup>138</sup> In *Funk Bros. Seed Co. v. Kalo Inoculant Co.*,<sup>139</sup> the Supreme Court explicitly invoked the language of infrastructure when it stated, “[t]he qualities of these bacteria, like the heat of the sun, electricity, or the qualities of metals, are part of the storehouse of knowledge of all men.”<sup>140</sup> Similarly, in *Gottschalk v. Benson*,<sup>141</sup> the Court recognized that “[p]henomena of nature . . . mental processes, and abstract intellectual concepts are . . . the basic tools of scientific and technological work.”<sup>142</sup> These metaphors of storehouses and tools reflect the principle of intellectual infrastructure, which is made widely available to the public at large to facilitate downstream productivity.<sup>143</sup>

As with trademark and copyright, concerns over productivity losses from intellectual monopolies have motivated courts in patent cases to preserve infrastructure in the public domain.<sup>144</sup> The *Funk Bros.* Court explicitly warned against monopolizing nature’s “storehouse of

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134. *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948) (emphasis added).

135. *See Parke-Davis & Co. v. H.K. Mulford & Co.*, 189 F. 95, 103 (S.D.N.Y. 1911), *aff'd in part and rev'd in part*, 196 F. 496 (2d Cir. 1912) (upholding a patent on extracted, purified adrenaline).

136. *See Gottschalk v. Benson*, 409 U.S. 63, 71–72 (1972); *see also Parker v. Flook*, 437 U.S. 584, 594–95 (1978).

137. *See Diamond v. Diehr*, 450 U.S. 175, 192 (1981) (upholding a patent on a process for curing rubber that employs the Arrhenius equation).

138. For additional rationales behind these exclusions, see Eileen M. Kane, *Patent Ineligibility: Maintaining a Scientific Public Domain*, 80 ST. JOHN'S L. REV. 519, 545–46 (2006).

139. 333 U.S. 127 (1948).

140. *Id.* at 130.

141. 409 U.S. 63 (1972).

142. *Id.* at 67.

143. *See Lee, Inverting the Logic of Scientific Discovery*, *supra* note 10, at 108–09.

144. Courts frequently employ the term “monopoly” in a manner different from the strict economic meaning of the term, which involves exercising market power. In most cases, sufficient substitutes for patented products exist to prevent a monopoly. However, because natural laws, physical phenomena, and abstract ideas lack substitutes, granting patents on such resources would likely confer market power on the patentee, thus facilitating a monopoly.

knowledge.”<sup>145</sup> *Brenner v. Manson*,<sup>146</sup> a case focusing on the statutory requirement that patentable inventions must be useful<sup>147</sup> rather than on patentable subject matter per se, is also illustrative in this regard. There, the Supreme Court denied a patent on a process for creating chemical compounds of no known utility but which might be useful in subsequent research.<sup>148</sup> The Court explained that the “metes and bounds of that monopoly are not capable of precise delineation . . . . Such a patent may confer power to block off whole areas of scientific development, without compensating benefit to the public.”<sup>149</sup> Similar concerns counsel against allowing strong exclusive rights on intellectual infrastructure.

In 2006, the Supreme Court dismissed the writ of certiorari in *Laboratory Corp. of America Holdings v. Metabolite Laboratories Inc.*<sup>150</sup> This left undisturbed a Federal Circuit decision upholding a patent on a process for diagnosing vitamin deficiencies from elevated levels of homocysteine in the human body.<sup>151</sup> Many commentators had viewed this case as a valuable opportunity to clarify the patentability of natural principles and ideas. In his dissent from the dismissal of the writ of certiorari, Justice Breyer noted that “sometimes *too much* patent protection can impede rather than ‘promote the Progress of Science and useful Arts.’”<sup>152</sup> This observation highlights the functional concern driving the exclusion of natural laws, physical phenomena, and abstract ideas from patentability.<sup>153</sup> Preserving this infrastructure in the public domain facilitates downstream invention and ultimately advances the utilitarian objectives of the patent system.<sup>154</sup>

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145. *Funk Bros. Seed Co.*, 333 U.S. at 130.

146. 383 U.S. 519 (1966).

147. *See* 35 U.S.C. § 101 (2000).

148. *See Brenner*, 383 U.S. at 532.

149. *Id.* at 534.

150. 548 U.S. \_\_\_, 126 S. Ct. 2921 (2006) (per curiam).

151. *Id.*

152. *Id.* at 2922 (Breyer, J., dissenting from the dismissal of certiorari) (citation omitted).

153. Justice Breyer’s concerns over patenting “upstream” discoveries are consistent with broader critiques of exclusive rights in research science. *See* ROBERT K. MERTON, *THE SOCIOLOGY OF SCIENCE: THEORETICAL AND EMPIRICAL INVESTIGATIONS* 275 (Norman W. Storer ed., 1973); Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 *YALE L.J.* 177, 180–95 (1987). *But see* Robert P. Merges, *Property Rights Theory and the Commons: The Case of Scientific Research*, *SOC. PHIL. & POL’Y*, Summer 1996, at 145, 150 (noting that informal sharing norms continue against a backdrop of formal patent rights) [hereinafter Merges, *Property Rights Theory and the Commons*].

154. *But see* R. Polk Wagner, *Information Wants to be Free: Intellectual Property and the Mythologies of Control*, 103 *COLUM. L. REV.* 995, 995 (2003). Professor Wagner argues that

Although patent and copyright law are more similar to each other than to trademark law, these fields are all bound by a utilitarian focus on promoting productivity. Furthermore, they achieve this end through a shared means: preserving open access to infrastructure and extending protection only to refined, particularized applications.<sup>155</sup> Maintaining infrastructure such as generic words, ideas, and natural principles in the public domain advances commercial, creative, and inventive activity.

This doctrinal tour has revealed that infrastructure plays a functional role in advancing intellectual property's utilitarian aims. Infrastructure, however, is not a static entity. More precisely, what constitutes "infrastructure" evolves as society comes to rely on new and different resources as critical for enabling downstream productivity. This raises the question of whether legal doctrines designed to enhance access to infrastructure accommodate this evolution, a question we will consider next.

## II. THE EVOLUTION OF PHYSICAL INFRASTRUCTURE AND REAL PROPERTY LAW'S RESPONSE: RECLASSIFYING PROPERTY FROM "PRIVATE" TO "PUBLIC" TO ENHANCE ACCESS AND PRODUCTIVITY

An examination of real property law reveals that social conceptions of infrastructure evolve and, more importantly, that legal doctrines respond to this evolution by relaxing exclusive rights on resources that *become* infrastructure. This examination reveals several key insights for understanding intellectual infrastructure. First, concerns over promoting productivity lead real property doctrines to ensure wide access to certain

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"information wants to be free," and that increased copyrighting and patenting will inevitably enrich the public domain because every creation provides "derivative" information about itself that cannot be captured. *Id.* at 1002–07. Examples of this derivative information include abstract ideas, scientific principles, and settings of creative works. *Id.* at 1007. Crucially, these assets largely correlate with elements that genericity, the idea-expression dichotomy, the scenes a faire doctrine, and exclusions from patentable subject matter are intended to preserve in the public domain. Propertization of these assets would undermine the supposed benefit of derivative information, thus corroborating concerns that expansive intellectual property rights are impoverishing the public domain.

155. These doctrines share another interesting similarity: they all deal with abstraction. Judge Hand explicitly defined ideas as more abstract than expressions. *Nichols v. Universal Pictures Corp.*, 45 F.2d 119, 121 (2d Cir. 1930). Similarly, generic trademarks are abstractions—they signify an entire class of products instead of a particularized member of that class. Analogously, an invention, if subjected to a "great number of patterns of increasing generality," could be conceptualized as a combination of scientific principles and mechanical forces. *Id.* At this level of abstraction, exclusive rights are prohibited.

“enabling” resources in a manner analogous to intellectual property’s open access approach to intellectual infrastructure. Second, resources can evolve into infrastructure based on widespread social use and adoption. For example, the public’s continued use of an open field for communal events can confer on that space an infrastructural quality. I call this phenomenon the “evolution of infrastructure.”

Finally, and most importantly, real property law doctrines respond to this evolution by relaxing (and in some cases eliminating) exclusive rights on resources that have become infrastructure. Thus, the public’s continual use of an open field can mature into a legally recognized right of access that is enforceable against the landowner. Within this view, related to the “social relations” school of property scholarship,<sup>156</sup> property emerges not as a fixed set of entitlements, but as a dynamic entity that accommodates evolving reliance interests.<sup>157</sup> In this Part, I focus on Professor Carol Rose’s work on inherently public property as particularly helpful for understanding the social evolution of infrastructure and how property law responds by relaxing exclusive rights over such assets.

### *A. Using Real Property Doctrine to Understand Intellectual Infrastructure*

First, real property law recognizes the utilitarian value of ensuring broad access to infrastructure. Rose’s examination of real property corroborates the key insight from infrastructure theory that nonrival, productivity-enabling resources are well-suited for open access. Responding to law and economics scholarship generally favoring private property, Rose explores the peculiar phenomenon of “inherently public property.”<sup>158</sup> This class of property includes resources that are generally ineligible for exclusive rights such as roads, waterways, and even open spaces for communal events.<sup>159</sup> Although Rose does not frame her inquiries into inherently public property in infrastructural terms and although the two categories are not coextensive, they do exhibit significant overlap. Roads, waterways, and communal gathering

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156. See Singer, *The Reliance Interest*, *supra* note 22, at 663; JOSEPH WILLIAM SINGER, *PROPERTY LAW: RULES, POLICIES, AND PRACTICES* xxxix-1 (4th ed. 2006).

157. Cf. Rose, *The Comedy of the Commons*, *supra* note 28, at 777–81.

158. Rose, *The Comedy of the Commons*, *supra* note 28, at 712–17.

159. See *id.*



spaces<sup>160</sup> are: (1) at least partially nonrival (subject to capacity and congestion), (2) enablers of productive ends, and (3) means to a wide variety of ends.<sup>161</sup> Furthermore, like infrastructure, inherently public property exhibits increasing returns to scale.<sup>162</sup> Roads, waterways, and fields for public dances reflect a “comedy of the commons,”<sup>163</sup> rather than the traditional “tragedy of the commons” associated with communal ownership.<sup>164</sup> For these assets, “the more the merrier”: the larger the number of dancers in a public field, the more fun is enjoyed by all.<sup>165</sup> Accordingly, “ownership” by the disorganized public at large is the ideal regime for generating the significant positive externalities associated with inherently public property.<sup>166</sup> The same is true for certain types of infrastructure, including intellectual infrastructure such as words, ideas, and natural principles.<sup>167</sup>

Rose’s later study of Roman roads even more explicitly relates inherently public property to infrastructure.<sup>168</sup> Rose’s typology of

160. *See id.* at 717–18, 758–61.

161. Frischmann, *Economic Theory*, *supra* note 15, at 956–57.

162. Rose, *The Comedy of the Commons*, *supra* note 28, at 768–70; *see* Frischmann, *Economic Theory*, *supra* note 15, at 928. Some inherently public property, such as roads and grazing fields, are rivalrous and thus may appear to exhibit diminishing returns to scale. However, Rose situates these resources within the context of a broader activity—commerce—that exhibits increasing returns to scale. Rose, *supra* note 28, at 768–69.

163. Rose, *The Comedy of the Commons*, *supra* note 28, at 767–68.

164. *See generally* Garrett Hardin, *The Tragedy of the Commons*, 162 *SCIENCE* 1243 (1968).

165. Rose, *The Comedy of the Commons*, *supra* note 28, at 768.

166. *See id.* at 721.

167. Frischmann, *Economic Theory*, *supra* note 15, at 927–28. *Cf.* Landsberg v. Scrabble Crossword Game Players, Inc., 736 F.2d 485, 488 (9th Cir. 1984) (recognizing a “strong policy permitting all to use freely the ideas contained in a copyrighted work so long as copyrighted expression is not appropriated”).

168. Carol M. Rose, *Romans, Roads, and Romantic Creators: Traditions of Public Property in the Information Age*, 66 *LAW & CONTEMP. PROBS.* 89, 100–01 (2003) (describing Roman roads as infrastructure and comparing them to the Internet) [hereinafter Rose, *Romans*]. *See also* Brett Frischmann, *Privatization and Commercialization of the Internet Infrastructure: Rethinking Market Intervention into Government and Government Intervention into the Market*, 2 *COLUM. SCI. & TECH. L. REV.* 1, 30–46 (2001). Rose’s study of Roman roads also relates to contemporary commons-based peer production, which is characterized by decentralized networks of individuals utilizing commonly accessible resources to contribute to a value creating program. *See* Yochai Benkler, *Coase’s Penguin, or, Linux and the Nature of the Firm*, 112 *YALE L.J.* 369, 378–79, 415–22, 436–38 (2002). Peer production, illustrated in the development of the Linux operation system, relies on a commons and challenges the superiority of linear production models where a single entity controls access to resources and coordinates the activities of workers. *See id.* at 425–26, 440–41, 443, 445. As with Linux, intellectual infrastructure—generic words, ideas, and natural principles—is also open source, thus enabling its most productive exploitation by the “disorganized public” at large.

nonexclusive property in ancient Rome includes “res publicae”: resources open and belonging to the public by operation of law such as roads, bridge, and rivers.<sup>169</sup> One “especially critical factor” justifying open access to these assets is that their broad exploitation gives rise to “wide-ranging synergies, or what are now called network effects.”<sup>170</sup> Similarly, generic words, ideas, and natural principles generate positive externalities and exhibit what can be called infrastructure effects.<sup>171</sup>

As with intellectual infrastructure, individual ownership of roads, waterways, and communal gathering spaces may enable monopolies that hold up socially productive activity.<sup>172</sup> The general absence of adequate alternatives to these resources renders exclusive rights over them particularly damaging.<sup>173</sup> To mitigate the excesses of individual exclusive rights, various mechanisms have developed to transform, in whole or in part, the legal classification of these assets from private to

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169. Rose, *Romans*, *supra* note 168, at 96–100.

170. *Id.* at 97. Network effects arise when a resource’s value increases as more people use it—such as when a person’s purchase of a telephone enhances the value of the entire network.

171. Frischmann distinguishes between network effects and infrastructure effects. Network effects are likely to be appropriable by owners of the network, who will be willing to pay a higher price for network access because of them. Infrastructure effects, by comparison, involve more far-ranging externalities (often involving public goods) that are not fully appropriable by those using the infrastructure. As such, infrastructure effects will not necessarily increase users’ willingness to pay for access to infrastructure. Frischmann, *Economic Theory*, *supra* note 15, at 972–74.

172. Rose does not address licensing, which could theoretically allow access to an infrastructural resource while still maintaining an individual’s ownership rights. However, licensing to all prospective users of inherently public property is generally not feasible and provides too unstable a basis for securing public access. Preventing holdouts requires actually changing the legal characterization of property (or at least establishing access rights to use that property).

173. In this regard, it is worthwhile to observe that both physical and intellectual infrastructure have arisen through a complex combination of private and public initiatives. In the nineteenth century, private companies largely financed railroads, though they received significant federal assistance through land grants and easements. *See generally* C. Knick Harley, *Oligopoly Agreement and the Timing of American Railroad Construction*, 42 J. ECON. HIST. 797 (1982). Also in the nineteenth century, states constructed canals, such as the Eerie Canal in New York. The U.S. radio broadcasting industry “represents a peculiar combination of competitive private enterprise and government franchise.” Huseyin Leblebici et al., *Institutional Change and the Transformation of Interorganizational Fields: An Organizational History of the U.S. Radio Broadcasting Industry*, 36 ADMIN. SCI. Q. 333, 334 (1991). Furthermore, the Internet has its roots in the Defense Department’s ARPANET. Judy E. O’Neill, *The Role of ARPA in the Development of ARPANET, 1961–1972*, 17 IEEE HISTORY OF THE ANNALS OF COMPUTING 76, 76–81 (1995). In comparison, intellectual infrastructure also owes its origins to both public and private sources. While individuals and firms are the primary sources of new words (including trademarks that become generic) and literary ideas, basic scientific research is heavily subsidized by the federal government and conducted in significant part by scientists at public and non-profit universities and research institutions.

public, such as eminent domain,<sup>174</sup> public prescription, the public trust doctrine, and perhaps most relevant for our purposes, custom.<sup>175</sup>

Second, resources can *become* infrastructure based on widespread social use and reliance. This dynamic view of infrastructure arises, counterintuitively, from Rose's concept of "inherently" public property. Ex ante, the open field that Rose describes is private property;<sup>176</sup> it only becomes inherently public property, ex post, upon a community's continued reliance on it for social events. Similarly, among the infinite number of potential paths within a stretch of land, the only one that becomes infrastructure is the one that people actually use as a road. The wide-ranging synergies and network effects that characterize Roman roads as infrastructure are incidents of *use*. Rose's work demonstrates that an asset may *become* infrastructure through society's widespread use and dependence on it as an enabler of downstream productivity.

