Article

When Copyright Law and Science Collide: Empowering Digitally Integrated Research Methods on a Global Scale

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INTRODUCTION

Much scholarly attention has focused on possible impediments to both science and innovation arising from extensions of patent protection to research tools and to other upstream knowledge assets in ways that threaten to undermine the cooperative norms of basic scientific research.[1] Until recently, however, far less attention has been paid to the growing capacity of global copyright law and related rights to impede access to, and use of, the cumulative scientific literature and data that digi-

1. *See, e.g.*, Rebecca S. Eisenberg, *Noncompliance, Nonenforcement, Nonproblem? Rethinking the Anticommons in Biomedical Research*, 45 HOUS. L. REV. 1059, 1093–97 (2008); Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research,* 280 SCI. 698, 698–701 (1998), *available at* http://www.sciencemag.org/content/280/5364/.698full.pdf; Kenneth G. Huang & Fiona E. Murray, *Does Patent Strategy Shape the Long-Run Supply of Public Knowledge? Evidence from Human Genetics*, 52 ACAD. MGMT. J. 1193, 1193 (2009) (finding that gene patents decrease public genetic knowledge); Fiona Murray & Scott Stern, *When Ideas Are Not Free: The Impact of Patents on Scientific Research*, 7 INNOVATION POL'Y & ECON. 33, 54–60 (2006) (finding some evidence that patents reduce the use of knowledge); Arti Kaur Rai, *Regulating Scientific Research: Intellectual Property Rights and the Norms of Science*, 94 NW. U. L. REV. 77, 94–100, 115–29 (1999). *See generally* DAVID C. MOWERY ET AL., IVORY TOWER AND INDUSTRIAL INNOVATION: UNIVERSITY-INDUSTRY TECHNOLOGY TRANSFER BEFORE AND AFTER THE BAYH-DOLE ACT 184–92 (2004) (discussing potential risks of patenting scientific research); Fiona Murray & Siobhán O'Mahony, *Exploring the Foundations of Cumulative Innovation: Implications for Organization Science*, 18 ORG. SCI. 1006, 1009–17 (2007) (discussing the importance of access to knowledge for innovation); Anthony D. So et al., *Is Bayh-Dole Good for Developing Countries? Lessons from the US Experience*, 6 PLOS BIOLOGY 2078 *passim* (2008), *available at* http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.0060262 (commenting that attributing U.S. economic growth to the Bayh-Dole Act is misleading).

tally integrated scientific research methods massively ingest.[2] In this Article, we contend that this latter phenomenon poses a more immediate and pervasive threat to basic scientific research methods today than the still controversial claims about thickets of rights and anticommons effects attributed to excesses of the patent system in recent years.[3]

A. POTENTIALLY BOUNDLESS SCIENTIFIC OPPORTUNITIES IN THE DIGITAL ENVIRONMENT

Information technology is transforming fields as diverse as molecular biology, especially genomics and proteomics,[4] and conservation ecology,[5] while spawning new fields, such as met-

2. For pioneer works, see, for example, Reto Hilty, *Copyright Law and Scientific Research*, *in* COPYRIGHT LAW, A HANDBOOK OF CONTEMPORARY RESEARCH 315, 318–21 (Paul Torremans ed., 2007) [hereinafter Hilty, *Copyright Law and Scientific Research*]; Reto Hilty, *Five Lessons About Copyright in the Information Society: Reaction of the Scientific Community to Over-Protection and What Policy Makers Should Learn*, 53 J. COPYRIGHT SOC'Y U.S.A. 103, 109–18 (2006) [hereinafter Hilty, *Five Lessons About Copyright*]; Jerome H. Reichman & Paul F. Uhlir, *A Contractually Reconstructed Research Commons for Scientific Data in a Highly Protectionist Intellectual Property Environment*, 66 LAW & CONTEMP. PROBS. 315, 319–22, 396–413 (2003); Matthew Sag, *Copyright and Copy-Reliant Technology*, 103 NW. U. L. REV. 1607, 1607–16 (2009) (finding the fair use doctrine crucial to information dissemination); Pamela Samuelson, *Anticircumvention Rules: Threat to Science*, 293 SCI. 2028 *passim* (2001), *available at* http://www.sciencemag.org/content/293/5537/2028.full.pdf; *see also infra* Part I.

3. *See generally* JAMES BESSEN & MICHAEL MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 1–6 (2008) (finding that the costs associated with patents have often exceeded their benefits); JAMES BOYLE, THE PUBLIC DOMAIN 49–53 (2008) (stressing that the types of patentable subject matter have grown); DAN BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 154–61 (2009); MICHAEL HELLER, THE GRIDLOCK ECONOMY: HOW TOO MUCH OWNERSHIP WRECKS MARKETS, STOPS INNOVATION, AND COSTS LIVES 16–20, 49–69 (2008) (discussing how anticommons can create innovation gridlock). *But see* Christopher M. Holman, *The Impact of Human Gene Patents on Innovation and Access: A Survey of Human Gene Patent Litigation*, 76 UMKC L. REV. 295, 297–301 (2007) (minimizing the effects of utilitarian patent thicket objections).

4. *See, e.g.*, COMM. ON INTELLECTUAL PROP. RIGHTS IN GENOMIC AND PROTEIN RESEARCH & NAT'L RES. COUNCIL, REAPING THE BENEFITS OF GENOMICS AND PROTEOMIC RESEARCH: INTELLECTUAL PROPERTY RIGHTS, INNOVATION, AND PUBLIC HEALTH 1 (2006); COMM. ON A NEW BIOLOGY FOR THE 21ST CENTURY & NAT'L RES. COUNCIL, A NEW BIOLOGY FOR THE 21ST CENTURY 49–52 (2009) [hereinafter A NEW BIOLOGY].

5. *See, e.g.*, JAMES B. CAMPBELL, INTRODUCTION TO REMOTE SENSING xv (4th ed. 2007); Karin S. Fassnacht et al., *Key Issues in Making and Using Satellite-based Maps in Ecology: A Primer*, 222 FOREST ECOLOGY & MGMT. 167, 167 (2006).

agenomics[6] and metabolomics.[7] The combination of massive storage capacity, powerful data manipulation techniques, and graphical capabilities has revolutionized both how basic research is conducted and how the resulting knowledge is preserved and disseminated in nearly all fields of science.[8] These methodologies have also helped to generate networked communities of users and collaborators, often working in dynamic

6. Metagenomics has been defined as "the application of modern genomics techniques to the study of communities of microbial organisms directly in their natural environments, bypassing the need for isolation and lab cultivation of individual species." Kevin Chen & Lior Pachter, *Bioinformatics for Whole-Genome Shotgun Sequencing of Microbial Communities*, 1 PLOS COMPUTATIONAL BIOLOGY 0106, 0106 (2005), *available at* http://www.ploscompbiol.org/article/info%3Adoi%2F10.1371%2Fjournal.pcbi.0010024. Advances in bioinformatics, refinements of DNA amplification, and the expansion of computational power have greatly facilitated analysis of DNA sequences recovered from environmental samples. These advances have enabled the adaptation of shotgun sequencing to metagenomics samples, for example, in global ocean sampling expeditions. *See generally* Mya Breitbart et al., *Genomic Analysis of Uncultured Marine Viral Communities*, 99 PROCEEDINGS NAT'L ACAD. SCI. U.S.A. 14250 *passim* (2002); J. Craig Venter et al., *Environmental Genome Shotgun Sequencing of the Sargasso Sea*, 304 SCI. 66, 66–67 (2004), *available at* http://www.sciencemag.org/content/304/5667/66.full.pdf.

7. "Metabolomics is the systematic study of the unique chemical fingerprints that specific cellular processes leave behind," i.e., the study of their small-molecule metabolite profiles. Bennett Daviss, *Growing Pains for Metabolomics*, SCIENTIST, Apr. 25, 2005, at 25–28. A closely related field is "metabonomics," which extends metabolic profiling at the cellular or any level to include information about perturbations of metabolism caused by environmental factors and other extragenomic influences, such as gut microflora. *See generally* D.G. Robertson, *Metabonomics in Toxicology: A Review*, 85 TOXICOLOGICAL SCIS. 809, 809–10, 815–18 (2005) (comparing metabonomics with metabolomics and discussing the latter's impact on toxicology). These disciplines rely heavily on mass spectrometry and nuclear magnetic resonance spectroscopy, among other detection methods, and on complex statistical software programs that analyze the data resulting from the use of these tools. *See, e.g.*, METABOLOMICS: METHODS AND PROTOCOLS vii–viii, 142, 229–46 (Wolfram Weckwerth ed., 2007); METAGENOMICS: THE FRONTIER OF SYSTEMS BIOLOGY 2–5, 8, 26–32 (M. Tomita & T. Nishioka eds., 2005). For the aspirations of systems biology and functional genomics to integrate proteomic, transcriptomic, and metabolomic information into a more complete picture of living organisms, see A NEW BIOLOGY, *supra* note 4, at 21–38.

8. Scholars are attempting to discuss and understand the impact of this newer ability to share large amounts of scientific research. *See generally* papers presented at The Future of Scientific Knowledge Discovery in Open Networked Environments: A National Symposium and Workshop, Bd. on Res. Data and Info. in Collaboration with Computer Sci. and Telecomm. Bd., Nat'l Acad. of Scis., Washington D.C., March 10–11, 2011, *available at* http://sites.nationalacademies.org/PGA/brdi/PGA_060424. For another example, see *The Digital Side of Biology*, AGENCY FOR SCI., TECH. & RES. (Mar. 2, 2011), http://www.research.a-star.edu.sg/feature-and-innovation/6291 (describing huge changes to biological research stemming from digital technology).

knowledge hubs,[9] whose interactive communications steer computational applications in potentially more fruitful directions[10] and fill open repositories with new data and information.[11]

In this promising new research environment, scientists increasingly rely on automated knowledge discovery tools to mine and recombine vast amounts of data and literature that are flowing at rates that exceed the capacity of a single investigator to comprehend and manage.[12] Exploitation of these new opportunities, in turn, requires integration of information and data scattered over a broad range of articles and databases that may or may not be available online for extensive computational research.[13] For example, the use of networked computational techniques for linking global collections of articles and data to generate relevant research results makes it possible to build

9. *See, e.g.*, YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM 68–90 (2006); SCOTT STERN, BIOLOGICAL RESOURCE CENTERS: KNOWLEDGE HUBS FOR THE LIFE SCIENCES 36–55 (2004); Brett M. Frischmann, *An Economic Theory of Infrastructure and Commons Management*, 89 MINN. L. REV. 917, 1017–20 (2005).

10. *See, e.g.*, James Boyle, *Mertonianism Unbound? Imagining Free, Decentralized Access to Most Cultural and Scientific Material*, *in* UNDERSTANDING KNOWLEDGE AS A COMMONS: FROM THEORY TO PRACTICE 123, 123–40 (Charlotte Hess & Elinor Ostrom eds., 2007) [hereinafter KNOWLEDGE AS A COMMONS]; Paul W. Jeffreys, *The Developing Concept of e-Research*, *in* WORLD WIDE RESEARCH: RESHAPING THE SCIENCES AND HUMANITIES 51, 51–52 (William H. Dutton & Paul W. Jeffreys eds., 2010) (noting that cooperation between research groups is necessary to perform complex research and analysis, and describing the pooling of "computational resources and research skills"); THE METAGENOMICS RAST SERVER (MG-RAST), http://metagenomics.anl.gov (last visited Apr. 16, 2012) (community resource for metagenome data set analysis).

11. *See* Jeffreys, *supra* note 10, at 51 (noting the possibility of a "data deluge").

12. *See, e.g.*, Mark Segal, *Accessing Microbiological Data: A User's Perspective*, *in* DESIGNING THE MICROBIAL RESEARCH COMMONS: PROCEEDINGS OF AN INTERNATIONAL WORKSHOP 161, 161–63 (Paul F. Uhlir ed., 2011) [hereinafter DESIGNING THE MICROBIAL RESEARCH COMMONS]; Thinh Nguyen, *The Web-Enabled Research Commons: Applications, Goals, and Trends*, *in* DESIGNING THE MICROBIAL RESEARCH COMMONS, *supra*, at 91, 94.

13. *See, e.g.*, Minna Allarakhia, *Microbial Commons: Governing Complex Knowledge Assets, in* DESIGNING THE MICROBIAL RESEARCH COMMONS, *supra* note 12, at 145, 148; NANCY L. MARON & K. KIRBY SMITH, CURRENT MODELS OF DIGITAL SCHOLARLY COMMUNICATION, ASS'N OF RES. LIBRARIES 27 (Nov. 2008), http://www.arl.org/bm~doc/current-models-report.pdf; Victoria Stodden, *Open Science: Policy Implications for the Evolving Phenomenon of User-Led Scientific Innovation*, J. SCI. COMM. 2–6 (Mar. 22, 2010), http://jcom.sissa.it/archive/09/01/Jcom0901%282010%29A05/Jcom0901%282010%29A05.pdf. For similar applications to digital research in the humanities, see, for example, Sag, *supra* note 2, at 1607–08, 1611–12.

field-specific knowledge repositories that capture reams of relevant scientific data and technical information and to apply general data-mining tools in the chosen environment.[14] Users receive more value when such tools can also be readily applied to the scientific literature.

The digitization of research inputs and outputs has thus engendered opportunities for the enhanced speed of dissemination of publicly funded scientific data, for the development of high performing search engines that diminish the search time for publications, and for automated cross-linking and text-mining based on standardized metadata. The goal of this digital infrastructure should be to maximize these opportunities for public research institutes and universities in both developed and developing countries, while maintaining the classical functions of certification and diffusion of research results of the predigital print markets.

B. COPYRIGHT AND RELATED LAWS AS DIGITAL GRIDLOCK

To make full use of search engines, data-mining techniques, and other automated knowledge discovery tools, scientists need unrestricted access to a broad range of journals and databases, and unrestricted rights to extract, use, and reuse the published research results they contain for purposes of future research.[15] The convergence of computerized technologies and telecommunications networks has now made this goal theoretically feasible, and the sharing norms of science pull in the same direction.[16] Researchers anywhere should, in principle, be able to locate, analyze, and disaggregate collections of scientific information and data once they have been digitally transmitted and made available to the public, subject only to the prevailing community norms of attributions.[17]

14. *See*, *e.g.*, Peter Dawyndt et al., *Knowledge Accumulation and Resolution of Data Inconsistencies During the Integration of Microbial Information Sources*, 17 IEEE TRANSACTIONS ON KNOWLEDGE AND DATA ENGINEERING 1111, 1111–12, 1124 (2005).

15. *See supra* notes 10–12 and accompanying text.

16. *See generally* OFFICE OF TECH. ASSESSMENT, OTA-ITC-622, WIRELESS TECHNOLOGIES AND THE NATIONAL INFRASTRUCTURE 27–28 (2005) (explaining the benefits and challenges of wireless information sharing).

17. The scientists' incentives flow primarily from reputational benefits, not pecuniary interests, with regard to actual publication of upstream research results, and the costs of the research itself are normally borne by public funders, foundations, and universities. However, scientists do have an interest in not sharing either results or data until they can obtain these reputational benefits via publication. *See* Karen A. Jordan, *Financial Conflicts of Interest in*

In reality, intellectual property laws, as currently configured, stand in the way of attaining these goals. Since the 1990s, in particular, there has been an unprecedented extension of copyright law and related rights protecting both literature and collections of data into the realm of basic science, with no adequate exceptions for research as such.[18] These developments tend to subject the growing profusion of scientific data and information to the same unbridled proprietary impulses that have lately dominated the regulation of creative endeavors in the traditional arts.[19]

For example, global copyright laws automatically confer exclusive proprietary rights on authors of scientific literature,[20] who routinely transfer those rights to commercial publishers.[21] Database protection laws, now enacted in more than fifty-five countries, simultaneously endow compilers and publishers (as assignees) with exclusive rights to the very data that copyright laws traditionally left unprotected.[22] Publishers, in turn, surround both scientific data and literature with a variety of technological protection measures (TPMs)—so-called electronic fences and digital locks—that cannot be penetrated or pried open even for purposes of scientific research without violating global norms rooted in an array of multilateral, regional, and bilateral treaties, as well as in a host of national legislative and regulatory instruments.[23]

Human Subjects Research: Proposals for a More Effective Regulatory Scheme, 60 WASH. & LEE L. REV. 15, 92–94 (2003) (noting importance of publication and priority for scientists); Philip M. Davis & Matthew J. L. Connolly, *Institutional Repositories: Evaluating the Reasons for Non-Use of Cornell University's Installation of DSpace*, D-LIB MAG. (Mar./Apr. 2007), http://www.dlib.org/dlib/march07/davis/03davis.html (noting researchers' reluctance to release results before publication).

18. *See infra* Part I.

19. *See* BOYLE, *supra* note 3, at 122–59 (discussing the harmful consequences of over extending music copyrights).

20. Agreement on Trade-Related Aspects of Intellectual Property Rights art. 9.1, Apr. 15, 1994, 108 Stat. 4809, 1869 U.N.T.S. 299 [hereinafter TRIPS Agreement]; Berne Convention for the Protection of Literary and Artistic Works arts. 2, 5; Sept. 9, 1886, 1161 U.N.T.S. 31 [hereinafter Berne Convention (1971)] (as last revised at Paris on July 24, 1971). The TRIPS Agreement incorporated the Berne Convention (1971) into the Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154 [hereinafter Agreement Establishing the World Trade Organization].

21. *See infra* Part III.

22. *See* Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the Legal Protection of Databases, 1996 O.J. (L 77) 20, 21 [hereinafter Database Directive].

23. *See infra* Part I.C.2.

The end result is a growing conflict between private rights and public goods at the core of today's most promising research techniques.[24] Enlightened policymakers view these upstream data and information resources as public goods that need to be widely shared in order to produce more downstream commercial applications that advance public welfare.[25] In contrast, intellectual property laws now impede access to scientific data and literature, just at the time when developments in scientific research methods require the use of automated knowledge discovery tools that depend on unfettered access and re-use conditions for their successful applications.[26]

C. NATURE AND SCOPE OF THIS ARTICLE

This Article examines the complex challenges posed by copyright and related laws for digitally integrated scientific research, which have emerged, piece by piece, from several decades of disjointed legislative initiatives undertaken at the global, regional, and national levels. We explain how this state of affairs came about and why fairly radical legislative reforms would be needed to undo the harm that this tangled regulatory net inflicts on global scientific research. More realistically, we then explore a number of self-help measures that the scientific

24. *See* Keith E. Maskus & Jerome H. Reichman, *The Globalization of Private Knowledge Goods and the Privatization of Global Public Goods*, *in* INTERNATIONAL PUBLIC GOODS AND TRANSFER OF TECHNOLOGY UNDER A GLOBALIZED INTELLECTUAL PROPERTY REGIME 3, 3–45 (K.E. Maskus & Jerome H. Reichman eds., 2005) [hereinafter INTERNATIONAL PUBLIC GOODS AND IP] (discussing IP roadblocks to the diffusion of public knowledge). *See generally* Peter Drahos, *The Regulation of Public Goods, in* INTERNATIONAL PUBLIC GOODS AND IP, *supra*, at 48, 61–64 (commenting on the impact of IP treaties on developing nations' access to public goods); Joseph E. Stiglitz, *Knowledge as a Global Public Good*, *in* GLOBAL PUBLIC GOODS: INTERNATIONAL COOPERATION IN THE 21ST CENTURY 308, 308–20 (Inge Kaul et al. eds., 1999) (explaining how knowledge is a global public good).

25. *See, e.g.*, Paul David, *The Economic Logic of "Open Science" and the Balance Between Private Property Rights and the Public Domain in Scientific Data and Information: A Primer*, *in* THE ROLE OF SCIENTIFIC AND TECHNICAL DATA AND INFORMATION IN THE PUBLIC DOMAIN 19, 19–34 (Julie M. Esanu & Paul F. Uhlir eds., 2003); Paul Uhlir, *Discussion Framework*, *in* THE ROLE OF SCIENTIFIC AND TECHNICAL DATA AND INFORMATION IN THE PUBLIC DOMAIN, *supra*, at 3, 3–4 (discussing public welfare advantages of sharing scientific knowledge and data widely).

26. *See* IAN HARGREAVES, DIGITAL OPPORTUNITY: A REVIEW OF INTELLECTUAL PROPERTY AND GROWTH 46–47 (2011); David, *supra* note 25, at 27–28. Except, of course, for the growing number of scientific journals whose publishers have adopted full or partial open access policies. *See*, *e.g.*, *infra* notes 496–507 and accompanying text.

community could itself adopt to alleviate some of the pressures emanating from a bevy of poorly conceived intellectual property laws. The overall goal is to persuade policymakers to avoid measures that might further fragment and balkanize the research environment and to affirmatively empower the public good functions of these laws once again, with a view to stimulating more and better scientific outputs and more downstream commercial applications.

In Part I, we map the historical context and evolution of the current deep divide between copyright law and science. Given that digital scientific research is necessarily global in its sweep, we focus considerable attention on comparative laws that tend to fragment essential research inputs into diversely accessible territorial compartments and to marginalize the need for unified fields of enquiry. We demonstrate that, under current conditions, scientists using automated knowledge discovery tools will likely become collective infringers of both domestic and international copyright laws and of national database protection laws where applicable.[27]

In Part II, we assess the limits of incremental legislative or judicial action traditionally associated with copyright reform processes and make the case for a strong and broad exception for scientific research. Such an exception, we argue, must be buttressed by imposing limits on the use of digital locks and related contractual restraints on users, lest publicly funded science become a hostage to the privatization impulses engendered by para-copyright regimes. We further propose complementary reforms to both national database protection laws and international intellectual property standards consistent with the need to empower *e*-science to flourish in a digitally integrated research space.

Finally, in Part III we argue that the best outcome for the future of scientific research may well be for the scientific community itself to take responsibility for managing the conditions under which its own knowledge assets will be created and deployed. We reconsider the wisdom of continuing to rely on proprietary publishing intermediaries in an environment increas-

27. *Cf.* JOHN TEHRANIAN, INFRINGEMENT NATION: COPYRIGHT 2.0 AND YOU xix–xxi (2011) (noting how easily individuals can violate modern day copyright laws); Sag, *supra* note 2, at 1608 (stating that "[c]opy-reliant technologies tend to interact with copyrighted works by copying them routinely, automatically, and indiscriminately. These technologies are vital to the operation of the Internet, but they are vulnerable to claims of copyright infringement at key stages of their operation").

ingly characterized by an array of promising open access options. This Article concludes with some final observations on the need to overcome the disconnect between private rights and public scientific research goals as a step towards the elaboration of a more rational, long-term innovation policy.

I. THE GROWING DIVIDE BETWEEN COPYRIGHT LAW AND SCIENTIFIC RESEARCH IN HISTORICAL PERSPECTIVE

Traditionally, copyright law and science operated in two relatively distinct spheres, with patents seen as the primary source of incentives for applications of research results to industry. Although most national copyright laws protected scientific literature,[28] this protection narrowly covered the author's mode of expressing research results, and not facts, data, or ideas as such.[29] In a major decision in 1991, the U.S. Supreme Court further truncated compilers' rights[30] by allowing third parties to make use of the disparate facts and data revealed even in an otherwise eligible compilation, notwithstanding the copyright owner's exclusive right to prepare derivative works.[31] Since 1994, international copyright law has also cautiously limited protection of so-called factual works—that is, compilations of facts and data—to their original selection and arrangement, but not to the underlying facts and data themselves.[32]

Questions about unauthorized reproductions of published research results in scientific journals were typically resolved by limitations and exceptions in the domestic copyright laws,[33] es-

28. *Cf.* Berne Convention (1971), *supra* note 20, art. 2(1) ("The expression 'literary and artistic works' shall include every production in the literary, *scientific* and artistic domain, whatever may be the mode or form of its expression . . . ." (emphasis added)).

29. *See, e.g.*, 17 U.S.C. §§ 102(a)–(b) (2006). *See generally* Paul Edward Geller, *International Copyright: The Introduction*, *in* 1 INTERNATIONAL COPYRIGHT LAW AND PRACTICE § 2, at para. 2(c) (Paul Edward Geller ed., 2011).

30. *See* 17 U.S.C. § 101 (defining "compilations"); *id.* § 103 (compilations as subject matter); *id.* § 106 (exclusive rights).

31. *See* Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 363–64 (1991).

32. *See* TRIPS Agreement, *supra* note 20, arts. 9.2, 10.2; *see also* 1 SAM RICKETSON & JANE C. GINSBURG, INTERNATIONAL COPYRIGHT AND NEIGHBORING RIGHTS 484 (2d ed. 2006) (noting that compilations have "long received protection under most national laws" and that protection for compilations is required under Art. 2(5) of the Berne Convention).

33. Technically, "exclusions" refer to content excluded from protection, while "exceptions" are "limitations" on the exclusive right in question. *See* WIPO STANDING COMM. ON THE LAW OF PATENTS, EXCLUSIONS FROM PATENT-

pecially a fair use exception in the United States and a private use exception in European copyright laws,[34] although these issues became much more complex with the advent of photocopying machines.[35] Moreover, U.S. copyright law has long dedicated government-generated data and literature to the public domain,[36] a practice that, until recently, had been rejected by many other members of the Organization for Economic Cooperation and Development (OECD).[37] What emerged, at least in

ABILITY AND EXCEPTIONS AND LIMITATIONS TO PATENTEES' RIGHTS 7 (2011), *available at* http://www.wipo.int/edocs/mdocs/scp/en/scp_15/scp_15_3-annex1.pdf. For historical and philosophical efforts, ultimately fruitless, to distinguish "exceptions" from "limitations" in copyright law, see Christophe Geiger, *Promoting Creativity through Copyright Limitations: Reflections on the Concept of Exclusivity in Copyright Law*, 12 VAND. J. ENT. & TECH. L. 515, 518–24 (2010) (finding that, in fact, "the terms . . . are always used together systematically in international copyright treaties and European legislation"). Both terms now often refer to "users' rights" in the literature.

34. *See infra* Parts II.A.1 & II.A.2.

35. *See generally* PAUL GOLDSTEIN, COPYRIGHT'S HIGHWAY 63–116 (2003) (describing conflicts between photocopying and copyright law); Barton Beebe, *An Empirical Study of U.S. Copyright Fair Use Opinions, 1978–2005*, 156 U. PA. L. REV. 549, 559–60 (2008) (noting problems posed for fair use by photocopying technology).

36. Much of today's most valuable scientific data and information is generated by government agencies or, increasingly, by intergovernmental consortiums of scientific undertakings. In the United States, copyright law denies protection for all works that government employees produce within the scope of their employment. *See* 17 U.S.C. § 105 (2006). Moreover, as a policy matter, government-generated data is distributed to would-be users at the marginal cost of dissemination, and does not reflect the actual cost of production. *See* Office of Mgmt. & Budget Exec. Office of the President, Circular No. A-130 (Revised) (Nov. 28, 2000), *available at* http://www.whitehouse.gov/sites/default/files/omb/assets/omb/circulars/a130/a130trans4.pdf; COMM. ON ISSUES IN THE TRANSBORDER FLOW OF SCIENTIFIC DATA ET AL., BITS OF POWER 111–13 (1997) [hereinafter BITS OF POWER].

37. *See, e.g.*, Copyright Act, R.S.C. 1985, c. C-42, § 12 (Can.); Heather J. Ritch, European Research Infrastructure Consortiums: Privately Ordered and Publicly Funded Research Commons for Data 45–57 (unpublished S.J.D. dissertation, Duke University) (on file with Goodson Library, Duke University). *See also* Council Directive 2003/98, 2003 O.J. (L 345) 90 (EU). Efforts to move these countries towards the U.S. position have produced mixed results. For example, Australia, which still retains crown copyright, has reached results similar to that in the United States by attaching Creative Commons licenses to government-generated works. *See Intellectual Property Principles for Australian Government Agencies*, ATTORNEY-GENERAL'S DEPT. (Oct. 1, 2010), http://www.ag.gov.au/Documents/Statement%20of%20IP%20Principles%20for%20Australian%20Government%20Agencies2.pdf. The United Kingdom currently licenses government generated information and databases covered by crown copyright under an Open Government Licence (OGL). OGL grants a royalty-free, perpetual, non-exclusive licence to use the information, subject to certain exemptions, including a requirement for attribution. *See Open Gov-*

the United States, was a relatively benign regulatory tradition that was further complemented by the sharing ethos of science, which favors open access to published research results for purposes of verification and the progressive generation of further research.[38]

This traditional approach, however, has been subverted by much discussed high-protectionist trends evolving in multiple directions.[39] For example, in an effort to restrain perceived acts of misappropriation, some federal appellate courts in the United States devised subtle doctrinal arguments to justify greater protection of disparate facts and data than the Supreme Court's "thin copyright" approach to compilations would otherwise seem to have warranted.[40] Outside the United States, efforts to strengthen the protection of factual compilations led some fifty-five countries, mostly, but not exclusively, affiliated with the European Union, to enact sui generis database protection laws that deviate from copyright tradition by directly protecting facts and data as such.[41]

Meanwhile, both the Agreement on Trade-Related Aspects of Intellectual Property Rights of 1994 (TRIPS Agreement) and the World Intellectual Property Organization's (WIPO) Copy-

ernment Licence for Public Sector Information, THE NAT'L ARCHIVES, http://www.nationalarchives.gov.uk/doc/open-government-licence/ (last visited Apr. 16, 2012). Meanwhile, in the United States, some government agencies have begun to license data suppliers from the private sector without waiving ownership and intellectual property interests, while a bill to impose some form of crown copyright on government-generated works has been presented to Congress. *See* H.R. 5704, 111th Cong. (2010) (proposing to allow faculty members at Department of Defense service academies and schools of professional military education to obtain copyright in scholarly articles).

38. *See* Séverine Dusollier, *Sharing Access to Intellectual Property Through Private Ordering*, 82 CHI.-KENT L. REV. 1391, 1401–02 (2007) ("Scientists and researchers have become increasingly opposed to the trend of the biotech industry to patent more and more biotechnological inventions. They have developed a strong ethos of sharing and a desire to keep the scientific commons available to all."); David E. Winickoff et al., *Opening Stem Cell Research and Development: A Policy Proposal for the Management of Data, Intellectual Property, and Ethics*, 9 YALE J. HEALTH POL'Y L. & ETHICS 52, 54 (2009) (noting the "tradition of openness and sharing in the biomedical sciences").

39. *See* Reichman & Uhlir, *supra* note 2, at 420–25.

40. *Compare* CDN Inc. v. Kapes, 197 F.3d 1256, 1262 (9th Cir. 1999) (allowing estimates of prices to fall under copyright law), *and* CCC Info. Servs. Inc. v. Maclean Hunter Mkt. Reports, Inc., 44 F.3d 61, 67 (2d Cir. 1994) (finding that logically organized price estimates can be original work of authorship), *with* Feist Publ'n, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340, 349 (1991) (concluding that facts are never protected under a "thin copyright" analysis of compilations).

41. *See* Database Directive, *supra* note 22, art. 7; *infra* Part I.C.2.

right Treaty of 1996 (WCT)[42] have imposed outer boundaries on limitations and exceptions to the exclusive rights recognized in national copyright laws. These laws cast some doubt on the continued ability of prior doctrinal tools to alleviate impediments to the conduct of scientific research.[43] Finally, the advent of digital technologies, and the global response to their impact on the transmission of copyrighted works online, has led both the United States and the European Union to adopt regulatory regimes, ostensibly pursuant to the WCT,[44] that can prevent the use of most existing limitations and exceptions, and even prevent third parties from accessing unprotectible facts and ideas.[45] As these privatizing trends increasingly encroach on the realm of scientific research,[46] access to basic knowledge inputs becomes ever more complicated and potentially difficult or costly to obtain.

A. TWO CONCEPTUAL APPROACHES IN THE APPLICATION OF COPYRIGHT LAW TO SCIENCE

The well-known philosophical differences between Continental "authors' rights" laws, rooted in natural law tradition, including protection of the author's personality interest, and the copyright laws of common law countries, rooted in utilitarian notions of social welfare,[47] led logically to contrasting views of limitations and exceptions to the basic bundle of authors'

42. *See* WIPO Copyright Treaty art. 10, Dec. 20, 1996, 112 Stat. 2860, 2186 U.N.T.S. 152 [hereinafter WCT]; TRIPS Agreement, *supra* note 20, art. 13.

43. *See infra* Part II.B.

44. WCT, *supra* note 42, arts. 11–12.

45. *See infra* Part I.B. Bilateral trade agreements have extended these approaches to many other countries, both developed and developing. *See* Robert Burrell & Kimberlee Weatherall, *Exporting Controversy? Reactions to the Copyright Provisions of the U.S.-Australia Free Trade Agreement: Lessons for U.S. Trade Policy*, 2008 U. ILL. J.L. TECH. & POL'Y 259 (analyzing U.S.-Australia Free Trade Agreement); Meredith Kolsky Lewis, *The Prisoners' Dilemma Posed by Free Trade Agreements: Can Open Access Provisions Provide an Escape?*, 11 CHI. J. INT'L L. 631, 641 (2011).

46. *See* Winickoff, *supra* note 38, at 54–55 (describing increasing privatization of scientific research).

47. *See* F. Willem Grosheide, *Paradigms in Copyright Law*, *in* OF AUTHORS AND ORIGINS: ESSAYS ON COPYRIGHT LAW 203, 203–28 (Brad Sherman & Alain Strowel eds., 1994); Edward C. Walterscheid, *The Nature of the Intellectual Property Clause: A Study in Historical Perspective (Part 1)*, 83 J. PAT. & TRADEMARK OFF. SOC'Y 763, 770 (2001) ("Madison's view that copyrights and patents were monopolies that should be tolerated because of the public good they could produce was in essence the common law justification for these limited-term monopolies.").

rights.[48] Under the Continental tradition, largely embodied in the Berne Convention of 1886, most uses of an author's creative work presumptively require compensation.[49] Any exceptions to or limitations on that principle should be narrowly drawn, lest authors be saddled with obligations to finance public goods that were not imposed on other forms of property.[50] Under the copyright approach, instead, as elaborated most fully in the United States, authors should receive only those entitlements needed to overcome the risk of market failure posed by free-riding copiers, and these entitlements remain subject to carve outs that support the public interest *ab initio*.[51]

These different philosophical foundations produced two different approaches to limitations and exceptions bearing on the exclusive rights that copyright law confers on authors of literary and artistic works. In Europe, the standard approach was to establish a list of enumerated exceptions, with the understanding that activities not covered by any of the listed exceptions were usually proscribed, even if they sometimes appeared to be natural extensions of an existing exception.[52] These codi-

48. *See, e.g.*, Martin Senftleben, *Bridging the Differences Between Copyright's Legal Traditions—The Emerging EC Fair Use Doctrine*, 57 J. COPYRIGHT SOC'Y U.S.A. 521, 524–27 (2010).

49. *See* Geiger, *supra* note 33, at 520, 527 ("The fact that an exempted use is not necessarily a free use is important to keep in mind . . . . Copyright limitations do not mean that works can always be used free of charge, and legislatures may provide a right to appropriate remuneration for all uses that copyright limitations legitimate.").

50. *See, e.g.*, Senftleben, *supra* note 48, at 524–25. *But see* Paul Edward Geller, *A German Approach to Fair Use: Test Cases for TRIPS Criteria for Copyright Limitations*, 57 J. COPYRIGHT SOC'Y U.S.A. 553, 555–601 (2010) (noting new trend in German case law favoring liberal construction of limitations based on constitutional considerations). *See also* Senftleben, *supra*, at 525–26 ("From an economic perspective, it can be added that copyright monopolies, while spurring investment in new information products, also impede follow-on innovation requiring the use of preexisting, protected material. Hence, there is a delicate balance between freedom and protection inherent in copyright law. The cultural innovation cycle supported by copyright law requires both rights broad enough to spur investment and creativity, and limitations broad enough to provide sufficient breathing space for freedom of expression and freedom of competition.").

51. *See* U.S. CONST. art. I, § 8, cl. 8 (IP Clause); LYMAN RAY PATTERSON & STANLEY W. LINDBERG, THE NATURE OF COPYRIGHT: A LAW OF USERS' RIGHTS 163–76 (1991); Ruth Okediji, *Givers, Takers and Other Kinds of Users: A Fair Use Doctrine for Cyberspace*, 53 FLA. L. REV. 107, 155–61 (2001).

52. *See* Annette Kur, *Of Oceans, Islands, and Inland Water—How Much Room for Exceptions and Limitations under the Three-Step Test?*, 8 RICH. J. GLOBAL L. & BUS. 287, 295–96 (2009) (contrasting civil and common law approaches to copyright exceptions). Hence some states carved out more expan-

fied exceptions thus need updating at regular intervals, and they are interpreted narrowly by courts, who tend to view them as undermining the dominant theme of authors' property rights.[53]

In contrast, U.S. legislation combines a list of fairly specific express exceptions to the exclusive rights of authors with a broad fair use provision that carves out additional space for noninfringing activity, usually transpiring within specified normative guidelines.[54] This open-ended carve-out then applies not only to new situations not directly reached by the codified list of exceptions, but it may sometimes retroactively expand even the scope of those exceptions that are codified.

