

Freedom to Tinker

*Pamela Samuelson**

Tinkering with technologies and other human-made artifacts is a long-standing practice. Freedom to tinker has largely existed without formal legal recognition. Tinkering has typically taken place in an unregulated zone within which people were at liberty to act unobstructed by others so long as they did not harm others. The main reason why it now seems desirable to articulate some legal principles about freedom to tinker and why it needs to be preserved is because freedom to tinker is being challenged by some legal developments. This Article explains that user-innovators have traditionally had considerable freedom to tinker under trade secrecy, patent, and trademark laws. Although copyright law permits a modest degree of tinkering with existing products, it restricts freedom to tinker more than other IP laws. Copyright law and sometimes contract law place substantial constraints on user rights to tinker with and modify computer programs and other digital works. These constraints are of particular concern to tinkerers because computer programs are embedded in such a wide range of technologies these days. This Article offers suggestions about how and why the law should protect a zone of freedom to tinker for socially beneficial purposes.

* Richard M. Sherman Distinguished Professor of Law, University of California, Berkeley. I have drawn the concept of “freedom to tinker” from Princeton computer scientist Edward Felten who has given considerable currency to it through his freedom-to-tinker.com blog. I wish to thank Jonathan Band, Julie E. Cohen, Brett Frischmann, Ariel Katz, Orin Kerr, Aaron Perzanowski, Margaret Jane Radin, Blake Ellis Reid, Andrew Torrance, Rebecca Tushnet, Molly Van Houweling, Eric von Hippel, and Fred von Lohmann for comments on an earlier version of this Article. I am grateful to colleagues at the University of Toronto School of Law for organizing the *Constitution of Information* symposium at which I presented an earlier version of this Article.

INTRODUCTION

Never before in human history has it been more possible for tens of millions of people around the world to express themselves in creative ways, including by tinkering with existing artifacts and sharing the fruits of their creativity with others.¹ Advances in information technologies and the advent of global digital networks have played important roles in enabling this creativity and its dissemination. These advances have been a boon to conventional industry sectors, but they have also enabled user-innovators to become a vital part of today's creative ecosystem.² Among the many technology-fueled user innovations yielding cultural and intellectual benefits are mashups and remixes, Wikipedia, websites providing do-it-yourself advice about how to make things using digital scanners and 3D printers, the maker movement more generally, and open source software and open access music, images, and texts. User innovation has also flourished in a wide array of physical product domains, such as improved sports equipment, craft and hobby tools, and household goods.³

People tinker with technologies and other human-made artifacts for a variety of reasons: to have fun, to be playful, to learn how things work, to discern flaws or vulnerabilities, to build their skills, to become more actualized, to tailor the artifacts to serve one's specific needs or functions, to repair or make improvements to the artifacts, to adapt them to new purposes, and, occasionally, to be destructive.⁴

1 See, e.g., MICHAEL MASNICK & MICHAEL HO, *THE SKY IS RISING*, <https://www.documentcloud.org/documents/562830-the-sky-is-rising.html> (reporting on the explosive growth of the entertainments on the Internet); Betty Kelly Sargent, *Self-Publishing Predictions*, PUBLISHERS WEEKLY (Jan. 16, 2015), <http://www.publishersweekly.com/pw/by-topic/authors-pw-select/article/65301-self-publishing-productions-for-2015.html> (citing a Bowker report showing that self-published titles had increased 437% from 2008 to 2013).

2 ERIC VON HIPPEL, *DEMOCRATIZING INNOVATION* (2005) [hereinafter VON HIPPEL, *DEMOCRATIZING*]; Eric von Hippel et al., *Comparing Business and Household Sector in Consumer Products: Findings From a Representative Sample in the UK*, 58 *MGMT. SCI.* 1669 (2012); Eric von Hippel et al., *The Age of the Consumer Innovator*, 53 *SLOAN MGMT. REV.* 27 (2011); Susumu Ogawa & Kritinee Pongtanalert, *Visualizing Invisible Innovation Content: Evidence from Global Consumer Surveys* (Working Paper, 2011), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1876186. See generally KAL RAUSTIALA & CHRISTOPHER SPRIGMAN, *THE KNOCKOFF ECONOMY: HOW IMITATION SPARKS INNOVATION* (2012) (exploring various fields and industries in which the freedom to copy promotes creativity).