Third, and most critically, real property law responds to patterns of social use by eliminating or relaxing exclusive rights on assets that society has come to rely on as infrastructural. Legal classifications of property are sensitive to evolving social practice and cultural norms. Thus, a community's reliance on a thoroughfare that runs through private property may lead the government to condemn that property to build a highway. Through the doctrine of public easements, the public's repeated trespass on private land can ripen into a right of use that is permanent and hostile to the property owner.<sup>177</sup> The responsiveness of legal classifications of infrastructure is also apparent in the public trust doctrine, which, among other functions, has traditionally provided open access to communal areas such as the foreshore of beaches.<sup>178</sup> Courts have extended this doctrine to include the sandy beach area adjacent to the foreshore to facilitate activities such as sunbathing that earlier generations did not regard as important.<sup>179</sup> Similarly, with the emergence

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174. Underscoring the importance of eminent domain as a means for allowing public interests to trump individual property rights, Contracts Clause doctrine prohibits legislatures from contracting away their eminent domain power. See Stewart E. Sterk, *The Continuity of Legislatures: Of Contracts and the Contracts Clause*, 88 COLUM. L. REV. 647, 690–91 (1988).

175. Rose, *The Comedy of the Commons*, *supra* note 28, at 749–50. Although it stands on uncertain legal ground, the essential facilities doctrine in antitrust may also fit within this paradigm. See Frischmann & Waller, *supra* note 76, at 45–46.

176. Rose, *The Comedy of the Commons*, *supra* note 28, at 750–51.

177. See JESSE DUKEMINIER ET AL., PROPERTY 699–701 (6th ed. 2006).

178. See, e.g., *Matthews v. Bay Head Improvement Assoc.*, 471 A.2d 355 (N.J. 1984).

179. *Id.* at 369.

of air travel, Congress passed the Air Commerce Act of 1926,<sup>180</sup> establishing a right of public transit over navigable airspace and abrogating the common law *ad coelum* rule that a landowner's right to exclude extends to the heavens.<sup>181</sup> In all of these cases, property law relaxes individual exclusive rights to accommodate evolving conceptions of what constitutes infrastructure.

Custom is particularly relevant to illustrating how social practice can create legal rights to access private property that has become infrastructure. Rose describes how the custom of holding communal dances on a particular plot of land can transform that land into "inherently" public property.<sup>182</sup> Reliance interests established by the public, which may have been arbitrary in their initial location, nevertheless trump the seemingly legitimate interests of the landowner. Rose notes, "[t]hus the location of customary public activities may matter a great deal, not because it would be impossible to conduct these activities elsewhere, but because to relocate would rupture the continuity of the community's experience and diminish the significance of the activity itself."<sup>183</sup> Rose goes on to observe that "habit, expectation, custom, perhaps tied to a variety of community practices, may make property hostage to private 'holdout' power. The public's custom of dancing and carousing in a particular place, like its habit of traveling on certain paths, makes these various lands *essential*."<sup>184</sup> Widespread social use and reliance can imbue resources with infrastructural qualities, and property law often responds by widening public access to those resources.<sup>185</sup>

Property law's responsiveness to changing notions of what constitutes infrastructure highlights the dynamic interaction of law and norms. Early scholarship on communal norms emphasized the role of norms and non-state actors in resolving disputes and managing communal resources without recourse to formal legal rules.<sup>186</sup> However, the legal doctrines

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180. See An Act To Encourage and Regulate the Use of Aircraft in Commerce, and for Other Purposes, Pub. L. No. 69-254, §6, 44 Stat. 568 (1926), *repealed by* Pub. L. No. 85-726, § 1401(a), 72 Stat. 731, 806 (1958).

181. See THOMAS W. MERRILL & HENRY E. SMITH, PROPERTY: PRINCIPLES AND POLICIES 13–15 (2007); *Hinman v. Pac. Air Transport*, 84 F.2d 755, 757 (9th Cir. 1936).

182. Rose, *The Comedy of the Commons*, *supra* note 28, at 758–61.

183. *Id.* at 759.

184. *Id.* at 760 (emphasis added).

185. See Singer, *The Reliance Interest*, *supra* note 25, at 665–77.

186. See generally ROBERT ELLICKSON, ORDER WITHOUT LAW (1991); ELINOR OSTROM,

mediating inherently public property reveal that cultural norms and social practice can themselves become incorporated in legal rules. This Article extends these real property considerations to show that resources can “become” infrastructure in the intellectual property realm as well, and that intellectual property law should similarly accommodate that evolution by changing the legal status of these resources to enhance their availability.

Infrastructure evolves, both in its social definition and legal classification. As a community comes to rely on a productivity-enabling resource such as a road or waterway, that resource may attain infrastructural status. In certain cases, real property law responds to this emerging reliance by granting public access rights to otherwise private property.<sup>187</sup> Similarly, intellectual infrastructure also evolves. Language shifts as people use trademarked terms as generic words. The set of “stock” elements necessary to tell communally recognizable stories changes over time. And the basic suite of infrastructural assets necessary to invent in a given field shifts as technology progresses. If infrastructure is both socially defined and warrants legal treatment different from other types of property, then the legal designation of infrastructure should change along with changing social notions of what constitutes infrastructure.<sup>188</sup> The question remains as to how well trademark, copyright, and patent law doctrines designed to enhance access to intellectual infrastructure accommodate this evolution.

### III. ACCOMMODATING THE EVOLUTION OF INTELLECTUAL INFRASTRUCTURE

As we have seen, intellectual property law promotes productivity by applying the opposing property regimes of open access and exclusive rights to intellectual infrastructure and application, respectively. Maintaining liberal access to infrastructure is critical to downstream productivity. Infrastructure, however, is a moving target. Widespread

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GOVERNING THE COMMONS (1990). For an overview of law-and-norms theory, see Arti Kaur Rai, *Regulating Scientific Research: Intellectual Property Rights and the Norms of Science*, 94 NW. U. L. REV. 77, 81–88 (1999).

187. Cf. Singer, *The Reliance Interest*, *supra* note 25, at 673–77.

188. There are, of course, a number of ways to accomplish this goal. I will explore doctrines in trademark and copyright that relegate assets that become infrastructure to the public domain on a case-by-case basis. Patent law’s relatively short term of twenty years represents another way to ensure timely public access to infrastructure. However, for reasons I discuss in Part III.D.1, this mechanism is inadequate.

social appropriation and reliance can enable a particularized intellectual creation to “evolve” into general infrastructure over which exclusive rights may be highly problematic.

While trademark and copyright law acknowledge and accommodate the evolution of intellectual infrastructure, patent law does not. Trademark is highly responsive to linguistic evolution, as the doctrine of genericide relies on changing consumer perceptions to determine when a trademark has become a generic word. Copyright is also sensitive to infrastructural evolution, though in a more subtle way. As once-novel expressions develop into widely needed creative building blocks, the idea-expression dichotomy and scenes a faire doctrine relegate them to the public domain where they are freely appropriable. Patent law takes the narrowest and most rigid approach to infrastructure. While “primary” infrastructure consisting of natural laws, physical phenomena, and abstract ideas is not protectable, patent law has no social feedback mechanism for relaxing exclusive rights on patented inventions that *evolve into* productivity-enabling infrastructure before expiration of the twenty-year patent term.<sup>189</sup> This inattentiveness to social reliance interests allows exclusive rights on widely needed technological infrastructure to persist, thus threatening to inhibit downstream productivity.

### A. *Trademarks: Sensitivity to Changing Social Practice*

Trademark law engages in a dynamic, socially responsive inquiry to distinguish protectable marks from nonprotectable intellectual infrastructure. Importantly, trademark law relegates marks to the public domain whether they begin as infrastructure or whether they achieve that status through social usage. As mentioned, 15 U.S.C. § 1064(3) authorizes cancellation of a registered mark at any time it becomes generic.<sup>190</sup> Within this framework, the “primary significance of the registered mark to the relevant public” at the time the mark is challenged (rather than at the time of creation) determines whether the mark is legally generic.<sup>191</sup> Courts apply genericide in a factually intensive

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189. *See infra* Part III.D.1.

190. 15 U.S.C. § 1064(3) (2000).

191. *Id.* This language comes from the Trademark Clarification Act of 1984. As courts have noted, this standard adopted the test of genericness articulated in *Bayer Co. v. United Drug Co.*, 272 F. 505, 509 (S.D.N.Y. 1921). *See* *Magic Wand, Inc. v. RDB, Inc.*, 940 F.2d 638, 640 (Fed. Cir. 1991).

manner. In so doing, they draw from social data such as consumer surveys, market information, and dictionaries to determine whether a trademark has become an infrastructural, generic word and is thus inappropriate for exclusive rights.<sup>192</sup> This highly contextual inquiry also allows courts to distinguish among the perceptions of various communities, allowing a mark to remain a protected trademark in situations where it has not become generic. Ultimately, this socially attentive approach to distinguishing generic linguistic infrastructure from protectable linguistic applications helps trademark law advance its utilitarian goals.

The first notable feature of genericide analysis is its high sensitivity to evolving consumer perceptions of meaning.<sup>193</sup> In the seminal case of *Bayer Co. v. United Drug Co.*,<sup>194</sup> the Southern District of New York considered Bayer's claimed trademark on the word "aspirin."<sup>195</sup> Focusing solely on the factual question of what buyers understood that term to mean,<sup>196</sup> the court concluded that for lay consumers, "aspirin" had entered the vernacular as a generic word.<sup>197</sup> As the commonly recognized signifier of an entire product class, "aspirin" was susceptible to a multitude of linguistic applications beyond Bayer's product and exclusive rights over such a generic term were inappropriate.

Courts rely on a wide array of social evidence to determine what the relevant public actually understands a given trademark to mean.<sup>198</sup> For example, in *Kellogg Co. v. National Biscuit Co.*,<sup>199</sup> the Supreme Court ruled that "shredded wheat" was generic, relying on evidence that "[e]ver since 1894 the article has been known to the public as shredded wheat."<sup>200</sup> Similarly, in *Dixi-Cola Laboratories v. Coca-Cola Co.*,<sup>201</sup> the

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192. *See infra* text accompanying notes 198–207

193. Courts have adopted a three-part test within which a party asserting genericide must: (1) identify the product class for which the mark is relevant, (2) identify the relevant purchasing community for that product, and (3) prove that the primary significance of the trademark is to identify the *class* of products to which the mark relates. *Glover v. Ampak, Inc.*, 74 F.3d 57, 59 (4th Cir. 1996).

194. 272 F. 505 (S.D.N.Y. 1921).

195. *Id.* at 509.

196. *Id.*

197. *Id.* at 514.

198. *Magic Wand, Inc. v. RDB, Inc.*, 940 F.2d 638, 641 (Fed. Cir. 1991); *see* 2 J. THOMAS MCCARTHY, MCCARTHY ON TRADEMARKS AND UNFAIR COMPETITION § 12:13 (4th ed. 2006).

199. 305 U.S. 111 (1938).

200. *Id.* at 117.

201. 117 F.2d 352 (4th Cir. 1941).

Fourth Circuit rejected Coca-Cola's claim to a trademark on the word "cola," noting widespread generic use of this term by competitors.<sup>202</sup> More recently, the Fourth Circuit relied on historical usage, consumer perception, and publications such as *America Online for Dummies* in concluding that "You Have Mail" was generic.<sup>203</sup> In holding that "beef stick" and "turkey stick" were generic, one court identified competitors' use, plaintiffs' use, dictionary definitions, media usage, testimony of persons in the trade, and consumer surveys as potential sources of evidence of genericity.<sup>204</sup>

In many cases, litigants conduct market surveys to determine consumer perceptions, as in *King-Seeley Thermos Co. v. Aladdin Industries, Inc.*<sup>205</sup> In ruling that "thermos" was generic, the Second Circuit cited one survey indicating that only about twelve percent of the American public knew that the word "thermos" had any trademark significance.<sup>206</sup> The court further noted that by the early 1950s, the generic use of "thermos" had grown significantly in non-trade publications and that it had become basically synonymous with "vacuum insulated container."<sup>207</sup> In all of these cases, social data showed that the public had come to understand a term as generic, thus warranting relegation of that infrastructural resource to the public domain.

Within the genericide framework, the trademark holder's efforts to "police" usage of the mark are irrelevant; what matters is actual public perception.<sup>208</sup> Thus, in *Bayer*, the plaintiff's expenditure of "large sums of money" in marketing aspirin could not prevent the loss of trademark status.<sup>209</sup> In an irony at the heart of genericide, Bayer was a victim of its own success.<sup>210</sup> A typical firm aims to "build brand dominance to the point of ubiquity, so that the brand is the first thing on a consumer's mind when considering a purchase of a particular type of good."<sup>211</sup> However, if the mark becomes the de facto means of signifying the class

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202. *Id.* at 360.

203. *Am. Online, Inc., v. AT&T Corp.*, 243 F.3d 812, 819–21 (4th Cir. 2001).

204. *Hickory Farms, Inc. v. Snackmasters, Inc.*, 500 F. Supp. 2d 789, 803 (N.D. Ill. 2007).

205. 321 F.2d 577 (2d Cir. 1963).

206. *Id.* at 579–80.

207. *Id.* at 579.

208. *See Abercrombie & Fitch Co. v. Hunting World, Inc.*, 537 F.2d 4, 9 (2d Cir. 1976).

209. *Bayer Co. v. United Drug, Co.*, 272 F. 505, 507 (S.D.N.Y. 1921).

210. *Id.* at 512–13.

211. Deven R. Desai & Sandra L. Rierson, *Confronting the Genericism Conundrum*, 28 CARDOZO L. REV. 1789, 1790 (2007).



to which the product belongs, the public establishes an easement over this infrastructural asset that the firm must accommodate.<sup>212</sup> Public perception that a mark is infrastructural trumps individual efforts to maintain it as a particularized, proprietary application.

The second notable feature of genericide analysis is its highly contextual nature. A mark may be arbitrary for one product but generic for another because of differences in use over time, among multiple groups, and even among various uses of the same product.<sup>213</sup> For example, “apple” is generic in the produce industry, but a distinctive trademark in the computer industry.<sup>214</sup> Accordingly, courts distinguish among the perceptions of various consumer communities. In *Bayer*, the court differentiated between chemists, physicians, and druggists, who were aware that aspirin was Bayer’s particular product, and lay consumers, for whom “aspirin” was generic.<sup>215</sup> This difference in perception led to a highly tailored remedy. The *Bayer* court allowed the alleged infringer, United Drug, to use “aspirin” in its marketing to the general public. However, the court enjoined United Drug from using “aspirin” in direct sales to chemists, physicians, and druggists. Because of their specialized knowledge, these consumers might be misled if United Drug marketed its product under the same name used by Bayer.<sup>216</sup>

Genericide is explicitly outward looking and engages the reality of linguistic evolution. Starting from the premise that generic words are intellectual infrastructure and inappropriate for exclusive ownership, the doctrine relies on social data such as consumer surveys, market reports, sales materials, brochures, and dictionaries to determine whether the relevant consuming public understands a mark to be generic. These social data may reveal a reality that genericide is designed to make legally relevant: once-particularized marks, even those fabricated by individual firms, can become the generic mechanisms by which the public refers to entire product categories. Although the doctrine is not

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212. Even registered marks that have reached “incontestable” status are subject to cancellation if they are or become generic. *Park ’N Fly, Inc. v. Dollar Park & Fly, Inc.*, 469 U.S. 189, 198 (1985). The Federal Trademark Dilution Act of 1995 establishes causes of actions to protect “famous” and distinctive marks from blurring and tarnishment; such protection, of course, does not extend to generic marks. *See* 15 U.S.C. § 1125 (2000).

213. *Abercrombie*, 537 F.2d at 9, 11.

214. *See Am. Online, Inc., v. AT&T Corp.*, 243 F.3d 812, 820 (4th Cir. 2001).

215. *Bayer Co.*, 272 F. at 510.

216. *Id.* at 514.

immune from criticism,<sup>217</sup> genericide's responsiveness to evolving social norms and its ability to facilitate context-specific remedies help it achieve the utilitarian goals of the trademark system.<sup>218</sup> Exclusive rights on generic words may confuse consumers and inhibit competition, and genericide addresses this problem in a dynamic, targeted fashion by relegating marks to the public domain as they achieve infrastructural status.

*B. Copyrights: Enhancing Access to Stock and Standard Expression*

Copyright also accommodates the evolution of intellectual infrastructure by liberalizing access to widely used material, though in a more subtle manner than trademark. Copyright accommodates evolving social practice in two related ways. First, when identifying where an element of a work falls on the continuum between idea and expression, courts are more likely to attach the label of nonprotectable "idea" to an element that is commonly used. Thus, society's repeated and varied use of what could arguably be categorized as an expression will help inch that element towards nonprotectability as infrastructure. Second, in a more direct fashion, the scenes a faire doctrine transmutes expressions that are stock or standard into nonprotectable elements residing in the public domain. Through these processes, copyright dynamically accommodates the creative community's need to access intellectual infrastructure, even as the definition of what constitutes "infrastructure" evolves.

*1. The Idea-Expression Dichotomy*

The key to recognizing courts' socially attentive application of the idea-expression dichotomy is that "idea" and "expression" are not qualitatively different, but represent different ends of the same continuum.<sup>219</sup> In *Nichols v. Universal Pictures Corp.*,<sup>220</sup> Judge Learned

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217. See Desai & Rierson, *supra* note 211, at 1790–92 (arguing that genericism should focus more narrowly on a mark's ability to identify a source in commercial contexts, notwithstanding noncommercial uses of the mark).