The differences between these two approaches have clearly diminished over time, as policymakers on both sides of the Atlantic rely on both incentives to create and natural-property-rights thinking to justify ever higher levels of copyright protection.[55] Conversely, scholars in Europe increasingly focus attention on the need for an appropriate balance between protection and free uses.[56] As will be seen below, a degree of harmonization has also been superimposed upon all the domestic copyright laws of WTO Members by international law. Nonetheless, these historical foundations help to explain the differences that

sive exceptions for science. *See* Sam Ricketson, *International Conventions and Treaties*, *in* THE BOUNDARIES OF COPYRIGHT—ITS PROPER LIMITATIONS AND EXCEPTIONS 3, 5–10 (Libby Baulch et al. eds., 1997) (noting recurring exceptions in national copyright laws for, *inter alia*, "general enhancement of scientific and intellectual discourse").

53. *See infra* notes 164–198 and accompanying text; *see also* Christophe Geiger, *supra* note 33, at 519–20 (noting narrow interpretation of copyright limitations and exceptions in civil law countries).

54. *See* 17 U.S.C. §§ 106–22 (2006); *see also* William W. Fisher, III, *Reconstructing the Fair Use Doctrine*, 101 HARV. L. REV. 1659, 1704 (1988); Ruth L. Okediji, *Toward an International Fair Use Doctrine*, 39 COLUM. J. TRANSNAT'L L. 75, 117–23 (2000); Pamela Samuelson, *Unbundling Fair Uses*, 77 FORDHAM L. REV. 2537, 2618 (2009).

55. *See* PAUL GOLDSTEIN, INTERNATIONAL COPYRIGHT 10 (2001) (stating that the traditions differ "more in emphasis than in outcome"); *see also* Jane C. Ginsburg, *A Tale of Two Copyrights: Literary Property in Revolutionary France and America*, 64 TUL. L. REV. 991, 1014 (1990) (noting that a mix of both utilitarian and natural rights reasoning underlie French and United States copyright laws). For an important attempt to reduce these differences by a fuller interpretation of the Lockean justification for property rights, see Wendy J. Gordon, *A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 YALE L.J. 1533, 1544–45 (1993).

56. *See*, *e.g.*, Geiger, *supra* note 33, at 517–18 (citing authorities); Senftleben, *supra* note 48, at 525–26.

still characterize the distinctive approaches to limitations and exceptions in the European Union and the United States.

1. Harmonizing the Designated Limitations and Exceptions that Defend Scientific Research in the European Union

In Continental Europe, limitations and exceptions to copyright law emerged from state practice and over time were largely incorporated into revisions of the Berne Convention of 1886.[57] The Berne Convention thus supplied the primary harmonizing platform for limitations and exceptions throughout the twentieth century, even though there still remained some undefined, if contested, space for supplementary state action.[58] In this context, early exceptions for science were squeezed into Article 10(2) of the Berne Convention, which as late as the Brussels Revision of 1948 allowed States to provide exceptions for "excerpts from literary or artistic works in educational or scientific publications," but only "in so far as this inclusion is justified by its purpose."[59]

Even this simple, if rigid, approach (still extant in the copyright law of the United Kingdom),[60] was not mandatory.[61]

57. For an account of the development of limitations and exceptions in the Berne Convention, see SAM RICKETSON, THE BERNE CONVENTION FOR THE PROTECTION OF LITERARY AND ARTISTIC WORKS: 1886–1986, at 477–548 (1987) [hereinafter RICKETSON, THE BERNE CONVENTION]. For an overview of limitations and exceptions in the international copyright system, see Ruth L. Okediji, *The International Copyright System: Limitations, Exceptions and Public Interest Considerations for Developing Countries*, Issue Paper No. 15, UNCTAD - ICTSD PROJECT ON IPRS AND SUSTAINABLE DEVELOPMENT (May 2006), *available at* http://www.iprsonline.org/resources/docs/Okediji%20-%20Copyright%20and%20DC%20-%20Blue%2015.pdf; *see also* SAM RICKETSON, WIPO STUDY ON LIMITATIONS AND EXCEPTIONS OF COPYRIGHT AND RELATED RIGHTS IN THE DIGITAL ENVIRONMENT (2003) [hereinafter RICKETSON, WIPO STUDY], *available at* http://www.wipo.int/edocs/mdocs/copyright/en/sccr_9/sccr_9_7.pdf.

58. *See* Mihaly Ficsor, *Copyright for the Digital Era: The WIPO "Internet" Treaties*, 21 COLUM.-VLA J.L. & ARTS 197, 204–05 (1997) (noting belief that Berne allows some flexibility in creating and expanding limitations and exceptions).

59. Berne Convention, art 10(2), 331 U.N.T.S. 217 (as revised at Brussels on June 26, 1948).

60. *See* Copyright, Designs and Patents Act, 1988, c. 48, §§ 29–30 (Eng.) (amended to implement the 2001 European Union Copyright Directive), *available at* http://www.legislation.gov.uk/ukpga/1988/48/contents; Lionel Bently, *R. v. The Author: From Death Penalty to Community Service*, 32 COLUM. J.L. & ARTS 1, 99 (2008) (noting lack of flexibility in U.K. copyright law); Robert G. Howell, *Recent Copyright Developments: Harmonization Opportunities for Canada*, 1 U. OTTAWA L. & TECH. J. 149, 170 (2003–04) (noting the "narrow" nature of U.K. copyright infringement test).

States attempting to facilitate science under its aegis need not have followed any particular model or any agreed view of the needs of science as distinct from or constrained by the economic interests of authors and publishers.

Things changed, however, when at the Stockholm Revision Conference in 1967, the Berne Convention formally incorporated an exclusive reproduction right into Article 9(1), along with a three-step test for enabling exceptions to that same reproduction right in Article 9(2).[62] That test confined national legislation on exceptions to the reproduction right to "certain special cases," that did "not conflict with a normal exploitation of the work" and that did "not unreasonably prejudice the legitimate interests of the author."[63]

Although nothing in this provision dealt expressly with science, the legislative history confirms that it was intended to govern the use of scientific literature for research purposes.[64] For this very reason, the express reference to science in regard to permissible excerpts under Article 10(2) was deleted at the same time.[65] A truncated version of Article 10(2), which now only regards excerpts for teaching, was ultimately incorporated into the 1971 Revision of the Berne Convention.[66] The decision

61. RICKETSON, THE BERNE CONVENTION, *supra* note 57, at 499.

62. Berne Convention for the Protection of Literary and Artistic Works art. 9(1)–(2), Sept. 9, 1886, 828 U.N.T.S. 221 [hereinafter RBC 1967] (as revised at Stockholm on July 14, 1967).

63. *Id*. art. 9(2). Both the legislative history and commentary suggest that, as originally conceived, all three factors must be answered affirmatively for any given national exception to satisfy this international minimum standard of legitimacy. *See* MARTIN SENFTLEBEN, COPYRIGHT, LIMITATIONS AND THE THREE-STEP TEST 43–53 (2004); Ficsor, *supra* note 58, at 214–15. *But see infra* text accompanying notes 447–65.

64. RICKETSON & GINSBURG, *supra* note 32, at 782, § 13.34.

65. *Id.*; s*ee also* RICKETSON, *supra* note 57, at 499. ("Article 10(2) no longer contains an exception for works 'having a scientific character' . . . . [It] was deleted on the recommendation of the Working Group which took the view that it was unnecessary 'in view of the expansion of the field of science and the number of exceptions to the right of reproduction which were already included in the Convention'. This must be correct: the legitimate interests of scientific research are now adequately served by the broader right of quotation allowed under article 10(1) and by the general exception to reproduction rights allowed under article 9(2).").

66. *See* Berne Convention (1971), *supra* note 20, art. 10(2) (permitting "utilization, to the extent justified by the purpose of literary or artistic works by way of illustration in publications . . . for teaching, provided such utilization is compatible with fair practice"). The 1971 text was largely incorporated into the TRIPS Agreement, *supra* note 20, art. 9.1, and is therefore binding on some 153 WTO members.

to deal with the principal exception for science under the newly enacted three-step test of Article 9(2), rather than by means of a separate provision, introduced new levels of uncertainty[67] about the scope of permissible scientific activities without mandating any specific action favoring scientific research as such.

Meanwhile, because the exceptions covered in the Berne Convention still were not exhaustive, a number of states adopted supplementary measures. For example, language ambiguously allowing reproductions and other uses "for the sole purpose of illustration for teaching or scientific research" was adopted in some national copyright laws.[68] State practice in mostly European countries also recognized a "private use" exception[69] that enabled scientists to make verbatim copies by hand of literary works for research purposes.[70] It was this latter provision that effectively promoted scientific research over-and-above other designated exceptions in the Berne Convention or state copyright laws, at least until the advent of photocopying machines, and then digital reproduction technologies, which led to regulation of the use of these devices in the interest of publishers.[71]

67. RICKETSON & GINSBURG, *supra* note 32, § 13.37 ("The decision of the Stockholm Conference to delete any list of permissible purposes leaves a considerable area of discretion to national legislation. . . . [T]his means that there will be divergences between national laws on these matters.").

68. *See*, *e.g.*, Congo Law on Copyright and Neighboring Rights (No. 24/82 of 7 July 1982), art. 98; Copyright Act adopted on 11 November 1992, as last amended on February 15, 2000, § 19(3) (Est.), *in* 2 WORLD INTELLECTUAL PROPERTY ORGANIZATION, CUMULATIVE INDEX OF COPYRIGHT AND NEIGHBORING RIGHTS LAW AND TREATIES (2001) [hereinafter CUMULATIVE INDEX OF COPYRIGHT LAW]; Romania Consolidated Law No. 8 of 14 March 1996 on Copyright and Neighboring Rights, art. 33(1)(d), *in* 4 CUMULATIVE INDEX OF COPYRIGHT LAW, *supra*.

69. *See, e.g.*, Law on Copyright and Neighboring Rights art. 22bis (as amended by the Law of April 3, 1995) (Belg.), *in* 1 CUMULATIVE INDEX OF COPYRIGHT LAW, *supra* note 68; Copyright Law, art. 53, (Text of Sept. 9, 1965, as last amended by the Law of July 16, 1998) (Ger.), *in* 3 CUMULATIVE INDEX OF COPYRIGHT LAW, *supra*. *See generally* BERNT HUGENHOLTZ ET AL., INST. OF INFO. LAW, UNIV. OF AMSTERDAM, THE FUTURE OF LEVIES IN A DIGITAL ENVIRONMENT, FINAL REPORT 10–31 (2003) (discussing the European Union private copying provisions).

70. *See* J.A.L. STERLING, WORLD COPYRIGHT LAW 435,¶ 10.03 (2d ed. 2003) (noting acceptance of copying by hand for private use until the advent of photocopying and other replicating technologies); *see also* Copyright, Designs and Patents Act, 1988, c. 48, § 29(1) (U.K.); STERLING, *supra*, at 437–38 ¶ 10.09 (noting that there is a distinction in some national laws between private use and use for purposes of research).

71. STERLING, *supra* note 70, at 437–38.

A major effort to harmonize limitations and exceptions at the regional level then occurred in 2001, with the adoption of the Directive of the European Parliament and the Council of Europe on the Harmonization of Certain Aspects of Copyright and Related Rights in the Information Society (InfoSoc Directive).[72] Ostensibly devised to implement the WCT of 1996[73] and the TRIPS Agreement of 1994,[74] this Directive sets out a deliberately exhaustive list of permissible exceptions and limitations to the exclusive rights of authors that European Union member states may enact at their discretion.[75] Besides allowing reproductions for photocopying, subject to payment of fair compensation, and for noncommercial reproductions by public libraries under Article 5(2),[76] the Directive expressly mentions scientific research in Article 5(3)(a). Echoing some prior state practice, this provision allows "use for the sole purpose of illustration for teaching or scientific research," so long as the source, including the author's name, is indicated . . . and "to the extent justified by the noncommercial purpose to be achieved."[77]

The meaning of this ambiguous provision is hard to pin down with any degree of certainty. Narrowly, it seems to limit excused uses to cases of "illustration" for both teaching and scientific research, unless the term "scientific research" can legitimately be detached from "the sole purpose of illustration" language. Although some state practice may lean towards such a broader construction favoring reuse of information for further research,[78] language concerning related rights in the Rome

72. Council Directive 2001/29, 2001 O.J. (L 167) 10, 16 (EC) [hereinafter InfoSoc Directive].

73. WCT, *supra* note 42.

74. TRIPS Agreement, *supra* note 20.

75. InfoSoc Directive, *supra* note 72, art. 5(2).

76. *Id.*

77. *Id.* art. 5(3)(a). Technically, the Commission has thus taken the "by way of illustration" language out of Berne Convention 1971, art. 10(2), which applies to teaching, and ostensibly applied it to excerpts of scientific research, in addition to the three-step test discussed *infra* text accompanying notes 120–36.

78. For example, the German legislature resolved this ambiguity by enacting one provision allowing use of certain published works for the purpose of illustration for teaching in schools, universities and the like and a second provision allowing use of such works for individual research purposes. Guido Westkamp, *The "Three-Step Test" and Copyright Limitations in Europe: European Copyright Law Between Approximation and National Decision Making*, 56 J. COPYRIGHT SOC'Y U.S.A. 1, 34–36 (2008) (citing sections 52(a)(1)–52(a)(4) of the German Copyright Act and observing that these provisions may exceed what the InfoSoc Directive expressly permits). The provision aims, "as a mat-

Convention of 1961 avoided any such ambiguity. It excused "use solely for the purposes of teaching or scientific research" without mention of illustrations or a non-commercial purpose as qualifying conditions.[79] Current applications of the Vienna Convention on the Law of Treaties may make it difficult to ignore this difference in language when courts take the InfoSoc Directive as a standard for construing national laws that implement its provisions, which renders a broad interpretation favoring science less likely to pass muster.[80]

Even if a broader interpretation were to prevail (by limiting the term "illustration" to exceptions for teaching), it must still overcome the Directive's noncommercial purpose qualifier.[81] Because universities now routinely engage in commercial exploitation of their scientific research results in both the European Union and the United States, rights holders (typically publishers) can argue that the bulk of such research is commercial in the strict sense of the word. Such an interpretation was recently upheld in a decision concerning university patents by the United States Court of Appeals for the Federal Circuit,[82] although it is not clear that European courts would take a similarly strict line in regard to either patents or copyrights.

In this unfavorable setting, Article 5(3) of the InfoSoc Directive has done little to strengthen or encourage digital scientific research or the rights of scientific investigators. To the contrary, the Directive may have fatally weakened them by definitively subjecting the old private use exception to a "pay equitable compensation" principle. This conclusion follows because, empirically, there is reason to believe that scientific

ter of national legislation . . . to allow researchers such as in universities, etc., to take advantage of digital technology." *Id*. at 35. Separate exceptions for private noncommercial use and noncommercial research purposes were also enacted in Austria. COPYRIGHT IN THE INFORMATION SOCIETY: A GUIDE TO NATIONAL IMPLEMENTATION OF THE EUROPEAN DIRECTIVE 70–71 (Brigitte Lindner & Ted Shapiro eds., 2011).

79. International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organizations art. 15(1)(d), Oct. 26, 1961, 496 U.N.T.S. 43.

80. *See* Vienna Convention on the Law of Treaties, May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention]. *See generally* Bryan Mercurio & Mitali Tyagi, *Treaty Interpretation in WTO Dispute Settlement: The Outstanding Question of the Legality of Local Working Requirements*, 19 MINN. J. INT'L L. 275 (2009) (analyzing recent WTO Appellate Body decisions applying the Vienna Convention).

81. *See* InfoSoc Directive, *supra* note 72, art. 5(3)(a); *see also id*. art. 5(2)(b) (restricting private use to non-commercial ends).

82. Madey v. Duke Univ., 307 F.3d 1351, 1361–64 (Fed. Cir. 2002).

research in the European Union actually relied on the private use tradition found in most domestic copyright laws, but never directly mentioned in either Berne or TRIPS.[83]

In any event, the ability of scientific researchers to fall back upon the traditional private use exception had already been compromised by the advent of modern means of technical reproduction, which risked allowing the exception to swallow the exclusive reproduction right and invited countervailing regulatory action in national laws. In this vein, the InfoSoc Directive responds with a double-edged regulatory sword in Article 5(2)(b) by subjecting both photocopying and private copying to an express obligation to pay fair compensation.[84] Arguably, these provisions cut back upon the preexisting ability of scientists to broadly copy literature for research purposes under the private use exception.[85] Moreover, apart from certain noncommercial library reproductions, these provisions in effect largely confine scientific research to the vague and somewhat ambiguous language of Article 5(3)(a) as implemented in actual state practice.[86]

Finally, the exhaustive list of permissible exceptions in the EC's Directive contains no fair use provision that might afford a greater degree of flexibility.[87] On the contrary, Article 5(5) of the EC's InfoSoc Directive imposes three additional requirements that negatively circumscribe all the limitations and ex-

83. With specific regard to scientific research, the InfoSoc Directive's ostensibly permissive language did nothing to clarify preexisting ambiguities or the lack of standard approaches among member states. For example, U.K. law, which has continued to tinker with preexisting exceptions inherited from the predigital age, further limited provisions allowing research and use for private study, already subject to a "fair dealing" proviso, by "inserting the requirements of non-commercial use and sufficient acknowledgement." COPYRIGHT IN THE INFORMATION SOCIETY, *supra* note 78, at 572 (citing CDPA, §§ 29(1)(a), 32, 36, 38, 39, 43 and § 61(4)(a)). Protests by user organizations were disregarded. *Id*. Because the Directive's merely permissive language concerning science requires no affirmative action whatsoever, there was arguably no need for these measures.

84. InfoSoc Directive, *supra* note 72, art. 5(2)(b).

85. Of course, paying equitable compensation in appropriate cases is better than imposing a duty to negotiate private uses under the burden of exclusivity. *See, e.g.*, Geiger, *supra* note 33, at 524. However, it is a bad idea to compel researchers to pay other researchers for research uses of their published works, especially when most of the research in question was probably government-funded to begin with. *See also infra* Part II.A.

86. InfoSoc Directive, *supra* note 72, art. 5(3).

87. *Id.* art. 5(2).

ceptions it otherwise allows.[88] This three-step provision—derived from Article 13 of the TRIPS Agreement—embodies a retroactive and excessively narrow reading of the applicable international minimum standards, and thus appears to ignore more flexible language later embodied in the WCT of 1996 and more clearly amplified in the accompanying Agreed Statements.[89] As we demonstrate in Part I.A.3, the end result is that the InfoSoc Directive, regardless of how it is implemented, could significantly cut back on the already narrow sphere of exceptions favoring scientific research in the past, whether or not this was its intended purpose.[90]

2. The Fair Use Approach in the United States

In contrast, the United States, which did not join the Berne Convention until 1989,[91] adopted a different approach to limitations and exceptions in general and to those bearing on research in particular. The designated limitations and exceptions in the U.S. Copyright Law of 1976 that are most relevant to scientific research include limitations on the reproduction rights for libraries in § 108[92] and, above all, the fair use exception codified for the first time in § 107.[93] By setting out the conditions under which library reproductions and interlibrary loans might be made for purposes of private study, scholarship, or research, § 108 operates in effect as a codified specification of fair use as it applies to libraries in general.

There are no other designated exemptions bearing on quotations, excerpts, or scientific research as such in the 1976 Act, like those under the Berne Convention[94] and the European Commission's InfoSoc Directive.[95] Hence, it is the codified fair use doctrine, as judicially interpreted, that effectively governs

88. *Id.* art. 5(5) ("The exceptions and limitations provided for in paragraphs 1, 2, 3 and 4 shall only be applied in certain special cases which do not conflict with a normal exploitation of the work or other subject-matter and do not unreasonably prejudice the legitimate interests of the rightholder.").

89. WCT, *supra* note 42.

90. Hilty, *Copyright Law and Scientific Research*, *supra* note 2; Hilty, *Five Lessons About Copyright*, *supra* note 2, at 113–18; *see also* Westkamp, *supra* note 78, at 26 (stressing that art. 5(5) will likely diminish public interest uses in the digital environment).

91. Berne Convention Implementation Act of 1988, Pub. L. No. 100-568, 102 Stat. 2853 (1988) (effective date of entry March 1, 1989).

92. 17 U.S.C. § 108 (2006).

93. *Id.* § 107.

94. Berne Convention, *supra* note 20, art. 10.

95. InfoSoc Directive, *supra* note 72, art. 5(3)(a).

the rights of researchers in the United States to avoid or mitigate the exclusive rights of authors and publishers. Any so-called private use exceptions, comparable to those traditionally found in European copyright laws,[96] must stand or fall as fair uses in U.S. law.

Section 107 of the 1976 Act expressly recognizes a set of preambular uses or "purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research" for which an open-ended fair use exception is deemed particularly suitable.[97] These uses promote public goods in ways that courts must reconcile with the private rights of authors in an appropriately balanced copyright system. Much depends, however, on how judges determine whether the harm incurred by the copyright owner is justified by the benefit to the public from allowing the use in question.[98]

To answer that question, the statute requires courts to evaluate four separate criteria that may pull in different directions and evince different weights, *viz*: (1) the purpose and character of the use (such as a noncommercial use or a so-called transformative use); (2) the nature of the copyrighted work (for example, is it of a factual or scientific character to begin with); (3) the amount and substantiality of the portion used (in both quantitative and qualitative terms); and (4) the effect of any given use upon the potential market or value of the copyrighted work.[99]

In the past, and for a fairly long period of time, it was the fourth factor—the so-called market harm test—that predominated in the case law.[100] Following *Campbell v. Acuff-Rose*,[101] however, all four factors must now be weighed by the courts, and the predominant factor has become the first, in practice, as courts focus increasingly on the presence or absence of a so-

96. *See supra* notes 68–69 and accompanying text. *See generally* Glynn S. Lunney, Jr., *The Death of Copyright: Digital Technology, Private Copying, and the Digital Millennium Copyright Act*, 87 VA. L. REV. 813 (2001).

97. 17 U.S.C. § 107.

98. *See, e.g.*, 2 PAUL GOLDSTEIN, COPYRIGHT § 10.1.2 to 10.1.4 (2d ed. 1996).

99. *See* 17 U.S.C. § 107(1)–(4); Campbell v. Acuff-Rose Music, Inc., 510 U.S. 569, 576–94 (1994) (explaining each of the four factors in § 107).

100. Jane C. Ginsburg, *Conflicts of Copyright Ownership between Authors and Owners of Original Artworks: An Essay in Comparative and International Private Law*, 17 COLUM.-VLA J.L. & ARTS 395, 401 n.22 (1993) (noting that "the inquiry into potential market harm remains dominant").

101. 510 U.S. at 569.

called transformative use, i.e., a new use not necessarily envisioned by the original author that enriches culture or the pursuit of knowledge.[102] This transformative use factor has prevailed in the digital arena, as seen in cases involving search engines that access and index massive amounts of data and information on the Internet.[103] Courts in the United States have now routinely held that the use of thumbnail images as markers for search engines, for example, is transformative and that the fair use defense can avail notwithstanding some use for commercial gain.[104]

Empirically, it can be demonstrated that judges also invoke other factors, especially a hidden fifth factor—namely, "the extent to which the claimed fair use serves the public interest"—without which few, if any, major federal appellate decisions affirming fair use are likely to be found.[105] In other words, the federal appellate courts look for transformative uses that advance the public interest, especially as identified with those

102. *See id.* at 579 (emphasizing uses that "provide social benefit[s] by shedding light on an earlier work, and in the process, creat[e] a new one"); *see also* Bill Graham Archives v. Dorling Kindersley Ltd., 448 F.3d 605, 609–10 (2d Cir. 2006) (promotional posters used in biography about rock music was "a purpose separate and distinct from the original artistic and promotional purpose for which the images were created"); L.A. News Serv. v. CBS Broad., Inc., 305 F.3d 924, 938–39 (9th Cir. 2002).

103. *See, e.g.*, Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1163–67 (9th Cir. 2007) (finding the use of thumbnails as highly transformative use); Kelly v. Arriba Soft Corp., 336 F.3d 811 (9th Cir. 2003) (holding the use of thumbnail images in search engine as fair use); *see also* A.V. v. IParadigms, L.L.C., 562 F.3d 630, 638–40 (4th Cir. 2009) (finding fair use for archival copies of student papers stored in digital form to help detect and prevent plagiarism); Field v. Google Inc., 412 F. Supp. 2d 1106, 1118 (D. Nev. 2006).

104. *Perfect 10, Inc.*, 508 F.3d at 1163–68 (holding that search engine compilation of thumbnail-sized photographs was fair use); *Arriba Soft Corp.*, 336 F.3d at 822 (same). For the view that these cases really turn on nonexpressive uses that do not substitute for the author's original expression, see Sag, *supra* note 2, at 1636–37.

105. *See, e.g.*, Cliff's Notes, Inc. v. Bantam Doubleday Dell Publ'g Grp., Inc., 886 F.2d 490, 494 (2d Cir. 1989) (holding parody not infringing given public interest in free expression); Corp. of Am. Sony v. Universal City Studios, Inc., 464 U.S. 417, 454 (1984) (finding the factor of societal benefits weighted in the outcome of fair use determination); Jerome H. Reichman, "Marching to a Three-Step Tune," (Comments, Program on the International Harmonization of Copyright Limitations and Exceptions, Cardozo School of Law, March 30–31, 2008); *see also* Shyamkrishna Balganesh, *Copyright and Free Expression: Analyzing the Convergence of Conflicting Normative Frameworks*, 4 CHI.-KENT J. INTELL. PROP. 45, 68–69 (2004) (discussing several cases and arguing, "[w]hat is of interest here, however, is that in applying the fair use doctrine, courts have sought to introduce an element of 'public interest' clearly not expressly mandated under the traditionally understood requirements of fair use").

public goods set out in the preamble,[106] without unduly compromising the author's reasonable expectations of commercial gain. In this context, public scientific research had fared relatively well under the fair use doctrine,[107] at least until the Digital Millennium Copyright Act (DMCA) was adopted in 1998.[108] For example, it was not customary in the United States for scientists to spend scarce research dollars on payments for photocopied articles for private research, as regularly occurs in Europe,[109] notwithstanding the absence of any private use exception in the 1976 Act.

Underlying unresolved conflicts concerning the theoretical groundings of fair use can, nonetheless, affect a court's willingness to expand or contract the doctrine on a case-by-case basis.[110] For example, much depends on whether fair use is seen as a mere technical adjustment allowing infringement of exclusive rights in exceptional cases, or whether it covers areas of use from which authors were granted no such exclusivity to

106. 17 U.S.C. § 107 (2006).

107. *See* Williams & Wilkins Co. v. United States, 487 F.2d 1345, 1354 (Ct. Cl. 1973), *aff'd by an equally divided Court*, 420 U.S. 376 (1975) (holding fair use permitted where copying of medical journals is for scientific purposes). Professor Tushnet characterizes the pre-DMCA landscape as uncertain. Rebecca Tushnet, *Copyright as a Model for Free Speech Law: What Copyright Has in Common with Anti-Pornography Laws, Campaign Finance Reform, and Telecommunications Regulation*, 42 B.C. L. REV. 1, 24 (2000) ("After decades of litigation, it is still difficult to tell when and whether one can photocopy copyrighted materials, even for scientific research.").

108. Digital Millennium Copyright Act, Pub. L. No. 105–304, 112 Stat. 2860 (1998) (codified in scattered sections of 17 U.S.C.); *see infra* notes 242–45 and accompanying text.

109. Thus scientists seem not to have encountered the difficulties that have otherwise constrained documentary film makers in the United States. *See, e.g.*, Peter Jaszi & Patricia Aufderheide, *Untold Stories: Collaborative Research on Documentary Filmmakers' Free Speech and Fair Use,* 46 CINEMA J. 133, 133–39 (2007).

110. *See* Wendy Gordon, *Fair Use as Market Failure: A Structural and Economic Analysis of the Betamax Case and Its Predecessors*, 82 COLUM. L. REV. 1600, 1638–39 (1982) (discussing courts' varying opinions regarding the serving of public interest); Edward Lee, *Technological Fair Use*, 83 S. CAL. L. REV. 797, 817–18 (2010) (discussing how technological fair use cases vary from other fair use cases); *see also* Campbell v. Acuff-Rose Music, Inc., 510 U.S. 569, 577 (1994) ("The task is not to be simplified with bright-line rules, for the statute, like the doctrine it recognizes, calls for case-by-case analysis."); *cf.* Kate O'Neill, *Against Dicta: A Legal Method for Rescuing Fair Use from the Right of First Publication*, 88 CALIF. L. REV. 369, 388–89 (2001) (urging courts to abandon a dogged allegiance to 17 U.S.C. § 107's four-factor analysis, at least in "hard cases").

begin with, in which case it can or should be seen as a form of "users' rights."[111]

More recently, under the influence of law and economics theory, the extent to which fair use is justified by various forms of market-failure analysis has attracted considerable attention from courts and commentators.[112] For example, at least one relatively recent case concerning photocopies for classroom use[113] and another for use at a commercial scientific laboratory[114] seemed to presage a growing judicial resistance to fair use, even for research purposes, especially where novel licensing strategies had emerged. In this vein, courts began to reason that yesterday's market failure—due, say, to the high transaction costs of seeking and negotiating permissions to use in certain cases—might be cured by tomorrow's establishment of clearinghouses, standard-form contracts, and digitally regulated access controls, which facilitate pay-per-use mechanisms not conceivable in a less technologically sophisticated era.[115] Fair use could then depend on the willingness of courts to envision public good overrides that apply irrespective of market failure.

For a time, the influence of market-failure theory, coupled with a surge in the "property rights" approach to intellectual property law generally, elicited growing scholarly criticism of an "incredibly shrinking doctrine of fair use."[116] Fortunately,

111. *See* Mary W. S. Wong, *"Transformative" User-Generated Content in Copyright Law: Infringing Derivative Works or Fair Use?*, 11 VAND. J. ENT. & TECH. L. 1075, 1096–97 (2009). *See generally* PATTERSON & LINDBERG, *supra* note 51.

112. *See, e.g.*, Gordon, *supra* note 110 (focusing attention on the use of a market approach in fair use cases).

113. *See* Princeton Univ. Press v. Mich. Document Servs., Inc., 99 F.3d 1381, 1388–92 (6th Cir. 1996).

114. *See* Am. Geophysical Union v. Texaco, Inc., 60 F.3d 913, 931–32 (2d Cir. 1994) (emphasizing that there was a convenient rights clearance regime to handle the use in question).

115. *See, e.g.*, *id.*; Tom W. Bell, *Fair Use v. Fared Use: The Impact of Automated Rights Management on Copyright's Fair Use Doctrine*, 76 N.C. L. REV. 557, 563–67 (1998); Paul Goldstein, *Fair Use in a Changing World*, 50 J. COPYRIGHT SOC'Y USA 133, 137 (2003) (suggesting pay-as-you-go schemes in a digital environment); *see also* June M. Besek, *Anti-Circumvention Laws and Copyright: A Report from the Kernochan Center for Law, Media and the Arts*, 27 COLUM. J.L. & ARTS 385, 472–73 (2004) (stating that "digital rights management systems" are advancing and many previously privileged uses may no longer be considered fair uses); Lunney, *supra* note 96, at 815 (discussing the move from guild control to copyright as a fundamental transformation that is now endangered.); *infra* Part II.C.b.2.

116. *See, e.g.*, Dan L. Burk & Julie E. Cohen, *Fair Use Infrastructure for Rights Management Systems*, 15 HARV. J.L. & TECH. 41, 44–47 (2001); Gor-

this period has lately given way to a series of more flexible decisions favoring transformative uses of various kinds and especially those performed by search engines.[117] On the surface, these recent decisions would seem more favorable to scientific research, subject to certain inherent constraints limiting the application of the fair use doctrine as a whole. In reality, new constraints arising from technological fencing measures under the DMCA[118] can enable content providers to effectively shut down the fair use exception in the online environment, precisely where it is of greatest use to computational science. These measures are discussed below.

B. NEW BOUNDARIES IMPOSED BY INTERNATIONAL LAW

So far, we have seen that the conceptual approach to limitations and exceptions affecting scientific research in domestic copyright laws differed considerably in the European Union and the United States. Later on, we shall evaluate the strengths and weaknesses of each approach, with specific regard to their implications for science.[119] Before doing so, however, we must take account of developments at the international level since 1994 that have greatly complicated the practical application of limitations and exceptions under either conceptual approach.

As previously observed, a major turning point had already occurred in 1967, when the Berne Union countries accepted a package deal in which an author's exclusive right of reproduction was codified in Article 9(1) of the Berne Convention and simultaneously subjected to the "three-step test" in Article 9(2).[120] Three decades later, history repeated itself when the drafters of the TRIPS Agreement attempted unsuccessfully to negotiate a set of designated limitations and exceptions to the exclusive rights of copyright, patent, and trademark laws that were about to be harmonized in a single convention for the first time. When, at the end of the day, no agreement could be reached on any of the listed proposals under consideration, the

don, *supra* note 110; Lydia Pallas Loren, *Redefining the Market Failure Approach to Fair Use in an Era of Copyright Permission Systems*, 5 J. INTELL. PROP. L. 1, 8–32 (1997).

117. *See* Sag, *supra* note 2, at 1636–51 (discussing relevant cases); *supra* notes 103–04 and accompanying text.

118. 17 U.S.C. §§ 1201–05 (2006).

119. *See infra* Part I.C.

120. *See supra* notes 63–67 and accompanying text.

drafters made the unprecedented—and some would say mindless—decision to extend that same three-step test, initially adopted as an expedient in 1967, with some minor variations, to all the exclusive rights bestowed on authors, inventors, industrial designers, and trademark owners in the final version of the TRIPS Agreement as adopted in 1994.[121]

The three-step test thus became a universal norm of world intellectual property law, binding on some 153 signatories to the Agreement Establishing the World Trade Organization.[122] Its enforcement also became subject to the WTO tribunals and cross-sectoral remedies governed by the WTO's Understanding on the Settlement of Disputes (DSU).[123]

1. Normative Blindness at the World Trade Organization

One major problem with the three-step formulation as embodied in Article 13 of the TRIPS Agreement[124] is that it remains devoid of any intrinsic normative guidance. It thus fails to tell courts and administrators what, if any, user pursuits are particularly worthy, from a policy perspective, of affirmative relief from the right holders' control under the exclusive rights that the TRIPS Agreement obliges WTO members to provide.[125]

121. *See* TRIPS Agreement, *supra* note 20, arts. 13 (copyrights), 30 (patents), 26 (industrial designs), & 17 (trademarks, which emerged as a two-step variant); DANIEL GERVAIS, THE TRIPS AGREEMENT: DRAFTING HISTORY AND ANALYSIS 5–27, 319–32 (1998); *see also* Jerome H. Reichman, *Intellectual Property in the Twenty-First Century: Will the Developing Countries Lead or Follow?*, 46 HOUS. L. REV. 1115 (2009).

122. Marrakesh Agreement Establishing the World Trade Organization, Apr. 15, 1994, 1867 U.N.T.S. 154; *see* Understanding the WTO, WORLD TRADE ORGANIZATION, http://www.wto.org/english/thewto_e/whatis_e/tif_e/org6_e.htm (last visited Jan. 26, 2012).

123. *See* Understanding on Rules and Procedures Governing the Settlement of Disputes, Marrakesh Agreement Establishing the World Trade Organization, Annex 2, 1869 U.N.T.S. 401 [hereinafter DSU]; Panel Report, *United States—Section 110(5) of the US Copyright Act*, WT/DS160/R (June 15, 2000) [hereinafter US–Section 110(5) Panel Report].

124. TRIPS Agreement, *supra* note 20, art. 13 (obliging WTO members to "confine limitations or exceptions to exclusive rights to certain special cases which do not conflict with a normal exploitation of the work and do not unreasonably prejudice the legitimate interests of the right holder.").

125. *See id*., arts. 9.1 (incorporating exclusive rights of the Berne Convention 1971), 11 (imposing rental rights on computer programs and cinematographic works), 14 (imposing recognition of related rights for performers, producers of phonograms (sound recordings) and Broadcasting Organizations), 16 (mandating exclusive rights of trademark owners), 28 (mandating exclusive rights of patentees), & 26 (mandating exclusive rights of protected industrial designs and subjecting them to still another version of the three-step test).

So far, the only WTO panel to apply the three-step test of Article 13 dealt with a broad exemption from the public performance rights for radio and television broadcasts of copyrighted musical works in bars and restaurants under § 110(5) of the U.S. Copyright Act of 1976.[126] After considering both the breadth of the exemption as codified and evidence of its potential substitution effects on live or recorded music covered by Article 11*bis* of the Berne Convention,[127] the panel held that § 110(5) was insufficiently "limited" to satisfy the first prong of the three-step test set out in Article 13 of the TRIPS Agreement.[128]

Section 110(5) was accordingly inconsistent with foreign authors' exclusive public communication rights under Article 11*bis* of the Berne Convention as incorporated into the TRIPS Agreement via Article 9.1.[129] While recognizing that "normative considerations" should play a part at step three, and possibly at step two of any analysis under Article 13, the panel's reified vision of "limited" exceptions under step one[130] inhibited it from telling us what those considerations might be or how that normative impact should be weighed against rights holders' interests.[131]

126. US–Section 110(5) Panel Report, *supra* note 123; *see also* 17 U.S.C. § 110(5) (2006).

127. Berne Convention (1971), *supra* note 20, art. 11*bis*; TRIPS Agreement, *supra* note 20, art. 9.1 (incorporating arts. 1–21 (minus art. 6*bis*) into the TRIPS Agreement of 1994).