3 See, e.g., sources cited *supra* note 2.

4 See William W. Fisher III, *The Implications for Law of User Innovation*, 94 *MINN. L. REV.* 1417, 1455-72 (2010) (discussing user motivations for tinkering with

As scholars consider the formation of a “Constitution of Information”⁵ that will foster the ongoing “progress of science and useful arts”⁶ for the current era and the future, they should recognize that preserving a substantial zone of liberty within which users are free to tinker with existing artifacts is essential to innovation and the health of the creative ecosystem.

Computer scientist Edward Felten has articulated well why freedom to tinker matters to scientific researchers, defining the term as “your freedom to understand, discuss, repair, and modify the technological devices you own.”⁷ He notes that “this freedom is more than just an exercise of property rights but also helps to define our relationship with the world as more and more of our experience is mediated through these devices.”⁸ Many of the advances in knowledge over the past few decades have been the product of a network of tinkerers who have shared and built upon each other’s insights in a cumulative and often collaborative fashion.⁹

Felten’s insights inspired me to investigate how intellectual property (IP) laws do and should treat tinkering. Building upon and extending his definition, I conceptualize freedom to tinker for the purposes of this Article as having several dimensions: it entails, first, an intellectual freedom to imagine what one might do with existing artifacts to learn more about them; second, an intellectual privacy and autonomy interest in investigating and exploring those artifacts in which one has a property or other legitimate interest, especially when the investigation is done in one’s own premises; third, a right to develop one’s skills by testing, analyzing, and interacting with existing artifacts; fourth,

technologies). Julie Cohen describes this interplay of being and doing as “the play of everyday practice.” See JULIE E. COHEN, *CONFIGURING THE NETWORKED SELF* 50-57 (2012). Destructive tinkering is discussed *infra* notes 18-20 and accompanying text.

5 See the volume in which this Article is included: Symposium, *The Constitution of Information: From Gutenberg to Snowden*, 17 *THEORETICAL INQUIRIES* L. 369 (2016).

6 U.S. CONST. art. I, § 8, cl. 8 (“The Congress shall have Power . . . [t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.”).

7 Edward Felten, *The New Freedom to Tinker Movement*, *FREEDOM TO TINKER* (Mar. 21, 2013), <https://freedom-to-tinker.com/blog/felten/the-new-freedom-to-tinker-movement/>.

8 *Id.*

9 See, e.g., Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 *TEXAS L. REV.* 989, 997 (1997) (“[K]nowledge is cumulative — authors and inventors must necessarily build on what came before them . . . if they did not do so, the societal costs in terms of reinvention would be enormous.”).

a liberty interest to learn from tinkering and to become a more actualized person as a consequence; fifth, a right to distill what one has learned from tinkering and disseminate the results of one's research to others; sixth, a right to repair that which is broken and make other uses of artifacts as long as one is not harming the interests of others; seventh, a right to act upon and create new artifacts based on what one has learned through tinkering; and eighth, a right to share with others any new creations that are the fruits of one's tinkering and build a community around this sharing.

Freedom to tinker has existed for millennia. Yet it has existed largely without a formally recognized legal identity. It has simply been an unregulated zone within which people were at liberty to act unobstructed by others so long as they did not harm others.¹⁰ The main reason why it now seems necessary to articulate what freedom to tinker is and why it needs to be preserved and legally protected is because freedom to tinker is being challenged by what Felten calls "the permission culture," which "punishes [tinkerers] not for crossing boundaries or causing damage, but for acting 'without authorization' — and it cranks up the penalties to make sure we get the message."¹¹ What's worse is that "permission culture tells us that we don't own the things we buy, that we are bound by contracts we have never seen, and that breaching those contracts is a felony punishable by years in prison."¹²