218. See Hans Zeisel, *The Surveys That Broke Monopoly*, 50 U. CHI. L. REV. 896, 898 (1983).

219. While courts differ on the exact application of the idea-expression dichotomy, they generally employ it to distinguish between nonprotectable and protectable elements when comparing copyrighted and allegedly infringing works for substantial similarity. See Kurtz, *Speaking to the Ghost*, *supra* note 97, at 1233–34.

220. 45 F.2d 119 (2d Cir. 1930).

Hand offered the “leading judicial effort”<sup>221</sup> to differentiate nonprotectable idea from protectable expression, concluding that they simply represent different levels of abstraction of the same subject matter.<sup>222</sup> In articulating his “abstractions” test, Judge Hand candidly acknowledged that any line between idea and expression is inherently arbitrary.<sup>223</sup> Other courts have also recognized that the distinction between idea and expression is “elusive”<sup>224</sup> and “faint.”<sup>225</sup> Not surprisingly, scholars have criticized the arbitrary nature of the idea-expression dichotomy, calling it “[t]he most notorious problem in copyright law.”<sup>226</sup>

The absence of an objective framework for distinguishing a work’s ideas and expressions leaves open the question of how, exactly, courts make these determinations. It is here that the connection between the idea-expression dichotomy and copyright’s accommodation of evolving intellectual infrastructure becomes apparent. Specifically, in the absence of a priori definitions of “idea” and “expression,” courts apply the idea-expression dichotomy in a *functional* manner to best promote creative productivity. Along the continuum between idea and expression, application of the idea-expression dichotomy is a policy judgment, similar to determining proximate cause in tort cases.<sup>227</sup> Courts calibrate

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221. Wiley, *supra* note 22, at 122.

222. In comparing a play and an allegedly infringing movie, Judge Hand stated:

Upon any work, and especially upon a play, a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. The last may perhaps be no more than the most general statement of what the play is about, and at times might consist only of its title; but there is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his “ideas,” to which, apart from their expression, his property is never extended.

45 F.2d at 121.

223. *Id.* at 122 (“[W]hile we are as aware as any one that the line, wherever it is drawn, will seem arbitrary, that is no excuse for not drawing it.”); see *Nash v. CBS*, 899 F.2d 1537, 1540 (7th Cir. 1990) (noting that Judge Hand’s test is “not a ‘test’ at all. It is a clever way to pose the difficulties that . . . does little to help resolve a given case . . .”).

224. *Williams v. Crichton*, 84 F.3d 581, 587–88 (2d Cir. 1996).

225. *Satava v. Lowry*, 323 F.3d 805, 807 (9th Cir. 2003).

226. Wiley, *supra* note 22, at 121; see Kurtz, *Speaking to the Ghost*, *supra* note 97, at 1222; Kurtz, *The Scenes a Faire Doctrine*, *supra* note 50, at 85 (characterizing the idea-expression dichotomy as subjective and ad hoc); Alfred C. Yen, *A First Amendment Perspective of the Idea/Expression Dichotomy and Copyright in a Work’s “Total Concept and Feel,”* 38 EMORY L.J. 393, 403 (1989); see also Amy B. Cohen, *Copyright Law and the Myth of Objectivity: The Idea-Expression Dichotomy and the Inevitability of Artistic Value Judgments*, 66 IND. L.J. 175, 178 (1990) (arguing that judges’ subjective estimations of artistic merit shade their application of the idea-expression dichotomy).

227. A continuum also exists in trademark, where some terms are universally perceived as

where an element of a creative work falls along this continuum to strike the best balance between granting exclusive rights and preserving a robust public domain. While vulnerable to criticisms of subjectivity, this approach allows courts to preserve as nonprotectable certain elements that society, through widespread use and reliance, has come to regard as infrastructural.

In some cases, a court's functional application of the idea-expression dichotomy is explicit. In *Herbert Rosenthal Jewelry Corp. v. Kalpakian*,<sup>228</sup> the Ninth Circuit considered the alleged copying of a jewel-encrusted bee pin.<sup>229</sup> The court noted that the "guiding consideration in drawing the line [between idea and expression] is the preservation of the balance between competition and protection reflected in the patent and copyright laws."<sup>230</sup> Thus, the court recognized that functional aims explicitly define idea versus expression. *Herbert Rosenthal* is remarkably candid: "We think the production of jeweled bee pins is a larger private preserve than Congress intended to be set aside in the public market without a patent. A jeweled bee pin is *therefore* an 'idea' that defendants were free to copy."<sup>231</sup> Here, the cart clearly comes before the horse. Jewel-encrusted bee pins do not satisfy some objective definition of "idea." Rather, they are ideas because treating them as such promotes creative productivity. This is a strictly *functional*, rather than formal, definition of idea.<sup>232</sup>

When locating an element of a creative work on the continuum between idea and expression, courts are more likely to construe commonplace elements of creative works as "ideas." While this appears intuitive, upon further reflection it becomes clear that just because something is common does not make it an idea. However, equating

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source-identifying marks, others are universally perceived as generic, and a middle range exists where marks may be generic in some contexts and not in others. See Stacey L. Dogan & Mark A. Lemley, *A Search-Costs Theory of Limiting Doctrines in Trademark Law*, 97 TRADEMARK REP. 1223, 1243–44 (2007).

228. 446 F.2d 738 (9th Cir. 1971).

229. *Id.*

230. *Id.* at 742.

231. *Id.* (emphasis added).

232. See also *Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc.*, 797 F.2d 1222, 1235 (3d Cir. 1986) ("[P]recisely because the line between idea and expression is elusive, we must pay particular attention to the *pragmatic* considerations that underlie the distinction and copyright law generally. In this regard, we must remember that the purpose of the copyright law is to create the most efficient and productive balance between protection (incentive) and dissemination of information, to promote learning, culture, and development.") (emphasis added).

commonplace elements with nonprotectable “ideas” is fully consistent with copyright’s aim of maintaining open access to widely needed building blocks of creation.

Thus, in *Mattel, Inc. v. Azrak-Hamway International, Inc.*,<sup>233</sup> the Second Circuit affirmed the district court’s ruling of noninfringement regarding two action figures exhibiting a similar crouching stance.<sup>234</sup> Crucially, the court held that the plaintiff’s figures displayed an “unprotectable idea—a superhuman muscleman crouching in what since Neanderthal times has been a traditional fighting pose.”<sup>235</sup> The court did not find that the fighting crouch was a once-copyrightable expression whose term had expired. Instead, the court found that the crouch was an *idea* itself. While, analytically, one could just as easily categorize the crouch as an expression, the fact that society has used this depiction repeatedly in a variety of contexts contributed to the conclusion that it was a nonprotectable “idea” that should be freely appropriable.

Other cases further illustrate this equation of “standard” or “commonplace” elements with nonprotectable ideas. In *Quaker Oats Co. v. Mel Appel Enterprises*,<sup>236</sup> the Southern District of New York compared two stuffed toy dogs for substantial similarity.<sup>237</sup> In response to the defendant’s arguments that any similarities between the two dolls arose from nonprotectable ideas, the court noted that the plaintiff’s doll was not “standard,” and therefore that the similarities arose from protected expression.<sup>238</sup> Similarly, in *Knickerbocker Toy Co. v. Genie Toys, Inc.*,<sup>239</sup> the court rejected the defendant’s argument that a dog in a train engineer’s uniform represented a nonprotectable idea.<sup>240</sup> The court noted that “[w]hile such a phenomenon might exist, it is *hardly so common* as to require the conclusion that this combination is common or somehow in the public domain.”<sup>241</sup>

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233. 724 F.2d 357 (2d Cir. 1983).

234. *Id.* at 361.

235. *Id.* at 360. The specific “expression” of the exaggerated musculature in Mattel’s dolls did constitute copyrightable material, but this was not substantially similar to the musculature of Azrak-Hamway’s dolls. *Id.*

236. 703 F. Supp. 1054 (S.D.N.Y. 1989).

237. *Id.*

238. *Id.* at 1060.

239. 491 F. Supp. 526 (E.D. Mo. 1980).

240. *Id.* at 528–29.

241. *Id.* at 529 (emphasis added).

Courts' equation of commonplace elements with ideas advances copyright law's utilitarian aims. Precisely because some expression has become so widely used, it becomes a basic building block freely open to the creative community. Adopting the awkward phrasing of the idea-expression dichotomy, society's continual use of an expression can transform it into a nonprotectable idea.

## 2. *The Scenes a Faire Doctrine*

The second, more direct mechanism by which copyright law accommodates the evolution of intellectual infrastructure is the scenes a faire doctrine. This doctrine recognizes that certain "stock" scenes, characters, and plot devices necessary to express a type of story are not subject to copyright protection.<sup>242</sup> As with the unfortunately named idea-expression dichotomy, the scenes a faire doctrine recognizes a continuum that requires greater particularization and unique detail in otherwise "stock" elements before those elements will receive protection. In applying a higher bar for copyright protection to stock or standard elements, the scenes a faire doctrine recognizes that certain well-traveled expressions can *become* basic infrastructure that should be generally available in the public domain.<sup>243</sup>

For example, in *Walker v. Time Life Films, Inc.*,<sup>244</sup> the Second Circuit compared a book and an allegedly infringing movie depicting a struggling police precinct in the Bronx.<sup>245</sup> The court noted that "[f]oot chases and the morale problems of policemen, not to mention the familiar figure of the Irish cop, are venerable and often-recurring themes of police fiction," and constitute nonprotectable scenes a faire absent some differentiating detail.<sup>246</sup> While the police fiction genre is of relatively recent vintage, these expressions are already so standard that, without some distinguishing features, they are not protectable.<sup>247</sup>

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242. See Kurtz, *The Scenes a Faire Doctrine*, *supra* note 50.

243. Of course, the scenes a faire doctrine does not relax exclusive rights on all types of expression that represent cultural infrastructure. See generally Anupam Chander & Madhavi Sunder, *Everyone's a Superhero: A Cultural Theory of "Mary Sue" Fan Fiction as Fair Use*, 95 CAL. L. REV. 597 (2007) (arguing for a fair use exception for "fan fiction" that builds upon widely-known cultural entities such as *Star Trek*).

244. 784 F.2d 44 (2d Cir. 1986).

245. *Id.*

246. *Id.* at 50.

247. See also Eichel v. Marcin, 241 F. 404, 409–10 (S.D.N.Y. 1913) (finding no copyright in elements of a play that were "old" and "well exploited" in numerous other literary works).

Labeling these expressions as nonprotectable scenes a faire facilitates their unfettered use by authors and helps promote creative productivity.<sup>248</sup>

The scenes a faire doctrine preserves in the public domain elements that are “necessary” for expression, and necessity is defined by social practice. In *Apple Computer Inc. v. Microsoft Corp.*,<sup>249</sup> the Ninth Circuit applied the scenes a faire doctrine to conclude that Apple’s overlapping windows graphical user interface was not protectable.<sup>250</sup> The court stated that only two options existed for displaying multiple windows at the same time: a tile system and overlapping windows. The court then observed, “[a]s demonstrated by Microsoft’s *scenes a faire* video, overlapping windows have been the clear preference in graphic interfaces. Accordingly, protectable substantial similarity cannot be based on the mere use of overlapping windows.”<sup>251</sup> Although Apple’s scheme of overlapping windows was a relatively recent innovation—as were all graphical user interfaces at that time—the emergence of overlapping windows as the preferred standard bolstered the court’s conclusion that this format represented a nonprotectable scene a faire.

Although not dealing with the scenes a faire doctrine per se, another computer software case also reflects copyright law’s aversion to allowing exclusive rights on expressions that have become standard infrastructure. In *Lotus Development Corp. v. Borland International*,<sup>252</sup> Borland copied the familiar menu command hierarchy from Lotus 1-2-3 in its competing spreadsheet program.<sup>253</sup> The First Circuit held that Lotus 1-2-3’s menu command hierarchy was a noncopyrightable method of operation and denied Lotus’s infringement claim.<sup>254</sup> While the court based its holding on the statutory exclusion of methods of operation from copyrightable subject matter, considerations of widespread

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248. See *Berkic v. Crichton*, 761 F.2d 1289, 1294 (9th Cir. 1985) (“The common use of such stock . . . merely reminds us that in Hollywood, as in the life of men generally, there is only rarely anything new under the sun.”); see also *Atari, Inc. v. N. Am. Philips Consumer Elecs. Corp.*, 672 F.2d 607, 617 (7th Cir. 1982) (holding that expressive elements in the Pac-Man video game such as a graphical maze and scoring table are “standard” elements that are not subject to copyright protection).

249. 35 F.3d 1435, 1444 (9th Cir. 1994).

250. *Id.*

251. *Id.*

252. 49 F.3d 807 (1st Cir. 1995).

253. *Id.*

254. *Id.* at 815; 17 U.S.C. § 102(b) (2000) (excluding “methods of operation” from copyright protection).

consumer reliance loomed large. The court rejected as “absurd” the possibility that users who had familiarized themselves with Lotus 1-2-3 would have to learn different methods for performing identical functions in programs from other manufacturers.<sup>255</sup> In his concurring opinion, Judge Boudin was even more explicit: “A new menu may be a creative work, but over time its importance may come to reside more in the investment that has been made by *users* in learning the menu and in building their own mini-programs—macros—in reliance upon the menu.”<sup>256</sup> While Lotus’s menu has some intrinsic merit, much of its value comes from its widespread adoption as a standard that customers have invested time and effort to learn.<sup>257</sup> Enabling a monopoly over such a socially constructed standard could ultimately undermine that investment and inhibit productivity.<sup>258</sup>

### 3. *Sensitivity to Infrastructural Evolution in Copyright Law*

While action figures and stock characters of police fiction may seem like rather trivial subject matter, the manner in which copyright treats them reveals an immensely valuable attentiveness to evolving social norms. The idea-expression dichotomy and the scenes a faire doctrine dynamically relegate elements to the public domain as they become infrastructure. Courts apply the idea-expression dichotomy not based on a priori definitions of these categories but on policy judgments for balancing exclusive rights with a robust public domain. While this approach is subject to criticism as arbitrary,<sup>259</sup> equating commonplace entities with nonprotectable ideas ensures that widely used infrastructure remains in the public domain. In a related vein, the scenes a faire doctrine “retires” commonly used expressions to the public domain as

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255. *Lotus Dev. Corp.*, 49 F.3d at 817–18.

256. *Id.* at 819–20 (Boudin, J., concurring).

257. Some have even argued for copyright law to adopt a genericity doctrine for “arbitrary” expressions that become widely used and generic in software programs. See Lee B. Burgunder & Carey E. Heckman, *An Emerging Theory of Computer Software Genericism*, 2 HIGH TECH. L.J. 229, 247 (1987); see also Peter S. Menell, *Tailoring Legal Protection for Computer Software*, 39 STAN. L. REV. 1329, 1364–67 (1987) (proposing a scheme in which patented, industry standard operating systems would be available to users through compulsory licenses).

258. Interestingly, the trademark doctrine of functionality would also prevent such a “standard” graphical user interface from being the subject of exclusive rights as trade dress. See ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, *PATENT LAW AND POLICY: CASES AND MATERIALS* 627, 714 (4th ed. 2007).

259. See *supra* notes 223–226 and accompanying text.



they become stock or standard infrastructure.<sup>260</sup> Assigning these infrastructural units to the public domain allows for their widespread use as building blocks for creative expression.

*C. Patents: Insensitivity to the Evolution of Intellectual Infrastructure*

Compared with trademark and copyright law, patent law takes the narrowest and most rigid approach to recognizing and liberalizing access to intellectual infrastructure. Excluding natural laws, physical phenomena, and abstract ideas from patentability serves the functional purpose of keeping basic building blocks of productivity in the public domain. However, these “raw” assets are not the only basic building blocks of invention. Patented technologies themselves can rapidly attain infrastructural status as inventive communities come to rely on them as enablers of downstream invention. However, patent law has no mechanism for liberalizing access to these refined infrastructural assets in a timely manner.<sup>261</sup>

As with the idea-expression dichotomy, the prohibition against patenting natural laws, physical phenomena, and abstract ideas does not involve objectively definable categories. As Justice Frankfurter remarked in his concurring opinion in *Funk Bros. Seed Co. v. Kalo Inoculant Co.*:

It only confuses the issue . . . to introduce such terms as “the work of nature” and the “laws of nature.” For these are vague and malleable terms infected with too much ambiguity and equivocation. Everything that happens may be deemed “the work of nature,” and any patentable composite exemplifies in its properties “the laws of nature.” Arguments drawn from such terms for ascertaining patentability could fairly be employed to challenge almost every patent.<sup>262</sup>

For both copyright and patent, the difference between ideas and natural principles, on the one hand, and particularized expressions and inventions, on the other, is one of degree rather than kind.<sup>263</sup>

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260. Cf. Cohen, *Creativity and Culture*, *supra* note 35, at 1177 (describing creativity as “an emergent property of social and cultural systems, continually shaped by and shaping other social changes”).

261. For an explanation of why the twenty-year patent term is inadequate to provide timely access to patented infrastructure, see Part III.D.1.

262. 333 U.S. 127, 134–35 (1948) (Frankfurter, J., concurring).