128. US–Section 110(5) Panel Report, *supra* note 123, ¶¶ 6.133, 6.160; TRIPS Agreement, *supra* note 20, art. 13 ("Members shall confine limitations or exceptions to exclusive rights to certain special cases . . . .").

129. US–Section 110(5) Panel Report, *supra* note 123, ¶¶ 6.133, 6.160, 6.209–6.211; TRIPS Agreement, *supra* note 20, arts. 9.1; Berne Convention, *supra* note 20, art. 11*bis* (1)(i)–(iii). Note, however, that a compulsory license favoring foreign—but not necessarily U.S.—authors could have cured the violation by dint of Article 11*bis*(2) of the Berne Convention. National authors in the country of origin have no standing under the Berne Convention. *See* Berne Convention (1971), *supra* note 20, art. 5.

130. The panel conflated the term "certain special cases" in Article 13 on exceptions to copyright protection with the term "limited exceptions" to patent protection in Article 30, without explanation, while reifying the concept in both cases. US–Section 110(5) Panel Report, *supra* note 123,¶ 6.109; GERVAIS, *supra* note 121, at 89–91.

131. *See* US–Section 110(5) Panel Report, *supra* note 123, ¶ 6.179–6.189 (emphasizing that the beneficiary of an exception should not enter into competition with the rightholder); Jane C. Ginsburg, *Toward Supranational Copyright Law? The WTO Panel Decision and the "Three-Step Test" for Copyright Exceptions*, 187 REVUE INTERNATIONALE DU DROIT D'AUTEUR [INTERNATIONAL JOURNAL OF AUTHOR'S RIGHTS] 3, 20–25 (2001).

To be fair, the WTO panel in the Section 110(5) case found little normative guidance in the legislative history accompanying the original three-step test adopted as Article 9(2) of the Berne Convention at the Stockholm Conference in 1967.[132] Rather, the experts who drafted that provision produced a single laconic paragraph of explanation, embodied in the Rapporteur's Statement at Stockholm. According to this source, the three-step test can be read to mean that an objectively small taking of protected matter may be allowed for some purposes, a large taking for any purpose is strongly discouraged, while a medium-sized taking for a good normative purpose might be cured by the payment of equitable compensation.[133]

The WTO panel may indeed have made this normative blindness even worse when, reasoning from trade law, it asserted that no public purpose was necessary to trigger application of the three-step test to any given dispute under Article 13 of the TRIPS Agreement.[134] However, the WTO panel's approach downplayed the fact that the TRIPS Agreement basically deals with private rights.[135] Even though it constitutes a treaty among sovereign entities, private rights holders are, in effect, a class of third-party beneficiaries, rather like residents of foreign enclaves whose ethnic, linguistic, and educational rights were protected by certain bilateral and multilateral trea-

132. US–Section 110(5) Panel Report, *supra* note 123,¶ 6.73.

133. *Compare id*., *with* Senftleben, *supra* note 48 (a more complex interpretation), *and* Mihály Ficsor, President, Hungarian Copyright Council, Paper Presentation at the Fordham Intellectual Property Conference (Apr. 15, 2009), *available at* http://fordhamipconference.com/wp-content/uploads/2010/08/MihalyFicsor_Three-step_Test.pdf (noting that the application of three-step test only recently became controversial). *See also* RICKETSON & GINSBURG, *supra* note 32, at 639–46 (discussing three-step test); Geiger, *supra* note 33 (discussing different ways to interpret copyright limitations).

134. *See* US–Section 110(5) Panel Report, *supra* note 123, at 33–34. In trade law, states are often tempted to couch would-be exceptions from the tariff bindings under the General Agreement on Tariffs and Trade (GATT) in terms of vague public-interest justifications. General Agreement on Tariffs and Trade 1994, Apr. 15, 1994; Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 187. The WTO tradition thus far is to focus on the literal fact of violation, which could only be rescued by reference to a WTO or GATT Member's reserved powers under article XX or to other specified safeguard measures. *See, e.g.*, General Agreement on Tariffs and Trade 1994 art. XX, Apr. 15, 1994, 1867 U.N.T.S. 190; Appellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products*, WT/DS58/AB/R, Oct. 8, 1998.

135. *See* TRIPS Agreement, *supra* note 20, pmbl.¶ 4 (recognizing that intellectual property rights are private rights).

ties in the past.[136] Without a public-purpose justification for derogating from the private rights protected under TRIPS, limitations in domestic laws—like those condemned in the Section 110(5) case—could merely allow a state to take money from one private pocket and put it into another.[137]

If the original three-step test embodied in Article 9(2) of the Berne Convention was thus rather normatively blind, that blindness became even more opaque after its incorporation and expansion under TRIPS, Article 13.[138] For example, there is no express obligation to take third-party interests into account under Article 13, as there is in the corresponding patent law formulation embodied in Article 30 of the same Agreement.[139] Moreover, the one WTO panel so far convened to consider that formulation in the patent context failed to take into consideration any of the rather evident public health effects of its decision when evaluating step one of the test.[140]

Because the formula as thus applied appears normatively blinkered, it tends to give undue positive weight to acquired rights and to codified exceptions recognized in existing legislation, such as the list set out in the EC InfoSoc Directive.[141] This approach harbors a flawed methodology because such lists only tell us the results of past legislative compromises. They do not provide a sound normative foundation on which to build, case-

136. *See, e.g.*, Sovereignty Over Certain Frontier Land (Belg. v. Neth.), 1959 I.C.J. 209 (June 1959).

137. *Cf.* Paul J. Heald & Suzanna Sherry, *Implied Limits on the Legislative Power: The Intellectual Property Clause as an Absolute Restraint on Congress*, 2000 U. ILL. L. REV. 1119, 1192 (criticizing such an approach).

138. *See* TRIPS Agreement, *supra* note 20, art. 9.1 (incorporating arts. 1–21 of the Berne Convention, except for art. 6*bis*); Berne Convention (1971), *supra* note 20, art. 9(2).

139. *See* TRIPS Agreement, *supra* note 20, arts. 13 ("Members shall confine limitations or exceptions to exclusive rights to certain special cases which do not conflict with a normal exploitation of the work and do not unreasonably prejudice the legitimate interests of the right holder."), 30 ("Members may provide limited exceptions to the exclusive rights conferred by a patent, provided that such exceptions do not unreasonably conflict with a normal exploitation of the patent and do not unreasonably prejudice the legitimate interests of the patent owner, *taking account of the legitimate interests of third parties*." (emphasis added)).

140. *See* Panel Report, *Canada—Patent Protection of Pharmaceutical Products*, WT/DS114/R, Mar. 17, 2000; *see also* Robert Howse, *The Canadian Generic Medicines Panel—A Dangerous Precedent in Dangerous Times*, 3 J. WORLD INTELL. PROP. 493, 502 (2000) (emphasizing what the Panel should have considered).

141. *See* InfoSoc Directive, *supra* note 72, art. 5.

by-case in the future, which could free domestic copyright laws from temporal rigidity.

This rigidity is then magnified by the conventional view that, for any given use to qualify as privileged under the three-step test, the decision maker must answer "yes" to all three questions posed by that test.[142] Until recently, this orthodox position went largely unquestioned,[143] and modified versions of this same approach have been extended to patents, trademarks, and industrial designs. Fortunately, the Max Planck Institute has launched a head-on challenge to this position, as we shall explore in our discussion of possible reforms below.[144]

2. Potential Flexibility Under the WIPO Copyright Treaty

With specific regard to copyright law, Article 13 of the TRIPS Agreement expressly extended the three-step test to all the exclusive pecuniary rights covered by the Berne Convention's 1971 text, as incorporated into TRIPS by virtue of Article 9.1.[145] Article 11 of the TRIPS Agreement also conferred new exclusive rights on authors of computer programs and cinematographic works.[146] On its face, Article 13 could thus be read as a potentially narrowing super-norm applicable to both the extant exceptions in the revised Berne Convention of 1971 and to all preexisting exceptions in the domestic copyright laws of Berne Union members, with perhaps due deference for so-called acquired rights (*acquis*), that is, certain state practices

142. *See, e.g.*, Senftleben, *supra* note 48, at 530–35.

143. *See, e.g.*, Ficsor, *supra* note 133.

144. *See infra* notes 424–35 and accompanying text.

145. *See* TRIPS Agreement, *supra* note 20, art. 9.1 (incorporating Articles 1–21 of Berne Convention as set out in the 1971 text and the Appendix thereto, except for Article 6*bis*, which deals with moral rights). Because moral rights under Article 6*bis* of the Berne Convention were expressly not incorporated into the TRIPS Agreement under Article 9, the three-step test does not apply to them at the international level. Whether the rights conferred on broadcasting organizations under Article 14.3 of TRIPS are also subject to the three-step test of Article 13 remains to be seen, as the relations between these provisions and the Rome Convention of 1961, *supra* note 79, are not entirely clear.

146. TRIPS Agreement, *supra* note 20, art. 11 (providing rental rights subject to an optional waiver for cinematographic works in the absence of "widespread copying" to accommodate U.S. law). Article 14.2 also seems to provide an exclusive right of reproduction to producers of phonograms. However, Article 14.6 allows WTO Members to invoke "conditions, limitations, exceptions and reservations to the extent permitted by the Rome Convention" for producers of phonograms covered by article 14.2. How to reconcile Article 14.6 with Article 13 remains unclear.

known to the TRIPS drafters and never expressly challenged or rejected during the Uruguay Round of Multilateral Trade Negotiations.[147]

Two years later at the Diplomatic Conference that produced the WIPO Copyright Treaty of 1996, the United States and the European Union submitted a draft text that expressly attempted to codify this narrowing interpretation of the three-step test, which the pending WIPO treaty was supposed to incorporate.[148] However, after extensive debate and the vigorous intervention of the U.S. science agencies and their representatives, a modified approach to the three-step test was enacted in Article 10 of the final text,[149] along with an Agreed Statement unanimously adopted by the parties.[150]

Article 10(1) of the WCT states expressly that contracting parties "may" adopt limitations and exceptions to rights granted authors under the new treaty in conformity with the three-step test;[151] while Article 10(2) states that these same contracting parties, when applying the Berne Convention, "shall" confine its limitations and exceptions to the three-step test.[152] The Agreed Statement, negotiated with direct inputs from the Pres-

147. *See, e.g.*, US–Section 110(5) Panel Report, *supra* note 123,¶ 6.65 ("We are not aware of any record in the Uruguay Round documentation of any country participating in the negotiations challenging or questioning the minor exceptions doctrine being part of the Berne *acquis* on which the TRIPS agreement was to be built.").

148. *See* Diplomatic Conference on Certain Copyright and Neighboring Rights Questions, Dec. 2–20, 1996, *Basic Proposal for the Substantive Provisions of the Treaty on Certain Questions Concerning the Protection of Literary and Artistic Works to Be Considered by the Diplomatic Conference on Certain Copyright and Neighboring Rights Questions*, n.7.07, WIPO Doc. CRNR/DC/4 (Aug. 30, 1996), *available at* http://www.wipo.int/edocs/mdocs/diplconf/en/crnr_dc/crnr_dc_4.pdf ("The purpose of [Article 7(2)] is to make it possible to exclude from the scope of the right of reproduction acts of reproduction that are not relevant in economic terms. By reference to Article 9(2) of the Berne Convention, the limitations are further confined to cases that pass the three-step test of that provision.").

149. WCT, *supra* note 42, art. 10.

150. Diplomatic Conference on Certain Copyright and Neighboring Rights Questions, Dec. 2–20, 1996, *Agreed Statements Concerning the WIPO Copyright Treaty*, WIPO Doc. CRNR/DC/96 (Dec. 20, 1996) [hereinafter WCT Agreed Statements], *available at* http://www.wipo.int/treaties/en/ip/wct/statements.html.

151. WCT, *supra* note 42, art. 10(1).

152. *See id.* art. 10(2).

idents of the U.S. National Academies and then Vice-President Gore's office,[153] further declared,

> It is understood that the provisions of Article 10 permit Contracting Parties to carry forward and appropriately extend into the digital environment limitations and exceptions in their national laws which have been considered acceptable under the Berne Convention. Similarly, these provisions should be understood to permit Contracting Parties to devise new exceptions and limitations that are appropriate in the digital network environment.
>
> It is also understood that Article 10(2) neither reduces nor extends the scope of applicability of the limitations and exceptions permitted by the Berne Convention.[154]

These changes were made for the specific purpose of avoiding posterior challenges to the fair use provisions of the U.S. Copyright Act of 1976 (as some scholars had previously feared could happen under the TRIPS Agreement)[155], but whose validity had not otherwise been compromised during the negotiations that led the United States to adhere to the Berne Convention in 1989.[156]

The full implications of this complex set of provisions remain to be worked out at both the national and international levels.[157] For example, these provisions could trump arguments that the three-step test can retroactively undo limitations and exceptions existing in national laws prior to the conclusion of the TRIPS Agreement. What cannot be denied is that any *future* interpretation of the three-step test codified in Article 13 of the TRIPS Agreement must also reflect the posterior, more flexible gloss on that same test as adopted by essentially the same parties two years later, in Article 10 of the WCT and its Agreed Statement.[158]

153. Paul F. Uhlir & Jerome H. Reichman represented the National Academies in these negotiations.

154. WCT Agreed Statements, *supra* note 150.

155. Okediji, *supra* note 54, at 136 (expressing doubt as to whether the fair use provisions could withstand a TRIPS agreement attack).

156. *See* The Berne Convention Implementation Act of 1988, Pub. L. No. 100-568, § 2(3), 102 Stat. 2853 (1988) ("The amendments made by this Act, together with the law as it exists on the date of the enactment of this Act, satisfy the obligations of the United States in adhering to the Berne Convention.").

157. *See, e.g.*, Senftleben, *supra* note 48, at 544–48 (describing the "open-ended" three-step test as "a flexible framework, within which national legislators . . . enjoy the freedom of safeguarding national limitations and satisfying domestic social, cultural and economic needs").

158. See, for example, Vienna Convention, *supra* note 80, art. 31:

> 1. A treaty shall be interpreted in good faith in accordance with the ordinary meaning to be given to the terms of the treaty and in their context and in the light of its object and purpose. . . .

By the same token, these cumulative legislative enactments oblige the members of the WTO to take account of the three-step test whenever they adopt or enforce limitations and exceptions in their domestic copyright laws, under whatever conceptual approach they prefer.[159] Failure to do so could result in adverse legal challenges at the WTO, with the risk of having to pay damages to states whose bargained-for trade expectations suffered harm by dint of any failure of any given exception to satisfy this test.[160]

C. THE SHRINKING REALM OF SCIENTIFIC USERS' RIGHTS UNDER EITHER APPROACH

Seventy years of practical experience with the teachings of the legal realists[161] has demonstrated, at the very least, that

3. There shall be taken into account, together with the context:
   (a) any subsequent agreement between the parties regarding the interpretation of the treaty or the application of its provisions;
   (b) any subsequent practice in the application of the treaty which establishes the agreement of the parties regarding its interpretation;
   (c) any relevant rules of international law applicable in the relations between parties.

159. *See, e.g.*, P. BERNT HUGENHOLTZ & RUTH L. OKEDIJI, CONCEIVING AN INTERNATIONAL INSTRUMENT ON LIMITATIONS AND EXCEPTIONS TO COPYRIGHT 7 (2008), *available at* http://www.soros.org/sites/default/files/copyright_20080506.pdf (noting that states view the three-step test "as a constraint on the sovereign discretion of nations to provide flexibilities in their laws"); Reichman, *supra* note 121, at 1156 (emphasizing the need for countries to reconcile potential "fair use" regimes with the three-step test).

160. *See, e.g.*, US–Section 110(5) Panel Report, *supra* note 123.

161. *See generally, e.g.*, KARL N. LLEWELLYN, JURISPRUDENCE: REALISM IN THEORY AND PRACTICE (1962) (laying out a theory of legal realism); SOIA MENTSCHIKOFF & IRWIN P. STOTZKY, THE THEORY AND CRAFT OF AMERICAN LAW—ELEMENTS (1981). The ostensible benefits of establishing a closed list of designated exceptions available to European legislators contemplating copyright reform are rooted in the myths of the positivist legal tradition, which appeal to practicing lawyers' ceaseless quest for legal certainty. The tenacity of this quest partly reflects the Continental approach to legal education and its historic indifference to the legal realist movement. *See* James R. Maxeiner, *Some Realism about Legal Certainty in the Globalization of the Rule of Law*, *in* THE RULE OF LAW IN COMPARATIVE PERSPECTIVE 41, 41–49 (2010) (explaining the "centrality of legal certainty to the thinking of continental jurists" in comparison to American legal realism). Paradoxically, some of the most influential leaders of that movement, including Llewellyn and Mentschikoff, were transplanted refugees from Europe, who made it their lives' work to challenge the shortcomings of both the civil and common law traditions. *Cf.* JACK DONNELLY, REALISM AND INTERNATIONAL RELATIONS 15 (2000) ("Hans Morganthau, an American refugee from Nazi Germany, was one of the leading realists of the 1950s and 1960s and perhaps the purest as well as the most self-conscious

the quest for legal certainty[162] cannot be separated from a clear analysis of both the underlying purposes of any given set of laws and the empirical experience accumulated over time from judicial efforts to implement those same laws in actual cases.[163] With specific regard to copyright law, history also teaches that changing factual conditions constantly elicit a need for creative new solutions that are inherently slow to materialize, and destabilizing to boot, while the lobbying of special interests often remains indifferent to the larger public interest that was supposedly to be advanced by any given set of enumerated exceptions.

For example, even the most enlightened policymakers found themselves confronted by a rapidly changing world in which legal categories designed for the print media collapsed or converged in the digital online environment.[164] Just when traditional scientific research methods were overtaken by the rise of computerized information technologies requiring unfettered access to and use of data and information, researchers discovered that the old categories of exceptions inherited from the print media were so freighted with narrow, legalistic interpretations that they could not readily be updated or accommodated to the challenges of modern science, even with the best of

apostle of realism of his generation.") (quotation omitted)).

162. Legal realists sought a higher synthesis that blended the best features of both the civil and common law traditions, while avoiding their respective defects, as reflected, for example, in Article 2 of the Uniform Commercial Code, drafted by Llewellyn and Mentischikoff. *See, e.g.*, GRANT GILMORE, DEATH OF CONTRACTS 55–85 (1974) (describing the messy state of contracts law before the reforms adopted in Article 2 of the UCC, which were deliberately designed to reform the general law of contracts).

163. *See* OLIVER WENDELL HOLMES, THE COMMON LAW 1–2 (1881) ("The life of the law has not been logic: it has been experience. . . . The law embodies the story of a nation's development through many centuries, and it cannot be dealt with as if it contained only the axioms and corollaries of a book of mathematics."); LAURA KALMAN, LEGAL REALISM AT YALE, 1927–1960 (1986); Karl N. Llewellyn, *Some Realism About Realism: Responding to Dean Pound*, 44 HARV. L. REV. 1222 (1931), *reprinted in* AMERICAN LEGAL REALISM 68, 72–75 (William W. Fisher III et al. eds., 1993) ("[Any law] needs constantly to be examined for its purpose, and for its effect, and to be judged in the light of both and of their relation to each other."). The Law and Economics Movement is itself a response to the challenge of the legal realists. *See, e.g.*, RICHARD A. POSNER, OVERCOMING LAW 2–3 (1995).

164. Margaret Chon, *New Wine Bursting from Old Bottles: Collaborative Internet Art, Joint Works, and Entrepreneurship*, 75 OR. L. REV. 257, 257–58 (1996) ("[A]s the old 'bottle' of print-based copyright law expands to cover new media and new uses, the transformative possibilities of these new uses in new media will occasionally pop the cork of existing legal categories.").

will.[165]

1. Impeding Scientific Research Even in the Print Media

In this Section, we first evaluate the existing approaches to limitations and exceptions affecting copyrighted scientific research results as they have worked, or failed to work, in the print media for which they were originally designed. We then show how this fragile, predigital foundation was further undermined by efforts to strictly regulate transmissions of copyrighted works over the Internet, and by the database protection laws adopted in the European Union after 1996.[166]

a. Strengths and Weaknesses of the Designated Exceptions Approach

The InfoSoc Directive adopted by the European Commission in 2001 was ostensibly an attempt to reconcile the "designated exceptions" approach of prior Continental copyright laws with the provisions of both the TRIPS Agreement of 1994 and the WCT of 1996.[167] It was also supposed to harmonize the limitations and exceptions found in all the copyright laws of European Union member states, as well as those of affiliated and would-be member countries.[168] In reality critics complain that, with respect to harmonization, the Directive failed in its essential purpose,[169] while its response to the WCT digital copyright

165. *See* Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 315–327, 351; Hilty, *Five Lessons About Copyright*, *supra* note 2, at 109–18; Reichman & Uhlir, *supra* note 2, at 324 (doubting the ability of legislators to accommodate the needs of the scientific research community with tweaks to an "increasingly high-protectionist regime").

166. *See infra* text accompanying notes 230–41.

167. *See* Bernt Hugenholz, *Why the Copyright Directive Is Unimportant, and Possibly Invalid*, 22 EUR. INTELL. PROP. REV. 499, 499 (2000).

168. David Gee, *A Copyright Balance? An Overview for Librarians of Current UK Copyright Law*, 35 INT'L J. LEGAL INFO. 47, 50 (2007) (stating that the goal for the directive was to harmonize copyright law across the European Union); Veronica Syrtash, *Supra-National Limitations on Copyright Exceptions: Canada's Ephemeral Exception and the "Three-Step Test*," 19 INTELL. PROP. J. 521, 549 (2006) ("The Copyright Directive introduced a regime of compulsory and permitted exceptions to the three exclusive rights provided for by member states.").

169. *See* Séverine Dussollier, *Fair Use by Design in the European Copyright Directive of 2001*, COMM. ACM, Apr. 2003, at 51, 55 (questioning the usefulness of the Copyright Directive's "private orderings model"); Thomas Heide, *The Berne Three-Step Test and the Proposed Copyright Directive*, 21 EUR. INTELL. PROP. REV. 105, 109 (1999) (concluding that the Copyright Directive leaves the three-step test "largely straitjacketed and therefore incapable of responding to the need for balance between various interests"); Hugenholz, *su-*

provisions embodies a high-protectionist regime inconsistent with the balancing norms actually adopted in that treaty.[170] Whether or not these criticisms prove valid, the inadequacies of this Directive with respect to scientific research remain painfully clear.

For example, even though Article 5(3)(a) of the Directive adopts a *soi disant* exception for science at the regional level that does not appear in the Berne Convention,[171] its tortured language may impose qualifiers that cut back upon the provisions of that Convention, which largely leave science at the mercy of the three-step test. Moreover, the exception for science in Article 5(3) is not mandatory, whatever its meaning turns out to be.[172]

If a European Union member country ignores Article 5(3)(a) of the Directive, it remains bound by Articles 10(1) and 10(2) of the Berne Convention, as revised in 1971, which make no mention of science whatsoever.[173] Even with regard to quotations or to other excerpts for teaching materials, Article 10(1) limits the former to "fair practice . . . and [the] extent justified by the purpose,"[174] while Article 10(2) permits the latter only "to the extent justified by the purpose . . . by way of illustration in publications . . . for teaching, provided such utilization is compatible with fair practice."[175] These provisions have been narrowly construed in the United Kingdom.[176] while in major markets outside the European Union, such as Brazil, university libraries reportedly ignore the analogous provision in the domestic copyright law altogether and deny students the possi-

pra note 167, at 499–502 (condemning the Directive as "a total failure"); Richard J. Peltz, *Global Warming Trend? The Creeping Indulgence of Fair Use in International Copyright Law*, 17 TEX. INTELL. PROP. L.J. 267, 283 (2009) (noting the shortcomings of the Copyright Directive).

170. *See* Jerome H. Reichman, Graeme Dinwoodie & Pamela Samuelson, *A Reverse Notice and Takedown Regime to Enable Public Interest Uses of Technically Protected Copyrighted Works*, 22 BERKELEY TECH. L.J. 981, 983–85 (2007) (explaining that the Directive's lopsided anti-circumventionist rules prioritized owner rights over legitimate user interests).

171. See *supra* text accompanying notes 76–86.

172. InfoSoc Directive, *supra* note 72, art. 5(3).

173. *See* Berne Convention (1971), *supra* note 20, art. 10(2).

174. *Id.* art. 10(1).

175. *Id.* art. 10(2).

176. *See* GOLDSTEIN, *supra* note 55, at 293 & n.847 (referring to the United Kingdom's "fair dealing" approach as an example of specified, narrow limitations on copyright). *See generally* ROBERT BURRELL & ALLISON COLEMAN, COPYRIGHT EXCEPTIONS: THE DIGITAL IMPACT (2005).

bility of photocopying even short excerpts from scientific texts.[177]

If, instead, a European Union member state decides to codify the permissible exception for science as set out in Article 5(3)(a) of the InfoSoc Directive, would-be users of scientific works are immediately confronted with the inherent ambiguities of the language in this provision that were identified earlier in this study.[178] For example, do the words limiting use for purposes of illustration pertain to both teaching and research, or are they confined to teaching only? Even if the latter, more liberal interpretation were to prevail, research uses would remain subject to both the non-commercial purpose clause and to the prevailing judicial tendency to view all exceptions and limitations as subordinate to the dominant purpose of copyright law, which in the European Union, is to protect the private interests of authors and publishers.[179]

This restrictive tendency is then reinforced by Article 5(5) of the InfoSoc Directive, which makes the three-step test expressly applicable to all the exceptions set out in Article 5.[180] As noted, traditional European jurisprudence requires that all three steps must be applied cumulatively and all must be given an affirmative response if any given act is to avoid a claim of infringement.[181] In sum, under the existing regime, nothing compels a European Union member state to favor scientific research, and those policymakers willing to do so encounter a daunting battery of constraints,[182] even without factoring in the effects of special interest lobbying.

177. Pedro Paranaguá, *Brazil's Copyright Reform: Will Brazil Lead or Follow?* 19–20 (Jan. 2012) (Duke University School of Law, draft SJD thesis) (on file with the authors).

178. See *supra* notes 76–86 and accompanying text.

179. Senftleben, *supra* note 48, at 524–25. Contrast the accepted formula in U.S. law, which holds that securing income to authors is but a means to the promotion of knowledge in the public interest. *Id.*; *see also* Mazer v. Stein, 347 U.S. 201, 219 (1954) ("The economic philosophy behind the clause empowering Congress to grant patents and copyrights is the conviction that encouragement of individual effort by personal gain is the best way to advance public welfare through the talents of authors and inventors in 'Science and useful Arts.'" (quoting U.S. CONST. art. I, § 8, cl. 8)); Salinger v. Colting, 607 F.3d 68, 82 (2d Cir. 2010) ("The object of copyright law is to promote the store of knowledge available to the public.").

180. *See* InfoSoc Directive, *supra* note 72, art. 5(5).

181. *See supra* notes 157–60 and accompanying text.

182. *See, e.g.*, Westkamp, *supra* note 78, at 15–18 (stressing inability of three-step test to deal with multiple markets, which disfavors both private use and research uses in general).

At least one expert on the three-step test nonetheless contends that both European courts and legislators could apply it in a more flexible, open-ended manner, somewhat comparable to fair use in the United States, despite the implicitly uncompromising approach of the InfoSoc Directive.[183] To this same end, the review of the legislative history pertaining to Article 9(2) of the Berne Convention by the Section 110(5) WTO tribunal did uncover a potentially more flexible interpretation than that found in the decisions of many Continental courts.[184] This approach, if subsequently upheld, might have the advantage of supporting greater use of liability rules to resolve hard cases in the print media, which would constitute a welcome addition in many sectors.[185]

However, even liability rules, i.e., "take and pay" rules,[186] do surprisingly little to support digitally integrated research methods, which ingest and mine massive amounts of data and information. Attempting to track such uses for purposes of calculating royalty streams conjures up a vision of thickets of rights and boundless transaction costs that could swallow the most robust research budgets, even if some system of automatic micro-payments were to be devised.[187]

If anything, the implicit duty to pay equitable compensation that could emerge from a more flexible judicial scrutiny of

183. Senftleben, *supra* note 48, at 538–40; *see also* Geller, *supra* note 50, at 569–71 (arguing that neither the idea-expression dichotomy, nor constitutionality grounded constructions of limitations or exceptions, are subject to the three-step test).

184. *See supra* notes 126–29 and accompanying text.

185. *See* Geiger, *supra* note 33, at 524–33 (arguing for a limitation-friendly copyright regime supplemented with remuneration rules); Annette Kur and Jens Schovsbo, *Expropriation or Fair Game for All? The Gradual Dismantling of the IP Exclusivity Paradigm*, *in* INTELLECTUAL PROPERTY IN A FAIR WORLD TRADE SYSTEM: PROPOSALS FOR REFORMING TRIPS 408, 408–46 (Annette Kur & Marianne Levin eds. 2011) (defending the utility of liability rules in a copyright regime).

186. *See* J.H. Reichman, *Of Green Tulips and Legal Kudzu: Repackaging Rights in Subpatentable Innovation*, 53 VAND. L. REV. 1743, 1776–86 (2000) (explaining that liability rules entitle property owners to compensation for the use of their innovations and are hence distinguishable from exclusive or hybrid property rights, which entail injunctive remedies that can pose high costs for innovation).

187. *See, e.g.*, Sag, *supra* note 2, at 1657–68, 1680–82 (stressing need for copy-reliant technologies to cover the entire Internet, for unwilling beneficiaries to opt out, and tendencies of collective rights organizations to license potential substitutes). However, it may make sense to retain a liability rule when whole, integral data sets or other data tools are used to develop downstream commercial applications. *See infra* text accompanying notes 429–44.

the three-step test only reinforces the express mandate to pay equitable compensation for so-called private uses mandated by Article 5(2)(b) of the InfoSoc Directive, and vice versa.[188] Taken together, Articles 5(2), 5(3), and 5(5) of the Directive cumulatively discourage, rather than enable, free access and reuse of published scientific information and data by the public research community, even though such research is normally funded by governments or other public entities and made available by researchers to advance knowledge (and their reputational interests), but not for financial gain.[189]

All the rigidity and uncertainty inherent in the provisions analyzed above are further compounded by the absence of any true fair use provision in the relevant international treaties,[190] in the InfoSoc Directive, or in the domestic copyright laws of the European Union.[191] Besides enabling courts to infuse greater "play in the joints" to facilitate scientific research, as explained above,[192] an explicit fair use provision in international or regional instruments could induce both courts and legislatures to give more weight to Articles 7 and 8 of the TRIPS Agreement, which expressly promote the public-interest goals of copyright law,[193] and to the express provision favoring scientific research and education in the preamble to the WCT itself.[194]

Lacking any such fair use provision, some European courts concerned about excesses of copyright protection have recently felt obliged to invoke human rights, especially constitutionally protected fundamental rights to free speech, as counterweights.[195] But such well-intentioned judicial ploys introduce

188. *See* InfoSoc Directive, *supra* note 72, arts. 5(2), 5(3), 5(5); *supra* text accompanying notes 83–86.

189. *See infra* text accompanying notes 519–31. Arguably, there is no obvious or logical reason to treat such scientific research any differently from traditional and directly funded government publications that are, at least in the United States, statutorily foreclosed from copyright's reach. *See* 17 U.S.C. § 105 (2006).

190. Okediji, *supra* note 54, at 525–28, 538–40 (arguing that the current European Union copyright regime suffers from both uncertainty and rigidity).

191. *See* Senftleben, *supra* note 48, at 524–25.

192. *See supra* text accompanying notes 174–83.

193. *See* TRIPS Agreement, *supra* note 20, art. 7 (objectives); *id.* art. 8 (principles); Peter K. Yu, *The Objectives and Principles of the TRIPS Agreement*, 46 HOUS. L. REV. 979, 981, 1028 (2009).

194. WCT, *supra* note 42, pmbl.

195. *See, e.g.*, Geller, *supra* note 50 (discussing German judicial decisions that broadened the infringement analysis as well as the exception for quotations to assure constitutionally protected freedom of expression); Peltz, *supra* note 169, at 282–83 (2009) (summarizing cases); *cf.* Lea Shaver, *The Right to*

significant uncertainty into an already complicated legal scenario,[196] and they could destabilize even well-settled principles of copyright law without directly addressing the needs of scientific researchers as such. One virtue of the fair use provision in U.S. copyright law is precisely its ability to foster a penumbra in which public good uses of protected matter may occur within copyright law itself,[197] while blunting the temptation to reach for more fundamental or constitutional justifications that could produce unintended destabilizing effects.[198]

Given these premises, any limitations favoring scientific research that do manage to emerge from the InfoSoc Directive as applied by the domestic laws of European Union member states will likely remain unmanageable and unpredictable for the foreseeable future. Hence, recent proposals to reform the three-step test itself have attracted considerable attention from scholars concerned about the prospects for digitally integrated research methods, as will be discussed below.[199]

Short of that, the ineluctable conclusion that emerges from this analysis is that researchers in general, and digitally empowered scientists in particular, will face the dismal prospects of choosing either to desist from pursuing promising research projects, with enormous opportunity costs, or to carry on in the knowledge that they are likely to infringe copyright laws at

Science and Culture, 2010 WIS. L. REV. 121, 169–84 (proposing a copyright regime that promotes universal access and author interests, in light of a conflict between intellectual property rights and a human right of access to science and culture).

196. Ruth Okediji, *The Limits of Development Strategies at the Intersection of Intellectual Property and Human Rights*, *in* INTELLECTUAL PROPERTY, TRADE & DEVELOPMENT: STRATEGIES TO OPTIMIZE ECONOMIC DEVELOPMENT IN A TRIPS-PLUS ERA 355, 367–73 (Daniel J. Gervais ed., 2007). The major human rights declarations expressly acknowledge the rights of authors as human rights that need to be reconciled with other fundamental rights. *See* LAURENCE R. HELFER & GRAEME W. AUSTIN, HUMAN RIGHTS AND INTELLECTUAL PROPERTY: MAPPING THE GLOBAL INTERFACE 53–56 (2011) (listing significant human rights declarations).

197. Okediji, *supra* note 196, at 355–84.

198. *See* Eldred v. Ashcroft, 537 U.S. 186, 219–20 (2003) (viewing the protection of free speech interests as embedded in the fair use doctrine). *But see* DAVID L. LANGE & H. JEFFERSON POWELL, NO LAW: INTELLECTUAL PROPERTY IN THE IMAGE OF AN ABSOLUTE FIRST AMENDMENT 305–24 (2009) (asserting the need for recourse to fundamental rights in order to curb recent excesses of copyright protection); Shaver, *supra* note 195, at 169–83 (advocating greater reliance on the basic human right of access to science and culture in rebalancing international intellectual property rights).

199. *See* discussion *infra* Part II.D.1.

every turn.[200] Needless to say, this choice becomes even starker when the European Union's database-protection laws are factored into the equation.[201]

b. Limits of the Fair Use Approach

At least in theory, the fair use exception enables courts to address fact patterns that legislators did not, or could not, have foreseen at the time any given copyright law was enacted. This property helps to keep needed responses to public interest priorities up to date without recurring amendments to existing statutes. In this capacity, fair use buttresses both the idea-expression principle (now codified in the TRIPS Agreement)[202] and constitutionally protected free speech in the United States, which in itself tends to favor access to published scientific research as a purveyor of unprotected facts and discoveries.[203] To this end, the preamble to § 107 of the U.S. Copyright Act of 1976 explicitly recognizes scientific research as a privileged subcategory within the general fair use framework.[204]

200. *Cf.* TEHRANIAN, *supra* note 27, at 5–14 (stressing the delegitimization of copyright law that results from analogous situations).

201. *See infra* Parts II.B.1.a&b.

202. TRIPS Agreement, *supra* note 20, art. 9.2.

203. The well-known function of fair use to preserve a buffer zone between infringement and free speech in the United States has its limits, however, and the expansion of copyright law's length and strength in the past thirty years has elicited a growing challenge from First Amendment scholars. *See, e.g.*, LANGE & POWELL, *supra* note 198, at 305–24; Eric Allen Engle, *When Is Fair Use Fair?: A Comparison of E.U. and U.S. Intellectual Property Law*, 15 TRANSNAT'L LAW. 187, 209 (2002) (describing tension between First Amendment to the U.S. Constitution and copyright law); Neil Weinstock Netanel, *Asserting Copyright's Democratic Principles in the Global Arena*, 51 VAND. L. REV. 217 *passim* (1998) (arguing that "copyright law serves fundamentally to underwrite a democratic culture"); Neil Weinstock Netanel, *Locating Copyright within the First Amendment Skein*, 54 STAN. L. REV. 1, 7 (2001) ("Copyright's speech encumbrance cuts a wide swath, chilling core political speech such as news reporting and political commentary, as well as church dissent, historical scholarship, cultural critique, artistic expression, and quotidian entertainment.") (footnotes omitted)); Melville Nimmer, *Does Copyright Abridge the First Amendment Guarantees of Free Speech and Press?*, 17 UCLA L. REV. 1180 (1970). Unless more attention is given to users' needs, this trend could eventually boomerang against both publishers and authors who depend on copyright protection in far less sensitive areas than scientific research.

204. *See* 17 U.S.C. § 107 (2006) ("[T]he fair use of a copyrighted work . . . for purposes such as . . . teaching (including multiple copies for classroom use), scholarship, or research, is not an infringement of copyright.").

i. Inherent Methodological Uncertainties

Nevertheless, whenever any given scientific work becomes the subject of a litigated fair use enquiry, courts must move beyond the preamble and subject it to the four "balancing subtests" codified in § 107, as previously described.[205] On the whole, the four-step test of U.S. fair use law accommodated conventional scientific research methods fairly well in the past, especially in view of the proresearch bias specified in the preamble. With few exceptions, uses for scientific research were usually permitted,[206] and this tradition played some of the role that a private use exception had performed in Europe.[207]

To the extent that photocopying became a problem for the case-by-case approach of § 107, industry-wide rules governing library photocopying were negotiated and codified in § 108 of the Copyright Act of 1976.[208] Under these provisions, neither students nor researchers are normally charged for library copies made for even large research projects (unlike the situation in the European Union), although charges will apply to copies made for classroom distribution, usually under blanket licenses from a collection society known as the Copyright Clearance Center.[209]

Occasionally, the federal appellate courts have rendered decisions circumscribing the reach of fair use even with regard to conventional scientific research methods.[210] But these cases usually turned on the inherently unstable line between com-

205. *See id*.

206. *See, e.g.*, Williams & Wilkins Co. v. United States, 487 F.2d 1345 (Ct. Cl. 1973), *aff'd without opinion by an equally divided court* 420 U.S. 376 (1975). For efforts to enact an international treaty governing worldwide library practices and needs, see INT'L FED'N OF LIBRARY ASS'NS & INSTS., TREATY PROPOSAL ON LIMITATIONS AND EXCEPTIONS FOR LIBRARIES AND ARCHIVES (2011), *available at* http://www.ifla.org/files/hq/topics/exceptions-limitations/documents/TLIB_v4.1.pdf.

207. *See supra* notes 63–70 and accompanying text.

208. 17 U.S.C. § 108 (2006).

209. Molly Shaffer Van Houweling, *Author Autonomy and Atomism in Copyright Law*, 96 VA. L. REV. 549, 637 (2010) (describing the Copyright Clearance Center, which provides licenses allowing individuals to reproduce works that are listed with the CCC).

210. Princeton Univ. Press v. Mich. Document Servs., Inc., 99 F.3d 1381, 1386–88 (6th Cir. 1996) (holding that copy shop that sold coursepacks to university students without paying fees or royalties was not fair use). *See generally* U.S. COPYRIGHT OFFICE, REPRODUCTION OF COPYRIGHTED WORKS BY EDUCATORS AND LIBRARIANS (2009), *available at* http://www.copyright.gov/circs/circ21.pdf (explaining the judicial doctrine of fair use and when it applies in a particular case).

mercial and noncommercial research purposes and on the growing ability of technological measures to overcome preexisting market failures.[211] For example, researchers at a petroleum company were obliged to pay for additional copies of back-dated scientific articles available from a collection society, despite their subscription to the journal in question.[212]

However, subsequent jurisprudence—especially at the federal appellate level—may correct questionable decisions. The very dependence of the fair use doctrine on unique sets of facts makes it relatively easy for later courts to ignore the appearance of *stare decisis* by relying on subtle distinctions in the underlying fact patterns.[213] This adds to the overall flexibility of the U.S. approach.

Critics of the fair use doctrine tend to emphasize the relative uncertainty likely to attend any new fact pattern[214] and the high transaction costs arising from the need to litigate close cases.[215] Both objections have some merit but are easily overstated.[216] The fair use doctrine cannot intrinsically claim the kind of legal certainty apologists for the positivist approach demand, disregarding their failures to achieve it in practice.[217] Because fair use decisions are always fact-specific, attorneys can only base their predictions on general categories of fair use

211. *See, e.g.*, *Princeton Univ. Press*, 99 F.3d at 1385–86; Am. Geophysical Union v. Texaco, Inc., 60 F.3d 913, 918–25 (2d Cir. 1994).

212. *Am. Geophysical Union*, 60 F.3d at 915, 931–32.

213. *Compare, e.g.*, Rogers v. Koons, 960 F.2d 301, 309–12 (2d Cir. 1992) (denying fair use for a sculptor who made a sculpture based on artist's photograph, where the sculptor specified that the sculpture had to be "just like the photo"), *with* Blanch v. Koons, 467 F.3d 244, 251–54 (2d Cir. 2006) (finding reproduction of photographic image by a painter as "transformative," because the painter had a new purpose in using the image which altered the original image's character, thus satisfying requirements for fair use).

214. *See, e.g.*, David Nimmer, *"Fairest of Them All" and Other Fairy Tales of Fair Use*, 66 LAW & CONTEMP. PROBS. 263, 287 (2003); *see also* BURRELL & COLEMAN, *supra* note 176, at 249–53 (citing authorities and stressing the risk of hostile judicial attitudes); Okediji, *supra* note 51, at 157 (discussing the problems associated with raising a fair use defense, such as a lack of financial resources for litigation).

215. *See* Samuelson, *supra* note 54, at 2540–41.

216. *See* Beebe, *supra* note 35, at 575–76 (evaluating fair use win rates and litigation costs); Neil Weinstock Netanel, *Making Sense of Fair Use*, 15 LEWIS & CLARK L. REV. 715, 733–34 (2011) (discussing perceptions about the fair use doctrine); Samuelson, *supra* note 54, at 2540–41 (arguing that the fair use doctrine is more predictable than critics suggest).

217. *See, e.g.*, Senftleben, *supra* note 48, at 527–28 (discussing the invalidity of counterarguments against the fair use doctrine that criticize its lack of legal certainty).

as established by the precedents.[218] Yet, as scholars have shown, when cases are bundled within specified subject-matter categories, patterns of stability and predictability emerge.[219]

Admittedly, any preexisting set of fair use precedents may be enhanced or narrowed by the judicial *zeitgeist* prevailing at the time. This observation holds particularly true for swings in the judicial pendulum from a more proproperty rights outlook to a more procompetition outlook, and back again, as routinely occurs in U.S. intellectual property jurisprudence.[220] Care must accordingly be taken when predicting a future outcome on a past set of precedents to allow for shifts in the underlying trends, especially with regard to federal appellate and Supreme Court decisions.[221] For example, some important older precedents lost their relative weight in the late 1980s when the market failure approach temporarily squeezed other normative considerations out of the fair use equation.[222] But, as we noted earlier, that trend itself has given way to the rebirth of a so-called transformative use doctrine[223] and its aggressive extension in recent decisions to search engines.[224]

At least two commentators who dislike the uncertainty as-

218. Beebe, *supra* note 35, at 575–81.

219. Samuelson, *supra* note 54, at 2541; *see also* Netanel, *supra* note 216, at 736–59 (discussing the patterns and probability of a favorable finding in fair use cases). *See generally* Michael J. Madison, *Beyond Creativity: Copyright as Knowledge Law*, 12 VAND. J. ENT. & TECH. L. 817 (2010) (discussing the relationship between copyright and creativity).

220. *Cf.* Jerome H. Reichman & Rochelle Cooper Dreyfuss, *Harmonization Without Consensus: Critical Reflections on Drafting a Substantive Patent Law Treaty*, 57 DUKE L.J. 85, 107–22 (2007) (discussing shifts in judicial attitudes to patents). These shifts, when they occur, can invite a more than customary degree of forum shopping.

221. *Cf.* Gordon, *supra* note 110, at 1646–57 (providing case studies of two Supreme Court decisions affecting fair use).

222. *Cf. id.* (disavowing the judicial response to the fair use doctrine in several Supreme Court decisions and discussing flaws in the Court's reasoning).

223. *See* Campbell v. Acuff-Rose Music, Inc., 510 U.S. 569, 578–79 (1994).

224. *See* Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1160–61 (9th Cir. 2007) (finding that operator's display of thumbnail images of copyright owner's photographs was fair use); Kelly v. Arriba Soft Corp., 336 F.3d 811, 822 (9th Cir. 2003) (holding that search engine operator's use of owner's images as "thumbnails" in its search engine qualified as fair use); *see also* Field v. Google Inc., 412 F. Supp. 2d 1106, 1111 (D. Nev. 2006) (finding fair use in Google search engine's use of cached snapshots of websites). Contrast the situation in the European Union, where some member states, under the positivist approach, have declined to consider digital developments as a basis for a more flexible approach to the enumerated lists of exceptions contained in their copyright legislation. *See* Senftleben, *supra* note 48, at 550–52 (explaining the European Union approach to copyright limitations).

sociated with fair use have expressed appreciation for a "public interest" criterion instead.[225] Yet, that criterion harbors a considerable degree of ambiguity all its own (given that copyright law itself expresses one facet of the public interest).[226] Besides, as earlier noted, the federal appellate courts in the United States almost invariably invoke an uncodified public interest criterion when evaluating the express normative factors set out in § 107 of the 1976 Copyright Act.[227] Where science is concerned, moreover, both the public interest criterion and the normative criteria of § 107 should typically favor use and reuse of research results in close cases concerning research methods.

A more troubling source of uncertainty arises from the tendency of U.S.-style fair use decisions to operate under an all-or-nothing premise that the challenged use must either infringe or not infringe, in which case noninfringing uses imply no corresponding compensatory burden.[228] This practice leads some courts to hand down vacillating decisions depending on how they evaluate the appearance of free riding in fact specific situations.[229]

In this respect, the three-step test embodied in the TRIPS Agreement has something to teach U.S. courts and policymakers.[230] As acknowledged by a WTO tribunal, the legislative history concerning this test may allow equitable compensation—a "take and pay" rule—to resolve hard cases where more than a

225. *See* BURRELL & COLEMAN, *supra* note 176, at 80–111, 249–74, 287–88.

226. Fogerty v. Fantasy, Inc., 510 U.S. 517, 526 (1994) ("We have often recognized the monopoly privileges that Congress has authorized, while 'intended to motivate the creative activity of authors and inventors by the provision of a special reward,' are limited in nature and must ultimately serve the public good." (citations omitted)); Iowa State Univ. Research Found., Inc. v. Am. Broad. Cos., 621 F.2d 57, 61 (2d Cir. 1980) (emphasizing that copyright law itself promotes the public interest).

227. Sometimes this criterion can be carried very far. *See, e.g.*, Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 454–56 (1984) (concluding that time-shifting of commercial television programs promoted the public interest for fair use purposes, despite abundant evidence that most off-air reproductions were not motivated by time-shifting needs); *see also* Gordon, *supra* note 110, at 1624–25 (stating that a defendant must prove the nature of the public interest served by his or her use).

228. *See* Reichman, "Marching to a Three-Step Tune," *supra* note 105; Orit Fischman Afori, *Flexible Remedies as a Means to Counteract Failures in Copyright Law*, 29 CARDOZO ARTS & ENT. L.J. 1, 6 (2011).

229. *See* Afori, *supra* note 228 at 5–99.

230. TRIPS Agreement, *supra* note 20, art. 13 ("Members shall confine limitations or exceptions to exclusive rights to certain special cases which do not conflict with a normal exploitation of the work and do not unreasonably prejudice the legitimate interests of the right holder.").

little was taken for a particularly valid public purpose.[231] United States fair use law might benefit from this additional element of flexibility in close cases, even as European Union law needs the flexibility of fair use, a topic to which we shall return below.[232]

These very sources of uncertainty can, in turn, exert a restraining effect on both publishers and would-be users of copyrighted works, depending on the facts at issue in any given case. While scientific entities must be wary of engaging in litigation that could issue in an adverse precedent for future research prospects, publishers must be equally wary of challenges to the status quo that may further abridge the scope of yesterday's exclusive rights. This inherent burden of reciprocal uncertainty tends to reduce transaction costs over time by discouraging overly adventurous fair use challenges as potentially too costly for either side.[233]

In this standoff, much fair use occurs by default, although a threat of future litigation acts sometimes as a sword of Damocles. If scientists are frequently wholesale infringers even with respect to conventional research methods, in the sense that they refuse to allow unreasonable or obsolete laws to obstruct customary or necessary research and teaching practices, rights holders have traditionally been reluctant to sue their sources of publication (often their customers as well) in cases where damages appeared modest at best.[234]

Nevertheless, the high costs of litigation, combined with recent extraordinary statutory damages awards,[235] may at times deter would-be users from pursuing even meritorious disputes that ought to enable courts to clarify the proper boundaries of a fair use exception.[236] Users may thus find themselves unable to defend their legitimate rights unless

231. *See supra* notes 136–38 and accompanying text.

232. *See infra* Part III.B.1 (discussing efforts for copyright reform in the European Union).

233. *Accord* Afori, *supra* note 228, at 9–10 (agreeing that uncertainties in the U.S. copyright approach can create disincentives to litigate).

234. We are grateful to Paul Uhlir for this insight.

235. *See* Pamela Samuelson et al., *The Copyright Principles Project: Directions for Reform*, 25 BERKELEY TECH. L.J. 1175, 1196 (2010) ("[W]e are troubled that statutory damage awards sometimes appear arbitrary or grossly excessive in comparison with a realistic assessment of actual damages incurred."); Michael Traynor & Katy Hutchinson, *Some Open Questions about Intellectual Property Remedies,*14 LEWIS & CLARK L. REV. 453, 458–59, 459 n.35 (2010) (summarizing damage awards in copyright infringement cases).

236. Afori, *supra* note 228, at 2–3.

some larger nonprofit entities can be found to finance the campaign and absorb its potential costs if the cause is lost. The power of publishers' cease-and-desist letters in this regard adds to this potential *in terrorem* effect by warning that certain cases will lead to high legal transaction costs regardless of the merits.[237] At the moment, there is no expeditious, low-cost means of testing a fair use defense without incurring such litigation costs, although several proposals to remedy this defect have been put forward.[238]

ii. Outer Limits of the Case-by-Case Approach

None of these considerations addresses the deeper problems that render the fair use doctrine of little use to practitioners of the digitally empowered, computerized research techniques of primary concern in this Article. The systematic need that researchers, as users of automated knowledge discovery tools, have to survey vast or, indeed, unlimited amounts of literature and data in virtually every contemporary, large-scale scientific investigation, particularly in the life sciences, overwhelms the boundaries set by the four-step test of § 107 and increasingly makes a mockery of the very concept of fair use.

Consider, for example, that the implicit purpose of the substantiality test set out in § 107(3) is to ensure that fair use reproductions of a protected text will be quantitatively and qualitatively reasonable in relation to the work as a whole. In no area, not even parody,[239] can this provision be interpreted to permit wholesale reproduction (as technically defined) of every relevant text in every relevant case, which routinely occurs in computational science or in any scientific research project where automated knowledge discovery tools are employed.[240]

237. Mark A. Lemley & Eugene Volokh, *Freedom of Speech and Injunctions in Intellectual Property Cases*, 48 DUKE L.J. 147, 241–42 (1998) (arguing that preliminary injunctions should be available when there is a high probability of success on the merits).

238. Emily Meyers, *Art on Ice: The Chilling Effect of Copyright on Artistic Expression*, 30 COLUM. J.L. & ARTS 219, 220 (2007) (proposing system to allow exploitation of existing work so long as user does "not unreasonably commercialize or in any way merchandize her work without the consent of the appropriated work's copyright owner").

239. *But* s*ee, e.g.*, Campbell v. Acuff-Rose Music, Inc., 510 U.S. 569, 593–94 (1994) (holding that entire song may be considered a parody under fair use); Elsmere Music, Inc. v. Nat'l Broad. Co., 482 F. Supp. 741, 746–47 (S.D.N.Y. 1980) (holding that television show "Saturday Night Live" parody of the song "I Love Sodom" to the tune of "I Love New York" constituted fair use).

240. Robert C. Denicola, *Copyright in Collections of Facts: A Theory for the*

By the same token, the market-harm test of § 107(4)[241] becomes drained of precedential meaning if the scientific texts thus scrutinized were published to serve both the research needs of the scientific community and the commercial interests of publishers.

Professor Matthew Sag's brilliant article on copy-reliant technologies[242] sheds considerable light on this conflict of interest. His efforts to reconcile the search engine cases with prior decisions concerning transformative uses of copyrighted works under § 107(1) leads him to posit that nonexpressive, nonsubstitutional uses, in conjunction with copy-reliant technologies, should normally qualify as fair uses across the board, especially if the technologies in question were geared to recognize and implement an opt-in clause.[243] When this intriguing proposition is applied to digitally integrated scientific research methods, however, it reveals a number of key differentiating factors.

For example, one must immediately confront the possibility that, from a rights holders' perspective at least, massive copying of published research articles to generate further research by means of automated knowledge discovery tools colorably represents both a substitutional and an expressive use of those same articles. Even if that were precisely what scientists *qua* authors most dearly desired in their relentless pursuit of reputational benefits, *gratis* fair use on this scale is hardly consistent with the aims of commercial science publishers.[244]

If only scientific researchers were involved as both creators and users of their own published outputs, then Professor Sag's default formula for fair uses in regard to copy-reliant technologies could significantly improve the research community's technical legal position, especially if it were underpinned with an opt out, rather than an opt in default condition. Scientists inclined to opt out of such a voluntary pool would immediately incur countervailing peer pressure and perhaps risk jeopardiz-

Protection of Nonfiction Literary Works, 81 COLUM. L. REV. 516, 536 (1981).

241. 17 U.S.C. § 107(4) (2006) (stating that a factor to be considered in determining fair use is "the effect of the use upon the potential market for or value of the copyrighted work").

242. *See* Sag, *supra* note 2.

243. *See id*. at 1675–82.

244. *See, e.g.*, Letter from Michael Mabe, CEO, Int'l Assoc. of Scientific, Technical & Med. Publishers, to Copyright Review, Dep't. of Jobs, Enterprise and Innovation, Dublin, Ireland (July 14, 2011) [hereinafter Letter from STM] ("Consultation on the Review of the Copyright and Related Rights Act 2000") (strongly opposing fair use).

ing future grants to boot. If, instead, scientists constitute the market for published scientific research, and if that published research cannot be freely and digitally perused without impermissible market harm to publishers, then automated research tools risk becoming instruments of massive and systematic infringement, which no transformative use doctrine could excuse if publishers' customary interests are to be preserved.

That, indeed, poses one of the fundamental questions raised by our present enquiry, namely, should scientific publishers' customary interests be preserved at the expense of scientists' need for wholesale access to, and reuse of, the exploding universe of published scientific literature and data? That question, in turn, raises ancillary questions about what added-value the scientific community obtains from its traditional reliance on external, for-profit publishers, and what the opportunity costs would be if the scientific communities were to break that tie to the publishing industry. These and related questions will be more directly addressed in the final Part of this Article.[245]

For present purposes, what seems undeniable is that the case-by-case approach of the fair use doctrine is currently overwhelmed by the magnitude and scope of copying necessitated by today's digitally empowered research techniques.[246] A proper response to this challenge could require at least industry-wide negotiations and settlements, like those between research libraries and publishers that gave rise to § 108 of the 1976 Act.[247] At best, new institutional arrangements would redefine (or eliminate) publishers' interests in order to satisfy the scientific community's need for open access to publicly funded research results in any form they were made available to the public.[248] Between these two poles, some possible incremental legislative reforms are skeptically examined below.

As matters stand, however, it is the publishers' lobby that has driven copyright law and policy with regard to science since the 1990s.[249] Rather than supporting the needs of digitally integrated scientific research, publishers have managed to sur-

245. *See infra* Part III.

246. *See* Timothy K. Armstrong, *Digital Rights Management and the Process of Fair Use*, 20 HARV. J.L. & TECH. 49, 60–62 (2006) (discussing contemporary copyright after the advent of new technologies).

247. Jessica D. Litman, *Copyright, Compromise, and Legislative History*, 72 CORNELL L. REV. 857, 869–79 (1987).

248. *See infra* Part III.

249. *See* Armstrong, *supra* note 246, at 56–57.

round scientific information and data transmitted online with legally impenetrable electronic fences and with codified database protection laws that threaten the very foundations of contemporary scientific methodology, as explained in the next two Sections.

2. The *Coup de Grâce*: Digital Locks and Database Protection Laws

A growing number of scientific journals are now published online, without distribution in print copies at all.[250] Once digitally transmitted online, researchers anywhere can, in principle, locate, analyze, and disaggregate any collection of scientific information and data that has been made available to the public, subject only to the prevailing default rules of applicable intellectual property laws and to the contractual restrictions that publishers or providers may otherwise impose.

Even when a journal continues to be published in print copies, the articles it contains, along with the supporting data, may often be made available online for the convenience of later scientific researchers.[251] Although, in principle, these developments greatly facilitate the traditional sharing norms of science, researchers can legally convert analog contents to digital formats only if they remain within the confines of the limitations and exceptions to the reproduction rights discussed above. Under the European Union's InfoSoc Directive, this process could be prohibitively expensive, as we have seen. Even under the U.S. fair use provision, such quantitatively large amounts of copying for research purposes could result in publishers' demands for additional compensation, not to mention the costs associated with the copying itself.

Regarding access to and use of information and data made directly available online, whether or not initially published in hard copies, researchers have discovered that virtually none of the proscience measures of copyright law that still survive in print media apply to works transmitted through telecommunication networks.[252] The digital revolution that created such promising opportunities for scientific research also generated

250. *See, e.g.*, Paul Uhlir, *Designing the Digital Commons in Microbiology—Moving from Restrictive Dissemination of Publicly Funded Knowledge to Open Knowledge Environments: A Case Study in Microbiology*, *in* DESIGNING THE MICROBIAL RESEARCH COMMONS, *supra* note 12, at 77, 79.

251. *See id.* at 80 (providing empirical data and citing authorities).

252. *See, e.g.*, Reichman & Uhlir, *supra* note 2, at 383–84.

intense fears that publishers would become vulnerable to massive infringements online and to other threats of market failure.[253] In response, publishers persuaded legislatures to recast and restructure copyright law in the online environment so as to preserve business models built around the print media.[254]

These new laws make it difficult to trigger preexisting limitations and exceptions in the online environment, including those favorable to science;[255] and they enable publishers to embed pay-per-use machinery among other restrictions into electronic fences surrounding online transmissions of scientific articles.[256] The most fundamental postulates of so-called users' rights, such as the idea-expression dichotomy or fair use in the United States, may thus be entirely overridden by a combination of technical protection measures (TPMs), statutory cutbacks, and contractually imposed restrictions rooted in these same provisions.[257] In the European Union, moreover, sui generis database protection laws, mandated by the European Commission in 1996, further restricted access to the very facts and data that are the lifeblood of basic scientific research.[258]

253. *See id.* at 317–21 (discussing the effects of the digital revolution on copyright infringement).

254. *See* Pamela Samuelson, *The U.S. Digital Agenda at WIPO*, 37 VA. J. INT'L L. 369, 374–75 (1997).

255. *See, e.g.*, Victoria Stodden, *Enabling Reproducible Research: Licensing for Scientific Innovation*, 13 INT'L J. COMM. L. & POL'Y 1, 12–24 (2009) (discussing the impediments to reuse of scientific work).

256. *See* 17 U.S.C. §§ 1201–1205 (2006) (providing for electronic fences and digital rights management systems); InfoSoc Directive, *supra* note 72, art. 6 (providing obligations of member states regarding circumvention of technological measures); Jessica Litman, *The Exclusive Right to Read*, 13 CARDOZO ARTS & ENT. L.J. 29, 34–48 (1994) (discussing proposed changes to copyright law in the digital milieu and arguing the case for better protection of the public interest); Samuelson, *supra* note 254, at 371–96 (discussing the goals of the United States at the WIPO conference and the positions that technology companies took in objecting to treaty draft provisions).

257. *See generally* Reichman et al., *supra* note 170 (discussing safe harbors from copyright liability and anticircumvention rules for Internet service providers along with rules prohibiting circumvention of Technical Protection Measures (TPMs) used by copyright owners to argue that Congress did not adequately balance interests when establishing rules for TPMs). For the view that these measures replace a copyright system designed to serve the public interest with a "mere guild monopoly" like that of the Stationers' Company of London in the period 1556–1694, see Lunney, *supra* note 96, at 814–20.

258. *See* Database Directive, *supra* note 22, art. 7; J.H. Reichman & Paul F. Uhlir, *Database Protection at the Crossroads: Recent Developments and Their Impact on Science and Technology*, 14 BERKELEY TECH. L.J. 793, 802–20 (1999) (exploring the damaging impact that the sui generis regime will likely have on scientific research); J.H. Reichman & Pamela Samuelson, *Intellectual*

a. Virtual Elimination of Limitations and Exceptions Favoring Science in the Online Environment

The WIPO Copyright Treaty of 1996 (WCT),[259] which established new rules governing digital transmissions of copyrighted works, did not mandate the radical change of the legal infrastructure just described. On the contrary, the WCT reflects a relatively balanced compromise that resulted from the negotiations of stakeholder coalitions with fairly equal bargaining power on both the publishers and users' sides.[260] The preamble itself thus recognizes "the need to maintain a balance between the rights of authors and the larger public interest, particularly education, research and access to information."[261]

However, the WCT said nothing about how states should implement the anticircumvention norms that defend electronic fences surrounding works transmitted online so as to preserve public interest privileges and immunities. When the treaty was translated into the domestic laws of the United States and European Union, powerful publisher interests persuaded the respective legislatures largely to ignore or override the safeguard provisions otherwise available.[262]

In the Digital Millennium Copyright Act of 1998 (DMCA),[263] for example, the U.S. Congress conditioned the ability of third-party users to invoke public interest measures, such as the idea-expression dichotomy or fair use, on their having first gained lawful access to the work being transmitted

Property Rights in Data?, 50 VAND. L. REV. 52, 113–24 (1997) (explaining the implications of a sui generis regime for scientific research).

259. WCT, *supra* note 42.

260. The users' coalition was largely organized and managed by Professor Peter Jaszi, American University School of Law, Washington, D.C. *See* Reichman & Uhlir, *supra* note 258, at 810–28 (explaining the negotiations and proposals to resolve database protection issues).

261. WCT, *supra* note 42, pmbl.¶ 5. Similarly, the agreed statement to Article 10 permits contracting parties "to carry forward and appropriately extend into the digital environment" existing limitations and exceptions in their national laws and "to devise new exceptions and limitations that are appropriate in the digital network environment." WCT Agreed Statements, *supra* note 150 (concerning Article 10). Finally, the very Article 11 that imposed "obligations concerning technological [protection] measures" (TPMs), also expressly declared that such TPMs were not meant to "restrict acts in respect of [authors'] works, which are . . . permitted by law." WCT, *supra* note 42, art. 11.

262. *See* Reichman et al., *supra* note 170, at 983–85, 1059 (explaining that efforts to implement a balancing of interests in the United States and European Union copyright laws have been unsuccessful).

263. Digital Millennium Copyright Act, Pub. L. No. 105-304, 112 Stat. 2860 (1998).

online.[264] Yet, the moment a would-be user seeks to gain lawful access to the copyrighted work transmitted online, he or she will normally encounter one-sided electronic contracts of adhesion that strip away most or all of the public interest user rights nominally available from the domestic copyright law.[265] The DMCA thus arguably created a new exclusive "right of access" subject to virtually no preexisting privileges or immunities of interest to scientific users whatsoever.[266]

A similar state of affairs (with different nuances in different jurisdictions) arises in the European Union. Article 6 of the InfoSoc Directive of 2001 expressly enables domestic legislators to authorize Technical Protection Measures (TPMs) that curtail or override the preexisting limitations and exceptions otherwise available in the hard copy format.[267] Article 6(4) of the same Directive then piously admonishes member states "to ensure

264. 17 U.S.C. § 1201 (2006); *see also* Timothy K. Armstrong, *Digital Rights Management and the Process of Fair Use*, 20 HARV. J. L. & TECH. 49, 67–74 (2006) (discussing fair use and the DMCA). *See generally* Dan L. Burk & Julie E. Cohen, *Fair Use Infrastructure for Rights Management Systems*, 15 HARV. J.L. & TECH. 41 (2001) (evaluating legal and institutional infrastructures that could support a rights management system).

265. In effect, once the user is forced through an electronic gateway, the contract of adhesion becomes a privately legislated intellectual property right. *See* J.H. Reichman & Jonathan A. Franklin, *Privately Legislated Intellectual Property Rights: Reconciling Freedom of Contract with Public Good Uses of Information*, 147 U. PA. L. REV. 875, 897–914 (1999) (discussing adhesion contracts for digital technologies); *see also* Dan L. Burk, *Anticircumvention Misuse*, 50 UCLA L. REV. 1095, 1099–102 (2003) (explaining how copyright holders can use technological control systems to prevent access to digital content); Nima Darouian, *Accessing Truth: Marketplaces of Ideas in the Information Age*, 9 CARDOZO PUB. L. POL'Y & ETHICS J. 1, 26–46 (2010) (discussing adhesion contracts and virtual marketplaces).

266. Jane C. Ginsburg, *From Having Copies to Experiencing Works: The Development of an Access Right in U.S. Copyright Law*, 50 J. COPYRIGHT SOC'Y USA 113, 125 (2003); *see, e.g.*, Pamela Samuelson, *Intellectual Property and the Digital Economy: Why the Anti-Circumvention Regulations Need to be Revised*, 14 BERKELEY TECH. L.J. 519, 519–20 (1999) (arguing that the DMCA antidevice provisions are overbroad, unclear, and need to be revised). However, some recent cases have looked askance at this result, and Professors Reichman, Dinwoodie and Samuelson have demonstrated how these recent precedents could lead courts to a more balanced solution in the future. *See generally* Reichman et al., *supra* note 170 (discussing several recent cases that have challenged the boundaries of copyright protection for digital works).

267. InfoSoc Directive, *supra* note 72, art. 6. *See generally* Guido Westkamp, *Code, Copying, Competition: The Subversive Force of Para-Copyright and the Need for an Unfair Competition Based Reassessment of DRM Laws after INFOPAQ*, 58 J. COPYRIGHT SOC'Y USA 601, 627–43 (2011) (analyzing the aggregate effects of InfoSoc Directive, arts. 2, 5(1)–5(5), after the European Court of Justice's decision in *Infopaq Int'l A/S v. Danske Dagblades Forening*).

that right holders make available to the beneficiary of an exception or limitation provided for in national law . . . the means of benefiting from that exception or limitation."[268] In practice, however, the Directive provides member states with no legal basis for implementing the thrust of Article 6(4), and national legislation concerning TPMs so far tends to largely ignore Article 6(4) altogether, with a few exceptions.[269]

As a result, technological fencing devices, coupled with electronic contracts, known respectively as TPMs and Digital Rights Management tools (DRMs), enable publishers to automatically protect both data and information delivered through online networks without gaps in enforcement and without any traditional exceptions for science or other public interest purposes.[270] When these technological fences and electronic contracts are further supported by anti-circumvention measures that forbid decryption or other means of cutting through such fences,[271] the publisher's control becomes virtually absolute. Database protection laws enacted in the European Union can then make this absolute control virtually perpetual to boot.

b. Exclusive Rights in Noncopyrightable Collections of Data

Compilations of facts and data receive relatively thin protection from the copyright laws of both the United States and the European Union.[272] Under these laws, only a creative selection and arrangement of facts or data qualifies as eligible subject matter, and the disparate facts remain available for use by third-party compilers,[273] at least in principle, if not always in

268. InfoSoc Directive, *supra* note 72, art. 6(4).

269. For an exception, see, for example, Copyright and Related Rights Regulations, 2003, S.I. 2003/2498, art. 24, §§ 296(2), 296 ZD (2) (U.K.). For a more detailed discussion of ways to implement art. 6(4), see generally Reichman et al., *supra* note 170.

270. Reichman et al., *supra* note 170, at 982–87; Westkamp, *supra* note 267, at 675–77.

271. 17 U.S.C. § 1201(b) (2006).

272. Feist Publ'ns, Inc. v Rural Tel. Serv. Co., 499 U.S. 340, 349–50 (1991) (applying "thin" protection doctrine of functional works cases to factual compilations in general). For statutory support in the United States, see 17 U.S.C. § 101 (defining compilations); *id.*, § 103 (defining subject matter of eligible compilations). For the European Union, see Database Directive, *supra* note 22, Part I § 13 (dealing with harmonization of copyright rules applicable to eligible compilations of data).

273. *See supra* notes 39–41 and accompanying text; *see also* Key Publ'ns, Inc. v. Chinatown Today Publ'g Enters., Inc., 945 F.2d 509, 512–14 (2d Cir. 1991) (discussing the test for infringement of original works and compilations).

practice.[274] In a remarkable further development, the U.S. government managed to codify both the idea-expression dichotomy and the principle of limited protection for factual compilations, of crucial importance to science, in the TRIPS Agreement[275] and the WIPO Copyright Treaty.[276] Global copyright law thus, in effect, encourages states to protect so-called factual works against little more than wholesale duplication of an otherwise creatively organized compilation of facts or data, but not the underlying facts or data as such.

In 1996, however, when promulgating its Directive on the Legal Protection of Databases,[277] the European Commission took the unprecedented step of enacting a law that established exclusive rights in the very data that copyright laws had left freely available in the public domain.[278] Ostensibly motivated by the Commission's stated goal of increasing the European Union's share of the global market for directories and compilations in general,[279] which so far has proved unattainable,[280] this sui generis regime introduced radical new restrictions on access to and use of compilations of data that were previously unknown to any intellectual property paradigm.

274. *See supra* notes 39–41 and accompanying text.

275. TRIPS Agreement, *supra* note 20, arts. 9.2, 10.2.

276. WCT, *supra* note 42, arts. 3, 5. However, there is remarkably no mention of this same doctrine in the European Union's Infosoc Directive of 2001, notwithstanding the fact that the idea-expression doctrine has now been embodied at the multilateral level in both article 9.2 of the TRIPS Agreement and in article 10 of the WCT. For this and other reasons, some commentators express reservations about over-reliance on this doctrine as a buttress to limitations and exceptions under the best of circumstances. *See, e.g.*, BURRELL & COLEMAN, *supra* note 176, at 20–25.

277. *See* Database Directive, *supra* note 22, arts. 1–11.

278. *See id.*

279. A more realistic motivation arose from the backing of the world's largest publisher of scientific journals, with headquarters in the Netherlands, which spearheaded ultimately unsuccessful efforts to enact a similar law in the United States. Maria Canellopoulou-Bottis, *A Different Kind of War: Internet Databases and Legal Protection or How the Strict Intellectual Property Laws of the West Threaten the Developing Countries' Information Commons*, 2 INT'L J. INFO. ETHICS 1, 10 n.22 (2004), *available at* http://www.i-r-i-e.net/inhalt/002/ijie_002_07_canellopoulou.pdf (referring to Reed Elsevier's lobbying for database protection).

280. COMM'N OF THE EUROPEAN COMMUNITIES, FIRST EVALUATION OF DIRECTIVE 96/9/EC ON THE LEGAL PROTECTION OF DATABASES (2005) [hereinafter FIRST EVALUATION], *available at* http://ec.europa.eu/internal_market/copyright/docs/databases/evaluation_report_en.pdf; *see also* Elad Harison, *Who Owns Enterprise Information? Data Ownership Rights in Europe and the U.S.*, 47 INFO. & MGMT. 102, 102 (2010) (stating that the United States continues to dominate the database market).

For example, no element of originality or creativity is required to qualify for this form of protection.[281] Instead, the database laws are triggered by a "substantial investment" in obtaining, verifying, or presenting any given collection of facts and data; and unlike copyright or patent laws, the exclusive rights to extract or reuse the data in question protect that investment as such.[282] Despite its anomalously low threshold of eligibility, this regime arises automatically, as if it were part of the copyright infrastructure. It thus poses a direct threat to digitally integrated scientific research by endowing compilers of noncopyrightable collections of data with exclusive rights to extract and reuse the disparate data that their sweat-of-the-brow investment made available to the public.[283]

These exclusive rights to data are potentially stronger and more rigid than those of copyright law.[284] Formally, independent creation remains a perfect defense,[285] as it would under copyright law.[286] Realistically, however, independent generation of costly accumulations of scientific data is economically unfeasible, even when conceptually possible.[287] The Directive

281. Database Directive, *supra* note 22, art. 7(1).

282. *Id.*; *see, e.g.*, Daniel J. Gervais, *The Protection of Databases,* 82 CHI.-KENT L. REV. 1109, 1120 (2007) ("The Directive essentially does two things: it confirms the application of copyright to compilations of data and creates a non-copyright, *sui generis* right in databases to protect the investment of the database maker.").