263. *Compare id.* at 132 (holding that an inoculum combining various bacteria does not constitute patentable subject matter), *with* *Diamond v. Chakrabarty*, 447 U.S. 303, 310 (1980) (holding that a

Historically, before a series of Supreme Court decisions in the 1980s, courts relied on functional considerations related to advancing progress when classifying an invention as protectable or nonprotectable subject matter. In this sense, these early courts operated analogously to modern copyright courts, which consider macroscopic objectives related to promoting progress when characterizing an element of a work as an idea or expression. In some cases, creations that may have satisfied some formal definition of “invention” were characterized as nonpatentable abstract ideas simply because they lacked technical ingenuity<sup>264</sup> or an immediate, tangible utility.<sup>265</sup> Conversely, the extraction and purification of a natural substance could render it patentable subject matter merely because it became commercially and therapeutically useful.<sup>266</sup> As we have seen, functional interests in promoting widespread access to a given “invention” could contribute to a court’s conclusion that it actually comprised a nonpatentable product of nature.<sup>267</sup> This was the case in *Funk. Bros.*, which sought to preserve natural elements as a “storehouse of knowledge.”<sup>268</sup> Without objective definitions of what constituted, say, a natural phenomenon, courts often drew what they perceived to be the appropriate line between nonprotectable and protectable assets to best promote technological progress.

Courts’ ability to apply intellectual infrastructure doctrine in a functional manner diminished sharply starting in 1980 with *Diamond v. Chakrabarty*.<sup>269</sup> In upholding a patent on a genetically engineered living organism, the Supreme Court articulated a remarkably expansive conception of patentable subject matter.<sup>270</sup> Quoting the legislative

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bacterium combining various plasmids does constitute patentable subject matter).

264. See, e.g., *Rubber-Tip Pencil Co. v. Howard*, 87 U.S. 498, 507 (1874); *MERGES & DUFFY*, *supra* note 258, at 627.

265. *Gottschalk v. Benson*, 409 U.S. 63, 71–72 (1972) (“The mathematical formula involved here has no substantial practical application except in connection with a digital computer, which means that . . . the patent would wholly pre-empt the mathematical formula and in practical effect would be a patent on the algorithm itself.”).

266. *Parke-Davis & Co. v. H.K. Mulford & Co.*, 189 F. 95, 103 (S.D.N.Y. 1911), *aff’d in part and rev’d in part*, 196 F. 496 (2d Cir. 1912).

267. See *supra* notes 138–143 and accompanying text.

268. *Funk Bros. Seed Co.*, 333 U.S. at 130.

269. 447 U.S. 303, 318 (1980). Other developments, such as the Bayh-Dole Act of 1980 and the creation of the Court of Appeals for the Federal Circuit in 1982, also reflect the generally pro-patent character of this period. See *Rai*, *supra* note 186, at 94–95.

270. A. Samuel Oddi, *Regeneration in American Patent Law: Statutory Subject Matter*, 46 *IDEA* 491, 546 (2006) (“[I]t marked a metamorphosis in how the Supreme Court approached patent issues—backing away from judicial restraint . . . to adopting an expansive view of the instrumental

history of the 1952 Patent Act, the Court noted that “Congress intended statutory subject matter to ‘include anything under the sun that is made by man.’”<sup>271</sup> This broad formulation of patentable subject matter has proven very influential.<sup>272</sup> By subtraction, it narrowly defines what I have been referring to as nonpatentable intellectual infrastructure, which the *Chakrabarty* court identified as “laws of nature, physical phenomena, and abstract ideas.”<sup>273</sup>

A year later in *Diamond v. Diehr*,<sup>274</sup> the Supreme Court further constrained expansive interpretations of intellectual infrastructure. In that case, the Supreme Court established that courts and the Patent and Trademark Office (PTO) should construe patentable subject matter formalistically, without regard to the functional merits of an invention.<sup>275</sup> In upholding the patentability of an algorithm-based process for curing rubber, the Court emphasized that determinations of patentable subject matter should be “wholly apart” from inquiries into other substantive criteria of patentability, such as novelty.<sup>276</sup> This decision encouraged a formalistic examination of whether a claimed invention constituted patentable subject matter, divorced from a holistic, contextual evaluation of the invention’s potential impact on downstream productivity.<sup>277</sup> As such, it undermined the flexibility of courts to characterize an invention as a natural law, physical phenomenon, or abstract idea when productivity considerations counseled *against* issuing a patent.

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goal of the patent system in evolving technologies.”).

271. *Chakrabarty*, 447 U.S. at 309 (quoting S. REP. No. 1979, at 5 (1952); H.R. REP. No. 1923, at 6 (1952)).

272. See Robert Greene Sterne & Lawrence B. Bugaisky, *The Expansion of Statutory Subject Matter under the 1952 Patent Act*, 37 AKRON L. REV. 217, 218–19 (2004) (“After *Chakrabarty*, reference to statutory subject matter and ‘anything under the sun’ appeared frequently in decisions.”).

273. *Chakrabarty*, 447 U.S. at 309.

274. 450 U.S. 175 (1980).

275. See *id.* at 188–91.

276. *Id.* at 191 (quoting *In re Bergy*, 596 F.2d 952, 961 (C.C.P.A. 1979)).

277. A foil to Justice Rehnquist’s formalistic holding is Justice Stevens’s dissent, which explicitly considers the burgeoning software industry and the role of patents in its development: “Notwithstanding fervent argument that patent protection is essential for the growth of the software industry, commentators have noted that ‘this industry is growing by leaps and bounds without it.’” *Diehr*, 450 U.S. at 217 (Stevens, J., dissenting) (quoting Michael G. Gemignani, *Legal Protection for Computer Software: The View From ’79*, 7 RUTGERS J. COMPUTERS, TECH. & L. 269, 270 (1980)).

The Federal Circuit's recent decision in *State Street Bank & Trust Co. v. Signature Financial Group, Inc.*<sup>278</sup> has further expanded patentable subject matter; this development concomitantly narrows permissible interpretations of nonpatentable intellectual infrastructure. *State Street* minimizes the importance of the statutory categories of process, machine, manufacture, and composition of matter, and instead focuses on utility as the lynchpin of patentable subject matter.<sup>279</sup> While considerable tension exists between *State Street* and *Diehr*, *State Street* continues a trend reflected in *Chakrabarty* of continually expanding patentable subject matter.

These decisions establish a narrow, formalistic approach to defining intellectual infrastructure. Courts may not consider the macroscopic implications of patenting an invention when determining where it falls along the continuum from nonpatentable intellectual infrastructure to patentable application. While this arguably enhances the analytical rigor of the categories comprising intellectual infrastructure (i.e., natural laws, physical phenomena, and abstract ideas), it eliminates much valuable flexibility.

Unlike trademark and copyright law, patent law lacks a mechanism to explicitly consider social needs and classify certain inventions as intellectual infrastructure to prevent upstream exclusive rights from inhibiting downstream productivity. Natural laws, physical phenomena, and abstract ideas are not patentable because open access to these kinds of intellectual infrastructure enhances productivity. However, certain *patented technologies themselves*, such as gene splicing, polymerase chain reaction, isolated and purified human embryonic stem cells, and information technology standards, can also attain infrastructural status, and do so well before the end of a twenty-year patent term. Similar demand-side reasons that counsel for liberalizing access to natural laws, physical phenomena, and abstract ideas apply as well to this refined technological infrastructure.

Existing exceptions permitting unlicensed use of patented infrastructure are inadequate. One potential avenue for enhancing access to patented infrastructure is the common law experimental use exception.<sup>280</sup> This doctrine traditionally exempted unauthorized

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278. 149 F.3d 1368 (Fed. Cir. 1998).

279. *See id.* at 1375.

280. *See* *Whittemore v. Cutter*, 29 F. Cas. 1120 (C.C.D. Mass. 1813) (No. 17,600); *Sawin v. Guild*, 21 F. Cas. 554, 555 (C.C.D. Mass. 1813) (No. 12,391); *Poppenhusen v. Falke*, 19 F. Cas. 1048, 1049 (C.C.S.D.N.Y. 1861) (No. 11,279); 3 WILLIAM C. ROBINSON, *THE LAW OF PATENTS*

academic, philosophical, and noncommercial uses of patented inventions from infringement. In theory, universities and noncommercial researchers lacking a license to some foundational patented technology could invoke this exception to avoid liability for using that technology in an infrastructural manner to pursue basic scientific research.<sup>281</sup> In particular, this doctrine was potentially helpful for allowing access to patented research tools—technological *inputs* to basic scientific research, such as gene fragments.<sup>282</sup> However, the Federal Circuit has severely narrowed the experimental use exception, virtually eliminating this doctrinal “safe harbor” from infringement.<sup>283</sup> An existing *statutory* experimental use exception, which allows unlicensed use of patented materials for tests related to new drug applications to the Food and Drug Administration, is clearly too narrow to facilitate access to a broad array of patented infrastructure.<sup>284</sup>

The so-called reverse doctrine of equivalents is also inadequate for allowing unauthorized users of patented infrastructure to avoid infringement.<sup>285</sup> This doctrine exempts from infringement inventions that literally fall within the claims of a prior patented invention but that are significantly different in principle and function from the original.<sup>286</sup> However, this doctrine eliminates liability for radical *improvements* to patented inventions and is thus inapposite when downstream developers simply use upstream patented infrastructure as it was originally designed. The reverse doctrine of equivalents, which is invoked

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FOR USEFUL INVENTIONS § 898, at 56 (1890).

281. See generally Elizabeth A. Rowe, *The Experimental Use Exception to Patent Infringement: Do Universities Deserve Special Treatment?*, 57 HASTINGS L.J. 921 (2006).

282. The National Institutes of Health (NIH) defines research tools as “tools that scientists use in the laboratory, including cell lines, monoclonal antibodies, reagents, animal models, growth factors, combinatorial chemistry and DNA libraries, clones and cloning tools (such as PCR), methods, laboratory equipment and machines.” Principles and Guidelines for Recipients of NIH Research Grants and Contracts on Obtaining and Disseminating Biomedical Research Resources: Final Notice, 64 Fed. Reg. 72,090, 72,092 n.1 (Dec. 23, 1999).

283. See *Madey v. Duke Univ.*, 307 F.3d 1351, 1362–63 (Fed. Cir. 2002); Katherine J. Strandburg, *What Does the Public Get? Experimental Use and the Patent Bargain*, 2004 WIS. L. REV. 81, 84.

284. 35 U.S.C. § 271(e)(1) (2000); see *Merck KGaA v. Integra Lifesciences I*, 545 U.S. 193, 205 n.7 (2005) (declining to categorically exempt from infringement liability the use of research tools for submissions to regulatory agencies under the statutory experimental use exception).

285. See, e.g., *Boyd Power-Brake Co. v. Westinghouse*, 170 U.S. 537, 571 (1898); see Lemley, *Economics of Improvement*, *supra* note 22, at 1010–13; Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 862–68 (1990).

286. See Lemley, *Economics of Improvement*, *supra* note 22, at 1010–11.

extremely rarely, will not shield the overwhelming majority of infrastructural uses of patented inventions from infringement liability.

As a result, the current patent framework is rigidly preoccupied with first-order progress dynamics in which exclusive rights encourage inventing end-user goods. This is a simple scheme in which patents promote progress. However, this framework does not adequately consider second-order progress dynamics in which patented technologies themselves may become indispensable inputs to downstream production, rendering upstream exclusive rights on those foundational technologies problematic. Like a trademarked term that has become generic or a particularized expression that has become a stock literary device, certain inventions can become so widely adopted and relied upon that they become basic infrastructure. Restricted access to these infrastructural technologies can inhibit technological advances, thus undermining scientific progress.<sup>287</sup>

### *D. Reasons for Patent Law's Rigid Approach to Intellectual Infrastructure: Illegitimate Justifications and Legitimate Concerns*

Unlike the dynamic approaches of trademark and copyright law, patent law possesses no mechanism for relaxing exclusive rights on inventions that evolve into infrastructure during the term of protection.<sup>288</sup> A continuum emerges wherein trademark law is highly responsive to evolving social practice, copyright law implicitly considers the “moving target” of what is perceived as stock and standard in applying the idea-expression dichotomy and scenes a faire doctrine, and patent law takes the narrowest and most rigid approach to identifying and enhancing access to intellectual infrastructure. This is particularly problematic given that relative to trademark and copyright law, patent law exhibits arguably the most accretive model of progress, wherein downstream advances depend on access to existing upstream technologies.

Of course, the mere existence of differences is not necessarily cause for concern. After all, trademark, copyright, and patent law do vary in

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287. See Peter Lee, Note, *Patents, Paradigm Shifts, and Progress in Biomedical Science*, 114 YALE L.J. 659, 690 (2004) (arguing that early, time-limited access to foundational technologies may be the most effective mechanism for sparking scientific paradigm shifts) [hereinafter Lee, *Paradigm Shifts*]. See generally KUHN, *supra* note 13.

288. While there is no fixed term of protection for trademarks, a finding of genericide will terminate protection. See *supra* Part I.B.1.

their ends and means. This section explores some reasons for patent law's singularity. Drawing on the rapid dynamics of patent-oriented industries, it concludes that the relatively short patent term and the availability of voluntary licensing are insufficient to justify patent law's rigid insistence on maintaining exclusive rights on patented infrastructure. Furthermore, it points out that patent law's formalistic rather than functional approach to identifying infrastructure is due in part to the unique timing of this inquiry relative to analogous inquiries in trademark and copyright. Finally, it concludes that patent law *is* different from trademark and copyright law in certain respects, and that the need to maintain incentives to invent suggests that patent law must liberalize access to infrastructure in a manner different from that of its intellectual property siblings.

### 1. *The Inadequacy of the Twenty-Year Patent Term*

Patent law's only effective mechanism for liberalizing access to patented infrastructure is its relatively short term of protection. Trademarks last indefinitely, as long as a mark continues to signify an individual product or firm.<sup>289</sup> This open-ended term of protection, coupled with rapid linguistic evolution, renders genericide a valuable mechanism for revisiting and cancelling marks that no longer identify particular sources. Copyrights last a relatively long time—generally the author's life plus seventy years.<sup>290</sup> The idea-expression dichotomy and the scenes a faire doctrine operate so that elements that may have been protectable expression at one point can become nonprotectable "ideas" or scenes a faire upon becoming stock or standard.<sup>291</sup> Given these long periods of protection, trademark and copyright law utilize dynamic doctrines to free up assets as they achieve infrastructural status.

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289. See Lanham Act § 9, 15 U.S.C. § 1059 (2000) (allowing successive ten-year periods of registration). For example, Coca-Cola first registered its trademark as early as 1893. See *Coca-Cola Co. v. Gemini Rising, Inc.*, 346 F. Supp. 1183, 1186 (E.D.N.Y. 1972).

290. See Sonny Bono Copyright Term Extension Act of 1998, Pub. L. No. 105-298, 112 Stat. 2827 (1998) (codified as amended at 17 U.S.C. §§ 301–304 (2006)) (extending copyright protection an additional twenty years to the author's life plus seventy years); see also *Eldred v. Ashcroft*, 537 U.S. 186, 208 (2003) (upholding the constitutionality of term extension). Currently, the term of protection of anonymous, pseudonymous, and institutional authors is the lesser of ninety-five years from the date of publication or 120 years from the date of creation. 17 U.S.C. § 302 (2006).

291. Such examples are most likely to arise in computer science cases. Cf. *Apple Computer v. Microsoft Corp.*, 35 F.3d 1435, 1444 (9th Cir. 1994) (noting that overlapping windows have become the clear standard in graphical interfaces and are nonprotectable under the scenes a faire doctrine).

In contrast, a patent term lasts only twenty years from the date of filing an application.<sup>292</sup> Clearly, the relatively short term of a patent mitigates concerns over the inaccessibility of patented infrastructure. All patented inventions fall into the public domain after twenty years; the positive externalities associated with open access to inventions upon patent expiration are essential to the basic quid pro quo of the patent system.<sup>293</sup> However, while the relative brevity of the patent term mitigates concerns over locking up infrastructure, it does not extinguish them. A one-size-fits-all patent term of twenty years ignores the widely divergent contributions of various inventions to subsequent technological development and does not account for how quickly certain inventions can achieve infrastructural status.

As seen in numerous examples, patented inventions may become infrastructure well before their patents expire, especially in fast-moving industries such as biotechnology and information technology. Absent efficient licensing, discussed below, exclusive rights on this infrastructure may inhibit myriad downstream applications. Here, my argument that patent law must better accommodate the evolution of intellectual infrastructure intersects with empirical evidence demonstrating the need for such accommodation. I thus offer four examples of patented inventions that attained infrastructural status well before expiration of their patent terms: gene splicing, polymerase chain reaction, human embryonic stem cells, and information technology standards such as JPEG.

In 1980, Stanley Cohen and Herbert Boyer patented the technique for gene splicing, the process by which researchers isolate, manipulate, and reintroduce DNA into cells.<sup>294</sup> The process is the bedrock of recombinant DNA technology and facilitates a wide array of downstream applications.<sup>295</sup> Patent assignee Stanford University experimented with several licensing arrangements but generally licensed the technology at a low fee of \$10,000.<sup>296</sup> The broad utility of the

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292. 35 U.S.C. § 154(a)(2) (2000).

293. See Frischmann & Lemley, *supra* note 26, at 291.

294. See U.S. Patent No. 4,740,470 (filed Apr. 20, 1984); U.S. Patent No. 4,468,464 (filed Nov. 9, 1978); U.S. Patent No. 4,237,224 (filed Jan. 4, 1979).

295. Sally Smith Hughes, *Making Dollars out of DNA: The First Major Patent in Biotechnology and the Commercialization of Molecular Biology, 1974–1980*, 92 *ISIS* 541, 542 (2001).

296. See Oren Bar-Gill & Gideon Parchomovsky, *The Value of Giving Away Secrets*, 89 *VA. L. REV.* 1857, 1871 (2003); Maryann Feldman et al., *Commercializing Cohen-Boyer 1980–1997*, 20–23 (Danish Research Unit for Indus. Dynamics, DRUID Working Paper No. 05-21, 2005).



invention coupled with this low license fee led to its widespread adoption in the biotechnology sector, and as early as seven years after the patent was issued, recombinant DNA product sales reached \$500 million.<sup>297</sup> Eleven years after the patent issued, firms were introducing 400 new products annually based on recombinant gene technology.<sup>298</sup> In all, 468 companies licensed the gene splicing patent, which generated \$254 million in licensing revenue over its seventeen-year term.<sup>299</sup> Gene splicing illustrates the immense benefits of wide access to infrastructure: broad, low-cost licensing of the fundamental gene splicing technology enabled myriad applications to develop. Given the rapidity of gene splicing's adoption, raising licensing fees or otherwise restricting access to this technology would, in all likelihood, have significantly and negatively impacted the emergence of the biotechnology industry.

Polymerase chain reaction (PCR) offers an illuminating comparison. In 1987, the private biotechnology company Cetus developed and patented PCR, a foundational laboratory technique for generating many copies of particular DNA strands. The immense utility of PCR, coupled with both reasonably priced licenses and rampant infringement, led to its broad adoption.<sup>300</sup> After a few years, PCR became "an indispensable research tool employed in nearly every biological field."<sup>301</sup> After PCR had significantly penetrated the biomedical research sector, Cetus threatened to aggressively enforce its patent against firms engaged in pharmaceutical development, and even threatened suit against noncommercial, academic researchers who shared their PCR-enabled research with industry.<sup>302</sup> While Cetus did not follow through with its threats, this example demonstrates the risks of strong exclusive rights on an infrastructural resource subject to rapid and widespread adoption.

Human embryonic stem cells are another technology that achieved infrastructural status only a few years after patenting.<sup>303</sup> James Thomson,

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297. Feldman, *supra* note 296, at 25.

298. *Id.*

299. *Id.* at 20, 23. Presently, the patent term is twenty years. 35 U.S.C. § 154(a)(2) (2000).

300. Joe Fore, Jr. et al., *The Effects of Business Practices, Licensing, and Intellectual Property on Development and Dissemination of the Polymerase Chain Reaction: Case Study*, 1 J. BIOMEDICAL DISCOVERY AND COLLABORATION 7, \*14–15 (July 3, 2006).

301. *Id.* at \*2.

302. *See Cetus To Exact Royalties from PCR Sales; Probe Absolves Convicted Rapist*, BIOTECH. NEWSWATCH, Sept. 5, 1988, at 7.

303. *See Lee, Inverting the Logic of Scientific Discovery*, *supra* note 10, at 108; Lee, *Paradigm Shifts*, *supra* note 287, at 692.

a researcher at the University of Wisconsin at Madison, first isolated and purified human embryonic stem cells in 1998 and ultimately received two key patents on this “technology.”<sup>304</sup> In a sense, stem cells are the quintessential infrastructure, for they retain the ability to differentiate into a wide array of particularized cells and have shown immense promise as the basis for a broad variety of regenerative therapies.<sup>305</sup> Despite only being about half-way through the term of the original patent, consensus has already developed that these assets are critical to a broad range of basic experimentation and applications.<sup>306</sup> Notwithstanding voluntary arrangements to license these cells to noncommercial, federally funded researchers on a royalty-free basis,<sup>307</sup> access to these cells has not met demand.<sup>308</sup> While these patents currently face challenges on nonobviousness grounds,<sup>309</sup> several years of exclusive rights have no doubt prevented some downstream research and development from occurring. Successful defense of these challenges may prolong this inhibition throughout the remaining years of the patent term.

Standards in information technology are another kind of invention that can achieve infrastructural status well before the patent term expires.<sup>310</sup> I focus here on “common platform” standards that facilitate

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304. U.S. Patent No. 5,843,780 (filed Jan. 18, 1996); U.S. Patent No. 6,200,806 (filed June 26, 1998).

305. See Nat’l Insts. of Health, STEM CELL INFORMATION 1 <http://stemcells.nih.gov/staticresources/info/basics/StemCellBasics.pdf>. Although recent advances indicate that certain adult stem cells can be reprogrammed to function like embryonic stem cells, many in the scientific community believe that embryonic stem cells are still better suited to serve as the basis for new therapies. Colin Nickerson, *Caution Urged in New Method for Stem Cells: Harvard Sticks to Cloning*, BOST. GLOBE, Dec. 17, 2007, at 1A.

306. See Hazuka, *supra* note 3, at 164–65 (describing various potential uses of embryonic stem cells); Nat’l Insts. of Health, *supra* note 305 (listing various uses).

307. Wisconsin Alumni Research Foundation, the holder of the two stem cell patents, see *supra* note 304, signed a Memorandum of Understanding allowing the NIH to retain rights to the ’780 patent because federal grants funded the underlying research. See also Josephine Johnston & Angela A. Wasunna, *Patents, Biomedical Research, and Treatments: Examining Concerns, Canvassing Solutions*, HASTINGS CENTER REPORT, Jan.–Feb. 2007, at s12; Loring & Campbell, *supra* note 3, at 1717.

308. See, e.g., Singer, *Stem Cells Stuck*, *supra* note 3; Loring & Campbell, *supra* note 3, at 1716–17.

309. Andrew Pollack, *3 Patents on Stem Cells Are Revoked in Initial Review*, N.Y. TIMES, Apr. 3, 2007, at C2.

310. See generally Janice M. Mueller, *Patent Misuse Through the Capture of Industry Standards*, 17 BERKELEY TECH. L.J. 623 (2002); Mark A. Lemley, *Intellectual Property Rights and Standard-Setting Organizations*, 90 CAL. L. REV. 1889 (2002) [hereinafter Lemley, *Standard-Setting*].

interoperability in information technology networks.<sup>311</sup> Patents on strong network standards can create durable market power in these fields.<sup>312</sup> The infrastructural nature of standards, which generate immense value from widespread use by a particular inventive community, has motivated calls to limit exclusive rights over them.<sup>313</sup> While many standard-setting organizations (SSOs) favor “open” rather than proprietary standards, patented inventions do find their way into widely adopted standards.<sup>314</sup> For example, in 1994, several SSOs created the Joint Photographic Experts Group (JPEG) standard for compressing photographic images. Within three years, the standard became a fundamental mass-marketed technology.<sup>315</sup> In 2002, video networking company Forgent Networks asserted patent rights over the technology underlying JPEG. Forgent collected over \$100 million in royalties before a consortium of information technology companies challenged the validity of the patent, resulting in settlement.<sup>316</sup> As this episode illustrates, in the context of patented information technology standards,<sup>317</sup> rapid adoption coupled with strong rights to exclude may allow a single actor to hinder productivity throughout an entire industry.<sup>318</sup> Taken together, these case studies show that certain patented technologies attain infrastructural status very quickly, revealing a need to relax exclusive rights *during* the patent term.

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*Organizations*].

311. See O'Rourke, *supra* note 22, at 1179 (“[I]n the market for operating systems software, which exhibits powerful network effects, strong patent protection can create an insurmountable barrier to entry while also allowing a single patentee to direct innovation in the market for applications running on the dominant system.”).

312. Cohen & Lemley, *supra* note 132, at 22.

313. See generally Pamela Samuelson, *Questioning Copyrights in Standards*, 48 B.C. L. REV. 193 (2007); Mark A. Lemley, *Ten Things to Do About Patent Holdup of Standards (And One Not To)*, 48 B.C. L. REV. 149 (2007) [hereinafter Lemley, *Patent Holdup of Standards*].

314. See Lemley, *Standard-Setting Organizations*, *supra* note 310, at 1893.

315. Priscilla Caplan, *Patents and Open Standards*, INFO. STANDARDS QUARTERLY, Oct. 2003, at 1, 2.

316. See Kannellos, *supra* note 6.

317. Although not relevant to JPEG, the problem of patented standards is accentuated where a single standard is based on multiple patents, thus increasing negotiating and other licensing costs. See Lemley, *Patent Holdup of Standards*, *supra* note 313, at 152.

318. See Greg R. Vetter, *Open Source Licensing and Scattering Opportunism in Software Standards*, 48 B.C. L. REV. 225, 230 (2007).

2. *Challenges Undermining Voluntary Licensing of Patented Infrastructure*

These case studies suggest another mechanism that could in theory ameliorate patent law's strict protection of patented infrastructure: voluntary licensing. However, voluntary arrangements may not provide adequate access to these foundational technologies. Standard economic theory generally predicts that patentees will efficiently license infrastructural technologies to allow all potentially valuable uses to occur.<sup>319</sup> Thus, for example, some may argue that patents on infrastructural human embryonic stem cells are not problematic because a licensing market will develop to enable downstream uses of these assets. However, for a variety of reasons efficient licensing (from a society-wide perspective) may fail to arise.

First, licensing transactions are complicated by the difficulty of valuing intellectual infrastructure.<sup>320</sup> Valuation difficulties endemic to technology in general are exacerbated for infrastructural inventions such as isolated, purified human embryonic stem cells that enable an extremely broad range of applications.

Second, private transactions will not always reflect the social benefits of utilizing infrastructure. When an individual uses infrastructure, such as when a researcher uses human embryonic stem cells to develop a new therapy, the price charged for the resulting product typically only captures a portion of the overall social benefit of the innovation. Put another way, society benefits more from an individual's use of infrastructure than that individual benefits herself. Because exploiting infrastructure produces spillovers that are not appropriable by transacting parties, patentees will demand higher fees and licensees will insist on lower fees than would be socially optimal.<sup>321</sup>

Third, strategic behavior in the form of holdouts by both patentees and prospective licensees may lead them to forgo deals that actually serve the best interests of both parties.<sup>322</sup>

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319. See O'Rourke, *supra* note 22, at 1179.

320. Frischmann, *Economic Theory*, *supra* note 15, at 958; David J. Teece, *The Market for Know-How and the Efficient International Transfer of Technology*, ANNALS AM. ACAD. POL. & SOC. SCI., Nov. 1981, at 81, 86.

321. See Frischmann & Lemley, *supra* note 26, at 257.

322. See Robert Coater, *The Cost of Coase*, 11 J. LEGAL STUD. 1, 19–23 (1982) (discussing bargaining theory generally); ROBERT P. MERGES, PETER S. MENELL & MARK A. LEMLEY, INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 350 (rev. 4th ed. 2007).

Fourth, patentees of infrastructural assets may exercise market power that leads them to demand supracompetitive prices.<sup>323</sup> Infrastructure such as PCR and established interoperability standards lack adequate substitutes. Where prospective licensees have made “irreversible investments” in particular technological platforms, patentees may charge high licensing fees to exploit this reliance.<sup>324</sup> For example, Rambus apparently attempted to corner the memory chip market by patenting key memory chips upon learning that they would become the industry standard.<sup>325</sup> Establishing a uniformly high licensing fee is particularly likely where transaction costs prevent a patentee from negotiating different prices with different licensees.

Fifth, as Professor Mark Lemley has thoroughly described, licensing transactions are costly.<sup>326</sup> Aggregate transaction costs will be particularly high for infrastructural inventions needed by many parties.<sup>327</sup> Finally, even if a patentee is willing to license such a technology at competitive prices, this may be only one of several inventions that a subsequent exploiter needs to use.<sup>328</sup> As Professors Michael Heller and Rebecca Eisenberg have chronicled, the need to bundle licenses from many different patentees may give rise to a “tragedy of the anticommons” rendering some downstream lines of development prohibitively

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323. Cf. Lemley, *Economics of Improvement*, *supra* note 22, at 1058–59. While Lemley discusses strategic behavior involving an inventor and a subsequent improver, similar behavior may apply to licenses for users of patented infrastructure who do not intend to improve on the infrastructure. A monopolist will maximize price where marginal cost equals marginal revenue. Because this monopoly price is higher than the competitive price (assuming a downward-sloping demand curve), some users will be “priced out” of the market and will not be able to access the good produced by the monopolist. MERGES ET AL., *supra* note 322, at 350.

324. Lemley, *Patent Holdup of Standards*, *supra* note 313, at 154.

325. See *In re Rambus Inc.*, No. 9302, at 3-5, Opinion of the Commission (F.T.C. Aug. 2, 2006); Pamela A. MacLean, ‘Rambus’ Ruling is a Standards Landmark, THE NAT’L L. J., Oct. 24, 2006, at 8; Lemley & Weiser, *supra* note 7, at 837–38.

326. Lemley, *Economics of Improvement*, *supra* note 22, at 1053–54; see also MERGES ET AL., *supra* note 322, at 350; FAROK J. CONTRACTOR, INTERNATIONAL TECHNOLOGY LICENSING: COMPENSATION, COSTS AND NEGOTIATION 104–05 (1981) (noting that transaction costs averaged approximately \$100,000 for typical licensing arrangements).

327. Extrapolating to “primary” intellectual infrastructure, the transaction costs of licensing patented natural laws, physical principles, and abstract ideas to all potential users would be prohibitively high. For these types of assets, prospect theory, which emphasizes the efficiency of allowing one party to orchestrate the development of a given prospect, is largely inapplicable. See generally Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977) (discussing prospect theory).

328. See Lemley, *Patent Holdup of Standards*, *supra* note 313, at 152 (describing the problem of royalty-stacking in the information technology sector).

expensive.<sup>329</sup> In sum, voluntarily licensing may not provide adequate access to patented intellectual infrastructure.

### 3. *The Nature of Patent Rights and Their Acquisition*

Another potential justification for patent law's unique approach to infrastructure is that, unlike trademarks and copyrights, patents do not implicate First Amendment concerns. Trademarks have become valuable mechanisms of expression, particularly in popular culture.<sup>330</sup> Furthermore, it is well-recognized that the idea-expression dichotomy plays a critical role in balancing exclusive rights on texts with First Amendment interests in widely disseminating ideas.<sup>331</sup> Perhaps courts justifiably pay greater attention to the downstream implications of exclusive rights in trademark and copyright law because of their potential burdens on speech, a concern that is perceived as absent from patent law.<sup>332</sup> However, concerns over inhibiting speech only strengthen the principle that intellectual property is and should be attentive to the implications of upstream exclusive rights on downstream activity. Furthermore, while the "speech" losses from upstream exclusive rights are lower in patent law relative to trademark and copyright law, the "utility" losses from decreased access to foundational technologies are arguably greater.

Another potential explanation for patent law's uniquely narrow and formalistic approach to defining intellectual infrastructure relates to the substantive hurdles necessary to obtain a patent.<sup>333</sup> Unlike trademarks

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329. Heller & Eisenberg, *supra* note 10, at 698–701. *See generally* Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998).

330. *See* Dreyfuss, *Expressive Genericity*, *supra* note 87, at 397.

331. *See* Melville B. Nimmer, *Does Copyright Abridge the First Amendment Guarantees of Free Speech and Press?*, 17 UCLA L. REV. 1180, 1189–93 (1970).

332. Mark A. Lemley & Eugene Volokh, *Freedom of Speech and Injunctions in Intellectual Property Cases*, 48 DUKE L.J. 147, 237 (1998) (“[P]atent law is qualitatively different from copyright law because most of the acts it restricts don’t involve speech at all.”). For a potential counterargument that patents in research science may implicate First Amendment concerns, see John A. Robertson, *The Scientist’s Right to Research: A Constitutional Analysis*, 51 S. CAL. L. REV. 1203, 1252 (1978). *See also* Dan L. Burk, *Patenting Speech*, 79 TEX. L. REV. 99 (2000).

333. *See* Herbert Rosenthal Jewelry Corp. v. Kalpakian, 446 F.2d 738, 740 (9th Cir. 1971) (“[The patent] monopoly . . . is carefully circumscribed by substantive and procedural protections.”); O’Rourke, *supra* note 22, at 1184 (observing that copyright law has few requirements for initial protection but greater flexibility to subsequently limit that protection, while patent law reflects the reverse situation).

and copyrights, patents undergo a rigorous examination process.<sup>334</sup> Examiners at the Patent and Trademark Office (PTO) assess whether an invention satisfies certain statutorily defined criteria, including novelty, utility, and nonobviousness.<sup>335</sup> During prosecution, the PTO may compel the patent applicant to narrow her claims, thus broadening the space available to subsequent innovators in the same field.<sup>336</sup> One might argue that these substantive requirements ensure that only inventions that truly advance the state of the art receive patents and that this is an ideal outcome. However, this argument misses the point. It is precisely because some inventions are *too* meritorious and *too* valuable that they become indispensable intellectual infrastructure meriting wide availability.<sup>337</sup> The PTO's rigorous examination of patentability neither directly addresses nor mitigates the problem of productivity losses arising from exclusive rights on productivity-enabling infrastructure.