283. Database Directive, *supra* note 22. For the rejection of sweat-of-the-brow protection of factual works in U.S. copyright law after a period of experimentation in that regard by some federal appellate courts, especially the Seventh Circuit, see generally Jane C. Ginsburg, *No "Sweat"? Copyright and Other Protection of Works of Information after* Feist v. Rural Telephone, 92 COLUM. L. REV. 338 (1992).

284. *See* J. H. Reichman, *Mondialisation et Propriété Intellectuelle: Database Protection in a Global Economy*, REVUE INTERNATIONALE DE DROIT ECONOMIQUE [INTERNATIONAL REVIEW OF ECONOMIC LAW] 455, 455–503 (2002) [hereinafter Reichman, *Database Protection in a Global Economy*] (discussing the evolution of intellectual property legislation and the issues relating to database protection and legislation). Until these laws were adopted, only the conduct-based liability rules of trade secrecy law were able to protect investment in know-how applied to industry. *See* J.H. Reichman, *How Trade Secrecy Law Generates a Natural Semicommons of Innovative Know-How*, *in* THE LAW AND THEORY OF TRADE SECRECY 185, 186–87 (Rochelle C. Dreyfuss & Katherine J. Strandburg eds., 2011).

285. Database Directive, *supra* note 22, § 15 (stating that independent creation of a database is sufficient for protection).

286. PAUL GOLDSTEIN, COPYRIGHT § 7.2.2 (2d ed. 1996) (stating that "conveying evidence" of independent creation constitutes a perfect defense to an action for copyright infringement).

287. Reichman & Uhlir, *supra* note 258, at 807 n.80, 814–15.

does allow a "small" amount of data to be taken without consequence, but courts have ensured that "small" means very small, and the Directive expressly prohibits repeated extractions of even small amounts of data from the same collection.[288]

Permissible exceptions to the database regime are paradoxically truncated when compared with those of copyright law.[289] With specific regard to the use of protected data for scientific research, the Directive allows states to adopt an exception couched in the same ambiguous language as that of the InfoSoc Directive of 2001, namely, "for the sole purpose of illustration for teaching or scientific research."[290] As in the InfoSoc Directive, this exception is not mandatory, and major countries such as France and Italy have ignored it.[291] Even when countries adopt this exception, it seems to enable only extractions for purposes of illustration, but not for reutilization of scientific data or information in other collections, which is the normal scientific practice.[292]

Once obtained, database protection nominally expires after fifteen years.[293] However, if the compilers make another substantial investment, say, by adding or updating new data to the preexisting collection, their efforts will renew the protection of the entire database for another fifteen-year period.[294]

In this respect, the sui generis database protection laws paradoxically provide stronger protection for derivative compi-

288. *See* Database Directive, *supra* note 22, arts. 6, 7(5), 8; British Horseracing Bd. Ltd. v. William Hill Org. Ltd., 2001 E.W.C.A Civ 1268, ¶¶ 29–48, 2001 WL 825162 (July 31, 2001) (finding that copying various pieces of information relating to British horseracing industry constituted extraction of a substantial part of the database, in addition to repeated extraction of insubstantial parts), *aff'd* Case C-203/02, 2004 E.C.R I-10415, ¶87.

289. *See, e.g.*, Miriam Bitton, *A New Outlook on the Economic Dimension of the Database Protection Debate*, 47 IDEA 93, 141–44, 150–53 (2006).

290. Database Directive, *supra* note 22, art. 6(2)(b); *see supra* notes 65–83 and accompanying text.

291. Reichman & Uhlir, *supra* note 258, at 803–04; Raquel Xalabarder, *Copyright Exceptions for Teaching Purposes in Europe* (Internet Interdisciplinary Inst., Working Paper WP04-004, 2004), *available at* http://www.uoc.edu/in3/dt/eng/20418/20418.pdf.

292. *See, e.g.*, ESTELLE DERCLAYE, THE LEGAL PROTECTION OF DATABASES: A COMPARATIVE ANALYSIS 129–33 (2008) (arguing that the exception is overly narrow and therefore over-protects database makers); *see also* Reichman & Samuelson, *supra* note 258, at 79.

293. Database Directive, *supra* note 22, art. 10(1).

294. *Id.* art. 10(3); *see also* Wesley L. Austin, *A Thoughtful and Practical Analysis of Database Protection under Copyright Law, and a Critique of* Sui Generis *Protection*, 3 J. TECH. L. & POL'Y 3,¶ 67 (1997).

lations than for derivative works obtained under traditional copyright laws. In the latter case, an original and creative derivative work receives copyright protection only for the eligible new matter added to the preexisting matter.[295] In the case of the data protection laws, where no originality at all is required for eligibility, any qualifying additional investment may renew the protection of the collection as a whole.[296] Perpetual protection thus becomes an attainable goal for the first time in the history of intellectual property laws (disregarding, of course, trademark laws, which operate on fundamentally different principles).[297]

In a series of recent decisions, the European Court of Justice (ECJ) has subsequently introduced an elusive subject-matter distinction between substantial investment for purposes of obtaining data that are *created* (presumably ineligible), and expenditures for purposes of obtaining data that are *collected* (i.e., developed and maintained in databases as such) and which presumably qualify for protection.[298] In other words, "only resources used to collect data that [are] already in existence" will qualify for database protection, but not "data compilations that are generated quasi 'automatically' as by-products of other activities."[299] To the extent that scientific databases are characterized as "created" under this slippery distinction, it might

295. 17 U.S.C. § 103 (2006); *see*, *e.g.*, Stewart v. Abend, 495 U.S. 207, 223–38 (1990) (finding that copyright protection extends only to the original content added to the derivative work); Waldman Pub. Corp. v. Landoll Inc., 43 F.3d 775 (2d Cir. 1994) (same).

296. *See* Database Directive, *supra* note 22, art. 10(3).

297. *See* Reichman & Samuelson, *supra* note 258, at 86 ("[A]ny publisher who continues to make a substantial investment in updating, improving, or expanding an existing database can look forward to perpetual protection.").

298. *See* Case C-46/02, Fixtures Mktg. Ltd. v. Oy Veikkaus Ab, 2004 E.C.R. I-10365, ¶49 (referred from Finland); Case C-338/02, Fixtures Mktg. Ltd. v. Svenska Spel AB, 2004 E.C.R. I-10497, ¶27 (referred from Sweden); Case C-203/02, British Horseracing Bd. Ltd. v. William Hill Org. Ltd., 2004 E.C.R. I-10415, ¶¶50–56 (referred from the United Kingdom); Case C-444/02, Fictures Mktg. Ltd. v. Organismos prognostikon anonon Podosfairou AE, 2004 E.C.R. I-10549, ¶27 (referred from Greece).

299. Ritch, *supra* note 37, at 127 (citing Directmedia Publ'g GmbH v. Albert-Ludwigs-Universitat Freiburg [2009] 1 C.M.L.R. 7 (ECJ 4th Chamber)); *see also* Mark J. Davison & P. Bernt Hugenholtz, *Football Fixtures, Horse Races and Spin-Offs: The ECJ Domesticates the Database Right,* 27 E.I.P.R. 113, 114 (2005) (stating that European Court of Justice discounts investments in collecting data that are indivisibly linked to their creation); Estelle Derclaye, *Databases Sui Generis Right: Should We Adopt the Spin Off Theory?*, 26 E.I.P.R. 402, 408–13 (2004) (finding that the database right should only protect investments that are directly attributable to producing a database).

conceivably reduce the total number of databases, particularly sole-source databases, eligible for protection.[300] Courts could, for example, exclude some collections of raw scientific data on these grounds.[301]

However, some commentators believe most scientific data are better characterized as collected and, therefore, automatically eligible for protection.[302] Even when scientific data are viewed as created, whatever this turns out to mean, entities seeking protection could always spend more money on verification or on improving the conditions of access to and posterior maintenance of the collection, which might have some scientific value even if undertaken for secondary motives. In other words, there is reason to believe that most collections of scientific data and information could be made to fit within these judicially contrived eligibility requirements by one means or another. If so, any collection of scientific data or information that did qualify would obtain broad and virtually endless protection against value-adding components of a future collection that made unauthorized use of an existing one.[303]

How the Database Directive actually affects science in any given country will then depend on a number of uncertain variables. In the United States, where the scientific community vigorously opposed enactment of database protection bills modeled on the European Union Directive,[304] only copyright law applies to compilations of data, although that law, as shown earlier, is much less science friendly today than in the past.[305] In European Union member states and affiliates, however, the sui generis database protection laws remain firmly in place de-

300. For the dangers of protecting sole source databases under this regime see, for example, Reichman & Samuelson, *supra* note 258, at 113–37.

301. *See* DERCLAYE, *supra* note 292, at 87–99 (arguing that there is no substantial investment in collecting, verifying or presenting raw scientific data such as event data, timetables, telephone subscriber data and the like).

302. *See, e.g.*, Davison & Hugenholtz, *supra* note 299, at 115–18 (arguing that when a large mass of collected data has been created, there are significant costs associated with presentation and verification which may meet the requirements of the Directive); *see also* Ritch, *supra* note 37, at 127.

303. *Cf.* DERCLAYE, *supra* note 292, at 255–67 (supporting the database protection regime generally, but strongly criticizing its treatment of science).

304. *See* Mark Davison, *Database Protection: Lessons From Europe, Congress, and WIPO*, 57 CASE W. RES. L. REV. 829, 853 (2007) ("In the United States, the lack of database protection and, in particular, its defeat in the Senate in 1998 was the direct product of the input of preexisting, institutionalized, funded, and Congressionally recognized scientific and educational lobby groups such as the National Research Council.").

305. *See supra* Part I.A.2.

spite serious criticism from within the European Union itself.[306] The European Commission has also made strenuous efforts to extend similar database regimes to developing and Least-Developed Countries through a series of regional and bilateral free trade agreements.[307]

The sui generis database protection laws in the European Union thus turn the relatively benign approach of traditional copyright law upside down. They not only protect the very aggregates of facts and data that international copyright law expressly left in the public domain, they confer potentially stronger and longer protection on these unoriginal compilations than copyright laws afford original works of authorship.[308]

Analogies drawn from the historical rhetoric promoting authors' rights, whatever one's view of them, were thus perversely applied to an investment-based scheme of protection governing the most fundamental building blocks of knowledge.[309] What the sui generis database laws actually codified instead was a scheme of powerful exclusive property rights that protect infinitely expansible collections of data from extraction and reuse, with a built-in propensity to favor the emergence of sole-source providers over time.[310] This regime conflicts head on with customary scientific research practices that long antedated the digital universe and the accelerated research opportunities it makes possible.[311]

306. *See* FIRST EVALUATION, *supra* note 280, at 11–27 (listing numerous criticisms of the Directive and proposals for change).

307. *See* Denise Rosemary Nicholson, *Intellectual Property: Benefit or Burden for Africa?*, 32 INT'L FED. LIBR. J. 310, 316 (2006), *available at* http://ifl.sagepub.com/content/32/4/310.full.pdf ("[T]he United States and European Union [free trade] Agreements contain a TRIPS-Plus Chapter, which far exceeds all current international obligations for all types of intellectual property.").

308. *See* Reichman, *Database Protection in a Global Economy*, *supra* note 284, at 463–67; *see also* Reichman & Uhlir, *supra* note 258, at 802–06.

309. Disregarding the impact of a powerful lobby, among other factors, see Craig R. Whitney, *European Union's Commission Is Revamped After a Scandal; A 'New Era' Is Promised*, N.Y. TIMES, July 10, 1999, at A6. The Commission responsible for elaborating the Database Directive completely failed to recognize or observe the systemic limits of the copyright paradigm. *Cf.* Denicola, *supra* note 240, at 518–41 (examining the scope of copyright protection available to writings and exploring the divergent and inconsistently applied rationales used to define property rights in factual works).

310. As correctly predicted by the German government, whose provision to allow compulsory licenses against sole-source providers was deleted, behind closed doors, by the Council of Ministers at the last moment, and without the approval of the European Parliament. *See* Reichman & Samuelson, *supra* note 258, at 86.

311. *See* David, *supra* note 25, at 19–33 (discussing the history and eco-

Nor should one suppose that the social costs of this dismal experiment, which cannot be repealed despite sweeping criticism from the Commission's own officially appointed reviewers, are confined to the some fifty-five countries that have adopted similar regimes at the behest of the European Communities.[312] Consider, instead, that because science is a global public good,[313] search engines and other digitally empowered research tools must transcend national borders in order to access all publicly available sources of data and information relevant to any given project. Standing in their way are all the formidable legal barriers rooted in the territorial copyright and database protection laws described above, which threaten to choke the transnational flow of upstream scientific data and information that would otherwise be capable of digital integration on a global scale.[314]

II. EMPOWERING DIGITALLY INTEGRATED SCIENTIFIC RESEARCH ON A GLOBAL SCALE

The foregoing analysis of the existing intellectual property framework portrays a set of rules and policies that are diametrically opposed to the needs of scientific researchers in a universe of discourse where automated knowledge discovery tools must freely explore the entire range of thematically relevant, digitally distributed literature and data.[315] Consider, for example, that the Wellcome Trust found that eighty-seven percent of

nomic logic of "open science"); Reichman & Uhlir, *supra* note 258, at 799–820 (discussing the potential impact of the database protection laws on science and technology); Paul A. David, *The Digital Technology Boomerang: New Intellectual Property Rights Threaten Global "Open Science"* 1–8 (Stanford Dept. of Econ., Working Paper No. 00-006, 2000), *available at* http://ideas.repec.org/p/wpa/wuwpdc/0502012.html.

312. *See* FIRST EVALUATION, *supra* note 280, at 11–27 (listing numerous criticisms of the Directive): *see also* HARGREAVES, *supra* note 26, at 19 ("The aim was to ensure the EU got a foothold in th[e] growing [database] sector at an early stage. The European Commission['s] . . . evaluation of the Directive in 2006 . . . found that EU database creation had declined since introduction of the Directive, whilst it had continued to rise in the US, undermining the rationale for the right in the first place. The EU Database Directive remains unchanged.").

313. *See generally* Stiglitz, *supra* note 24, at 65–115.

314. Paul Geller warns that the "interesting choice-of-law issues" are "[i]n practice, a mess—likely to intimidate house counsel for any research institution. Here we approach the bottom line, the chilling effect of the lack of a clear-cut exception with as global an application as possible . . . ." Letter from Paul Geller to Jerome Reichman (Oct. 30, 2011) (on file with authors).

315. *See supra* Introduction Section A.

the material housed in the United Kingdom's main medical research database (UK Pub Med Central) was unavailable for legal text and data mining.[316]

By the same token, a major independent study undertaken for the British Government reports that existing copyright laws make it virtually impossible to text mine about one thousand journal articles from the first half of the twentieth century that describe malaria in indigenous peoples and soldiers, as well as details of therapeutic measures available at that period.[317] Because of rights clearing requirements that appear out of all proportion to any benefit the rights holders could want, "even if they could be found," researchers cannot digitally index or text mine sources that offer potentially significant insights for the development of methods for preventing and treating malaria today.[318]

A. AUTOMATED KNOWLEDGE DISCOVERY TOOLS AS INSTRUMENTS OF MASSIVE INFRINGEMENT

Wittingly or unwittingly, these laws force scientific researchers to choose between ignoring an unmanageable and unreasonable set of legal constraints, in the interest of pursuing science as a public good, or foregoing research opportunities in order to avoid thickets of rights, burdensome transaction costs, and the fear of stirring up potential law suits down the line. The end result puts both science and the larger public interest in a no-win situation, at a time when the resources available to fund scientific research are shrinking.

If the relevant intellectual property laws were strictly enforced, and the scientific community continued to respect them, scarce public resources earmarked for basic research would be siphoned off to intermediaries from scientists seeking access to and use of their own published research results. In that event, the public pays twice for the same output, plus a surcharge for mushrooming transaction costs, while the "incipient transnational system of innovation," established by the TRIPS Agreement in 1996,[319] is progressively deprived of essential knowledge assets. Less innovation, not more, is the predictable result over time.

316. HARGREAVES, *supra* note 26, at 47.

317. *Id.* at 46.

318. *See* Hogarth Chambers, *The Hargreaves Review—Another Mixed Bag*, 33 E.I.P.R. 599, 600 (2011) (criticizing United Kingdom's copyright exceptions).

319. Maskus & Reichman, *supra* note 24, at 342.

Conversely, if intellectual property laws are ignored by researchers determined to carry on with their work irrespective of unreasonable legal constraints, automated knowledge discovery tools will have become transformed into engines of massive infringement.[320] It is hard to see how systematic disregard of intellectual property laws, coupled with growing contempt for the legislative process that fosters them,[321] will benefit authors, artists, and other creators in the long run, especially when those condemned to outlaw status are not free-riders on costly musical and cinematic productions, but publicly funded scientific researchers in pursuit of greater knowledge and applications that benefit humanity as a whole.

While the pressing need to reform the laws that have produced such anomalous results has not escaped notice,[322] efforts in this regard are confronted with a conflict between the interests of scientists, on the one hand, and those of publishers on the other. Scientists are authors whose primary interests in publication are the rewards of attribution and integrity—the so-called reputation benefits—that the moral rights of copyright laws, together with the norms of science itself, strive to protect.[323] These reputational benefits then serve to attract the kind of financing and status rewards attendant on academic success.[324] Given a conflict between the needs of scientific re-

320. *Cf.* Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd., 545 U.S. 913, 937–38 (2005) (stressing extent to which peer-to-peer music sharing schemes had become instruments of "massive infringement").

321. "Much of the data needed to develop empirical evidence on copyright . . . is privately held. It enters the public domain chiefly in the form of 'evidence' supporting the arguments of lobbyists ('lobbyonomists') rather than as independently verified research conclusions." HARGREAVES, *supra* note 26, at 18.

322. *See, e.g.*, *id.* at 11–27 (criticizing the InfoSoc Directive); Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 315–21 (citing problems with European copyright law); Hilty, *Five Lessons About Copyright*, *supra* note 2, at 109–38 (discussing the reaction of the scientific community to copyright over-protection).

323. In the United States, this is true at least in theory, if not in practice. For doubts about the appropriate level of moral rights enforcement in U.S. copyright law, see, for example, Roberta Rosenthal Kwall, *Originality in Context*, 44 HOUS. L. REV. 871, 874 (2007) ("Sound reasons may support confining the application of moral rights to a smaller category of works than are covered by copyright law.").

324. Scientists do have an interest in not sharing either research results or data until they can obtain these reputational benefits via publication. *See* Davis & Connolly, *supra* note 17 (finding that there is some reluctance among researches to use a repository if it could possibly jeopardize one's publication success); Jordan, *supra* note 17, at 82–85 (noting the importance of publication

search and the dictates of copyright and database laws, one can expect scientists normally to opt for the goals of research because their pecuniary interests lie elsewhere, and are, indeed, dependent upon the reputation benefits just described.[325]

In contrast, science publishers are the main pecuniary beneficiaries of the current state of the law, which they have lobbied hard to obtain, and they would resist any reforms likely to be put on the table.[326] This fact of life makes it logical to ask why the scientific community continues to rely and depend on publishing intermediaries in the first place. Disregarding the historical origins of such reliance, one feels compelled to ask whether the benefits of such reliance still outweigh the costs in today's digitally integrated, totally computerized research environment. No sensible scheme of reform can be devised without addressing these questions, and no specific proposals will make sense unless they are weighed against alternative options that result from such an enquiry.

B. THE LIMITS OF INCREMENTAL LEGISLATIVE REFORM TO ALLEVIATE OBSTACLES TO SCIENTIFIC RESEARCH

To the extent that publishers retain their traditional role as intermediaries, any efforts to reform applicable intellectual property laws must reconcile the needs of science with the needs of commercial publishers to turn a profit.[327] This factor greatly complicates the prospects for reform because the existing copyright and database laws so favor the interests of publishers over those of scientists that merely incremental or piecemeal reforms rooted in traditional exceptions and limita-

and priority for scientists).

325. *See* Jordan, *supra* note 17, at 82–85. This is often not the case with patents, where deeper conflicts of interest arise. *See* Reichman & Dreyfuss, *supra* note 220, at 107–22 (discussing shifts in attitudes towards patents).

326. *See* Statement by the Am. Chem. Soc'y, to the Comm. on the Impact of Copyright Policy on Innovation in the Digital Era 5–6 (Oct. 15, 2010), *available at* http://sites.nationalacademies.org/PGA/step/copyrightpolicy/index.htm (opposing sweeping policy changes that undermine peer reviewed publications); Letter from STM, *supra* note 244 (opposing proposals for a fair use exception); *see also* HARGREAVES, *supra* note 26, at 42 ("[C]opyright exceptions for educational purposes and for research are intended to promote knowledge, skills and innovation in the economy, without unduly undermining the incentive for educational and academic publishers to create the works that students, teachers and researchers need.").

327. *See, e.g.*, Julie E. Cohen, *Copyright as Property in the Post-Industrial Economy: A Research Agenda*, 2011 WIS. L. REV. 141, 142–44 (comparing author incentives to capital incentives).

tions are unlikely to give the research community what it needs.

A more promising approach might emerge if the scientific and publishing communities were to negotiate an industry-wide settlement that accommodated the research needs of one without sacrificing the commercial needs of the other. Arguably, one such example was the negotiated settlement between publishers and the library community with regard to photocopying, which replaced the case-by-case fair use approach in the United States with § 108 of the 1976 Copyright Act.[328] However, librarians have found this settlement unsuited to the digital age, and they are demanding widespread reforms requiring legislative enactments of limitations and exceptions that publishers strongly oppose.[329] The extraordinary powers that publishers have obtained under the DMCA in the United States and the InfoSoc Directive in the European Union make an industry-wide settlement favorable to science far more difficult now than it might have been prior to the 1990s.

In the remainder of this Article, we discuss possible solutions to the problems that intellectual property laws have created for digitally integrated scientific research from two very different angles. First, we consider the kinds of legal reforms that would be needed if commercial publishers continued to act as intermediaries between producers and users of scientific information and data, as they do today, without regard to the likelihood that such reforms would ever be enacted.

We then reconsider the role of publishers as such and ask whether, from a cost-benefit perspective, it should be significantly modified or abandoned altogether. In that Section, we

328. *See supra* notes 91–96.

329. *See, e.g.*, INT'L FED'N OF LIBRARY ASS'NS & INSTS., *supra* note 206, at 4–5 (suggesting reforms to the current copyright regime); *Fair Use: Its Effects on Consumers and Industry: Hearing Before the Subcomm. on Commerce, Trade, and Consumer Protection of the H. Comm. on Energy and Commerce*, 109th Cong. 6 (2005) (statement of Prudence S. Adler, on behalf of the Library Copyright Alliance), *available at* http://www.ala.org/ala/issuesadvocacy/copyright/LCANov05.pdf (arguing for fair use and stating that it safeguards the collective interest in the flow of information); Statement of Principles on Copyright Exceptions and Limitations for Libraries and Archives by Electronic Information for Libraries, International Federation of Library Associations and Institutions, and Library Copyright Alliance for WIPO Standing Comm. on Copyright and Related Rights (May 25–29, 2009), *available at* http://www.ifla.org/files/clm/statements/statement-of-principles-sccr20.pdf (urging WIPO Standing Committee on Copyright and Related Rights to support immediate reform of copyright exceptions and limitations).

examine alternative strategies that the scientific community itself could embrace in a concerted effort to manage its own upstream knowledge assets in ways that might avoid, or at least attenuate, the obstacles to digitally empowered scientific research currently flowing from a flawed intellectual property regime.

1. Possible Reforms of Domestic Copyright Laws

To the extent that the fruits of basic scientific research continue to stimulate economic growth in advanced industrial economies,[330] improving the environment for digitally integrated scientific research will enhance the prospects for future innovation. In the words of an authoritative report to the British Prime Minister in 2011:

> Innovation may be blocked and growth hampered when unduly rigid applications of copyright law enables rights holders to block potentially important new technologies. . . . Research scientists, including medical researchers, are today being hampered from using computerized search and analysis techniques on data and text because copyright law can forbid or restrict such usage. . . . In these circumstances, copyright in its current form represents a barrier to innovation and economic opportunity.[331]

This, along with other studies recently undertaken, could eventually lead to proposals for incremental legislative reforms that would move in the right direction.

For example, officials of the European Commission recently undertook an enquiry into the ways that limitations and exceptions in copyright laws might be improved with specific regard to scientific research.[332] As a result, the European Union

330. *See* DAVID C. MOWERY ET AL., *supra* note 1, at 129–51 (analyzing the effects of and experience with U.S. university patenting before and after the Bayh-Dole Act); David C. Mowery & Bhaven N. Sampat, *The Bayh-Dole Act of 1980 and University-Industry Technology Transfer: A Model for Other OECD Governments?*, 30 J. TECH. TRANSFER 115, 116–18 (2005) (discussing how academic research influences industrial innovation); Bhaven N. Sampat, *Changes in University Patent Quality after the Bayh-Dole Act: A Re-Examination*, 21 INT'L J. OF INDUS. ORG. 1371 (2003) (examining the growth of university patenting and licensing); Bhaven N. Sampat, *Patenting and US Academic Research in the 20th Century: The World Before and After Bayh-Dole*, 35 RES. POL'Y 772, 781–82 (2006) [hereinafter Sampat, *Patenting and US Academic Research*) (same).

331. HARGREAVES, *supra* note 26, at 43.

332. *See* COMM'N OF THE EUROPEAN COMMUNITIES, GREEN PAPER ON COPYRIGHT IN THE KNOWLEDGE ECONOMY 3 (2008), *available at* http://ec.europa.eu/internal_market/copyright/docs/copyright-infso/greenpaper_en.pdf [hereinafter EC Green Paper] (aiming to foster a debate on how knowledge for research, science and education can best be disseminated in the online

might conceivably decide to revise the InfoSoc Directive. Alternatively, it might wait for an overall codification of European Union copyright law, as contemplated in the Treaty on the Functioning of the European Union (FEU).[333]

In the United States, a group of scholars has been considering the need to update existing limitations and exceptions with a view to a prospective revision of the 1976 Copyright Act.[334] The National Academies of Science has just commissioned a study of the impact of copyright laws on scientific research.[335] A thorough-going study of this same topic as it affects developing countries is also under way within the ambit of the WIPO Development Agenda.[336]

These and other similar initiatives might conceivably restore a better balance between public and private interests than currently exists under the global copyright regime as strengthened since the 1990s. To this end, the next Section of this Article outlines a set of incremental reforms that could at least attenuate the obstacles to digital research that were identified above.

However, we remain skeptical that proposals for incremental reform, even in the unlikely event of legislative enactment, would adequately address the roots of the problem. As we view the matter, the head on conflict between *e*-science and copyright law depicted above cannot be resolved without fundamental legal and institutional reforms designed to prevent both copyright and database protection laws from reaching into the domain of basic scientific research in the first instance.

environment).

333. *See* Treaty on the Functioning of the European Union art. 118 (consolidated version), Sept. 5, 2008, O.J. C115/96 [hereinafter F.E.U.] ("[T]he European Parliament and the Council . . . shall establish measures for the creation of European intellectual property rights to provide uniform protection of intellectual property rights throughout the Union and for the setting up of centralised Union-wide authorisation, coordination and supervision arrangements.").

334. *See* Pamela Samuelson et al., *The Copyright Principles Project: Directions for Reform*, 25 BERKELEY TECH. L.J. 1175, 1181–82 (2010) (presenting conclusions of the Copyright Principles working group).

335. *See Committee on the Impact of Copyright Policy on Innovation in the Digital Era*, THE NATIONAL ACADEMIES' BOARD ON SCIENCE, TECHNOLOGY, AND ECONOMIC POLICY, http://sites.nationalacademies.org/PGA/step/copyright policy/index.htm (last visited Apr. 18, 2012) (creating a committee to evaluate and propose how to expand and improve research on the impacts of copyright policy, particularly on innovation in the digital environment).

336. *See* WIPO, COMM. ON DEVELOPMENT AND INTELLECTUAL PROPERTY, PROJECT ON INTELLECTUAL PROPERTY AND THE PUBLIC DOMAIN (2010), *available at* http://www.wipo.int/edocs/mdocs/mdocs/en/cdip_4/cdip_4_3.doc.

a. Improving the Information Society Directive in the European Union

Any serious reform effort in the European Union should start with a codification of the idea-expression principle, a subject-matter exclusion of fundamental importance for scientific research.[337] Most scientific literature conveys ideas and facts, not expression. Although the TRIPS Agreement and the WCT both embodied this exclusion in international copyright law,[338] the drafters of the InfoSoc Directive conveniently ignored it in 2001,[339] perhaps on the technical ground that it was not a limitation on, or exception to, authors' exclusive rights as such. All European Union member states should have to embody this principle in their domestic copyright laws.

Turning to the express exception for scientific research that the InfoSoc Directive introduced in Article 5(3)(a),[340] the first step in any incremental set of reforms would be to make this exception also mandatory and binding on all member states.[341] Absent such a measure, countries such as the United Kingdom might simply ignore this provision and continue to rely on older exceptions allowing quotations for certain purposes,[342] copies made for libraries and educational establishments,[343] as well as the new provision subjecting "private use" to fair compensation.[344] The byzantine snares emanating from domestic law implementations of such narrow provisions are exemplified in a recent survey of the relevant U.K. laws.[345]

Second, the express exception for science in Article 5(3)(a), once made mandatory, must be rid of its inherent ambiguity.[346]

337. *See, e.g.*, 17 U.S.C. § 102(b) (2006) ("In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.").

338. *See* WCT, *supra* note 42, art. 2; TRIPS Agreement, *supra* note 20, art. 9.2 ("Copyright protection shall extend to expressions and not to ideas, procedures, methods of operation or mathematical concepts as such.").

339. *See supra* notes 72–90.

340. *See supra* notes 77–83.

341. *Accord* HARGREAVES, *supra* note 26, at 51.

342. *See* InfoSoc Directive, *supra* note 72, art. 5(2)(b).

343. S*ee id*. art. 5(2)(c).

344. *See id*. art. 5(3)(d).

345. *See* BURRELL & COLEMAN, *supra* note 176, at 15–163; *see also* HARGREAVES, *supra* note 26, at 11–52.

346. InfoSoc Directive, *supra* note 72, art. 5(3)(a); *see supra* notes 77–83 and accompanying text.

Like the relatively more transparent phrase used in the Rome Convention of 1961, for example, the revised provision could directly permit "use solely for the purposes of teaching or scientific research"[347] and thus remove any reference to the confusing term for "purpose[s] of illustration."[348]

Third, any mandatory exception for scientific research must then be cloaked in some substantive content that promotes flexibility within an inherently proscience framework and deflects narrowing legalistic interpretation in advance. In particular, the revised provision should eliminate the current language that limits scientific use "to the extent justified by the non-commercial purpose to be achieved."[349] This language is unworkable in practice because, as we have noted earlier, virtually all scientific research conducted at today's universities and other public research entities can be perceived as abetting commercial ends that financially benefit their sponsors.[350]

To achieve even these minimalist proscience ends without departing from existing legislative models, the European Commission should also consider embedding a mandatory exception for science within a broader fair use framework, like that adopted in § 107 of the U.S. Copyright Act of 1976.[351] Recent European scholarship endorses this approach,[352] although opposition to it is strongly entrenched in business circles.[353] However, United States fair use law retains potential defects of its own that could limit its effectiveness if used to regulate digi-

347. International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organisations art. 15.1(d)., Oct. 26, 1961, 496 U.N.T.S. 43.

348. InfoSoc Directive, *supra* note 72, art. 5(3)(a).

349. *Id.*

350. *See*, *e.g.*, *supra* notes 82–86 and accompanying text. *But see* HARGREAVES, *supra* note 26, at 49 (recommending extension of private copying exception to the use of analytics and data mining tools, but only for "non-commercial" research).

351. *See supra* Part I.A.2.

352. *See*, *e.g.*, Senftleben, *supra* note 48, at 526 (stating that fair use "raises the fundamental question of appropriate balancing tools . . . *Flexible rights necessitate flexible limitations* . . . . [Given] new technological developments . . . broad exclusive rights are likely to absorb and restrict new possibilities of use . . . . [F]lexible fair use factors ensure a fast reaction . . . [and] allow the courts to reestablish a proper balance between freedom and protection"(emphasis added)).

353. *See, e.g.*, HARGREAVES, *supra* note 26, at 44 ("Most responses to the Review from established UK businesses were implacably hostile to adoption of a US fair use defence in the UK on the grounds . . . that it would bring . . . massive legal uncertainty.").

tal research in the European context. Accordingly, suggestions to improve the fair use approach in the United States highlighted below should also be considered for possible application in the European Union context.

b. Improving the Fair Use Approach

We previously pointed out that the fair use approach in the United States, while more flexible than the designated exceptions approach in the European Union, could not readily cope with either quantitative or qualitative amounts of copyrighted matter that digitally driven scientific research would have to process. Similarly, application of the market-harm test in such cases might be difficult if publishers successfully insisted that such uses constituted the natural market for their proprietary outputs.[354]

Here, we note a further possible snag in the transformative use doctrine described earlier, which the federal appellate courts have recently expanded as a tool for equating public good uses of protected works with presumptively fair uses.[355] Tensions arise because the very concept of transformative use partakes of the definition of a derivative work,[356] and U.S. copyright law gives strong protection to derivative works.[357] Today,

354. *See supra* notes 242–45 and accompanying text.

355. A growing number of cases, building on this doctrine, have begun to expand a fair use exception that had shrunk during the 1980s and 1990s. *See, e.g.*, Perfect 10, Inc. v. Amazon.com, Inc., 508 F.3d 1146, 1146 (9th Cir. 2007) (finding that operator's display of thumbnail images of copyright owner's photographs was fair use); Kelly v. Arriba Soft Corp., 336 F.3d 811, 811 (9th Cir. 2003) (holding that operator's use of owner's images as "thumbnails" in its search engine was fair use); *see also* Vanderhye v. iParadigms, LLC, 562 F.3d 630, 642–45 (4th Cir. 2009) (finding fair use for archival copies of student papers stored in digital form to help detect and prevent plagiarism). *See generally* Netanel, *supra* note 216, at 759–68 (providing illustrative cases of the legal development of fair use).

356. *See* 17 U.S.C. § 101 (2006) ("A 'derivative work' is a work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgment, condensation, or any other form in which a work may be recast, *transformed*, or adapted. A work consisting of editorial revisions, annotations, elaborations, or other modifications which, as a whole, represent an original work of authorship, is a 'derivative work'." (emphasis added)).

357. *See, e.g.*, Ralph S. Brown, *The Widening Gyre: Are Derivative Works Getting Out of Hand?*, 3 CARDOZO ARTS & ENT. L.J. 1, 10–20 (1984) (examining rights in derivative works); Paul Edward Geller, *Beyond the Copyright Crisis: Principles for Change*, 55 J. COPYRIGHT SOC'Y U.S.A. 165, 168–99 (2008) (discussing the evolution of derivative rights in the United States); Paul Goldstein, *Derivative Rights and Derivative Works in Copyright*, 30 J. COPY-

indeed, some U.S. courts have begun to distinguish transformative markets from transformative uses, which captures the exquisite ambiguity of the underlying concept and could begin to wrap so-called transformative uses in the numbing foil of market-failure analysis once again.[358]

In the leading Supreme Court decision on fair use, Justice Souter dropped a footnote identifying this very conflict.[359] He suggested that a judicially imposed license allowing a transformative use with equitable compensation to the derivative right holder could resolve the dilemma in close cases.[360] To date, no U.S. court has taken the hint, which is why U.S. fair use decisions often vacillate between all-or-nothing outcomes in a path that sometimes defies logic or rationalization.[361] Perhaps the recent pertinent decision by the U.S. Supreme Court in *eBay, Inc. v. MercExchange, LLC*,[362] will finally focus the copyright courts' attention on the possibility of using a liability rule, in place of an injunction, in appropriate cases.[363]

RIGHT SOC'Y U.S.A. 209, 211–15 (1983) (same).

358. Bill Graham Archives, LLC v. Dorling Kindersley Ltd., 448 F.3d 605, 614–15 (2d Cir. 2006) (discussing "transformative markets"); Castle Rock Entm't, Inc. v. Carol Publ'g Grp., 150 F.3d 132, 146 n.11 (2d Cir. 1998) ("[C]opyright owners may not preempt exploitation of transformative markets, which they would not '*in general* develop or license others to develop,' by actually developing or licensing others to develop those markets. Thus, by developing or licensing a market for parody, news reporting, educational or other transformative uses of its own creative work, a copyright owner plainly cannot prevent others from entering those fair use markets." (citations omitted)).

359. *See* Campbell v. Acuff-Rose Music, Inc., 510 U.S. 569, 578 n.10 (1994) (discussing the fact that the goal of copyright law is "to stimulate the creation and publication of edifying matter" and this interest is not always best served by automatically granting an injunction in "parody, news reporting, educational or other transformative uses"; thus 17 U.S.C. § 502(a) gives courts discretion in granting injunctions, because "there may be a strong public interest in the publication of the secondary work [and] the copyright owner's interest may be adequately protected by an award of damages for whatever infringement is found" (internal citations and quotation marks omitted)); *see also* Abend v. MCA, Inc., 863 F.2d 1465, 1479 (9th Cir. 1988) (finding "special circumstances" that would cause "great injustice" to defendants and "public injury" were injunction to issue), *aff'd sub nom*. Stewart v. Abend, 495 U.S. 207 (1990).

360. *Campbell*, 510 U.S. at 578 n.10.

361. *Compare, e.g.*, Elsmere Music, Inc. v. Nat'l Broad. Co., Inc., 482 F. Supp. 741, 746–47 (S.D.N.Y. 1980), *aff'd*, 632 F.2d 252 (2d Cir. 1980), *with* MCA, Inc. v. Wilson, 425 F. Supp. 443, 453–54 (S.D.N.Y. 1976), *aff'd and modified by* 677 F.2d 180 (2d Cir. 1981) (finding copyright violation where infringer did not comment on original work itself), *and* Walt Disney Prods. v. Mature Pictures Corp., 389 F. Supp. 1397, 1398–99 (S.D.N.Y. 1975) (same).

362. 547 U.S. 388 (2006).

363. *See* David Carson, Copyright Office Gen. Counsel, Remarks at the

On this issue, the three-step test familiar from European law (and now mandatory under international law) may have a valuable lesson to teach U.S. courts. In cases where normative considerations sounding in the larger public interest favor a given use, but the amount of the taking appears relatively large with some negative impact on the potential market for the copyrighted work, the legislative history of the three-step test would support allowing that use in return for equitable compensation from the proceeds of the otherwise unauthorized use, if any, to the authors whose support of the public interest had thus been co-opted.[364] Should the European Union decide to adopt a modified fair use provision along these lines,[365] it might move world copyright law toward some new synthesis that could combine the normative wisdom of U.S. fair use law with the practical wisdom of those reticent drafters of the gloss on Article 9(2) of the Berne Convention.[366]

Fordham Intellectual Property Law Institute: Intellectual Property Law and Policy (Apr. 8–9, 2010) (on file with authors), (program available at http://fordhamipconference.com/wp-content/uploads/2010/08/2010Conference Program.pdf) (stating that *eBay*'s extension to copyright law was "likely"); *see also* Christopher Phelps & Assocs., LLC v. Galloway, 492 F.3d 532, 535 (4th Cir. 2007) (applying *eBay* rationale to copyright cases). In *Salinger v. Colting*, 607 F.3d 68, 74–75 (2d Cir. 2010), a copyright infringement action, the Second Circuit announced a standard for injunctive relief that had been approved by *eBay, Inc. v. MercExchange*, LLC, 547 U.S. 388 (2006). The three-judge panel in *Salinger* held that a plaintiff seeking a preliminary injunction in a copyright case must show (1) a likelihood of success on the merits; (2) that "he is likely to suffer irreparable injury in the absence of an injunction"; (3) that "remedies at law, such as monetary damages, are inadequate to compensate for that injury"; (4) that the balance of hardships tips in his favor; and (5) that "the 'public interest would not be disserved' by the issuance of a preliminary injunction." *Salinger*, 607 F.3d at 77–80 (citations omitted). Although the panel in *Salinger* explicitly limited its holding "to preliminary injunctions in the context of copyright cases," it also saw "no reason that *eBay* would not apply with equal force to an injunction in *any* type of case." *Id.* at 78 n.7. Moreover, U.S. copyright law can impose statutory damages or lost profits for infringement, a possibility that must be factored into the equation in some cases. *See* 17 U.S.C. § 504(c) (2006) (providing for statutory damages). The outcome depends on how one views the court's equitable powers, and also on whether or not the court deems an infringement to have occurred in the first place.

364. *Accord* GERVAIS, *supra* note 121, at 71–79 (discussing the legislative history of Article 9 of the Berne Convention); *see also supra* notes 129–33 and accompanying text.

365. See Senftleben, *supra* note 48, at 541–44 for an argument in support of such a solution. "Fair use in the EC . . . would not necessarily mean use free of charge." *Id.* at 551.

366. Any such synthesis would also have to take account of the privacy interests recognized in the European Union's traditional exceptions for private use. *See* InfoSoc Directive, *supra* note 72, art. 5.2(b) (requiring compensation

The trouble even with this sort of adjustment is that it would probably not meet the needs of twenty-first century computational science, however beneficial it might be in other areas of literary and artistic endeavor. Because U.S. fair use cases remain so fact specific, the four normative criteria set out in § 107 of the Copyright Act could play out differently when tested before different judicial panels. In particular, the amount of material taken for digital research and, increasingly, included in new research results could always make some courts fearful of undermining the derivative work right, as mentioned above, even though strong derivative work rights make economic sense only in the entertainment sector.

Much would depend on the federal courts' continued willingness to defend the transformative uses of science in the name of an overriding public interest. Even then, some decisions—though often criticized—introduce into U.S. fair use law the same untenable distinction between so-called commercial and noncommercial scientific research[367] that European Union law has codified in its basic exception to the reproduction right favoring science.[368] Because we believe that U.S. fair use law will have to take the internationally mandated three-step test more fully into account as time goes on[369] (at least where foreign authors' rights are at stake),[370] this element alone could add an additional reason to fear a chilling effect on scientific research stemming from the uncertain application of the fair use doctrine to digital and computational science.[371]

To obviate this uncertainty in U.S. law, economist Paul David has proposed codifying an "automatic fair use exception"

for private use); *see also* HARGREAVES, *supra* note 26, at 48–49 (recommending limited private copying exception that corresponds to "what consumers are already doing," but recognizing that private copying exceptions in European Union member states usually carry levies on copying equipment).

367. *See, e.g.*, Am. Geophysical Union v. Texaco Inc., 37 F.3d 881, 889–91 (2d Cir. 1994) (addressing distinction between commercial and noncommercial uses), *order amended and superseded by* 60 F.3d 913 (2d Cir. 1994).

368. *See supra* text accompanying notes 195–99 (discussing exceptions for science in InfoSoc Directive).

369. *See infra* Part II.C.1.

370. *See supra* note 195.

371. *See* Stodden, *supra* note 255 at 20–24 (discussing the effects of lesser copyright protections for scientific research); Senftleben, *supra* note 48, at 522–25 (stressing tendency of three-step test to narrow preexisting exceptions in European courts, but not usually to broaden them).

for these purposes.[372] That exception could operate in tandem with voluntary contractual waivers, like those of the Creative Commons and Science Commons initiatives,[373] discussed below. By the same token, the Hargreaves Review favors a new exception in the United Kingdom's copyright law allowing uses enabled by technology that do not directly trade on the underlying creative and expressive purpose of the work.[374] Reportedly, the U.K. government is favorable to this proposal.[375] Some clearinghouse arrangements might nonetheless become necessary for purposes of guaranteeing reputational benefits through proper attribution.[376]

A codified automatic fair use provision for *e*-science, or at least a strong normative guideline to the same effect, would not impede the publishers' ability to price discriminate their initial subscriptions in keeping with the subscribers' capacities to pay.[377] Both print publishers (whose numbers are decreasing)[378] and online publishers (discussed below)[379] could legitimately extract more revenue from commercial entities than from public science institutes under this approach. An automatic fair use provision might also further encourage commercial publishers to accept open access subsidies from science

372. *See* David, *supra* note 25, at 29 (discussing automatic fair use exception); Anselm Kamperman Sanders, *Limits to Database Protection: Fair Use and Scientific Research Exemption*, 35 RES. POL'Y 854 *passim* (2006) (comparing European Union copyright law with U.S. copyright law in the area of sharing scientific research); Stodden, *supra* note 255, at 20–25 (arguing for less stringent regulation of copyrights in the scientific arena).

373. *About the Licenses*, CREATIVE COMMONS, (Jan. 17, 2012, 5:43 PM) http://creativecommons.org/licenses (describing licensing scheme); *Science*, CREATIVE COMMONS, (Jan. 17, 2012, 5:46 PM) http://creativecommons.org/science (stating that Creative Commons licensing should be extended to scientific and technical research); *see also* Stodden, *supra* note 255, at 20–24 (proposing a more comprehensive form of private ordering for computational science, known as the Reproducible Research Standard).

374. HARGREAVES, *supra* note 26, at 4; *see also* CODE DE LA PROPRIÉTÉ INTELLECTUELLE arts. L.134-1-134.9, (Fr.) (creating a public database dedicated to out-of-print books that is accessible at no charge).

375. *See* Chambers, *supra* note 318, at 600 (noting, however, that the European Commission's Intellectual Property Strategy ignores any such move).

376. *See* HARGREAVES, *supra* note 26, at 46–48 (discussing issues with data mining to determine authors of orphan works).

377. *See* John P. Conley & Christopher S. Yoo, *Nonrivalry and Price Discrimination in Copyright Economics*, 157 U. PA. L. REV. 1801, 1818–20 (2009) (discussing price discrimination in the context of copyright law).

378. For evidence concerning the rise of online and open access publishing in the field of microbiology, see Uhlir, *supra* note 250, at 77–87.

379. *See* discussion *infra* Part III.A.2.

funders, a trend we discuss below.[380]

However, even an enlightened fair use approach raises obstacles rooted in print media models that ought to simply become irrelevant to the conduct of online, worldwide scientific research. In this context, for example, it makes little sense to focus on "reasonable" uses of published scientific articles,[381] or to attempt to track revenue streams from upstream uses of published scientific information and data by researchers who exploit automated knowledge discovery tools.[382] On the contrary, we believe intellectual property laws should not permit publishers to further control uses or reuses of their authors' scientific research results for purposes of further research at all.

2. What *E*-Science Really Needs from Any Legislative Reform

We doubt that the foregoing proposals to incrementally reform existing measures bearing on scientific research could be enacted in an uncompromising format that would provide digital science with the user-friendly regime it needs to flourish. Any such proposals could easily become entangled in the coils of more intricate, legalistic provisions largely derived from experience in the entertainment sectors. Precisely because these so-called reforms would be deemed science friendly in name, they could mire modern science ever more deeply in the need to make unpalatable choices between obeying complex, inherently obsolete provisions or ignoring them altogether.

a. A Tailor-Made Exemption for Scientific Research

The only workable solution is to adopt a broad and uncompromising exemption for scientific uses that requires no gloss, no fine print, and no elaborately contrived exceptions to a

380. *See infra* notes 459–65 and accompanying text.

381. *Cf., e.g.*, BURRELL & COLEMAN, *supra* note 176, at 288–93 (proposing to make the designated exceptions under U.K. law more favorable to science).

382. *See* Sag, *supra* note 2, at 1648–49 (calculating Google's transaction costs, in the absence of fair use, in millions or even billions of dollars, depending on coverage and strategic behavior of copyright proprietors). However, some exceptions to this general proposition become more feasible when researchers make use of data tools or whole data libraries for specific downstream applications. For arguments that "compensatory liability rules" may legitimately be applied in such cases see JEROME H. REICHMAN ET AL., GLOBAL INTELLECTUAL PROPERTY STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS: GOVERNING DIGITALLY INTEGRATED GENETIC RESOURCES, DATA AND LITERATURE (forthcoming 2013) [hereinafter GLOBAL IP STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS] (Part III); Ritch, *supra* note 37, at 183–84; *see also* discussion *infra* Part II.D.1.

grudgingly acknowledged "exception" for scientific research. To this end, the Max Planck Institute's response to the European Commission's Green Paper in 2008[383] proposed that such a broad and general provision, allowing use and reuse of published research materials for virtually any scientific purpose, should expressly legitimize storage, archiving, data extraction, linking, and the like.[384]

While endorsing this proposal, which makes a good start, we think even more may be needed. In particular, scientists must be free to subject any published article (and, as we shall see later, any article made publicly available online)[385] to data mining procedures and data manipulation by automated knowledge discovery tools, including virtual scientific experimentation, without any constraint other than attribution under the norms of science.[386] The same exemption must apply to the public release of selectively chosen material in any scientific paper or report. Such a regime should be applied directly, and in harmonized express terms, in the copyright laws of every European Union member state, without any allowance for the sort of off-setting, detailed provisions that are currently thought necessary for "a workable system . . . of users' rights,"[387] which in practice usually means an unreasonable system of publishers' constraints on science.

Such a broad exemption should expressly clarify its application to so-called derivative works, a concept that has virtually no meaning in upstream scientific research as currently practiced. So long as prior research results are incorporated into new scientific work with clear and appropriate attribution, there is no need for permission, which, in effect, operates as a de facto prior restraint on scientific speech.[388] Nor should any

383. *See* RETO M. HILTY ET AL., EUROPEAN COMMISSION–GREEN PAPER: COPYRIGHT IN THE KNOWLEDGE ECONOMY–COMMENTS BY THE MAX PLANCK INSTITUTE FOR INTELLECTUAL PROPERTY, COMPETITION AND TAX LAW (2008), *available at* http://www.ip.mpg.de/files/pdf1/comments_on_the_green_paper1.pdf [hereinafter MAX PLANCK RESPONSE TO EC GREEN PAPER].

384. *See id.*; *see also* HARGREAVES, *supra* note 26, at 48 ("The Government should introduce a UK exception in the interim under the non-commercial research heading to allow use of analytics for non-commercial use . . . as well as promoting at EU level an exception to support text mining and data analytics for commercial use.").

385. *See infra* notes 459–65 and accompanying text.

386. See, for example, Stodden, *supra* note 255 *passim* for a discussion regarding attribution and its problems.

387. BURRELL & COLEMAN, *supra* note 176, at 276.

388. One who applies a scientific theory or finding to some new phenome-

commercial/noncommercial distinction be embedded in the copyright law's broad research exemption, for the primary reason stated earlier, that basic scientific research results are properly to be treated as a public, not a private good, regardless of their origin.[389]

Effort should then be made to persuade the United States and other WTO members to adopt a similar provision, over and above any existing fair use provisions. Pending the formulation of a truly transnational science funding entity in the European Union, the Commission's own science funding division should help to enforce such a broad scientific research exemption, as well as any other proscience provisions that may exist in the domestic copyright laws. The developing countries should also throw their weight behind a strong exemption for scientific research, in keeping with the WIPO Development Agenda.[390]

b. Breaking the Digital Locks

No provision exempting scientific research from the exclusive rights of copyright law, as proposed above, could fully achieve its purpose unless complementary legislative action were taken to ensure its effectiveness in the online environment. Here we encounter the blocking effects of technical protection measures (TPMs) as implemented in the domestic laws,[391] whose drafters ignored the proscience mandate expressed in the preamble to the WCT itself,[392] as well as other balancing provisions set out in that treaty.[393]

If rights holders who make scientific works available through digital networks can simply enclose those works behind technological fences and then abolish all user-friendly provisions by contract, little would be gained by clarifying the idea-expression dichotomy or the scope for private and fair uses, or by enacting broad exceptions for scientific research and teaching as advocated above. The imposition of private intellec-

non is not a derivative author, even though his or her work necessarily applies and draws on prior work. *See supra* notes 230–37 and accompanying text (discussing importance of idea-expression principle for science).

389. *See supra* notes 24–26 and accompanying text.

390. *See* DEVELOPMENT AGENDA FOR WIPO, WIPO (2007), *available at* http://www.wipo.int/ip-development/en/agenda/ (advocating a strong copyright exception for scientific research).

391. *See supra* notes 230–37 and accompanying text.

392. WCT, *supra* note 42, pmbl.

393. *See supra* notes 137–50 and accompanying text.

tual property rights by such technological means[394] also raises profound conflicts with constitutional law in the United States[395] and with fundamental rights in Europe.[396]

In effect, publishers of digitally transmitted scientific articles online have the same legal entitlements as owners of music, films, and other cultural assets under the framework established by the DMCA in the United States and by parallel legislation in the European Union.[397] These provisions give publishers the best of two worlds. On the one hand, if Internet Service Providers (ISPs) transmit copyrighted scientific articles without permission, publishers may force them to remove the offending publications under a set of provisions known as the "notice and take down" regime.[398]

Scientific researchers, on the other hand, like users of cultural goods from the mundane to the sublime, enjoy virtually no analogous powers to oblige online publishers to respect any of the privileges and immunities that are supposed to defend their interests.[399] On the contrary, copyright laws protecting digital transmissions give publishers virtually absolute control over use and dissemination, as reinforced by their ability to impose licensing terms and conditions backed up by the impenetrable electronic fencing discussed earlier.[400]

Science publishers, who thus combine private law tools with the exclusive rights of intellectual property laws, can operate as unregulated ISPs under no obligation to respect the sharing norms of science and with a direct financial interest in

394. *See* Reichman & Franklin, *supra* note 265, at 884–914 (discussing the protection of copyright owners' rights through a combination of technological means and adhesion contracts).

395. *See, e.g.*, LANGE & POWELL, *supra* note 198, at 108 (stating that the conflict between intellectual property regimes and constitutional rights is "a conflict in multiple dimensions, in which interests in property are pitted against freedom of expression"); Netanel, *supra* note 203, at 30–36 (discussing developments in First Amendment law as they pertain to copyright law).

396. *See, e.g.*, Natali Helberger & P. Bernt Hugenholtz, *No Place Like Home for Making a Copy: Private Copying in European Copyright Law and Consumer Law*, 22 BERKELEY TECH. L.J. 1061, 1083 (2007) (discussing fundamental rights to be considered in shaping European consumer policy); *see also* HELFER & AUSTIN, *supra* note 196, at 259–83 ("Article 10 of the ECHR . . . provides the principle framework for balancing copyright and the right to freedom of information in European human rights jurisprudence.").

397. *See supra* notes 86–110 and accompanying text.

398. *See, e.g.*, 17 U.S.C. § 512(e)(3) (2006) (outlining "Elements of notification").

399. *See* discussion *supra* Part I.C.2.

400. *See supra* Part I.C.2.

deciding whether or not collaborative research and innovation will occur, and under what terms and conditions. Yet, there is simply no policy justification for subsuming the needs of science, with its far different economic and social considerations, and far larger impact on human life, to the current undiscriminating framework of copyright and database protection laws.

Some courts in both jurisdictions have begun to push back against these controversial digital locks,[401] and numerous proposals have been made for legislative or administrative solutions to pry them open.[402] For example, some have suggested a system of "electronic locks and keys," which, however, could trigger costly and burdensome administrative procedures that could indirectly exert a chilling effect on users' freedom to build on preexisting scientific and technological data and information.[403] Professor Dan Burk has proposed a doctrine of "anticircumvention misuse" to deal with this same problem,[404] while Professors Reichman and Franklin would impose "a fair and reasonable terms," standard on all non-negotiable restrictions on access to and uses of computerized information goods.[405] Still other proposals, while not without merit, would

401. *See, e.g.*, Storage Tech. Corp. v. Custom Hardware, Eng'g & Consulting, Inc., 421 F.3d 1307 (Fed. Cir. 2005); Lexmark Int'l. Inc. v. Static Control Components, Inc., 387 F.3d 522 (6th Cir. 2004); Chamberlain Grp., Inc. v. Skylink Techs., Inc., 381 F.3d 1178 (Fed. Cir. 2004); *see also* Senftleben, *supra* note 48, at 545–46 for examples of German cases that show how the European Union has dealt with this issue.

402. *See, e.g.*, Robert C. Denicola, *Access Controls, Rights Protection, and Circumvention: Interpreting the Digital Millennium Copyright Act to Preserve Noninfringing Use*, 31 COLUM. J.L. & ARTS 209, 214 (2008) ("There have been legislative bills and academic proposals to amend the anti-circumvention provisions in order to accommodate noninfringing use of technologically-protected works."); Jacqueline D. Lipton, *Solving the Digital Piracy Puzzle: Disaggregating Fair Use from the DMCA's Anti-Device Provisions*, 19 HARV. J.L. & TECH. 111, 113 (2005) (proposing an administrative complaint mechanism to address DMCA restrictions on fair use); Aaron K. Perzanowski, *Rethinking Anticircumvention's Interoperability Policy*, 42 U.C. DAVIS L. REV. 1549, 1610–16 (2009) (suggesting two legislative changes); *see also* Dan Burk, *Anticircumvention Misuse*, *supra* note 265, at 1102–10 (proposing a new doctrine of "anticircumvention misuse" to deal with the problem).

403. Reichman, *supra* note 121, at 1159 (noting that a reverse notice and takedown system would be "less costly and burdensome" than a system of "electronic locks and keys" (citations omitted)); *see also* Lunney, *supra* note 96, at 845–69 (discussing methods by which to address copyright issues without foisting unnecessary costs on the public for administration of those laws).

404. Burk, *supra* note 265, at 1132–40.

405. *See* Reichman & Franklin, *supra* note 265, at 930 ("All mass-market contracts, non-negotiable access contracts, and contracts imposing non-negotiable restrictions on uses of computerized information goods must be

generally entail a considerable amount of political and legislative momentum and, unless carefully implemented, could in some cases complicate rather than simply avoid existing obstacles.[406]

Legislatures enacting appropriate exceptions for scientific research, like the one proposed above, should also simultaneously implement the proviso set out in Article 11 of the WCT, which expressly exempts "acts . . . which are . . . permitted by law" from the obligation of signatories to "provide adequate legal protection and effective legal remedies against the circumvention of effective technological measures."[407] For example, the copyright revision bill now languishing in Brazil initially took a major step forward by prohibiting content providers from using TPMs to defeat privileged uses or to impede access to public domain matter.[408] Whether these and other provisions that seek to expand the copyright misuse doctrine[409] will survive the legislative process in that country remains to be seen, as are the means of implementing them in practice, which future regulations would have to specify.

Meanwhile, one relatively expedient suggestion is the "reverse notice and takedown" regime put forward by Professors Reichman, Dinwoodie, and Samuelson.[410] Under their proposal, bona fide public interest users could avoid passing through a content provider's electronic gateway and, instead, send a request or "flaming arrow" over the electronic fence to catch the

made on fair and reasonable terms and conditions, with due regard for the public interest in education, science, research, technological innovation, freedom of speech, and the preservation of competition."); *see also* Darouian, *supra* note 265, at 36–40 (endorsing this standard).

406. *See, e.g.*, Lunney, *supra* note 96, at 851–58 (discussing possibility of levies with clear entitlement to private copying, among other proposals); *see also* Westkamp, *supra* note 78, at 45–50 (discussing legislative barriers to effective lawmaking in this area).

407. WCT, *supra* note 42, at 71, art. 11.

408. Law No. 9610 of 19 February 1998, on Copyright and Neighbouring Rights, Consolidated with the Bill in Public Consultation since 14 June 2010, *available at* http://www.vgrass.de/wp-content/uploads/2010/07/Brazilian_Copyright_Bill_Consolidated_June_2010.pdf (last visited Jan. 25, 2012) (English translation); *see also* Pedro Paranaguá, *A Comprehensive Framework for Copyright Protection and Access to Knowledge: From a Brazilian Perspective and Beyond*, *in* HOW DEVELOPING COUNTRIES CAN MANAGE INTELLECTUAL PROPERTY RIGHTS TO MAXIMIZE ACCESS TO KNOWLEDGE 103, 106–07 (Xuan Li & Carlos M. Correa eds., 2009) (discussing the Brazilian National Copyright Forum).

409. *See generally* Burk, *supra* note 265.

410. *See* Reichman et al., *supra* note 170, at 1032–39 (discussing the contours of the proposed "reverse notice and takedown regime").

copyright proprietors' attention.[411] This notice would signal that the user intended to obtain specified matter held by the proprietor in an online repository for purposes allowed under specified limitations and exceptions.[412] It would give proprietors a period—say fourteen days—in which to accede to the request or deny it on specified grounds that it was willing to defend in court or an administrative proceeding.[413]

In the latter event, both sides would know that a judicial test of the validity of the request under relevant exceptions would be the likely outcome, and the copyright authorities could establish an expedited judicial or administrative procedure for this purpose.[414] Once the legitimacy of the request was established, the relevant authority or court could enable third parties, if necessary, to disarm or decrypt the TPMs in order to extract the desired scientific material for the specified research purposes.[415] Publishers who needlessly barred the initial request and thereby necessitated a judicial inquiry should bear at least the transaction costs and might be made subject to additional penalties for abuse of TPMs.[416]

While a "reverse notice and takedown" regime might entail palpable transaction costs at the outset, it would likely give rise to a jurisprudence of exceptions to TPMs that would, over time, facilitate use of the method.[417] Besides, to the extent that a broad exemption for scientific research purposes were enacted along the lines indicated above, requests for access to and use of technically protected data and information should normally elicit an automatic positive response.[418]

411. *Id.*

412. *Id.*

413. *Id.*

414. *Cf.* Mark A. Lemley & R. Anthony Reese, *Reducing Digital Copyright Infringement Without Restricting Innovation*, 56 STAN. L. REV. 1345, 1351–52 (2004) (discussing how changing procedures for enforcing copyrights would affect behavior of those infringing them).

415. *See* Reichman et al., *supra* note 170, at 1032–34.

416. *Cf.* Lenz v. Universal Music Corp., 572 F. Supp. 2d 1150, 1154–56 (N.D. Cal. 2008) (requiring publishers who send notice and takedown requests under DMCA § 512 to evaluate fair use considerations in advance); Burk, *supra* note 265, at 1127–32; *see also* Reichman & Franklin, *supra* note 265, at 929–32 (discussing a "public interest unconscionability" doctrine in contract law).

417. *See* Reichman et al., *supra* note 170, at 1032–38 (arguing that a new reverse notice and takedown regime should develop through case law, rather than through administrative rulings).

418. At the same time, publishers would retain a measure of control over how the process was implemented. First, they must decide whether or not to

Recent case law in the United States has made judicial resort to a reverse notice and takedown procedure more feasible even without enabling legislation.[419] However, given the massive amounts of literature and data processed by automated knowledge discovery tools, even the reverse notice and takedown regime—backed by supporting judicial decisions—could break down unless published scientific works in general were governed by some globally effective "digital copyright exchange," like that recommended in the Hargreaves Review.[420] Even then, much would depend on the willingness of science funding agencies to insist that science publishers either refrained from surrounding scientific works transmitted online with TPMs and DRMs or that they made such works automatically accessible to scientists seeking access to them through approved portals for research purposes.

In sum, absent some procedure like the reverse notice and take down regime for freeing up unprotectable scientific information, the TPMs become a means of inducing massive abuses of the copyright law,[421] much as peer-to-peer file sharing can

risk a decision on the merits of a specific request, with probable precedential value, as occurs routinely under U.S. fair use practice today. Second, if publishers acquiesced in a valid request to avoid litigation, they would remain in a position to acknowledge the precise uses for which the material had been requested and to monitor the actual uses to which it was put. Hence, users must adhere to a good faith implementation of their own proposals and be prepared to negotiate if they needed to go farther. *See id.* at 1032–37.

419. For example, two antilockout cases have provided various legal bases for overcoming TPMs that deny access to unprotected matter. *See* Storage Tech. Corp. v. Custom Hardware Eng'g & Consulting, Inc., 421 F.3d 1307 (Fed. Cir. 2005); Chamberlain Grp., Inc. v. Skylink Techs., Inc., 381 F.3d 1178 (Fed. Cir. 2004). *But see* MDY Indus., LLC v. Blizzard Entm't, Inc., 629 F.3d 928, 950 (9th Cir. 2010) (sympathizing with the policy underlying these decisions, but rejecting their legal reasoning), *as amended on denial of reh'g*, Nos. 09-15832, 09-16044, 2011 U.S. App. LEXIS 3427 (9th Cir. Feb. 17, 2011). One recent district court case has obliged proprietors to take fair use factors into account before sending a request for notice and take down under the existing regime regulating safe harbors and the secondary liability of ISPs. *See Lenz*, 572 F. Supp. 2d at 1154–56.

420. HARGREAVES, *supra* note 26, at 28–35 (proposing a digital copyright exchange); *see also* Joel Smith & Rachel Montagnon, *The Hargreaves Review—A "Digital Opportunity*," 33 EUR. INTELL. PROP. REV. 596, 597 (2011) (stressing need for "digital copyright exchange" to facilitate cross-sectoral and cross-border licensing, plus codes of practice for collection societies).

421. *See* Burk, *supra* note 265, at 1100; Reichman et al., *supra* note 170, at 1023 (arguing how people can design TPMs in order to "opt out of those parts of the copyright system they dislike"). Such an approach, if upheld at the appellate level, further supports the impropriety of denying fair use by technical means when it is proprietors who must respond to the needs of scientists.

become an instrument for inducing massive infringements of exclusive rights.[422] A reverse notice and take down regime would at least enable scientific researchers to avoid access controls and any resulting electronic contracts that imposed waivers of statutory limitations and exceptions or other harsh restrictions on use and reuse of privileged information and data. This feature should make it particularly attractive to the European Commission in that it would finally provide them with a practical means of fulfilling the obligation that Article 6(4) of the InfoSoc Directive already imposes on member states to ensure the availability of the specified exceptions set out in Article 5 when implementing the Directive itself.[423]

c. Disciplining Contractual Overrides

The foregoing discussion demonstrates that no set of limitations and exceptions enacted by enlightened legislators can achieve the goal of strengthening scientific research so long as the proprietors of scientific publications can contractually override them, whether in print media or in the online environment. For this reason, the Max Planck Institute rightly proposes that both new and existing exceptions favoring scientific research must be made peremptory, mandatory, and nonwaivable.[424]

422. *See, e.g.*, Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd., 545 U.S. 913, 918–20 (2005) (holding a peer-to-peer platform liable for copyright infringements of its users). To ensure its success both in the United States and the European Union, legislative endorsement of the reverse notice and takedown proposal would, ultimately, be desirable. Such an enactment should also establish an administrative or judicial authority to break through the technological fence once the relevant authority sided with a public-interest user against a recalcitrant rights holder. In that event, the legislation must immunize the public-interest user from liability for breaking through the fence to extract privileged matter if the rights holder refused to open the lock or ignored an injunction to do so. *See* Reichman et al., *supra* note 170, at 1023 (arguing that there is "no incentive for copyright owners or TPM vendors to fine-tune TPMs to enable non-infringing uses").

423. *See* Reichman et al., *supra* note 170, at 1039–40 (discussing how a reverse notice and takedown would be consonant with Article 6(4) of the European Union InfoSoc Directive). Nevertheless, paragraph 4 of art. 6(4) would require an amendment or at least some clarifying interpretation to this end. *See* InfoSoc Directive, *supra* note 72, art. 6(4)¶ 4.

424. *Accord* HARGREAVES, *supra* note 26, at 51 ("Applying contracts in this way means a rights holder can rewrite the limits the law has set on the extent of the right conferred by copyright. It creates the risk that should Government decide that UK law will permit private copying or text mining, these permissions could be denied by contract."); *see also* MAX PLANCK RESPONSE TO EC GREEN PAPER, *supra* note 383, at 11–16 (proposing various exceptions to gov-

Short of this logical proposal, other important, if less efficacious measures, remain available. For example, Professor Burk's principle of anticircumvention misuse mentioned earlier could be adopted on both sides of the Atlantic to limit private interference with specified public good uses of copyrighted works.[425] To the same end, Professors Reichman and Franklin's proposals for a "public interest unconscionability" standard for non-negotiable contracts could be employed to give courts more common law tools for alleviating conflicts between private ordering and the goals of federal copyright and related laws.[426]

There is reason to believe such a tool would fit well within certain existing European approaches to consumer protection and contract laws in general.[427] Professor Hilty also stresses the possibility of invoking European competition law, with its concept of abuse of a dominant position, when proprietors leverage their power in the market for scientific articles to inhibit use and reuse of scientific contents by downstream investigators.[428]

What matters is that legislatures concerned with promoting scientific research should take a forthright position against contractual overrides of lawful and permitted uses while also clarifying scientific research as a peremptory example of a lawful and permitted use. In reality, however, there is no reason to expect any such enlightened approach in the immediate future. On the contrary, newly proposed measures on enforcement, in

ern scientific use).

425. *See* Burk, *supra* note 265, at 1132–40.

426. *See* Reichman & Franklin, *supra* note 265, at 929–32; *see also* Darouian, *supra* note 265.

427. Mel Kenny, *Globalization, Interlegality and Europeanized Contract Law*, 21 PENN ST. INT'L L. REV. 569, 575 (2003) (noting "the trend towards higher standards of EC consumer protection").

428. *See* Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 315 (calling the European Union Directive "designed one-sidedly to protect the entertainment industry . . . thwarting the efforts to make Europe the leading centre for research"). Prospective development of a competition-based limit to the abuse of TPMs and to contractual limits on use and reuse of uncopyrightable data remains one area where the international regime established by the TRIPS Agreement remains relatively unburdened by the strictures of the three-step test or other rigid limitations to national discretion concerning the design of an appropriate copyright system. TRIPS Agreement, *supra* note 20, art. 40; ESTELLE DERCLAYE, AN ECONOMIC APPROACH TO WHAT THE CONDITIONS OF ABUSE OF A DOMINANT POSITION OF COPYRIGHT SHOULD BE 6 (2003), *available at* http://www.serci.org/2003/derclaye.pdf (noting "that a dominant position or even a monopoly is (or rather: can be) a natural consequence of the grant of a copyright"); Sara K. Stadler, *Relevant Markets for Copyrighted Works*, 34 J. CORP. L. 1059 *passim* (2009) (arguing that reframing copyright law as a species of competition law would benefit the public interest).

their present form,[429] could actually strengthen the proprietors' ability to impose privately legislated intellectual property rights[430] on the scientific research community.

c. Aligning Database Protection Laws with Broad Exceptions for Science in Copyright Law

Any legislative reform of domestic copyright laws that ignored the database protection laws in the European Union would inadvertently allow the latter to surround the former with a net that would block access to and use of the very facts and data that the copyright paradigm ostensibly left free.[431] It would also impede transnational efforts to pool large collections of scientific data by automatically subjecting contributions from providers in the European Union to a strong regime of exclu-

429. *See, e.g.*, *Proposal for a Directive of the European Parliament and of the Council on Measures and Procedures to Ensure the Enforcement of Intellectual Property Rights*, COM (2003) 0046 final (Jan. 30, 2003), *available at* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52003PC0046:EN:NOT (proposing to protect countries from the "growing phenomenon" of counterfeiting and piracy issues); *see also* Anti-Counterfeiting Trade Agreement, Dec. 3, 2010, *opened for signature* Mar. 1, 2011, *available at* http://www.ustr.gov/webfm_send/2417 [hereinafter ACTA]; Charles R. McManis, *The Proposed Anti-Counterfeiting Trade Agreement (ACTA): Two Tales of a Treaty*, 46 HOUS. L. REV. 1235, 1235–39 (2009) (discussing the ACTA controversy); THE U.S. TRADE REPRESENTATIVE, THE ANTI-COUNTERFEITING TRADE AGREEMENT–SUMMARY OF KEY ELEMENTS UNDER DISCUSSION (2009), *available at* http://www.ustr.gov/webfm_send/1479 (summarizing discussions of anti-counterfeiting agreements among different countries).

430. *See* ACTA, *supra* note 429; Steven Seidenberg, *Tough Measures: ACTA May Replace Global IP Treaties with an International Regime More Favorable to IP Owners*, INSIDE COUNSEL, June 1, 2010, at 24, *available at* 2010 WLNR 16875706 (noting that "ACTA would impose a tougher international stance against anyone seeking to circumvent technological protections on copyrighted works"); Am. Univ. Washington Coll. of Law, *Text of Urgent ACTA Communique*, PIJIP (June 23, 2010) http://www.wcl.american.edu/pijip/go/acta-communique (finding that ACTA has "grave consequences for the global economy"); *cf.* Reichman & Franklin, *supra* note 265, at 913 (writing that "the power to impose privately legislated rights . . . becomes a power to determine the competitive boundaries of the underlying intellectual property rights themselves").

431. *See* Database Directive, *supra* note 22, arts. 1, 3; Reichman & Samuelson, *supra* note 258, at 52–53 (noting the "breakdown" of the patent-copyright dichotomy towards the end of the twentieth century). The information economy most likely to emerge from an unrestricted exclusive right in data would then "resemble models already familiar from the Middle Ages, when goods flowing down the Rhine River or goods moving from Milan to Genoa were subject to dozens, if not hundreds of gatekeepers demanding tribute." Reichman, *Database Protection in a Global Economy*, *supra* note 284, at 484*; see also* HELLER, *supra* note 3, at 3 (discussing the practices of German "robber barons" in the Middle Ages and subsequent damage to free trade).

sive property rights not applicable to other contributors.[432] For these and other reasons, neither science nor culture[433] could fully attain the payoffs that digital technologies make possible without ancillary adjustments of the Database Directive.

When the Max Planck Institute called for a broad exemption from the exclusive rights of the European Union's domestic copyright laws for published scientific information and data, it logically demanded that the Commission should also insert similar language into the Database Directive as well.[434] In effectuating any such alignment, the Institute insists that the exceptions for science in both copyright laws and database protection laws should be preemptory, mandatory, and immune from both contractual overrides and TPMs.[435]

As was the case with copyright law, a broad exemption that clearly allowed extraction and reutilization of non-copyrightable data for scientific research must expressly empower the use of automated knowledge discovery tools for this same purpose.[436] Such language should ensure the rights of scientists to aggregate data and information in a research commons, to conduct data mining and similar techniques, and to extract data embedded in scientific articles for use in further research.[437]

To the extent that the production of scientific data remains largely government-funded, no exclusive property rights should normally attach, even to downstream commercial uses of such

432. *See, e.g.*, John Wilbanks, *Public Domain, Copyright Licenses and the Freedom to Integrate Science*, 7 J. SCI. COMM. 1, 4 (2008) (discussing legal tools necessary to develop open data sharing). Waivers become necessary to achieve the research goals of the pool, which would hinge on the lowest common denominator set of default intellectual property rules. *Id.* at 5.