A further reason for patent law's divergent approach from trademark and copyright law relates to differences in the timing of the relevant intellectual infrastructure inquiries. As a general matter, courts determine genericity and apply the idea-expression dichotomy and scenes a faire doctrine in the context of an infringement action. At that point, usually long after a mark or text has been created, courts have a wealth of social data from which to draw when analyzing whether elements of those creations have achieved infrastructural status. For trademarks, courts consider consumer surveys, market information, brochures, and dictionaries to ascertain whether a trademark has become a generic word.<sup>338</sup> In copyright law, courts can consider the relative success of the original work, commonality with other works, and

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334. 35 U.S.C. § 131 (2000 & Supp. V 2005). The Patent and Trademark Office does examine applications to register trademarks on the principal register. 15 U.S.C. § 1051 (2000). However, this examination is not nearly as extensive as patent examination, and marks are protectable even without registration. 15 U.S.C. § 1125(a) (2000) (establishing "false designation of origin" protection for unregistered marks).

335. See 35 U.S.C. §§ 101–103 (2000).

336. See Lemley, *Economics of Improvement*, *supra* note 22, at 1000–03; Merges & Nelson, *supra* note 285, at 843.

337. While I do not articulate here a strict constructivist theory of technology contending that the *meaning* of technology is entirely contingent on social perception, such a theory does help legitimate communal claims over widely needed patented infrastructure. See Cohen, *Creativity and Culture*, *supra* note 35, at 1183–84 (discussing strict constructivist theory relating to texts and technology).

338. See *supra* Part III.A; *Am. Online, Inc. v. AT&T Corp.*, 243 F.3d 812, 815 (4th Cir. 2001).

patterns of social adoption in determining whether specific elements of that work are stock or standard and thus nonprotectable.

The timing of the analysis is different in patent law. The PTO first determines patentable subject matter, which is the analogous inquiry into intellectual infrastructure, at the time of patent issuance.<sup>339</sup> At this point, there is little or no social data on the invention to consider, thus leading these determinations to be formalistic rather than functionally attentive to social use. While the issue of patentable subject matter can be litigated in an infringement action, the statutory design of this requirement as a *threshold* condition for patent issuance discourages considering an invention's social history and context. An ideal "infrastructural" analysis would explicitly consider social data on a patented invention and its adoption in determining whether it merits liberalized access. Even more, this analysis would be highly contextualized to specific cases, distinguishing between infrastructural and non-infrastructural uses of the same patented invention.

Finally, in addition to the problem of timing, courts are naturally hesitant to invalidate patents on infrastructural inventions because doing so would undermine incentives to invent. While open access to *existing* patented infrastructure helps optimize its exploitation, eliminating patent rights would discourage future inventors from creating new infrastructure in the next round of innovation.<sup>340</sup> This concern is inapposite to trademark law, which does not exist to encourage creating more trademarks. It is attenuated in copyright law, where the cost of developing "new" ideas and scenes a faire is relatively low. However, the need to maintain some return on investment is critical to developers of technological infrastructure, thus counseling against simply relegating such inventions to the public domain.

As we have seen, the relatively brief term of protection, availability of licensing, perceived absence of First Amendment concerns, and substantive examination process characteristic of patents do not justify patent law's rigid approach to intellectual infrastructure. However, the timing of patent law's infrastructure inquiry and the need to maintain incentives to invent are key differences that warrant attention. A recent Supreme Court case offers solutions to both the problems of timing and

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339. See 35 U.S.C. § 101 (2000).

340. Cf. *Integra Lifesciences I, Ltd. v. Merck KGaA*, 331 F.3d 860, 867 (Fed. Cir. 2003) (noting that subjecting research tools to the 35 U.S.C. § 271(e)(1) research exception would compromise incentives to invent those foundational technologies).



incentives, thus opening the door for a more nuanced and functional approach to identifying and protecting patented intellectual infrastructure. In so doing, it provides a guide for fruitfully navigating the wide gray area between open access and exclusive rights to allow for use-specific, compensation-dependent access to patented infrastructure.

#### IV. INCORPORATING INFRASTRUCTURAL ANALYSIS IN DETERMINING PATENT INFRINGEMENT REMEDIES: A PROPOSAL FOR APPLYING *eBAY INC. v. MERCEXCHANGE, L.L.C.*

##### A. *Denying Injunctions and Allowing Liability Rule Protection for Infrastructural Uses of Patented Inventions*

Viewed through the lens of infrastructure theory, the Supreme Court's recent decision in *eBay Inc. v. MercExchange, L.L.C.* provides an immensely valuable framework for liberalizing access to patented infrastructure on a dynamic basis.<sup>341</sup> In *eBay*, the Supreme Court provided courts with greater flexibility to deny injunctions in patent infringement cases, thus opening the door for protecting patented inventions with a liability rule rather than a property rule.<sup>342</sup> I propose a two-tiered system in which courts continue to protect ordinary inventions serving a non-infrastructure role with a property rule (via injunctive relief) but protect patented inventions serving as infrastructure with a liability rule (via royalties) in certain circumstances.<sup>343</sup> Applying this proposal, courts should deny injunctions in cases of patent infringement that meet three criteria: (1) the infringed patent claims an infrastructural invention, (2) the infringer is actually using the patented invention in an infrastructural manner, and (3) the patented invention is not reasonably available through licensing.<sup>344</sup> In such cases, denying injunctions creates the opportunity for continued infringement of an infrastructural resource contingent on the defendant paying court-determined royalties. However, my proposal would preserve ample opportunities for parties to voluntarily negotiate a license, but against the

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341. 547 U.S. \_\_\_, 126 S. Ct. 1837 (2006).

342. *See id.* at 1839.

343. *Cf.* Calabresi & Melamed, *supra* note 21, at 1092 (describing entitlements as protected by either a property or liability rule).

344. *See infra* Part IV.A.2.

changed background of liability rules rather than property rules. Ultimately, this proposal builds a valuable social feedback mechanism into patent law. It provides use-specific, compensation-dependent access to patented technologies that become infrastructure during the patent term, thus promoting downstream productivity while maintaining upstream incentives to invent.

### 1. *The eBay Decision*

*eBay Inc. v. MercExchange, L.L.C.* significantly changed the law of patent remedies.<sup>345</sup> In that case, eBay and Half.com, a wholly owned subsidiary, infringed MercExchange's business method patent for an electronic market.<sup>346</sup> However, the district court denied MercExchange's motion for permanent injunctive relief.<sup>347</sup> The Federal Circuit reversed, applying its "general rule that courts will issue permanent injunctions against patent infringement absent exceptional circumstances."<sup>348</sup> On appeal, the Supreme Court reversed the Federal Circuit. Writing for the majority, Justice Thomas held that the decision to grant or deny injunctive relief rests within the discretion of the district court, consistent with traditional equitable principles.<sup>349</sup> Within this framework,

A plaintiff must demonstrate: (1) that it has suffered an irreparable injury; (2) that remedies available at law, such as monetary damages, are inadequate to compensate for that injury; (3) that, considering the balance of hardships between the plaintiff and defendant, a remedy in equity is warranted; and (4) that the public interest would not be disserved by a permanent injunction.<sup>350</sup>

*eBay* is a simple holding with profound implications. Courts are no longer constrained to a syllogism wherein patent infringement leads inexorably to an injunction. The possibility of denying an injunction and

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345. While the law changed significantly, there is open debate as to whether courts will substantially deviate from the general practice of granting injunctions. *eBay Inc.*, 547 U.S. at \_\_\_, 126 S. Ct. at 1841–42 (Roberts, C.J., concurring) (suggesting that courts will continue to grant injunctions in most patent infringement cases).

346. *MercExchange, L.L.C. v. eBay, Inc.*, 275 F. Supp. 2d 695, 698–99 (E.D. Va. 2003), *aff'd in part, rev'd in part*, *MercExchange, L.L.C. v. eBay, Inc.*, 401 F.3d 1323 (Fed. Cir. 2005).

347. *Id.* at 715.

348. *eBay Inc.*, 547 U.S. at \_\_\_, 126 S.Ct. at 1839 (quoting *MercExchange*, 401 F.3d at 1339).

349. *Id.* at 1841.

350. *Id.* at 1839.

allowing infringement to continue contingent on paying royalties—in essence, protecting a patent with a liability rule—offers important flexibility to courts.<sup>351</sup> In particular, *eBay* opens the door for a social feedback mechanism in patent law that relaxes exclusive rights on inventions that become infrastructure.

I argue that courts in patent infringement cases should consider the infrastructural use of a patented invention within the *eBay* framework, denying injunctive relief where appropriate to allow continued use of foundational technologies. The first *eBay* factor, irreparable harm to the plaintiff, may be difficult to establish by patentees of infrastructural technologies. Continued infringement by a particular user (who must pay an ongoing royalty) does not prevent the patentee from licensing to other users.<sup>352</sup> Furthermore, the “upstream” nature of infrastructure means that infringing users typically operate in “downstream” markets and do not directly compete with the patentee. Because the infringer and patentee do not directly compete with each other, denying an injunction will not cause the patentee to lose brand name recognition or market share, factors that ordinarily weigh towards establishing irreparable harm.<sup>353</sup>

For related reasons, it will be difficult for patentees of infrastructural technologies to establish the second factor, the inadequacy of legal remedies. Without losing brand name recognition or market share, for which an injunction would be an appropriate remedy, monetary damages should be sufficient to compensate the patentee. While calculating damages is difficult, these difficulties are surmountable and would not render legal remedies inadequate.<sup>354</sup>

Within *eBay*'s equitable framework, the third (relative hardship of an injunction) and fourth (public interest) factors are particularly relevant for determining that a patented invention serving as infrastructure should not receive injunctive protection.<sup>355</sup> Regarding the third factor, the relative hardship of an injunction will fall heavily on the defendant, for whom the patented item is indispensable for a particular line of research or development. Downstream parties enjoined from using polymerase chain reaction, embryonic stem cells, and patented interoperability standards would be severely hampered in their productive pursuits.

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351. See Calabresi & Melamed, *supra* note 21.

352. See *z4 Techs., Inc. v. Microsoft Corp.*, 434 F. Supp. 2d 437, 440 (E.D. Tex. 2006).

353. See *id.*

354. See *infra* Part IV.E.

355. See *eBay Inc.*, 547 U.S. at \_\_\_, 126 S. Ct. at 1839.

Under *eBay*, courts also consider the availability of other remedies to a patentee in determining the relative hardship of an injunction. In many cases, monetary damages will be adequate to compensate patentees, thus lessening their relative hardship.

The fourth factor, the public interest, counsels even more strongly against enjoining infrastructural use of patented inventions. Inventive communities benefit greatly from access to infrastructure because of its productivity-enhancing qualities, wide ranging applicability, and general lack of substitutes. Furthermore, because inventors typically capture only a small proportion of the social value of their inventions, the widespread use of infrastructure generates immense spillovers benefiting society at large.<sup>356</sup> Additionally, allowing liability rule protection will not overly compromise the public's interest in maintaining incentives to invent.<sup>357</sup> Under this proposed application of *eBay*, infringement is not free. Infringers who are not enjoined must pay damages to patentees for any ongoing use, thus allowing patentees to recoup their investment costs and encouraging future innovation.<sup>358</sup>

In considering the public interest, courts should also consider non-patent incentives driving the creation of particular inventions. Patents provide incentives to invent, but they also impose a social cost, measured by the access constraints enabled by exclusive rights. To the extent that exclusive rights are not necessary to motivate invention, these distributional losses are not socially justified. In a significant number of instances—particularly in biotechnology—the federal government has funded the development of infrastructural technologies that are then patented.<sup>359</sup> Federal funding of inventions severely attenuates the incentive rationale for patents, and such public funding should militate

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356. Frischmann & Lemley, *supra* note 26, at 268–70.

357. *See Abbott Labs. v. Andrx Pharm., Inc.*, 452 F.3d 1331, 1348 (Fed. Cir. 2006) (noting that public policy favors enforcing patent rights).

358. *See* J.H. Reichman, *Legal Hybrids Between the Patent and Copyright Paradigms*, 94 COLUM. L. REV. 2432, 2504–05 (1994).

359. The National Institutes of Health provide \$28 billion in funding for basic scientific research every year. NIH - Overview, <http://www.nih.gov/about/NIHoverview.html> (last visited Dec. 17, 2007). Indeed, the NIH funded a considerable portion of the research leading to James Thomson's patents on human embryonic stem cells. Federally funded researchers enjoy a "double bonus" because of the federal Bayh-Dole Act, which allows recipients of federal funds to patent any inventions arising from taxpayer-supported research. *See* 35 U.S.C. §§ 200–212 (2000 & Supp. V 2005). *See generally* Arti K. Rai & Rebecca S. Eisenberg, *Bayh-Dole Reform and the Progress of Biomedicine*, 66 LAW & CONTEMP. PROBS. 289 (2003).

against protecting resulting inventions with an injunction.<sup>360</sup> Although much more difficult to analyze, where the incentives of self-use and self-benefit have motivated a patentee to develop an invention, the rationale for strict property rule protection of that patent is also undermined.<sup>361</sup>

In sum, courts should consider infrastructural use of a patented invention when applying *eBay*, with such use weighing against granting an injunction and in favor of maintaining access to that foundational technology. This proposal does not represent a radical departure from existing precedent, but arises organically within the *eBay* framework. Indeed, considering the infrastructural use of a patented invention is arguably necessary under *eBay*'s equitable test.

## 2. *The Proposed Application of eBay*

This proposed application of *eBay* aims to promote inventive activity and only applies to a relatively narrow set of situations involving patented infrastructure. This proposal creates two tiers of patent protection. Ordinary patented inventions not used as infrastructure would continue to be subject to traditional property rule protection upon infringement. However, infrastructural use of a foundational patented technology would, on a case-by-case basis, militate *against* imposing an injunction if that technology is not otherwise reasonably available through voluntary licensing.

Accordingly, for courts to deny injunctions and allow liability rule protection in cases of patent infringement, three conditions must be satisfied. First, a patented invention must qualify as intellectual infrastructure, meaning it must be: (1) a nonrival resource, (2) valuable primarily for its enabling capabilities, and (3) a means to a wide variety of downstream applications.<sup>362</sup> Second, the infringer must be using the invention in an infrastructural capacity, taking advantage of its particular enabling properties. Third, a court must conclude that efficient licensing

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360. See Rai & Eisenberg, *supra* note 359, at 300.

361. See Katherine J. Strandburg, *Users as Innovators: Implications for Patent Doctrine*, (Mar. 2007) (unpublished manuscript), available at <http://ssrn.com/abstract=969399>.

362. Frischmann, *Economic Theory*, *supra* note 15, at 956. These factors suggest an implicit fourth factor characterizing infrastructure: lack of adequate substitutes. For example, the industry-wide "irreversible investments" made in adopting a patented standard such as JPEG may render other standards inadequate substitutes. See Lemley, *Patent Holdup of Standards*, *supra* note 313, at 154. In other cases, the unique properties of the infrastructural invention, as with human embryonic stem cells, make it nearly impossible to substitute. In still other cases, the sheer technological ingenuity of an invention helps it both enable a wide array of downstream applications and render any potential substitutes inadequate, as with gene splicing.

and attendant widespread accessibility has not and is not likely to occur. This means that voluntary, reasonable, and nondiscriminatory licensing, either directly by the patentee, or as mediated by a standard-setting organization,<sup>363</sup> would not trigger liability rule protection. This proposal allows parties to voluntarily license their patented infrastructure widely, but preserves the possibility of a liability rule as a backstop if such licensing does not arise.

Regarding the first condition, the range of patented technologies qualifying as infrastructure would be narrow but significant. Familiar examples include gene splicing, polymerase chain reaction, human embryonic stem cells, and information technology standards.<sup>364</sup> Comparing these technologies indicates that two classes of technologies would satisfy the threshold determination as “infrastructure.” The first class includes patented technologies whose widespread licensing and adoption clearly establishes their infrastructural status. Low-cost licensing of gene splicing and no-cost licensing of the JPEG standard engendered widespread adoption and reliance, helping these assets become infrastructure. My proposal would prevent patentees from subsequently exploiting this reliance by significantly raising licensing fees or otherwise restricting access to these inventions, a strategy that Cetus and Forgent attempted with PCR and the JPEG standard, respectively.<sup>365</sup> My approach is conceptually related to estoppel, but would not require any element of patentee deception.<sup>366</sup> In this manner, the custom of biomedical researchers and software developers of using patented infrastructure at reasonable cost would remain undisturbed, like the public’s tradition of using a particular open field for a communal dance.<sup>367</sup>

However, correlating a liability rule with widespread adoption of an invention may discourage a patentee from licensing it widely in the first place, which is far from ideal. Therefore, this proposal would also apply

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363. Lemley, *Patent Holdup of Standards*, *supra* note 313, at 156–57.

364. *See supra* Part III.D.1. While empirical evidence from the biotechnology sector suggests that patentees often refrain from suing basic researchers who infringe their patents, my proposal offers a sustainable and simple doctrinal solution that does not rely on the unpredictable forbearance of patentees to ensure access to proprietary infrastructure. *See* Mark A. Lemley, *Ignoring Patents* (July 3, 2007) (unpublished manuscript), *available at* <http://ssrn.com/abstract=999961>.