433. For the adverse effects of digital copyright on new forms of cultural expression, see Mira Burri-Nenova, *Trade versus Culture in the Digital Environment: An Old Conflict in Need of a New Definition*, 12 J. INT'L ECON. L. 17, 57 (2009) ("Since these [traditional copyright law] models are often too rigid to allow full realization of the possibilities of the digital mode of content production and distribution or render them illegal, obstructing the 'creative play', [sic] some new hybrid models for the protection of authors' rights have emerged."); Senftleben, *supra* note 48, at 521 (arguing that current EC copyright law is likely to frustrate cultural development); Wong, *supra* note 111, at 1084–97 (describing conflicts between copyright law and new forms of creative expression in digital media).

434. *See* MAX PLANCK RESPONSE TO EC GREEN PAPER, *supra* note 383, at 14–15.

435. *Id.*

436. *See supra* notes 385–87 and accompanying text.

437. *See id.*

data.[438] However, commercial uses of large semi-autonomous data sets as functional tools, such as microarrays or diagnostic tools,[439] could become suitable candidates for equitable compensation under nonexclusive licenses.[440] In such cases, a compensatory liability regime—i.e., a take-and-pay rule described earlier—might provide a workable incentive without the blocking effects that patents tend to impose on research tools in general.[441]

Still other measures are necessary to attenuate the deleterious effects that the European Commission's Database Directive has imposed on all scientific, educational, and cultural pursuits that depend on ready access to published facts, data, and information. For example, compulsory licenses should become available when the database is the sole source for the data in question.[442] The Directive as approved by the Council of Ministers was stripped of such a provision at the last minute, and the importance of restoring a comparable provision is clear from hindsight.[443] The potentially unlimited duration of database protection also remains an untenable assault on basic principles of intellectual property law. Provision for the entrance of older data into the public domain after a specified period of expiry should be a governmental priority even as new

438. *See, e.g.*, Reichman & Uhlir, *supra* note 2, at 326 (demonstrating why the scientific community should be able to access government-funded research via the research commons); So et al., *supra* note 1, at 2078 (arguing in favor of government-funded research managed in the interest of the public).

439. *See, e.g.*, Stodden, *supra* note 255, at 13 (citing authorities).

440. *Accord* Ritch, *supra* note 37, at 148.

441. In such a case, there would be no general distinction between commercial and noncommercial research or any prior restraint on access, use, or reuse of published scientific information and data for scientific research purposes. Nor would there be a "compulsory license," in the traditional sense, (i.e., an ex post modification of an author's anticipated ex ante exclusive rights). On the contrary, such a "compensatory liability rule" should be conceived as an ex ante entitlement to compensation for specified commercial uses, accompanied by an equally clear *ex ante* third party entitlement to make such uses subject to a duty to pay reasonable compensation for them. *See* Reichman, *supra* note 186, at 1791–93 (discussing a compensatory liability regime); *see also* Mark Lemley, Ex Ante *Versus* Ex Post *Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129 (2004) (contrasting differences between ex ante and ex post theories).

442. *See* Reichman & Uhlir, *supra* note 2, at 338; *see also* DERCLAYE, *supra* note 292, at 280 (arguing such licenses should apply in the case of users not falling within specified exceptions).

443. Jacqueline Lipton, *Information Property: Rights and Responsibilities*, 56 FLA. L. REV. 135, 147 (2004) (describing some techniques of overpropertization by various European Union member states).

data added to the collection attracts new protection rights.[444]

C. ADJUSTING THE INTERNATIONAL LEGAL FRAMEWORK TO ACCOMMODATE THE NEEDS OF SCIENCE

The prevailing international minimum standards of intellectual property protection are not necessarily in conflict with the proposals set out above. First, the standards themselves are broad and open to interpretation, as will be shown in more detail below, while both Article 1.1 of the TRIPS Agreement and Article 14(1) of the WCT contain crucial deference provisions that deliberately leave room to maneuver when states make a good faith effort to conform these standards to national needs and policy.[445] Second, the flexibility built into the TRIPS and WCT standards applies in two directions. Although tightening the exclusive rights with more restrictive conditions is always an option,[446] it remains equally possible to flesh out the limitations and exceptions, along with other balancing features, in a manner more favorable to the provision of public goods than has been the case in some OECD countries and in many developing countries as well.[447]

444. *See* Reichman & Samuelson, *supra* note 258, at 90; Reichman & Uhlir, *supra* note 2, at 412 (providing an example of the problems behind extracting underlying data from a protected database even after the expiration of a nominally expired patent).

445. *See* WCT, *supra* note 42, art. 14(1) ("Contracting Parties undertake to adopt, in accordance with their legal systems, the measures necessary to ensure the application of this Treaty."); TRIPS Agreement, *supra* note 20, art. 1.1 ("Members shall be free to determine the appropriate method of implementing the provisions of this Agreement within their own legal systems and practice."). *See generally* J.H. Reichman, *Securing Compliance with the TRIPS Agreement After* U.S. v. India, 4 J. INT'L ECON. L. 585 (1998) (noting awareness of WTO Appellate Body of this deference provision). The WTO gave significant weight to this deference norm in the WTO's most recent TRIPS decision bearing on copyright law in China. *See* Panel Report, *China–Measures Affecting the Protection and Enforcement of Intellectual Property Rights* WT/DS362/R (09-0240) (Jan. 26, 2009) (showing the United States and China disputing the meaning of Article 1.1); *see also* TRIPS Agreement, *supra* note 20, arts. 7 (objectives), 8 (principles); Peter K. Yu, *The Objectives and Principles of the TRIPS Agreement*, *supra* note 193, at 1008–18 (discussing TRIPS article 8).

446. *See, e.g.*, Bryan Mercurio, *TRIPS-Plus Provisions in FTA's: Recent Trends*, *in* REGIONAL TRADE AGREEMENTS AND THE WTO LEGAL SYSTEM 215, 215–37 (Lorand Bartels & Federico Ortino eds., 2006) (discussing the possibility of TRIPS-plus provisions affecting many different areas of IP law).

447. Okediji, *supra* note 196, at 350 (remarking on TRIPS setting "important limits on the scope of copyright protection . . . in some cases for the first time in history"); *see also* WIPO DEVELOPMENT AGENDA PROPOSAL, *supra* note 390 (pledging "to ensure that development considerations form an inte-

For these and other reasons, we remain confident that the positive law mandates of the treaties do not negate the proposals for reform outlined above, so much as a lack of political will and an absence of the kind of collective action needed to stimulate it. In what follows, nonetheless, we devote particular attention to the three-step test itself, which some consider the biggest obstacle of all to reform.

1. Reinterpreting the Three-Step Test

At least one expert believes that the three-step test already allows more open-ended assessments of both existing and future limitations and exceptions, in the manner of U.S.-style fair use decisions, than many courts and commentators suppose.[448] On this view, the extension of the three-step test to all of copyright law would actually provide a tool—if properly worked—that could help to deal with fact-specific cases, without necessarily undermining the force of general exceptions for research and education.[449] Support for this view exists in a number of recent decisions by German Courts,[450] in the Agreed Statement to Article 10 of the WCT,[451] and in the willingness of one WTO panel to read the TRIPS Agreement in light of subsequent developments under Article 10 of the WCT itself.[452] Unfortunately, the EC's InfoSoc Directive ignored these openings and deliberately used the three-step test to further confine even

gral part of WIPO's work"); HUGENHOLTZ & OKEDIJI, *supra* note 159, at 7 (noting the reconsideration of balancing principles within the framework of international copyright); Maskus & Reichman, *supra* note 24, at 35 (observing the possibility of governments acting as "defenders and promoters of a transnational system of innovation in which properly balanced intellectual property rights were not ends in themselves, but rather the means of generating more scientific and technical inputs into a healthy competitive environment").

448. *See* Senftleben, *supra* note 48, at 543 (observing that "the three-step test sets forth open-ended factors"); *see also* Geller, *supra* note 50, at 571 (arguing that neither the idea-expression distinction nor constitutionally rooted exceptions favoring free speech and other uses ought to be subject to the three-step test).

449. *See* Senftleben, *supra* note 48, at 545–52 (analyzing the three-step test in the context of fair use).

450. *See* Geller, *German Approach*, *supra* note 50, at 563 (describing the methodology by which German judges analyze infringement cases); *id*. at 535–40 (discussing German cases in detail). *But see* Senftleben, *supra* note 48, at 530–34 (discussing rigidity of the Netherlands and French courts).

451. *See supra* note 42 and accompanying text.

452. *See* US–Section 110(5) Panel Report, *supra* note 123,¶ 6.67 (outlining the position of the United States regarding Article 10 of the WIPO Copyright Treaty).

preexisting limitations and exceptions in the copyright laws of member states,[453] an outcome Professor Senftleben has deemed "a worst case scenario."[454]

More promising in this regard are recent proposals from the Max Planck Institute for judges applying the three-step test, which could induce them to undertake a more normative analysis than in the past.[455] That type of analysis is something European positivist courts are unaccustomed to doing,[456] although under a fair use provision, as codified in U.S. copyright law in 1976, for example, courts must routinely perform this very task.[457]

The Max Planck proposals deliberately build on the preamble to the WCT, which recognizes "the need to maintain a balance between the rights of authors and the larger public interest, particularly education, research, and access to information . . . ."[458] In that vein, the proposal would:

- Mandate that courts applying the three-step test falling under Article 13 of the TRIPS Agreement in copyright cases take into account the interests of third parties, including individual and collective interests of the general public, and not just the interests of rights owners;[459]
- Avoid prioritizing any one step, or requiring an affirmative answer to all steps, but would instead require a judicial balancing of the different prongs, as occurs under

453. *See supra* text accompanying note 72.

454. Senftleben, *supra* note 48, at 528–29.

455. *See* Christophe Geiger et al., *Declaration: A Balanced Interpretation of the "Three-Step Test" in Copyright Law*, 39 INT'L REV. INTELL. PROP. & COMPETITION L. 707, 708 (2008) [hereinafter Max Planck Declaration on the Three-Step Test].

456. And should not do, according to some. *See, e.g.*, Ficsor, *supra* note 133.

457. One should recall that the relevant WTO Panels do insist that the test has normative content, but without so far specifying its nature, and indirectly limiting its impact. *See, e.g.*, US–Section 110(5) Panel Report, *supra* note 123,¶ 6.184 (describing the EC's emphasis on potential impact of an exception versus the actual market effects); *cf.* Panel Report, *Canada–Patent Protection of Pharmaceutical Products*,¶ 7.54, WT/DS114/R (Mar. 17, 2000), (writing that the panel believes the word normal used in Article 30 "can be understood to refer either to an empirical conclusion about what is common within a relevant community, or to a normative standard of entitlement").

458. WCT, *supra* note 42, pmbl.

459. Such a provision was expressly inserted into Article 30 of the TRIPS Agreement with regard to patents. *See* TRIPS Agreement, *supra* note 20, art. 30 (extending the three-step test to patent law for the first time while adding the words "taking account of the legitimate interests of third parties").

U.S. fair use law;[460]

- Give particular weight to unauthorized uses that are underpinned by fundamental rights[461] and other "common interests," notably "in scientific progress and cultural or economic development;"[462]
- Seek to promote competition, especially in secondary markets, by a correct balancing of interests, but without making the three-step test a proxy for competition law;
- Expressly recognize that adequate compensation may be less than market pricing where other public concerns are at stake, including third-party interests or the general public interest.[463]

The Max Planck Institute's carefully considered reforms would introduce a healthy dose of legal realism into the traditional positivism surrounding European copyright jurisprudence. They would counter the prevailing notion in Continental copyright law, which favors narrowly confined exceptions in deference to the authorial interest.[464] They would also curb the

460. *See* 17 U.S.C. § 107 (2006) (discussing fair use). *But see* Ficsor, *supra* note 133 (arguing that the legislative history of the Berne Convention prohibits this approach, even though the three-step test itself has now been recodified with significant variations in both art. 30 (patents) and art. 17 (trademarks) of the TRIPS Agreement). It is not clear why the legislative history of the experimental "package deal" that gave us article 9 of the Berne Convention in 1967 should operate as a deadweight bar to a judicially more enlightened approach to the revised three-step test as now applied, with significant variations, to all four of international intellectual property law's major subject-matter categories. Otherwise, we are obliged to assume that only authors' rights remain somehow immune from the need "to take into account the interests of third parties" at the international level.

461. *Cf.* HUGENHOLTZ & OKEDIJI, *supra* note 159, at 31 (noting fundamental rights must be balanced with other IP rights); LANGE & POWELL, *supra* note 198, at 171–72 (stressing the First Amendment); *see also* HELFER & AUSTIN, *supra* note 196, at 221–33 (examining interface between fundamental rights and intellectual property rights in both American and international contexts). *But see* Laurence R. Helfer, *Toward a Human Rights Framework for Intellectual Property*, 40 U.C. DAVIS L. REV. 971, 994 (2007) (arguing that if authors' interests are fundamental rights, government regulation of those rights should be narrow).

462. Max Planck Declaration on the Three-Step Test, *supra* note 455, at 712*; cf.* Chon, *supra* note 164, at 275–76.

463. *See* Max Planck Declaration on the Three-Step Test, *supra* note 455, at 712; Shaver, *supra* note 195, at 183–84 (calling for a reexamination of the consistency between IP policies and the greater public interest in science).

464. However, at least one authority questions the ability of courts adjudicating private law disputes to tinker with international public law mandates. Email from Paul Geller to Jerome Reichman (Oct. 9, 2011, 12:08 EST) (on file with the authors); *see also* Ficsor, *supra* note 133.

European Commission's tendency to fall back upon a market failure rationale for limitations and exceptions,[465] a tendency from which U.S. courts have increasingly retreated in recent important decisions bearing on fair use.[466]

2. Leveraging the WIPO Development Agenda

The outlook for these proposals could depend in part on the continued spread of the fair use doctrine beyond the United States,[467] and on the extent to which the developing countries affirmatively responded to them within the ambit of the WIPO Development Agenda.[468] This Agenda has already mandated formal scrutiny of limitations and exceptions under the prevailing copyright conventions, with a view to clarifying the extent to which they insufficiently promote access to knowledge in developing countries. The WIPO Development Agenda has also spawned a major normative reexamination of limitations and exceptions, prepared by Professors Hugenholtz and Okediji, to this same end.[469]

465. *See* BURRELL & COLEMAN, *supra* note 176, at 167–87.

466. *See supra* note 133 and accompanying text. It is worth noting that Dr. Ficsor claims one could interpret the three-step test to yield the flexibility that the Max Planck Declaration on the Three-Step Test seeks to attain, albeit by more traditional means. *See* Ficsor, *supra* note 133.

467. *See, e.g.*, Lei No. 9.610, de 19 de Fevereiro de 1998, DÍARIO OFICIAL DA UNIÃO [D.O.U], (art. 46 (viii)) de 20.2.1998 (Braz.) (listing transformative and incidental uses among non-violations of copyright); Copyright Act, R.S.C. 1985, c. C-42, § 29 (Can.) ("[f]air dealing"); Copyright and Related Rights Act 2000 (Act No. 28/2000) § 50(2), (Ir.), *available at* http://www.wipo.int/wipolex/en/text.jsp?file_id=128034 ("[f]air dealing"); Copyright Act, 5768-2007 2199 LSI 34, § 19 (2007) (Isr.), *available at* http://www.wipo.int/wipolex/en/text.jsp?file_id=132095 (allowing use for, among other things, research by an educational institution); INTELLECTUAL PROPERTY CODE, § 185 (Phil.), *available at* http://www.wipo.int/wipolex/en/text.jsp?file_id=129343 (noting that fair use for reporting, teaching and other educational uses is not copyright infringement). *But see* HARGREAVES, *supra* note 26, at 5 (declining to follow this trend).

468. *See* Treaty on Access to Knowledge (Draft) art. 1-1, May 9, 2005, *available at* http://www.cptech.org/a2k/a2k_treaty_may9.pdf (last visited Jan. 23, 2012) (providing that the objectives of the treaty "are to protect and enhance [expand] access to knowledge, and to facilitate the transfer of technology to developing countries"); HUGENHOLTZ & OKEDIJI, *supra* note 159, at 8 (finding the goal of the WIPO Development Agenda is to bridge knowledge and technology gaps between nations with differing economic conditions); WIPO DEVELOPMENT AGENDA PROPOSAL, *supra* note 390 (underscoring the importance of development considerations).

469. *See* HUGENHOLTZ & OKEDIJI, *supra* note 159, at 30–34 (reexamining limitations and exceptions in the context of human rights, competition law, and consumer law); *see also* SÉVERINE DUSOLLIER, WORLD INTELLECTUAL PROP. ORG., SCOPING STUDY ON COPYRIGHT AND RELATED RIGHTS AND THE

If influential WIPO members lent it their support, these initiatives could at least produce a soft-law declaration of normative content that might turn the three-step test into a pathway towards a proper users' rights formulation.[470] A soft-law instrument adopted at WIPO could become particularly influential if it endorsed or incorporated the Max Planck Institute's own "Declaration on the Three-Step Test."[471] If, moreover, a regional group of, say, Latin American, Asian, or African countries decided to implement proposals emerging from these deliberations in their domestic laws,[472] as Brazil had begun to do at the time of writing,[473] it could trigger a broader movement

PUBLIC DOMAIN 12–13 (2010), *available at* http://www.wipo.int/edocs/mdocs/mdocs/en/cdip_4/cdip_4_3_rev_study_inf_1.pdf (discussing the role of the public domain as a "repository of traditional knowledge").

470. HUGENHOLTZ & OKEDIJI, *supra* note 159, at 49 (discussing the idea "that a joint initiative between the WIPO and WTO could be an ideal and appropriate expression of a soft-law modality with real impact for collective action on an international instrument on L&E's"). In this connection, we would particularly welcome recognition from the WIPO process that government use of copyrights for, say, science and educational purposes, trumps all other legal or normative considerations. *See* Daniel J. Gervais, *Making Copyright Whole: A Principled Approach to Copyright Exceptions and Limitations*, 5 U. OTTAWA L. & TECH. J. 1, 22 (2008) (Can.) (contending that "[c]opyright rights should not prevent governmental use in the public interest").

471. *See* Max Planck Declaration on the Three-Step Test, *supra* note 455, at 711–13 (reformulating practical applications of the three-step test).

472. *Cf.* Laurence R. Helfer, Karen J. Alter & M. Florencia Guerzovich, *Islands of Effective International Adjudication: Constructing an Intellectual Property Rule of Law in the Andean Community*, 103 AM. J. INT'L L. 1, 2–4 (2009) (noting that the Andean Tribunal of Justice, an international court in South America, has helped solidify appropriate IP laws); *see also* ACCESS TO KNOWLEDGE IN AFRICA: THE ROLE OF COPYRIGHT (C. Armstrong et al. eds., 2010); Karen J. Alter et al., *Transplanting the European Court of Justice: The Experience of the Andean Tribunal of Justice* 19–23 (Duke Law Faculty Scholarship Paper 2458, 2012), *available at* http://scholarship.law.duke.edu/faculty_scholarship/2458.

473. Current Brazilian law already implements a provision on "transformative and incidental uses" while novel pending proposals could more aggressively expand this provision within the context of the three-step test. *See* Paranaguá, *supra* note 177, at 29–42. However, the current Brazilian Government may retreat from the positions staked out by its predecessor. Pedro Paranaguá, *Brazil's Copyright Reform–an update*, PEDRO PARANAGUÁ (Apr. 19, 2011), http://pedroparanagua.net/2011/04/19/brazils-copyright-reform-an
-update/ (stating "[t]he whole work and progress [on copyright reform] of the past 8 years undertaken under Lula's government is at risk"); Pedro Paranaguá, *Inside Views: Brazil's Copyright Reform: Schizophrenia?*, IP-WATCH (Feb. 8, 2011), http://www.ip-watch.org/weblog/2011/02/08/inside-views-brazils-copyright-reform-schizophrenia/ (questioning the viability of some pending reforms).

for codification of users' rights at the international level.[474]

III. ENABLING *E*-SCIENCE TO MANAGE ITS OWN UPSTREAM RESEARCH ASSETS

So far, our focus on measures to make copyright and related laws more science friendly has operated on the premise that publishers would continue to play their traditional role in the process of disseminating research results. This very premise, however, makes it unlikely that the legislative or judicial reforms outlined above are implementable within the OECD countries in the near future, despite growing attention to the conflict between intellectual property laws and the needs of science in a digital age.[475]

The lobbying power of publishers has never been greater. Concerns about protecting the interests of the entertainment and cultural industries continue to elicit stronger intellectual property laws at both the national and international levels, with little or no regard for their potentially deleterious effects on scientific research or the provision of other public goods.[476] Whether reform efforts underway in some emerging economies may create a countervailing trend is impossible to predict,[477]

474. *See generally* Reichman, *supra* note 121 (noting the possibility of intellectual property institutions benefitting countries at varying levels of economic development if developing countries lead, rather than follow, on the path to reform).

475. *But see* HARGREAVES, *supra* note 26, at 43 (demanding relief for science as a fillip to economic growth); NATIONAL ACADEMIES OF SCIENCE COMMITTEE ON THE IMPACT OF COPYRIGHT POLICY ON INNOVATION IN THE DIGITAL ERA, http://sites.nationalacademies.org/PGA/step/copyrightpolicy/index.htm (last visited Jan. 23, 2012) (stating the goal of the Board is "to expand and improve research on the impacts of copyright policy, particularly on innovation in the digital environment").

476. *See supra* notes 428–30, 446 (citing EC's Enforcement Directive, ACTA, SOPA, and FTAs). However, SOPA has stalled for the moment, and there are also some other exceptions to this trend. In the EC, for example, *see* Ritch, *supra* note 37, at 66–77. In the United States, sponsors of the Sabo Bill would have placed all published articles resulting from publicly funded research results in the public domain, but this proposal has never moved forward. H.R. 2613, 108th Cong. (1st Sess. 2003).

477. *Cf*. Amy Kapczynski, *Harmonization and Its Discontents: A Case Study of TRIPS Implementation in India's Pharmaceutical Sector*, 97 CALIF. L. REV. 1571 (2009); Rochelle Dreyfuss, *The Role of India, China, Brazil and Other Emerging Economies in Establishing Access Norms for Intellectual Property and Intellectual Property Lawmaking* 1–3 (Inst. for Int'l Law and Justice, Working Paper 2009/5, Public Law Research Paper No. 09-53, 2009), *available at* http://ssrn.com/abstract=1442785 (discussing the role of developing nations in the larger context of developing intellectual property law); *see*

but the benefits of such a trend—if it emerges—would likely play out over a lengthy period, and might not extend, at best, beyond certain regional alignments.

Science policy will, accordingly, have to evolve defensive measures of its own in order to neutralize interference from the default rules of copyright, contract, and database protection laws as they stand. Scientists, in short, will increasingly have to manage their own upstream research assets as global public goods, sheltering them within a reinvigorated sharing ethos, in the interests of a more productive downstream innovation system otherwise driven by the incentives of industrial property laws.[478]

As will be seen below, the scientific community, led by many dedicated and visionary individuals and institutions, has already taken steps to widen the choice of open distribution outlets for scientific literature and data. These promising initiatives nonetheless remain hampered by the community's continued reliance on publishing intermediaries. In this Part, we first reevaluate the role that these intermediaries should play under existing institutional constraints. We then ask if better solutions are not likely to emerge from a change of paradigm, in which the outsourced intermediaries are either downgraded or abandoned altogether, open access modes of dissemination were to take their place and the knowledge production and scholarly communication functions were increasingly to be absorbed into digitally integrated thematic research environments.[479]

A. REASSESSING THE ROLE OF PUBLISHING INTERMEDIARIES

Until recently, the customary practice of the scientific community was to rely almost entirely on external publishing

also Graeme B. Dinwoodie & Rochelle C. Dreyfuss, *Designing a Global Intellectual Property System Responsive to Change: The WTO, WIPO, and Beyond*, 46 HOUS. L. REV. 1187, 1212 (2009) (remarking on emerging nations discovering different interest balancing methodologies than those in the developed world); Reichman, *supra* note 121, at 1118–19 (noting the pressures developing countries face to mimic the legislation of other OECD countries and the possibilities for exerting new leadership).

478. Maskus & Reichman, *supra* note 24; Reichman & Uhlir, *supra* note 2. For applications to patented research inputs, see Lee, *supra* note 110, at 901 (arguing that upstream patents on research tools in the biomedical arena may adversely affect downstream productivity).

479. Uhlir, *supra* note 250, at 83. *See generally* Jorge L. Contreras, *Data Sharing, Latency Variables, and Science Commons*, 25 BERKELEY TECH. L.J. 1601 (2011) (suggesting latency analysis and other design techniques be implemented to support the information commons).

intermediaries, even though the bulk of published scientific research would have been government-funded.[480] In conformity with this practice, authors of scientific articles normally assign their copyrights to publishers, who are either commercial entities or learned societies and other not-for-profit scientific organizations.[481] As a result, it was publishers, rather than authors, that initially determined the conditions for access to these same articles and for reuse of the information and data they contain.[482] At the same time, authors benefit from the peer-review mechanisms many of these publishers manage, which makes them reluctant to publish outside traditional, well-established or high impact outlets, when they have the choice.

1. Costs and Benefits of the Traditional Approach

Historically, the logic behind this custom was the need to defray high front-end publishing costs and to perform laborious tasks, such as typesetting and formatting, as well as the physical distribution of printed copies.[483] A second factor was the willingness of many scientific subcommunities to entrust learned societies with the publication task, which in turn became a primary source of revenue for the societies whether they actually performed the publishing service, or, increasingly in recent years, outsourced it to a commercial publisher in return for a share of the proceeds. Over time, the possibilities for profit

480. *See, e.g.*, JOHN WILLINSKY, THE ACCESS PRINCIPLE: THE CASE FOR OPEN ACCESS TO RESEARCH AND SCHOLARSHIP 2 (2006) (reporting that NIH itself funds some 60,000 scientific papers per year); Contreras, *supra* note 479, at 1652 (reporting that some "50,000 different scientific journals [were] in print at the end of 2003, many of which are published by commercial entities that charge significant subscription fees").

481. *See, e.g.*, Contreras, *supra* note 479, at 1652–55 (reporting that the three largest publishers of scientific journals—Reed Elsevier (about 1800 titles), Taylor and Francis (about 1000 titles) and Springer Verlag (about 500 titles) together control about sixty percent of scientific research content).

482. *See, e.g.*, Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 326; Hilty, *Five Lessons About Copyright*, *supra* note 2, at 123–24. Professor Hilty, among others, stresses that for-profit publishers tend to impose greater restrictions on access and use than authors or the scientific community more generally would deem desirable, given that the latter receives motivation through reputation benefits that may accrue from unhindered diffusion. *See supra* note 2 and accompanying text.

483. *See* Hilty, *Five Lessons About Copyright*, *supra* note 2, at 120–21 (discussing the decline of such high-end tasks with the rise of personal computer programs). However, university presses absorbed these or similar functions with respect to specialized books subject to market failure in the normal book trade. Eugene Volokh, *The Future of Books Related to the Law?*, 108 MICH. L. REV. 823, 838–40 (2010) (discussing markets and academic book publishing).

have enticed commercial publishers to buy out the learned societies, although some commercial publishers do make continuing payments.[484]

Lately, scholars have challenged such logic,[485] and some have argued that the value added by such intermediaries has reached diminishing returns.[486] The once costly front-end publishing function has increasingly been reduced to desktop publishing and automated formatting,[487] while the peer-review function, of great importance to the integrity of science, is performed gratis by scientists who themselves gain power, reputation, and advanced access to new developments from their voluntary labor.[488] This built-in quid pro quo within the scientific community has perpetuated the dominance of the proprietary intermediaries, along with the practice of negotiating the sale (now licensing) of subscriptions directly to libraries without inputs from users. Meanwhile, the supervisory or editorial role of

484. *See* Toby Miller, *"Drowning in Information and Starving For Knowledge": 21st Century Scholarly Publishing*, 1 INT'L J. COMM, 123, 125 (2007), *available at* http://ijoc.org/ojs/index.php/ijoc/article/viewFile/121/56 ("Since that time, the development of digital technologies has seen for-profit [science] publishers proliferate, as the cost of entering the industry has diminished, and prices have continued to outstrip inflation . . . ."); Interview by Research Information Staff with Rene Olivieri, CEO, Blackwell Publ'g (Jan./Feb. 2005) *available at* http://www.researchinformation.info/features/feature.php?feature_id=92 (stating that "[t]hree quarters of the top 200 and two-thirds of the top 500 ISI-ranked titles are owned by societies or other non-profit organisations. The majority of these titles are self-published, but between a quarter and a third are contracted out to another publisher").

485. Among the many excellent analyses, too numerous to cite, see, for example, WILLINSKY, *supra* note 480; Nancy Kranich, *Countering Enclosure: Reclaiming the Knowledge Commons*, *in* KNOWLEDGE AS A COMMONS, *supra* note 10, at 85, 98 (noting the popularity of papers posted on open access databases versus those not available on such databases); Peter Suber, *Creating an Intellectual Commons through Open Access*, *in* KNOWLEDGE AS A COMMONS, *supra*, at 171, 185–86 (Charlotte Hess & Elinor Ostrom eds., 2007) (noting the cancellation of expensive databases by libraries at Harvard, Cornell, Duke, and University of California in favor of open access platforms); s*ee also* Contreras, *supra* note 479, at 1652–55 (citing authorities).

486. *See* Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 326–27.

487. *See, e.g.*, *id.* at 325–26 (noting that Internet-based web sources did away with the need to produce tangible goods).

488. Even this traditional form of peer review is now under attack. *Cf.* Linda Hooper-Bui, *A Gulf Science Blackout*, N.Y. TIMES, Aug. 25, 2010, at A21. Note, however, that some journals pay scientists to conduct peer reviews of articles. *The Economic Case for Open Access in Academic Publishing*, FREE ACAD. RES. ASS'N (Feb. 17, 2011), http://www.faraweek.org/?p=6 ("If a journal is highly selective, it must pay for peer review of many articles for each article it accepts.").

the learned societies, with some exceptions, has diminished over time, although the dependence of such societies on income from publishing seems ironically to have increased.[489]

This web of traditional practices and interests carries into the digital age, even though digital networks offer repeated opportunities to break with the limits of the print model and make whole new dimensions of publishing possible. What really changes in the online environment are not the basic principles of scientific collaboration,[490] so much as the burdens and role of publishing intermediaries in the sciences, who increasingly may never publish a physical print copy at all.

This growing tendency to rely on online distribution in the sciences has undermined prior balancing effects of the first sale principle under traditional copyright law.[491] For example, there are fewer printed copies extractable from initial revenues and then freely redistributed, and the subscription price per journal may rise prohibitively.[492] Even when printed copy distribution continues, the role of publishing intermediaries' in the online environment changes radically, as they add less value to the authors' own research results[493] and become online service pro-

489. Exceptions occur if the learned society maintains its own editorial subsidiary, as occurs with the Journal of the American Medical Association (JAMA). In Latin America, and probably most other developing countries, scientific journals are still published at universities. Universities in OECD countries have themselves massively entered the book publishing trade to overcome market failure attributable to commercial presses, while oddly remaining aloof from the publication of scientific journals, with rare exceptions. *See* GLOBAL IP STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS, *supra* note 382 (Part III).

490. *See, e.g.*, David, *supra* note 25, at 21 (describing the various ethos and norms within various academic fields); Stodden, *supra* note 255, at 33 (finding "public safeguards should also enable digital telecommunications networks to link the providers of scientific and technical inputs in an endless research commons").

491. *See, e.g.*, R. Anthony Reese, *The First Sale Doctrine in the Era of Digital Networks*, 44 B.C. L. REV. 577, 577–78 (2003) (discussing first-sale doctrine and the effect of technology).

492. *See, e.g.*, Contreras, *supra* note 479, at 1652–53 (discussing the cancellation of subscriptions by academic libraries due to rising costs); *see also* NAT'L ACAD. OF SCIS. ET AL., ENSURING THE INTEGRITY, ACCESSIBILITY, AND STEWARDSHIP OF RESEARCH DATA IN THE DIGITAL AGE 78 (2009) (observing rise in subscription prices for scientific, medical, and technical journals).

493. *See, e.g.*, Hilty, *Five Lessons About Copyright*, *supra* note 2, at 123 (questioning the added value of electronic-only data compiled and formatted by the researchers themselves); Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 326–27 (indicating a lack of added value within the electronic data management framework); MAX PLANCK RESPONSE TO EC GREEN PAPER, *supra* note 383, at 5–6 (categorizing the divergent roles and interests of inter-

viders whose primary contribution to authors is convenience.[494]

Notwithstanding these changed conditions, the rules of copyright law have simultaneously been extended to the digital environment, and the protections available have been greatly strengthened, as demonstrated earlier, in order to make the online environment safe for the transmission of printed text. Because scientific publishing has drifted along with this tide, the full possibilities of digitally manipulating research results for new scientific discoveries are hamstrung by the layers of protection inherited from these legal and institutional developments, and there is a pressing need to avoid the resulting harm to science.[495]

The open access movement is a major response to this challenge. Today, an ever-growing number of scientific journals are published online, on a fully or partially open access basis,[496] although these are not yet always the most prestigious journals in their respective fields.[497] To the extent that the learned soci-

mediaries).

494. This characterization, among others, is of course hotly contested by publishers who see themselves as indispensable pillars of the scientific endeavor that add considerable value to its research outputs, whereas less rigorous "open access" methods enable less deserving articles to be published. *See* John Ochs, Am. Chem. Soc'y, ACS Submission to the National Academies' Committee on the Impact of Copyright Policy on Innovation in the Digital Era, Address Before the Board on Science, Technology and Policy 2–4 (Oct. 15, 2010) *available at* http://sites.nationalacademies.org/PGA/step/copyrightpolicy/PGA_066845; *see also* Letter from STM, *supra* note 243 (extolling large amounts STM publishers invest in digital technologies to benefit researchers). In reality, not only have publishers sought to configure the online environment on the model of print media, they have also tried to subordinate the new class of intermediaries that digital technology has generated, the Internet System Providers (ISPs), to their own ends, adding yet another layer of potential barriers and transaction costs to the diffusion of research results. *See, e.g.*, Okediji, *supra* note 51, at 116 (calling for meaningful fair use standards); Okediji, *supra* note 196, at 349–50 (describing the process by which owners used new technological advances to stake claims to previously noncopyrighted material).

495. *See, e.g.*, HARGREAVES, *supra* note 26 at 46–47; Kranich, *supra* note 485.

496. *See, e.g.*, Contreras, *supra* note 479, at 1652–57; Lucie Guibault, *Owning the Right to Open Up Access to Scientific Publications*, *in* OPEN CONTENT LICENSING: FROM THEORY TO PRACTICE 137, 137–67 (Lucie Guibault & Christina Angelopoulos eds., 2011). For empirical evidence in one major field, see Uhlir, *supra* note 250, at 79–80 (summarizing evidence about microbiology journals from GLOBAL IP STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS, *supra* note 382).

497. Many of these journals are relatively new, while the ISI index (which counts only citations) does not begin tracking impact until a journal has been published for a five-year period. Moreover, some open access journals have

eties themselves resist the drive for greater use of open access modalities, their dependence on royalty streams from commercial publishers for scholarly pursuits and other activities may explain their reluctance to change more than the economics of publishing itself.

While the outsourcing of scientific journals to commercial publishers may still make sense, despite an array of other options, there is a growing trend to subsidize the open access format, even in an otherwise commercial context, as part of the publicly funded research process. The funding agencies, foundations, and universities that support specific research projects may thus provide supplementary funds to pay the commercial publisher a set fee in lieu of royalties or other compensation.[498] In such cases, the funders may—and increasingly will—set open access terms as the quid pro quo of the subsidy itself.[499] Commercial publishers are increasingly disposed to allow this option, and science funders have begun aggressively to insist on it in some disciplines,[500] although the sustainability of this approach obviously depends on the continued availability of financial resources for this purpose.

The point is that desktop-publishing techniques and online transmission have made it technically (if not culturally) feasible to redefine the role of existing intermediaries who benefit from research-hostile intellectual property laws and practices. By the same token, once publicly funded research results are

achieved high impact in recent years. For pressures by the Harvard faculty advisory council to "move prestige to open access [journals]" in order to offset soaring subscription prices, see Faculty Advisory Council, *Faculty Advisory Council Memorandum on Journal Pricing*, HARVARD UNIVERSITY, Apr. 17, 2012, http://isites.harvard.edu/icb/icb.do?keyword=k77982&tabgroupid=icb.tabgroup143448.