365. *See supra* Part III.D.1.

366. *See* *Studiengesellschaft Kohle mbH v. Eastman Kodak Co.*, 616 F.2d 1315, 1325 (5th Cir. 1980).

367. *See* Rose, *The Comedy of the Commons*, *supra* note 28, at 760.

to a second class of inventions: patented technologies whose limited availability has demonstrated a significant *potential* for widespread infrastructural use.<sup>368</sup> For example, while licensed selectively, the early availability of human embryonic stem cells established their immense potential as basic research and development infrastructure. Such inventions would also qualify as infrastructure.

In tandem, these two classes address the chicken-and-egg problem of what comes first—widespread social adoption or infrastructural status. Inventions that have achieved infrastructural status, as well as those that would achieve that status “but for” their limited availability, would both satisfy the threshold classification as infrastructure.

Regarding the second condition, liability rule protection would only be available in cases where an infringer is using an infrastructural invention *as* infrastructure. As we have seen from trademark and copyright law, what is infrastructure in one context may be protectable application in another. Thus, in *Bayer Co. v. United Drug Co.*, the word “aspirin” was generic for lay consumers but a particularized trademark for chemists, physicians, and druggists.<sup>369</sup> Similarly, in copyright, a Swiss bank account may constitute a scene a faire in an international espionage story but may be protectable expression in a tale about invading aliens. Accordingly, using patented infrastructural technology for non-infrastructural uses would not trigger liability rule protection. For example, using human embryonic stem cells to develop a therapy for Parkinson’s disease that exploits the unique properties of those cells would constitute an infrastructural use. Experimenting on stem cells to investigate the general properties of cell membranes, where other types of cells would be adequate substitutes for such research, would constitute a non-infrastructural use. This proposal for applying *eBay* is based on the premise that liberal access to infrastructure promotes productivity. Accordingly, only those uses of infrastructural inventions that take advantage of their unique enabling capabilities would qualify for liability rule treatment.

Finally, potential liability rule protection would not be available if the invention were available to the infringer through reasonable and nondiscriminatory licensing. Court-determined ongoing royalties are

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368. Cf. Philip J. Weiser, *The Internet, Innovation, and Intellectual Property Policy*, 103 COLUM. L. REV. 534, 593 (2003) (“[I]f it seems clear that a single standard will emerge as dominant, the law should facilitate competition *within* . . . the platform standard by allowing horizontal access.”).

369. 272 F. 505, 510 (S.D.N.Y. 1921).

designed to address situations where negotiations have failed, not to replace market transactions. While determining the reasonableness of a prevailing licensing fee is no easy task, courts could rely on established doctrinal frameworks for determining reasonable royalties to guide them.<sup>370</sup>

In this context, it is important to stress that this proposal preserves ample opportunities for parties to voluntarily negotiate a license, thus incorporating the Federal Circuit's recommended approach to implementing *eBay*.<sup>371</sup> Whereas the threat of an injunction skews the balance of power in favor of a patentee,<sup>372</sup> negotiating in the shadow of a potential liability rule provides more leverage for a prospective licensee to demand lower licensing fees.<sup>373</sup> Before litigation, the murky prospect of receiving damages upon a finding of infringement may encourage patentees to reduce or simply pay the transaction costs necessary to strike deals with willing licensees. While potential liability rule protection may be perceived as decreasing the incentives of prospective licensees to negotiate (because they can simply hold out for a court-determined royalty), the uncertainty, length, and cost of litigation still provide ample motivation for these parties to actually negotiate licenses. My proposal is best understood not as a substitute for private ordering, but as an action-forcing mechanism that will motivate patentees to come to the negotiating table and rationalize the balance of power once they get there.

At the close of litigation, if a court has denied an injunction under *eBay*, another opportunity for negotiation arises. In this situation, judges should encourage parties to voluntarily negotiate a license against the backdrop of imminent court-determined royalties. Relative to negotiations before litigation, the certainty that a court will impose an ongoing royalty (coupled with uncertainty as to the terms of the royalty) may motivate a patentee and prospective licensee to strike a deal. This process of utilizing a court-determined liability rule solely as a last resort encourages parties to voluntarily agree to terms.

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370. See *Georgia-Pacific Corp. v. U.S. Plywood Corp.*, 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970) (establishing a fifteen-factor framework for determining reasonable royalties); *infra* Part IV.E.

371. See *Paice L.L.C. v. Toyota Motor Corp.*, 504 F.3d 1293, 1315 (Fed. Cir. 2007) (“In most cases, where the district court determines that a permanent injunction is not warranted, the district court may wish to allow the parties to negotiate a license amongst themselves regarding future use of a patented invention before imposing an ongoing royalty.”).

372. *MERGES ET AL.*, *supra* note 322, at 349.

373. See *Lemley & Weiser*, *supra* note 325, at 795.



*B. Merits Relative to Other Potential Solutions*

The primary advantage of this proposal is the use of liability rules to provide mediated access to patented technologies.<sup>374</sup> This proposal provides for compensation-dependent, use-specific access to patented infrastructure when mixed supply-side and demand-side considerations render a binary choice between open access and exclusive rights inadequate. This proposal differs from suggestions to simply place infrastructural technologies in the public domain<sup>375</sup> and offers an analytically robust method for handling “difficult” cases of infrastructure access.

Generic words, literary ideas, natural laws, physical phenomena, and abstract technical ideas are clear candidates for open access based on both supply-side and demand-side considerations. From the supply side, exclusive rights are generally perceived as unnecessary for producing generic words, ideas, and basic scientific knowledge.<sup>376</sup> From the demand side, these foundational assets enable such a wide range of downstream uses that users’ interest in freely accessing them is high. Thus, there are relatively few disadvantages and many advantages to maintaining this primary infrastructure in the public domain.

The situation is more complex for patented infrastructural technologies such as isolated, purified human embryonic stem cells. From the supply side, this “value-added” infrastructure is costly to develop, and simply equating infrastructure with open access would undermine incentives to invent.<sup>377</sup> From the demand side, these

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374. Others have also argued in favor of liability rules to provide compensation to innovators while allowing access to protected innovations. *See, e.g.*, Reichman, *supra* note 358, at 2504–05; Pamela Samuelson et al., *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308, 2370 (1994). My proposal is unique in situating liability rule protection for patented infrastructure within the Supreme Court’s *eBay* framework.

375. *Cf.* Frischmann, *Economic Theory*, *supra* note 15, at 922–23; Frischmann & Lemley, *supra* note 26, at 282 (“Frischmann’s organizing heuristic is ‘if infrastructure, then commons.’”).

376. This is, of course, a highly debatable premise. However, intrinsic motivations to create, government funding of basic research, and norms of non-exclusivity in academic science suggest that economic incentives may not be *as* necessary to produce this primary infrastructure. *See* MERTON, *supra* note 153, at 270–78 (discussing traditional scientific norms such as disinterestedness, according to which scientists do not pursue basic research for financial gain); *Katz v. Horni Signal Mfg. Corp.*, 145 F.2d 961, 961 (2d Cir. 1944) (stating that pecuniary incentives do not motivate basic scientific research). Furthermore, while companies invest considerable resources to create new marks that become generic words, trademark law does not exist to encourage new trademarks, and neologisms generally arise organically from culture, free of charge. *See* Lemley, *Lanham Act*, *supra* note 39, at 1695.

377. Frischmann & Lemley, *supra* note 26, at 282 (“One cannot automatically make the

infrastructural assets enable a smaller range of downstream applications than “primary” infrastructure such as natural laws, physical phenomena, and abstract ideas. Furthermore, some downstream uses of these assets may be non-infrastructural. Therefore, the argument for categorically relegating these infrastructural technologies to the public domain is attenuated. For these difficult cases, my proposal addresses supply-side needs to maintain incentives to invent by compelling an infringer of patented infrastructure to compensate the patentee.<sup>378</sup> Regarding the demand side, the fact-intensive and case-specific *eBay* analysis can distinguish between non-infrastructural and infrastructural uses of patented inventions, leading courts to only exempt the latter from injunctive relief.

This proposal also offers advantages relative to a compulsory licensing scheme, where Congress or an agency would determine pre-set fees for licensing patented infrastructure.<sup>379</sup> It is not clear how a rule-making body would define, a priori, the kinds of inventions that should be subject to infrastructural treatment. Given the rapid dynamics of the biotechnology and information technology sectors, as well as the fact that infrastructural status is highly use specific, courts are in a better position to identify infrastructural uses of patented technology on a case-by-case basis. Further arguing against compulsory licenses is Professor Robert Merges’s observation that such licenses discourage industry players from resolving patent issues through voluntary negotiations.<sup>380</sup> The possibility that a court will apply liability rules at the end of a long and expensive patent infringement suit leaves enough flexibility (and uncertainty) to motivate parties to negotiate a license before any contemplated infringement.

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infrastructure-commons equation, particularly where IP is concerned, since producers need some incentive to innovate.”).

378. This proposal would rely on existing measures of damages, which at a minimum award a “reasonable royalty” to the patentee. *See* 35 U.S.C. § 284 (2000). For firms that first licensed widely and then increased fees, prior licensing fees would provide a guide for reasonable royalties. Disgorging all profits based on unjust enrichment would overly deter unlicensed use of patented infrastructure and would thus be inappropriate. *See* Mark Schankerman & Suzanne Scotchmer, *Damages and Injunctions in Protecting Intellectual Property*, 32 RAND J. ECON. 199, 218 (2001).

379. *Cf.* 17 U.S.C. § 115 (2000) (establishing a compulsory license fee schedule for recording cover songs).

380. Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293, 1391–92 (1996) [hereinafter Merges, *Liability Rules*].

C. Courts' Attentiveness to Downstream Progress in the Wake of eBay

Early decisions in the wake of *eBay* reflect courts' newfound attentiveness to the downstream implications of upstream patents and illustrate the workability of the proposal advanced here.<sup>381</sup> In *z4 Technologies, Inc. v. Microsoft Corp.*,<sup>382</sup> a jury found that Microsoft's Windows and Office software products infringed z4's patents on software activation technology.<sup>383</sup> However, the district court denied z4's motion for injunctive relief. Applying the balance of hardships test, the court observed that an injunction against Microsoft would necessitate re-releasing 450 versions of Office and 600 versions of Windows.<sup>384</sup> The court also found that damages could adequately compensate z4 for the infringement<sup>385</sup> and concluded that the balance of hardships from an injunction favored Microsoft.<sup>386</sup> Regarding the public interest, the court gave substantial weight to the widespread use of Windows and Office and to the worldwide implications of a mandatory re-release.<sup>387</sup> The court found that enjoining Microsoft could disrupt its product distribution and if so, "would have an effect on the public due to the public's undisputed and *enormous reliance* on these products."<sup>388</sup> Given the public's widespread adoption of these products, the potential productivity losses from a re-release, and the absence of significant public benefits arising from an injunction, the court concluded that the public interest weighed *against* enjoining Microsoft's infringement.<sup>389</sup> Considerations of downstream productivity led the court to protect z4's patented invention with a liability rule rather than a property rule.<sup>390</sup>

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381. This contextual examination of a patented technology's impact on society finds some parallel in calls for agencies to better incorporate social context when making decisions in the realm of environmental law and policy. See Holly Doremus, *Listing Decisions under the Endangered Species Act: Why Better Science Isn't Always Better Policy*, 75 WASH. U. L.Q. 1029, 1152–53 (1997).

382. 434 F. Supp. 2d 437 (E.D. Tex. 2006).

383. *Id.* at 438. The jury also found that co-defendant Autodesk had infringed z4's patents. *Id.*

384. *Id.* at 442.

385. *Id.* at 441–42.

386. *Id.* at 442–44.

387. *Id.* at 443 ("Microsoft's Windows and Office software products are likely the most popular software products in the world.").

388. *Id.* at 443–44 (emphasis added).

389. *Id.* at 444.

390. Microsoft had indicated that it would phase out all infringing products starting with the

Similarly, in *Paice v. Toyota Motor Corp.*,<sup>391</sup> a jury found that Toyota had infringed Paice's patents on hybrid engine technology, but the district court denied Paice's request for an injunction.<sup>392</sup> Invoking *eBay*, the court noted that the balance of hardships favored Toyota.<sup>393</sup> If Paice received the permanent injunction, "[t]he burgeoning hybrid market could . . . be stifled as the research and expense of bringing [Toyota's] product line to market would be frustrated."<sup>394</sup> Here, productivity concerns led the court to protect Paice's patented invention with an ongoing royalty rather than an injunction.<sup>395</sup>

Of course, one must place these decisions in context. Paice was arguably a "patent troll," as it did not actually practice the patents upon which it was suing.<sup>396</sup> Additionally, in both cases, the patented technologies represented relatively small components of larger inventions—Microsoft Office and Windows in *z4* and hybrid cars in *Paice*.<sup>397</sup> While courts should consider status as a "troll" and a relatively small contribution to a larger invention in applying *eBay*, these factors will not necessarily apply to all cases of alleged infringement of patented infrastructure.

In one important way, however, these decisions go beyond the proposal developed here. Significantly, neither *z4* nor *Paice* involved intellectual infrastructure. Both inventions are nonrival inputs into downstream development. However, while the product activation component at issue in *z4* was ultimately widely used, neither it nor the hybrid transmission claimed in *Paice* is so foundational to a broad array of downstream uses that it represents infrastructure. These were direct inputs to end-user goods, software and cars. Unlike infrastructural assets

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release of Windows 2007 and Office 2007. Thus, the royalty rate was calculated for prospective sales over the two- to three-year phase-out period. *Id.* at 442. Ultimately, the jury awarded damages of \$115 million against Microsoft and \$18 million against co-defendant Autodesk. *Id.* at 438–39.

391. No. 2:04-CV-211-DE, 2006 WL 2385139 (E.D. Tex. Aug. 16, 2006).

392. *Id.*

393. *Id.* at \*6.

394. *Id.*

395. On appeal, the Federal Circuit subsequently reversed and remanded to allow the district court to clarify its calculation of the ongoing royalty. *Paice v. Toyota Motor Corp.*, Nos. 2006-1610, -1631, 2007 WL 3024994, at \*19 (Fed. Cir. Oct. 18, 2007).

396. *Paice*, 2006 WL 2385139, at \*2 ("Plaintiff does not manufacture competing vehicles, but rather is geared toward licensing its technology . . .").

397. *z4 Techs., Inc. v. Microsoft Corp.*, 434 F. Supp. 2d 437, 441 (E.D. Tex. 2006); *Paice*, 2006 WL 2385139, at \*5; see *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. \_\_\_, 126 S. Ct. 1837, 1842 (2006).

such as gene splicing, PCR, human embryonic stem cells, and information technology standards, these technologies do not *enable* wide swaths of downstream productivity in innovation markets. The fact that concern for follow-on productivity motivated courts to protect non-infrastructure inventions with liability rules renders it even more persuasive, a fortiori, that they should protect infrastructure inventions with liability rules.

*D. Advantages Relative to Current Practice and Other Intellectual Property Disciplines*

Allowing courts to consider infrastructure uses of patented inventions in determining whether to apply liability rule protection has several advantages. First, relative to current patent practice, determining intellectual infrastructure at the point of infringement allows courts to consider instructive social data on an invention. The PTO assesses patentable subject matter at the time of patent issuance. At this point, it is relatively easy to determine the formal “first layer” of intellectual infrastructure by inquiring if the patent claims a natural law, physical phenomenon, or abstract idea. At this early stage, however, it is almost impossible to predict what inventions, such as gene splicing or polymerase chain reaction, will become so widely needed and so indispensable for downstream development that they will constitute intellectual infrastructure. The invention at that time simply lacks the history necessary to make such a determination. Analyzing intellectual infrastructure at the time of infringement allows courts to consider a history of demonstrated social adoption and reliance, as well as an informative history of licensing.

Second, folding the infrastructure inquiry into remedies analysis enables highly specific remedies. The four-factor equitable test at the heart of *eBay* shuns bright line, formalistic rules and encourages courts to consider context when determining infringement remedies.<sup>398</sup> As discussed, whether or not a resource serves as infrastructure is highly contextual.<sup>399</sup> Under this proposal, liability rule protection is use-specific and would not apply to infringers using foundational technologies in a non-infrastructure capacity.<sup>400</sup> This is not a “pay-for-play” compulsory

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398. See *eBay Inc.*, 547 U.S. at \_\_\_, 126 S. Ct. at 1839.

399. See *supra* Part IV.A.2.

400. My approach has some similarities to the fair use doctrine that Professor Maureen O'Rourke

license scheme in which certain patented inventions would be available for all uses upon payment of a fee.<sup>401</sup>

Third, this framework particularly addresses strategic behavior by patent trolls holding patents on key infrastructure. In his concurring opinion in *eBay*, Justice Kennedy discussed patent trolls—firms that hold but do not practice patents, generating revenue through licensing fees and suing other firms for infringement.<sup>402</sup> Such firms routinely use the threat of an injunction to inflate their licensing fees and proposed settlement amounts.<sup>403</sup> Since trolls do not practice inventions, infringement by competitors does not erode their market share, thus rendering royalties an adequate remedy. For this and the reasons mentioned above, the relative hardship of an injunction in such cases would weigh heavily in favor of defendants. In addition, allowing firms that do not even practice their patents to exploit social reliance on these inventions to charge supracompetitive prices does not serve the public interest. Allowing liability rule protection for patented intellectual infrastructure held by trolls will help mitigate their threats of holdout.