498. *See, e.g.*, Contreras, *supra* note 479, at 1655–57.

499. Raym Crow, *Developing an Institutionally-Funded Publishing Channel: Context and Considerations for Key Issues*, ECOMMONS@CORNELL 10–11 (July 1, 2004), http://hdl.handle.net/1813/178; *Research Funders' Open Access Policies*, SHERPA, http://www.sherpa.ac.uk/juliet/index.php (last visited July 29, 2011) (showing a number of research funders whose guidelines require open access to funded research).

500. *See* Robert Terry & Robert Kiley, *Open Access to the Research Literature: A Funder's Perspective, in* OPEN ACCESS: KEY STRATEGIC, TECHNICAL AND ECONOMIC ASPECTS 101, 101–03 (Neil Jacobs ed., 2006); *Open Access Policy,* WELLCOME TRUST, http://www.wellcome.ac.uk/About-us/Policy/Policy-and-position-statements/WTD002766.htm (last visited Apr. 20, 2012); Policy on Enhancing Public Access to Archived Publications Resulting from NIH-Funded Research, 70 Fed. Reg. 6891-01 (Feb. 9, 2005), *available at* http://grants.nih.gov/grants/guide/notice-files/NOT-OD-05-022.html; *see also* Contreras, *supra* note 479, at 1652–55.

made available to the scientific community, with due respect for attribution, it becomes logical to ask why scientists *qua* users should ever pay scientists *qua* authors, irrespective of what the default rules of copyright and database laws provide to the contrary.[501]

2. Redefining the Role of Publishing Intermediaries under Current Institutional Constraints

Given the diminished costs incurred by today's intermediaries in the online environment, and the shrinking amount of added value they actually contribute under modern conditions,[502] one must logically ask what entitlements they should be allowed to claim for secondary uses of published scientific research results in either the print media or the online environment, and how such claims should be implemented when recognized. At bottom, what science publishers provide in the online environment are measures to maintain quality assurance and control, marketing and distribution, plus certain technical services that the research community could provide for itself, yet typically does not in rich countries, perhaps because of inertia. The reputational benefits that are of primary importance for authors accrue from the peer-review function that is largely provided gratis by other reputable scientists. The intermediaries' utility stems from maintaining and updating electronic collections, possibly also from electronic indexing of these collections, and possibly from the provision of other technical services needed to make embedded data and information available upon request.[503]

501. As noted earlier, the scientists' incentives flow almost exclusively from reputational benefits. *See* Davis & Connolly, *supra* note 17 (noting researchers' reluctance to release results before publication); Jordan, *supra* note 17 (noting the importance of publication and priority for scientists).

502. As providers of digital services, publishing intermediaries increasingly resemble the Red Hat Corporation, which provides services to users of Linux Software but does not control the rights to Linux. Robert Young, *Giving it Away: How Red Hat Software Stumbled Across a New Economic Model and Helped Improve an Industry*, 4(3) J. ELEC. PUB. (Mar. 1999), *available at* http://quod.lib.umich.edu/cgi/t/text/text-idx?c=jep;view=text;rgn=main;idno=3336451.0004.304*; see also* BITS OF POWER, *supra* note 36, at 111–13. However, the science publishers insist that they actually contribute more services than are identified in the text and at considerably greater investment costs than are recognized in the text. *See, e.g.*, Letter from STM, *supra* note 244. The question is whether these investments actually benefit research science or merely ensure greater profits to publishers under restrictive copyright laws.

503. *See* Young, *supra* note 502; Letter from STM, *supra* note 244. *But cf.* BITS OF POWER, *supra* note 36, at 111–13 (discussing the ways in which the

Although science publishers must necessarily charge for these services, funding agencies should, and increasingly do, ensure that government-funded research results remain freely available in public or private repositories, so that to defray these costs, users could perform the needed technical services on their own.[504] Such a policy also serves to attenuate the problems of sole-source providers, who monopolize public science and can pose serious challenges for digitally integrated scientific research.[505]

Recognizing that publishers must charge for their technical *services* need not extend to endowing them with exclusive rights to downstream uses or reuses of the scientific *product* they make available. On the contrary, the proprietary restrictions that such rights enable intermediaries to impose in the name of authors' rights, without any palpable authorial contribution, should be swept away as inconsistent with both the needs of science and the principles of sound exceptions to copyright and database laws as expounded above.

Because publishers of scientific journals depend, in the first instance, on contractual relationships with the learned societies (or other sponsors of academic journals), these regulatory adjustments can be achieved by contract, without need of legislation.[506] For example, institutional mandates can restrict the transfer of copyrights in publicly funded research results

price imposed by private intermediaries for these services is "countercultural" to scientific communities in which "exchange is not monetized but depends on social norms specifying expected and well-understood levels of contribution").

504. *See* HARGREAVES, *supra* note 26; Stodden, *supra* note 255 (discussing NSF Guidelines, Creative Commons and Science Commons licensing and proposing a new standard contractual template of her own); Michael W. Carroll, *Complying with the National Institutes of Health Public Access Policy: Copyright Considerations and Options*, SPARC/SCIENCE COMMONS/A-RL White Paper (Feb. 2008), *available at* http://www.arl.org/sparc/bm~doc/NIH_Copyright_v1.pdf; US Dep't of Health & Human Servs., *Quick Facts About The NIH Public Access Policy*, PUB. ACCESS NIH (Mar. 2009), http://publicaccess.nih.gov/Public_Access_Brochure.pdf.

505. *See, e.g.*, HARGREAVES, *supra* note 26; Reichman & Uhlir, *supra* note 258, at 799–812.

506. For example, universities and publishers have negotiated six to twelve month embargo periods giving the latter a term of exclusivity before articles are deposited in open access repositories. *See, e.g.*, Contreras, *supra* note 479, at 1616, 1654 (labeling this practice as "knowledge latency"). For a recent analysis, see Jorge L. Contreras, *Wait for it . . . Commons, Copyright, and the Private (Re)ordering of Scientific Publishing* 37–38 (Working Paper, Mar. 4, 2012), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2015885 (proposing that scientific authors grant publishers a 1-year license to recoup costs and make a profit).

and require that such results be made available in appropriate repositories. Until this transformation of the current publishing model occurs, however, funders of scientific research—whether government agencies, foundations, or academic institutions—should insist on open access publishing conditions as part of the grant-making process.[507]

So long as the subscription model is preserved, intermediaries whose services are deemed of value to the relevant scientific communities should thus be required to allow scientists to make any and all needed research uses of published scientific articles, including full digital empowerment for uses of automated knowledge discovery tools, computational tools, and the like, without need for express permission, in exchange for fixed compensatory charges built into the online subscription price. That price could be tiered to reflect the for-profit nature of a subscribing entity, but it should never be calculated on a pay-per-article basis or the like.

Intermediaries would then be recognized for what they are, i.e., information brokers, and permissible charges would be negotiated on a reasonableness basis, one for example resembling the virtual-market criteria proposed by the Max Planck Institute.[508] In this context, however, we stress that the "market" for published scientific articles is already an artificial construct to begin with, built more on captured products than on verifiably value-adding services,[509] and increasingly sustained by compromise embargo periods following publication before some articles are deposited in open access repositories.[510]

Under such a contractually reconstructed regime,[511] scientists should have a right to use digitally provided content for any research purpose, including both personal use and redistribution, subject to the above-mentioned negotiated-service charges to cover the costs of delivery and maintenance. Disputes over the reasonableness of costs should not bar access to the use of these resources, but would have to be settled offline

507. *See infra* Section IV.B.

508. *See* MAX PLANCK RESPONSE TO EC GREEN PAPER, *supra* note 383, at 10–11; *see also* Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 315, 331–35 (elaborating the need for a response to the "prohibitive conditions of access and use" created by intermediaries).

509. *See* Uhlir, *supra* note 250; *see also* Reichman & Uhlir, *Database Protection*, *supra* note 258 at 796–869 (discussing the commodification of data and fears of its effects on science).

510. *See, e.g.*, Contreras, *supra* note 479, at 1616, 1654.

511. Reichman & Uhlir, *supra* note 2.

by mediation, arbitration or, as a last resort, litigation.[512] Resort to collection societies could then be avoided precisely because there would be no need to monitor actual use for payment purposes.

Only the actual costs of the intermediaries' brokerage services would need to be taken into account, along with a negotiated surcharge for profit.[513] All parties should understand that outer limits on the aggregate online service charges necessarily follow from the fact that taxpayers largely support the entire enterprise; from the need to conserve scarce resources for scientific investigation; and from the implicit threat that, if intermediaries refuse to cooperate, the funders themselves could support alternative arrangements, like those discussed below, including some institutionally organized not-for-profit providers.[514]

In fact, the movement to implement open access scholarly journals has rapidly expanded in the past decade, with over 7500 journals currently operating on this basis.[515] Under this approach, authors, research funders, and institutions (or some combination thereof) cover the costs of publication. Absent such an approach, care must be taken to avoid fostering sole-source

512. In practice, these prices could perhaps be set via negotiations between funding agencies, scientific subcommunities, and intermediaries, with a baseline open access proviso.

513. Any such negotiations must take into account the ways in which open access publishing itself is funded, including author pays, research funder pays or institution pays models. *See, e.g.*, INT'L COUNCIL FOR SCI.: COMMITTEE ON DATA FOR SCI. AND TECH., http://www.codata.org (last visited Apr. 20, 2012); *Sponsoring Consortium for Open Access Publishing in Particle Physics*, SCOAP^3, http://scoap3.org (last visited Apr. 20, 2012); *Jet Propulsion Lab.: Cal. Inst. of Tech.*, SCI FLO NETWORK, http://sciflo.jpl.nasa.gov/SciFloWiki/FrontPage (last visited Apr. 20, 2012).

514. *See infra* Parts IV.B & C. For-profit intermediaries may require some protection from copyright law and unfair competition law in order to prohibit wholesale duplication of an existing proprietary compilation. But such measures should not impede good-faith competitors from accessing public repositories and starting up comparable endeavors of their own, especially if these endeavors add new value to preexisting information. That, indeed, is the true thrust of the "thin copyright" doctrine. Feist Publ'ns, Inc. v. Rural Tel. Serv. Co., 499 U.S. 340 (1991). In that event, the negotiations under the contractual setup would presumably determine whose services were of value at what prices to the relevant subcommunities. In our opinion, however, reliance on not-for-profit intermediaries is always the preferable option. In that event, the negotiations under the contractual set up would presumably determine whose services were of value at what prices to the relevant subcommunities.

515. For a browsable directory of such journals, see DIRECTORY OF OPEN ACCESS JOURNALS, http://www.doaj.org (last visited Jan. 3, 2012); *see also* NAT'L FED'N OF ADVANCED INFO. SERVICES, http://www.nfais.org (last visited Jan. 25, 2012).

monopolies over unsubstitutable scientific materials that can never realistically be regenerated or otherwise readily obtained from public repositories.[516]

B. FUNDERS' ABILITY TO CONTRACTUALLY REGULATE ACCESS, USE, AND REUSE OF SCIENTIFIC LITERATURE AND DATA

Implicit in the foregoing analysis is the premise that most published scientific research results, at least in OECD countries, will have been funded largely by governments or nonprofit foundations. These entities have the power to impose conditions on use and reuse of the research results they fund, at least with respect to literature and data.[517]

For example, governments can dedicate government-generated work to the public domain, as occurs in the United States.[518] Funding agencies can mandate the deposit of publications in open access journals or, at least, in open access repositories,[519] as is happening ever more frequently in both the United States and the European Union. They can even impose analogs to fair use and to other codified limitations and exceptions by contract,[520] which both publishers and individual sci-

516. *See* Hilty, *Copyright Law and Scientific Research*, *supra* note 2, at 353; MAX PLANCK RESPONSE TO EC GREEN PAPER, *supra* note 383, at 14–16. *See generally* BITS OF POWER, *supra* note 36 (discussing the impact that strengthened protection of private databases could have on the public-good uses of scientific data).

517. *See, e.g.*, Contreras, *supra* note 479, at 1641–57 (examining steps taken by the NIH and Department of Energy to ensure that the output of the Human Genome Project was released to the public); Reichman & Uhlir, *supra* note 2, at 331–51 (discussing the formal and informal means by which institutions can shape the use of government-funded data). Patented research results would, of course, be subject to the Bayh-Dole Act, 35 U.S.C. §§ 200–212 (2006 & Supp. III 2009). Given the likely pushback from publishers and learned societies, however, the extent to which funding agencies would fully exercise this power remains to be seen.

518. 17 U.S.C. § 105 (2006); *see also supra* note 36 and accompanying text. For similar efforts underway in the European Union, see Miriam Bitton, *Implementing the Public Sector Information Directive*, 34 E.I.P.R. 75, 75–86 (2012).

519. *See, e.g.*, Carroll, *supra* note 504, at 2–3 (discussing NIH's mandatory policy of public accessibility); Reichman & Uhlir, *supra* note 2, at 331 (same); Stodden, *supra* note 255, at 9 (same); *see also* Lee, *supra* note 110, at 963–65 (comparing the freedom of states to regulate the public accessibility of patents as opposed to that of the NIH and the California Institute for Regenerative Medicine).

520. *See, e.g.*, Carroll, *supra* note 504, at 10–16 (discussing Science Commons licenses); Stodden, *supra* note 255, at 20–25 (proposing a Reproducible Research Standard to ensure attribution and facilitate the sharing of scientific works).

entists, as grantees, have to respect, especially if they wished to qualify for future grants. Funders can also support or reinforce self-archiving practices, and they increasingly provide for the costs of open access publishing in their grants.[521]

Besides building open access provisions into their research grants, funding agencies can support the formation of digitally integrated research commons to serve the needs of diverse thematic communities.[522] Universities can lend their own weight to all these initiatives,[523] and many have established open repositories for their employees' scholarly works. Individual scientists can adopt existing Creative Commons and Science Commons licenses when publishing their works.[524] Innovative proposals that go even farther, such as Victoria Stodden's proposed Reproducible Research Standard, should also be tested and perfected.[525]

The common feature of these and other initiatives is that relevant information is made openly and freely available in digital format and online. Through many of these initiatives, material is made available either under suitably reduced proprietary terms and conditions set out in permissive licenses[526] (e.g., the GNU licenses for open source software,[527] or Creative Commons licenses[528] for open access journals or for some works in open repositories), or it will have entered the public domain.[529] Under other mechanisms, such as the delayed open

521. *See, e.g.*, Contreras, *supra* note 250, at 1653–54, 1656.

522. *See* Uhlir, *supra* note 250. For examples, see GLOBAL IP STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS, *supra* note 382.

523. *See, e.g.*, Stodden, *supra* note 255, at 48–49; Faculty Advisory Council, *supra* note 497 (describing efforts by Harvard to reduce subscription costs).

524. *See* Mia Garlick, *A Review of Creative Commons and Science Commons*, 40(5) EDUCAUSE REV., Sept./Oct. 2005, at 78–79*; see also* Niva Elkin-Koren, *Exploring Creative Commons: A Skeptical View of a Worthy Pursuit*, *in* THE FUTURE OF THE PUBLIC DOMAIN: IDENTIFYING THE COMMONS IN INFORMATION LAW 325, 329–31 (Lucie Guibault & P. Bernt Hugenholtz eds., 2006).

525. *See* Stodden, *supra* note 255, at 36–42; *see also* Guibault, *supra* note 496; Contreras, *supra* note 506 (proposing 1-year license for publishers' subscription).

526. For an overview of such permissive licensing approaches spanning all information types, see Lawrence Liang, *Guide to Open Content Licenses* (2004), http://www.theartgalleryofknoxville.com/ocl_v1.2.pdf.

527. *See* GNU, http://www.gnu.org/ (last visited Jan. 3, 2012).

528. See *supra* notes 345, 492 and accompanying text.

529. *See generally* BOYLE, *supra* note 3 (illustrating several ways in which works enter the public domain). Apart from overt decisions to abandon copyright protection, information enters the public domain when it meets the following conditions: (1) the information is not copyrightable, such as factual

availability option, the works retain full copyright protection, but eventually become freely and openly accessible, at least on a read-only basis.[530]

Taken together, these activities are part of the emerging broader movement in support of both formal and informal peer production and dissemination of publicly funded scientific (and other) information in a globally distributed, voluntary, and open networked environment:[531]

> [They] are based on principles that reflect the cooperative ethos that traditionally has imbued much of [the] academic and government (civilian) research agencies; their norms and governance mechanisms may be characterized as those of "public scientific information commons," rather than of a market system based upon proprietary data and information.[532]

How far these open access initiatives can be carried remains to be seen. The potential unwillingness of intermediaries or grantees to accept such contractual templates, in addition to intrinsic constraints on funders' abilities to defray the costs of such institutional arrangements over time, effectively limit the regulatory powers of funders to achieve these objectives.[533] With respect to grantees, a requirement to publish only in open access journals or only under Creative Commons or Science

compilations or data sets that lack creativity and originality in their selection and arrangement; (2) the information is produced by a government that does not apply copyright to its own works (e.g., the U.S. federal government); or (3) the statutory period of intellectual property protection has expired, which in many jurisdictions now is the life of the author plus 70 years.

530. *See, e.g.*, Contreras, *supra* note 479, at 1653–54.

531. BENKLER, *supra* note 9, at 2 (discussing the role this movement has played in creating "new opportunities for how we make and exchange information, knowledge, and culture"); Elinor Ostrom & Charlotte Hess, *A Framework for Analyzing the Knowledge Commons*, *in* KNOWLEDGE AS A COMMONS, *supra* note 10, at 41, 41–82; Michael J. Madison et al., *Constructing Commons in the Cultural Environment*, 95 CORNELL L. REV. 657, 669–74 (2010).

532. Paul A. David & Paul F. Uhlir, *Creating the Information Commons for e-Science: Toward Institutional Policies and Guidelines for Action*, CODATA NEWSLETTER 91 (Int'l Council for Sci., Paris, France), July 2005, at 1; *see also* BENKLER, *supra* note 9, at 2 (noting that this broader movement has "increased the role of nonmarket and nonproprietary production"). For governance issues, see GLOBAL IP STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS, *supra* note 382 (Part IV).

533. *See* Terry & Kiley, *supra* note 500, at 106–08 (arguing that open access initiatives are sustainable). The extent to which funders actions with regard to copyrighted literature (and data) might or might not be limited by the Bayh-Dole Act depends on how broadly one interprets that Act. *Cf* Arti K. Rai & Rebecca S. Eisenberg, *Bayh-Dole Reform and the Progress of Biomedicine*, 66 LAW & CONTEMP. PROBS. 289, 293 (2003) (discussing the limits the Bayh-Dole Act imposes on funders' ability to oversee the use of patents by grantees).

Commons licenses[534] could hinder publication in some high prestige, peer-reviewed journals and breed resistance from leading members of the relevant scientific communities. Whether funding agencies, and the research community itself, can persuade these journals to become more open remains to be seen, but the evidence suggests that there is considerable momentum in that direction.[535]

C. INTEGRATING THE INTERMEDIARIES' FUNCTIONS INTO TRANSNATIONAL DIGITAL KNOWLEDGE ENVIRONMENTS

Aggressive resort to open access licensing conditions espoused by funders could, but not necessarily would, persuade some private publishers to abandon the field. This has not happened so far because funders are increasingly willing to enable grantees to purchase open access conditions from publishers at prices that appear to remain profitable for them. Pressure from funders can thus change the commercial publishers' business model and persuade some to allow scientists to purchase open access rights and even make a profitable business out of selling such rights at about the same costs as publishing in an open access journal.[536] Unfortunately, the percentage of grantees that actually opt to exercise this option, when not otherwise mandatory, still remains relatively small.[537]

Although reliance on intermediaries is deeply entrenched in the system, science policymakers might eventually want to reevaluate the costs and benefits of maintaining customary relationships with them and consider alternative strategies for disseminating research results. Such an exercise could, in particular, focus attention on the advantages of absorbing the publishing function, when feasible, into integrated, open-knowledge environments—as one study underway now advocates.[538]

534. *See supra* notes 345, 492.

535. *See, e.g.*, Contreras, *supra* note 479, at 1647–48, 1652–57 (discussing the Budapest, Bethesda, and Berlin declarations, and similar initiatives).

536. David J. Brown, *Repositories and Journals: Are They in Conflict? A Literature Review of Relevant Literature*, ASLIB PROCEEDINGS, Mar. 1, 2010, at 116, *available at* 2010 WLNR 25881660 (noting that Springer Science and Business Media recently acquired BioMed Central).

537. *See* Contreras, *supra* note 479.

538. *See* Uhlir, *supra* note 250, at 83–87 (summarizing Open Knowledge Environments (OKEs) thesis, with illustrative examples developed in GLOBAL IP STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS, *supra* note 382, Part III). Obviously, much depends on the availability of funding. For the view that such funding would yield greater benefits per research dollar than the present system, see Paul F. Uhlir et al., *Measuring the Social and Economic*

Once anchored in appropriate institutions and freed from the legal and commercial fetters of both the professional societies and the commercial publishers, the very object of the publishing exercise could dramatically change. No longer would it be bound by obsolete concepts of the print model, which treat each monthly installment as a discrete legal and substantive unit. Rather, every new collection of research results made available to the relevant thematic community could enrich and expand an ever growing, digitally integrated database of aggregate scientific results.

Each of these thematically organized repositories, in turn, would remain fully open to data mining, manipulation, and other automated knowledge discovery tools, with full respect for reputational benefits but without palpable legal or economic constraints.[539] Moreover, digital portals could link the formally published literature with so called grey literature, i.e., conference proceedings, and the like (which are not peer-reviewed). This aggregate resource can then be further linked with other data and relevant information bearing on all aspects of the science, including voluntarily contributed data pertaining to research of interest to a given thematic community.[540]

While this is not the place to fully elaborate on this concept, the astounding creative possibilities of unlimited, fully integrated knowledge hubs along these lines clearly dwarfs the gains that could be made from incremental or even structural reforms of the global intellectual property system. We believe that these or similar initiatives are essential for the progress of both science and culture, and would especially be needed to implement the sweeping new research vision that the National Research Council recently put forward for the life sciences.[541]

Support for these and other initiatives could further encourage publishing intermediaries either to accommodate the

Costs and Benefits of Public Sector Information Online: A Review of the Literature and Future Directions, *in* NAT'L RESEARCH COUNCIL, THE SOCIOECONOMIC EFFECTS OF PUBLIC SECTOR INFORMATION ON DIGITAL NETWORKS: TOWARD A BETTER UNDERSTANDING OF DIFFERENT ACCESS AND REUSE POLICIES 61, 62 (Paul F. Uhlir ed., 2009) (listing reports on benefits of open access for publicly funded data and literature).

539. *See* Uhlir, *supra* note 250, at 83–87.

540. *See id.* at 83–89 (finding that the "logical response is to cut the Gordian knot by retaining ownership and control of all knowledge assets produced by the relevant research community with public funding within the science framework itself, rather than assigning them to external publishing intermediaries").

541. A NEW BIOLOGY, *supra* note 4.

open access movement or leave the scientific publishing business. By the same token, digitally integrated knowledge hubs could greatly magnify the creative and educational powers of universities and other analogous research institutions.[542]

For all these reasons, we question the customary practices of wholesale reliance on external-information brokers in a scientific world where it has become conceptually and technically feasible to link a given thematic community's essential-knowledge resources into a seamless, digitally integrated network of inputs and outputs that remains open to all the contributors to any given research commons or semi-commons.[543] The scientific community, now operating within a hostile intellectual property environment, faces the challenge of organizing and managing these knowledge assets with a view to establishing a broad upstream research space[544] in which its own contractually imposed rules could apply without compromising the possibilities for commercial exploitation of downstream applications of the resulting research results.[545]

Nevertheless, the long-term drive to achieve these science policy goals should not obscure nor detract from the pressing short-term need to make the global intellectual property system more science-friendly than at present, along the lines we have explored. Legislatures concerned about the future of sci-

542. In principle, universities themselves could consider reintegrating some academic journals into their publishing operations. Alternatively, one or more universities could jointly produce the journals in question, with direct support of the funding agencies. In so doing, they could integrate the skills and services of different departments, such as the relevant scientific groups, the computer and technical service departments, and especially library services, which could coordinate and manage editorial and publishing functions. Students and postdoctoral candidates could similarly be co-involved at all levels as part of their educational experience, a phenomenon that routinely occurs in U.S. law schools. University librarians so far exposed to these proposals have expressed a positive response. *See, e.g.*, Charlotte Hess, *Institutional Design and Governance in the Microbial Research Commons*, *in* DESIGNING THE MICROBIAL RESEARCH COMMONS, *supra* note 255, 177, 184; Interview with Richard Danner, Duke Univ. Sch. of Law librarian in Durham, N.C. However, we think more is to be gained from thematically organized digitally integrated knowledge hubs, as indicated in the text. *See generally* REICHMAN ET AL., GLOBAL IP STRATEGIES FOR THE MICROBIAL RESEARCH COMMONS, *supra* note 382 (Part III) (discussing the concept of "Open Knowledge Environment"); Uhlir, *supra* note 250, at 83–89 (discussing the "open knowledge environment").

543. *See, e.g.*, Boyle, *supra* note 10, at 123–44.

544. *See* A NEW BIOLOGY, *supra* note 4.

545. *Cf.* Reichman & Uhlir, *supra* note 2.

entific research in the digital online environment[546] should take steps now to reconfigure a legal domain that has become increasingly inimical to the needs of the scientific research community. Policymakers in OECD countries should join with key national institutions, such as the U.S. National Institutes of Health, in affirmatively promoting open access to scientific publications.

To this end, the relevant government agencies and private foundations should become funders of first resort for scientific publications and for the institutional repositories and *e*-commons in which those publications can be collected. Policymakers should likewise support the process of making government-funded research publications widely available through self-archiving and institutional archiving, with the fewest possible restrictions on use or reuse of published results.[547]

FINAL OBSERVATIONS

Scientific discoveries depend upon access to a robust public domain, in which preexisting discoveries become the building blocks of future investigations[548] and existing information and data become inputs to future-knowledge assets that cannot be generated nearly as effectively without them.[549] However, the recent tendency to elevate standards of intellectual property protection at both the national and international levels has been motivated largely by interests seeking to protect existing knowledge goods, destined mainly for end users, with insufficient regard for the social costs and burdens imposed on future creation and innovation, and with a corresponding bevy of new problems that hinder both objectives.[550] This movement has generated thickets of intellectual property rights, high transac-

546. *See, e.g.*, EC Green Paper, *supra* note 332. *See generally* Ritch, *supra* note 37, at 136–81.

547. For a positive step in this direction, see the U.K. government's response to the Hargreaves Review's call for a broad research exemption that cannot be overridden by contract, see Chambers, *supra* note 318, at 600; *see also* HARGREAVES, *supra* note 26.

548. *See, e.g.*, BOYLE, *supra* note 3, at 160–78; David, *supra* note 25, at 16; David Lange, *Recognizing the Public Domain*, 44 LAW & CONTEMP. PROBS. 147, 165 (1981).

549. *See* Reichman & Uhlir, *supra* note 2, at 332.

550. *See, e.g.*, MOWERY ET AL., *supra* note 1, at 184–92; David, *supra* note 25, at 27–28; Sampat, *Patenting and US Academic Research*, *supra* note 330, at 784–86; *see also* Maskus & Reichman, *supra* note 24, at 20–23 (discussing the imbalance in modern intellectual property regimes resulting from a "prolonged effort to strengthen the protection of investors").

tion and litigation costs, receding access to the public domain, growing anticommons effects, and the stifling of privileged uses by means of technological protection measures and digital rights management tools in the online environment.[551]

In this Article, we have traced the contradictory measures in copyright and related laws that have increasingly impeded upstream scientific investigation and thereby complicated the exploitation of downstream applications of research results. By over-extending the protection of scientific information and data, these laws have made it harder for all investigators to build upon, rework, or further elaborate upon the contributions of others and to harness the astounding research potential of digital information technologies to their fullest extent.

From this perspective, the worldwide copyright system as it has lately evolved can hardly be said to benefit scientists *qua* authors. On the contrary, authors and compilers of scientific works and databases are still often obliged to surrender their outputs to publishers from whom they must buy back the very information and data they supplied (often at government expense). Rather than opening new vistas for producers of research data and information—as occurred after the printing press was invented and at regular intervals of technological change since then—copyright and database protection laws in the digitally networked environment seem bent on closing off new horizons in order to defend old business models for which publishers have sought few alternatives.[552]

A. BRIDGING THE DISCONNECT BETWEEN PRIVATE RIGHTS AND PUBLIC SCIENCE

Given the opportunities that digital networks and automated knowledge discovery tools make possible, the logical goal for policymakers is to remove obstacles that the existing legal infrastructure poses for twenty-first century scientific endeavor. In this context, copyright law's limitations and exceptions have an important role to play. They are not some nuisance-like sideshow of demands to be appeased as narrowly as possible. Rather, they should at least be viewed as a form of users'

551. *See* BESSEN & MEURER, *supra* note 3 (dealing with patents); HELLER, *supra* note 3, at 1–22; *see also* Geller, *supra* note 357, at 166 ("Copyright law is in crisis . . . . [I]t has become more and more complicated and less and less reliable, while losing legitimacy."); Lunney, *supra* note 96, at 869–92.

552. *See* HARGREAVES, *supra* note 26, at 41–42.

rights,[553] which help to supply inputs for scientific discoveries, innovation, and trade that are as indispensable to the dynamic production and dissemination of knowledge goods as suitably crafted incentives for authors and inventors.

A fundamental change of attitudes would be necessary. A top priority for policymakers should be to avoid generating legally established fiefdoms, in which a few private rights holders can combine the bulk of all scientific data and literature into monopolized repositories where access and use are restricted and controlled from the top down, and in which the commodified inputs of publicly funded science are distributed on a proprietary basis. Failure to achieve such a shift in priorities places digital and computational science in developed countries at risk of becoming progressively entangled in "copyright thickets"[554] precisely at a time when these countries face stiff challenges from the growing scientific and technological capacities of the emerging economies.[555]

Despite the complexity of these issues, and the countervailing pressures of a powerful publishers' lobby, policymakers need to resist the temptation to leave copyright and database protection laws where they stand or to strengthen them further in keeping with present trends. Few decisions could generate so many unintended harmful consequences. If these laws continue to impede *e*-science in the ways portrayed above, the much vaunted comparative advantages that industry and government spokespersons associate with maximalist levels of intellectual property protection could give way to private-sector strangleholds on the most promising avenues of public digital

553. *See, e.g.*, HUGENHOLTZ & OKEDIJI, *supra* note 159, at 16–27*; see also* Abraham Drassinower, *Authorship as Public Access: On the Specificity of Copyright vis-à-vis Patent and Trademark*, 2008 MICH. ST. L. REV. 199, 199–204 (2008) (arguing that users' rights, instead of simply serving as an exception to copyright, are so integral to the modern copyright system that they entail a redefinition of the wrongs copyright laws were meant to address).

554. In patent law, such thickets had threatened to undermine information science and such frontier sciences as synthetic biology at least until the U.S. Supreme Court intervened to readjust the most fundamental design principles of preexisting patent law itself. *See, e.g.*, Arti K. Rai & James Boyle, *Synthetic Biology: Caught Between Property Rights, the Public Domain, and the Commons*, 5 PLOS BIOL. e58, 390 (2007); Arti K. Rai & Sapna Kumar, *Synthetic Biology: The Intellectual Property Puzzle*, 85 TEX. L. REV. 1745, 1756–58 (2007).

555. *See, e.g.*, Dreyfuss, *supra* note 477; Peter Yu, *Sinic Trade Agreements and China's Global Intellectual Property Strategy*, *in* IP ASPECTS OF FREE TRADE AGREEMENTS IN THE ASIA PACIFIC REGION 2–4 (Christoph Antons & Reto M. Hilty eds., 2011), *available at* http://ssrn.com/abstract=1333431.

research, with the predictable result of killing the goose that lays the golden eggs.[556]

B. RECONCILING THE GOALS OF INNOVATION POLICY WITH THE NEEDS OF SCIENCE POLICY

In retrospect, it seems ironic that just as new technologies were producing significant breakthroughs in scientific research, and as digitally networked sites and other information technologies began empowering new models of collaborative investigation, innovation policies that should embrace these developments were instead using intellectual property rights to control or, in many cases, impede them. The successive use of public and private law to preclude access to basic knowledge resources, as well as knowledge-based goods, has increased the political and social burden of an intellectual property regime that, in theory, remains dedicated to the public interest of society at large.

Meanwhile, within the public-science community, efforts are underway to promote the formation of contractually constructed research commons (or semi-commons, as the case may be), that can flourish in an otherwise highly protectionist intellectual property environment. If successful, the resulting infrastructure could help to maintain a steady flow of downstream research products and socially beneficial commercial applications that do respond positively to the incentives of intellectual property rights.[557] Given this transnational movement, what both the European Union and United States require is a long-term policy perspective that discriminates between the needs of the scientific community, operating within an emerging research commons that is increasingly capable of managing and integrating its own supplies of data and information, and the needs of the downstream technology sectors, which depend on the traditional incentives of intellectual property law to translate scientific discoveries into commercial applications.[558]

556. For farsighted comments in this regard, see Tilman Lüder, Remarks at the Workshop on Creation and Innovation, Seventeenth Annual Fordham Intellectual Property Law Institute Conference, Cambridge, United Kingdom (Apr. 15–16, 2009) (advocating urgent reforms of copyright law's limitations and exceptions to meet needs of digital and computational science).

557. *See, e.g.*, BENKLER, *supra* note 9, at 122–27; BRETT M. FRISCHMAN, INFRASTRUCTURE: THE SOCIAL VALUE OF SHARED RESOURCES (2012).

558. *Cf.* Arti K. Rai et al., *Pathways Across the Valley of Death: Novel Intellectual Property Strategies for Accelerated Drug Discovery*, 8 YALE J. HEALTH POL'Y L. & ETHICS 1 (2008) (articulating a multi-firm, public and private col-

The object is to avoid pushing the exclusive rights that primarily govern those downstream incentives deep into the realm of basic science, where they will fracture and balkanize the research commons.[559] Needed instead are measures that broaden the research commons and enable it to operate its computational tools in digitally integrated, field-specific communities that span the world, smoothly and without disruption from domestic toll collectors waiving IP stop signs.

These projects will require more than tinkering at the edges of copyright law. They will depend on some overall vision, a willingness to remove obstacles to modern research methods, and a determination to fund the necessary operations. Reforms on this scale will entail more than recognition of "users' rights,"[560] which denote important cultural interests and the public enrichment that ensues from access to literary and artistic works in general. Where science is concerned, information and data function as inputs to the process of discovery and thereby constitute an essential ingredient of future scientific progress.

Exclusive intellectual property rights do not provide the appropriate set of incentives in this upstream research space.[561] Policymakers should accordingly take pains to ensure that domestic and international intellectual property laws no longer undermine or impede the most promising opportunities that automated knowledge discover tools now make possible.

laboration model for research in the field of medicinal drug discovery).

559. *See, e.g.*, Charlotte Hess & Elinor Ostrom, *A Framework for Analyzing the Knowledge Commons*, *in* KNOWLEDGE AS A COMMONS, *supra* note 10, at 41, 41–82; Charlotte Hess & Elinor Ostrom, *Introduction: An Overview of the Knowledge Commons*, *in* KNOWLEDGE AS A COMMONS, *supra*, at 3, 3–26; *see also* Jerome H. Reichman, *How Trade Secrecy Law Generates a Natural Semicommons of Applied Industrial Know-How*, *in* THE LAW AND THEORY OF TRADE SECRECY: A HANDBOOK OF CONTEMPORARY RESEARCH 185, 185–201 (Rochelle C. Dreyfuss & Katherine J. Strandburg eds., 2011).

560. *See, e.g.*, Rochelle Cooper Dreyfuss, *TRIPS—Round II: Should Users Strike Back?*, 71 U. CHI. L. REV. 21 (2004) (considering the question of how a system with a background rule of proprietary rights should be structured to recognize positive users' rights).

561. However, liability rules may resolve many conflicts between incentives and user research needs that otherwise seem intractable. *See, e.g.*, Rai et al., *supra* note 558, at 25–27; Jerome H. Reichman, *A Compensatory Liability Regime to Promote the Exchange of Microbial Genetic Resources for Research and Benefit Sharing, in* DESIGNING THE MICROBIAL RESEARCH COMMONS: PROCEEDINGS OF AN INTERNATIONAL WORKSHOP, *supra* note 479, at 43, 43–53; Reichman, *supra* note 284, at 185–200; *see also* ROSA CASTRO BERNIERS, EX POST LIABILITY RULES IN MODERN PATENT LAW 47–56 (2010) (summarizing arguments for and against liability rules in patent law).

These tools are critical for addressing the most pressing social and environmental challenges of our time.

Making the internet safe for publishers of print media should no longer justify hindering the aggregation of scientific information and data, or the uses of digitally integrated research methods capable of analyzing them on a global scale. Rather, the task is to reconcile the historical values of intellectual property law with the modalities of a digital age, in order to reinforce the needs of scientific investigators operating under twenty-first century conditions, and to stimulate maximum public welfare payoffs from their new technological tools.