Finally, relative to copyright’s idea-expression dichotomy, this approach offers a more intellectually honest means of protecting intellectual infrastructure. Courts take a functional approach to the idea-expression dichotomy, characterizing an element of an expressive work as an “idea” when they determine that it should be preserved in the public domain.<sup>404</sup> Similarly, courts could take a wholly functional approach to interpreting the meaning of “natural laws, physical

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suggests for patent law. See O’Rourke, *supra* note 22. However, my proposal differs from O’Rourke’s in both ends and means. O’Rourke, writing before *eBay*, recommended sui generis Congressional action to codify a fair use defense for patent law. Here, I situate infrastructure analysis within the now-existing *eBay* framework, which itself draws upon traditional equitable principles. See *id.* at 1210. Additionally, while O’Rourke focuses on the fair use doctrine’s emphasis on market failure, I draw from parallel regimes of relaxed protection of intellectual infrastructure in trademark, copyright, and patent.

401. See *Paice v. Toyota Motor Corp.*, Nos. 2006-1610, 2006-1631, 2007 WL 3024994, at \*33 n.13 (Fed. Cir. Oct. 18, 2007) (“The term ‘compulsory license’ implies that anyone who meets certain criteria has congressional authority to use that which is licensed . . . . By contrast, the ongoing royalty order at issue here is limited to one particular set of defendants.”).

402. *eBay Inc.*, 547 U.S. at \_\_\_, 126 S. Ct. at 1842 (“An industry has developed in which firms use patents not as a basis for producing and selling goods but, instead, primarily for obtaining licensing fees.”) (Kennedy, J., concurring).

403. See *id.* at 1842 (noting that for patentees, “an injunction, and the potentially serious sanctions arising from its violation, can be employed as a bargaining tool to charge exorbitant fees to companies that seek to buy licenses to practice the patent”) (Kennedy, J., concurring).

404. See *supra* notes 228–232 and accompanying text.

phenomena, and abstract ideas” to keep certain technologies in the public domain.<sup>405</sup> For example, courts could label human embryonic stem cells as nonpatentable “natural phenomena” and characterize information technology standards as “abstract ideas” to deny exclusive rights and promote downstream productivity. While demand-side considerations support such an interpretation,<sup>406</sup> it is open to criticisms applying to the idea-expression dichotomy as being subjective and lacking analytical rigor.<sup>407</sup> The JPEG standard does not *become* an abstract idea simply because its broad utility counsels that it should be widely available. Following *Diamond v. Diehr*, it is preferable to retain some analytical rigor around the threshold categories of patentable subject matter and to reserve further determinations of intellectual infrastructure for a separate inquiry.<sup>408</sup>

#### *E. Potential Critiques and Responses*

Of course, this proposal must address several critiques. First, differentiating between intellectual infrastructure and application is highly technical and raises institutional competence questions for courts.<sup>409</sup> However, the downstream productivity analyses in *z4* and *Paice* suggest that courts are capable of determining when liberalized access is warranted for patented upstream infrastructure.<sup>410</sup> Just as courts in genericide cases consider market data, consumer surveys, and industry information in determining whether a trademark has become generic, courts in patent cases could consider similar evidence to determine whether a particular use of a patented invention is infrastructural. To address technical limitations, courts may also consider input from expert witnesses, SSOs, and agencies.<sup>411</sup>

Second, the possibility of losing property rule protection upon widespread adoption of a patented infrastructural technology compromises a patentee’s incentives to develop that invention in the first place.<sup>412</sup> This decreases incentives to invent precisely the kind of

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405. See Lee, *Inverting the Logic of Scientific Discovery*, *supra* note 10.

406. *Id.*

407. See *supra* notes 219–226 and accompanying text.

408. See *Diamond v. Diehr*, 450 U.S. 175, 190 (1981).

409. See Lemley & Weiser, *supra* note 325, at 839–41.

410. See *supra* Part IV.C.

411. See Lemley & Weiser, *supra* note 325, at 839–41.

412. See Frischmann, *Economic Theory*, *supra* note 15, at 946; Lemley, *Free Riding*, *supra* note

infrastructural inventions that arguably contribute most to technological progress.<sup>413</sup> However, aside from any explicit consideration of intellectual infrastructure, *eBay* already introduces uncertainty into how courts will resolve patent infringement suits.<sup>414</sup> Firms now face a general risk that their patented inventions will be protected by a liability rule rather than a property rule upon infringement. The present proposal simply applies this flexibility in the helpful direction of allowing courts to allow infrastructural uses of patented technologies to continue. Most importantly, ongoing royalties mitigate the incentives problem: infringers will still have to compensate patentees—in some cases on terms the patentee has previously approved.

Third, awarding damages gives rise to complicated valuation problems.<sup>415</sup> As discussed, calculating appropriate royalties will be particularly difficult given the complexity of valuing infrastructure.<sup>416</sup> However, for infrastructural technologies that patentees have already licensed widely, royalties will correlate with previous licensing fees already adopted by the patentee. For the second class of technologies subject to this proposal, a limited history of licensing can guide courts in calculating appropriate royalties. It bears emphasizing that damages are the only remedy available for infringement occurring before litigation, so regardless of the imposition of a permanent injunction, courts cannot avoid the difficulties of valuing technology.<sup>417</sup> District courts and the Federal Circuit have developed a sophisticated jurisprudence for calculating damages, and the valuation challenges do not appear to be

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10; see Lemley & Weiser, *supra* note 325, at 798.

413. See generally Lee, *Paradigm Shifts*, *supra* note 287 (arguing that, at a macroscopic level, strict patent protection of upstream assets may encourage paradigm shifts at the level of basic theory, thus helping science advance in the most revolutionary manner). The analysis here and in my other work calling for increased access to upstream inventions must be balanced against the rare but significant gains to be achieved from paradigm shifts resulting from compelling inventors to “design around” existing infrastructure. See generally Lee, *Inverting the Logic of Scientific Discovery*, *supra* note 10.

414. See Lemley, *Patent Holdup of Standards*, *supra* note 313, at 167. But see *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. \_\_\_, 126 S. Ct. 1837, 1841–42 (2006) (Roberts, C.J., concurring) (suggesting that a “long tradition of equity practice” will lead courts to continue granting injunctions in most patent infringement cases)

415. See *supra*, Part III.D.2; cf. Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. REV. 1719, 1762–63 (2004) (arguing that information costs, including those related to valuation, render property rules preferable to liability rules).

416. Frischmann, *Economic Theory*, *supra* note 15, at 958.

417. MERGES ET AL., *supra* note 322, at 349.



insurmountable.<sup>418</sup> Again, courts could also consider the input of expert witnesses, SSOs, and agencies to help determine appropriate liability rule protection.<sup>419</sup>

*F. Summary: A Social Feedback Mechanism for Patent Law*

This proposed application of the *eBay* framework would bring patent law closer to its intellectual property siblings in accommodating the evolution of intellectual infrastructure. One could liken it to a doctrine of genericide for patents. If an invention becomes indispensable to a wide range of downstream applications, the patentee's exclusive rights over it become attenuated. In a sense, innovative firms would be penalized for creating technologies that are so useful that they attain infrastructural status. This is analogous to genericide, where widespread use of a trademarked name can produce a term that is so valuable for general linguistic purposes that the trademark owner loses its exclusive rights.<sup>420</sup> One could also analogize this proposal to a doctrine of scenes a faire for patents. If a patented invention becomes "stock" or "standard" for conducting a wide range of valuable downstream research, it becomes subject to liberalized access.<sup>421</sup>

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418. There are two prevailing methods for calculating damages: lost profits and reasonable royalties. To establish lost profits, a patentee must show: (1) demand for the patented product, (2) the absence of acceptable noninfringing substitutes, (3) manufacturing and marketing capability to exploit the demand, and (4) the amount of profit the patentee would have made. *Panduit Corp. v. Stahl Bros. Fibre Works, Inc.*, 575 F.2d 1152, 1156 (6th Cir. 1978). Because lost profits may be particularly difficult to calculate on a prospective basis, and because some patentees (such as universities) may lack manufacturing and marketing capability to practice their patents, reasonable royalties will generally be the preferred method of calculating damages under this proposal. Calculating a reasonable royalty "contemplates a hypothetical negotiation between the patentee and the infringer at a time before the infringement began." *Riles v. Shell Exploration & Prod. Co.*, 298 F.3d 1302, 1311 (Fed. Cir. 2002). While this involves a legal fiction, the widely adopted fifteen-factor test articulated in *Georgia-Pacific v. U.S. Plywood Corp.* provides guidance for determining a reasonable royalty. 318 F. Supp. 1116, 1120 (S.D.N.Y. 1970) (including, as the fifteenth factor, "[t]he amount that a licensor (such as the patentee) and a licensee (such as the infringer) would have agreed upon (at the time the infringement began) if both had been reasonably and voluntarily trying to reach an agreement . . .").

419. See Lemley & Weiser, *supra* note 325, at 840–41.

420. See *supra* Part III.A.

421. This proposal is conceptually similar to antitrust law's essential facilities doctrine, which "imposes liability when one firm, which controls an essential facility, denies a second firm reasonable access to a product or service that the second firm must obtain in order to compete with the first." *Alaska Airlines, Inc. v. United Airlines, Inc.*, 948 F.2d 536, 542 (9th Cir. 1991). See *Frischmann, Economic Theory*, *supra* note 15, at 963; Waller & Frischmann, *supra* note 76; see generally Robert Pitofsky, *The Essential Facilities Doctrine Under United States Antitrust Law*, <http://www.ftc.gov/os/comments/intelpropertycomments/pitofskyrobert.pdf>; cf. Lee, *Inverting the*

However, this proposal takes the unique characteristics of patent law into account and moves beyond a binary choice between open access and exclusive rights. It relies on voluntary negotiation and liability rules to provide qualified, compensation-dependent access to patented infrastructure.<sup>422</sup> Instructive in this regard, courts in copyright cases have long endorsed liability rules to ensure downstream access to protected content while providing compensation to upstream creators.<sup>423</sup> However, this Article's proposal is more explicitly infrastructural in its orientation and seeks to liberalize access to generally needed "basic building blocks" of invention. This application of *eBay* thus solves two problems. It allows for a nuanced, contextual, and historical evaluation of whether a patented invention functions as intellectual infrastructure at the time of infringement. It also offers the flexibility of protecting that invention with a liability rule, thus balancing incentives to invent with access to foundational resources that facilitate invention.

In sum, intellectual infrastructure and its responsiveness to evolving social practice reveal a natural limitation on exclusive rights in intangible entities. Rhetorical tropes such as the entrepreneurial firm, romantic author, and inventive genius have historically justified expansive intellectual property rights.<sup>424</sup> However, intellectual property is not a natural right, but exists to promote society-wide progress.<sup>425</sup> Firms, authors, and inventors may receive exclusive rights on their creations, but those rights may not confer *too* much power. At a primary level, certain "raw" inputs, such as words, ideas, and natural principles, are preserved in the public domain as intellectual infrastructure. Infrastructure, however, is socially defined and consequently evolves.

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*Logic of Scientific Discovery*, *supra* note 10, at 84 (arguing that a lack of substitutes for a patented research tool should weigh in favor of liberalizing access to it).

422. Lemley & Weiser, *supra* note 325, at 785 ("Stated simply, where property rules have pernicious consequences, liability rules look better by comparison.").

423. *See supra* note 117.

424. *See* Keith Aoki, *Authors, Inventors and Trademark Owners: Private Intellectual Property and the Public Domain Part I*, 18 COLUM.-VLA J.L. & ARTS 1, 11–12 (1993); Keith Aoki, *Authors, Inventors and Trademark Owners: Private Intellectual Property and the Public Domain Part II*, 18 COLUM.-VLA J.L. & ARTS 191 (1993); JAMES BOYLE, SHAMANS, SOFTWARE, & SPLEENS: LAW AND THE CONSTRUCTION OF THE INFORMATION SOCIETY 53–59 (1996); Jessica Litman, *The Public Domain*, 39 EMORY L.J. 965, 965 (1990).

425. *See* Letter from Thomas Jefferson to Mr. Isaac McPherson (Aug. 13, 1813), in 13 THE WRITINGS OF THOMAS JEFFERSON 326, 355 (Albert Ellery Bergh ed., 1907) ("Considering the exclusive right to invention as given not of natural right, but for the benefit of society, I know well the difficulty of drawing a line between the things which are worth to the public the embarrassment of an exclusive patent, and those which are not.").

Accordingly, doctrines aimed at preserving wide access to infrastructure should respond to accommodate this evolution. Firms may trademark names, but if those names enter the vernacular as generic words, they become freely appropriable to competitors and the public at large. Authors may copyright their texts, but common ideas and well-traveled expressions considered stock or standard are not protectable. Under the proposal here, inventions that become standard platforms for subsequent innovation would be open to downstream inventors on a liberalized, but not free, basis. Society at large, which imbues these creations with value,<sup>426</sup> has certain claims on their availability.<sup>427</sup> Where the community holds its public dances matters and may limit the exclusive rights claimed by the landowner.

## CONCLUSION

To promote productivity, trademark, copyright, and patent law all distinguish between upstream intellectual infrastructure and downstream intellectual application. Trademark law ensures open access to generic words and only allows exclusive rights on terms that identify individual sources. Copyright law preserves ideas and stock expressions in the public domain, only granting protection to particularized expressions. Patent law maintains the free availability of natural laws, physical phenomena, and abstract ideas while only permitting ownership of refined inventions. Intellectual infrastructure, which comprises nonrival assets valuable as inputs to a wide array of downstream uses, remains open to all.

Infrastructure, however, is a moving target. Accordingly, this Article has compared doctrines ensuring access to intellectual infrastructure based on their responsiveness to infrastructural evolution. Trademark's doctrine of genericide is highly attentive to linguistic change and relies on timely social data to determine if and when a protected mark has become a generic word. Copyright law occupies an intermediate

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426. Cf. Wendy J. Gordon, *A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 YALE L.J. 1533, 1588 n.277 (1992–1993) (noting that trademark owners and consumers are joint producers of promotional value and goodwill). While Professor Gordon argues that consumers have a particularly prominent role in creating value in the trademark context, she acknowledges that “even standard intellectual products . . . will be beneficial only if someone appreciates them; labor is never the only source of value, even for Locke.” *Id.*

427. See Rochelle Cooper Dreyfuss, *We are Symbols and Inhabit Symbols, So Should We Be Paying Rent? Deconstructing the Lanham Act and Rights of Publicity*, 20 COLUM.-VLA J.L. & ARTS 123, 142 (1996).

position. As society's notion of common ideas and "stock" elements evolves, so does the repository of resources made freely available to subsequent authors as creative infrastructure. Patent law takes the narrowest and most rigid approach to defining intellectual infrastructure. As such, it does not accommodate the reality that certain patented inventions can evolve from mere applications to productivity-enhancing infrastructure warranting liberalized access.

This Article has drawn on *eBay Inc. v. MercExchange, L.L.C.* to argue that courts should take a functional approach to identifying and permitting unauthorized infrastructural uses of patented inventions.<sup>428</sup> It proposes a two-tiered system: property rule protection for non-infrastructural uses of patented inventions and liability rule protection—where appropriate—for patented inventions used as infrastructure. This proposal encourages voluntary licensing negotiations between patentees and prospective licensees, reserving liability rule protection as a judicial backstop if such negotiations fail. Significantly, it offers a robust method for mediating "difficult" cases of infrastructure access where neither open access nor exclusive rights is adequate. Situating this analysis in the context of an infringement action, rather than relying on the PTO's determinations of patentable subject matter upon patent issuance, allows courts to consider an invention's social history in determining whether it should be eligible for liability rule protection. Additionally, this case-specific analysis allows courts to craft contextually nuanced, targeted remedies. While this approach has general application to patented infrastructure, it has particular salience to foundational patented inventions in biotechnology and information technology.

Comparing analogous doctrines in trademark, copyright, and patent law reveals the shared principle of intellectual infrastructure as a natural limitation on exclusive rights. Analogy to the realm of inherently public property and physical infrastructure further reveals that infrastructure is socially defined and subject to evolution, a dynamic that patent law currently does not accommodate. While firms, authors, and inventors benefit society greatly through their innovations, creating value is a reciprocal process. Society itself, through widespread adoption, use, and reliance, helps make infrastructural creations valuable. A graduated approach that provides compensation to upstream creators and qualified

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428. Articulating a similar theme, the Supreme Court recently replaced the Federal Circuit's "formalistic" approach to determining nonobviousness with an "expansive and flexible approach." *KSR Int'l Co. v. Teleflex Inc.*, \_\_\_ U.S. \_\_\_, 127 S. Ct. 1727, 1739 (2007).

access to downstream users balances the interests of both groups,<sup>429</sup> and represents a valuable step towards effectuating the overarching goals of the intellectual property system.

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429. Cf. Singer, *The Reliance Interest*, *supra* note 25, at 663 (arguing that property is best understood as mediating social relations).