Similar concerns have motivated IP researcher Andrew Torrance and user innovation scholar Eric von Hippel to call for preservation of the "innovation wetlands" that are essential to the ability of users to innovate.¹³ Marshy ecosystems were for a very long time, they point out, conceived of either as "resources ripe for conversion into more beneficial uses" or as "noxious sources of pestilence and disease."¹⁴ Over time, environmentalists and regulators realized that wetlands were "among the most productive and diverse of ecosystems on earth" and the law should protect and preserve them.¹⁵ Torrance and von Hippel coined the phrase "innovation wetlands" to suggest an analogous need

10 See, e.g., Andrew W. Torrance & Eric von Hippel, *The Right to Innovate*, 2015 MICH. ST. L. REV. 793, 802.

11 Felten, *supra* note 7.

12 *Id.* The legal impediments to which Felten refers are discussed in Part II below.

13 Torrance & von Hippel, *supra* note 10, at 798. The innovation wetlands metaphor recalls earlier scholarship by, among others, James Boyle, whose work motivated the cultural environmentalism movement. See, e.g., James Boyle, *Cultural Environmentalism and Beyond*, 70 LAW & CONTEMP. PROBS. 5 (2007); James Boyle, *A Politics of Intellectual Property: Environmentalism for the Net?*, 47 DUKE L.J. 87 (1997).

14 Torrance & von Hippel, *supra* note 10, at 797.

15 *Id.* at 797-98.

for an awakening in the intellectual realm. They believe that legislation and other forms of regulation can have a “significant negative impact” on the “fragile” innovation ecosystem that enables user innovation to flourish.¹⁶ The legal system should, they believe, provide protections that will preserve the innovation wetlands that are so essential to freedom to innovate akin to the legal protections that marshy wetlands now have from the Clean Water Act.¹⁷ Torrance and von Hippel’s article canvasses various common law, statutory, and constitutional rules and principles that could support preservation of innovation wetlands. While they do not speak of freedom to tinker as such, they would unquestionably consider tinkering to be essential to user innovation.

To be sure, a socially responsible conception of freedom to tinker must recognize that there are and should be checks on this freedom because some tinkering sometimes causes meaningful harm. Tinkering and innovations that may result from it are often touted as wonderful developments, but innovations may be put to destructive uses as well. Sometimes these may be unintended (for example, a modification to software that fixes one problem while creating another, perhaps bigger problem).¹⁸ When undertaken with destructive intent, such as hacking into computer systems to tamper with data, tinkering may be very harmful and expose the tinkerer to criminal liability.¹⁹ Felten does not deny that there are bad actors out there who deserve to be sanctioned for harms they cause,²⁰ but he thinks that the law should

16 *Id.* at 801.

17 *Id.* at 797-98.

18 *See also, e.g.*, ALEC FOEGE, *THE TINKERERS: THE AMATEURS, DIYERS, AND INVENTORS WHO MAKE AMERICA GREAT* 107-19 (2013) (describing the creation of highly leveraged investment instruments as an example of tinkering veering off course).

19 *See, e.g.*, Kim Zetter, *Coder Behind Notorious Bank-Hacking Tool Pleads Guilty*, *WIRED* (Jan. 28, 2014, 5:23 PM), <http://www.wired.com/2014/01/spy-eye-author-guilty-plea/>. Certainly, though, the term “hacking” encompasses a wide spectrum of behavior. *See, e.g.*, Cassandra Kirsch, *The Grey Hat Hacker: Reconciling Cyberspace Reality and the Law*, 41 N. KY. L. REV. 383 (2014) (describing the security industry’s classification of hackers as white, black, and grey hats based on their activity); Jose Pagliery, *The Evolution of Hacking*, *CNN* (June 4, 2015, 9:27 PM), <http://www.cnn.com/2015/03/11/tech/computer-hacking-history/> (describing early hackers as curious youths in contrast to modern criminal syndicates, government spies, and political “hacktivists”). Similarly, Paul Ohm distinguishes between ordinary computer users and “superusers” and how attempts to regulate a minority set of behaviors have disproportionate effects on the larger group. *See* Paul Ohm, *The Myth of the Superuser: Fear, Risk, and Harm Online*, 41 U.C. DAVIS L. REV. 1327 (2008).

20 Felten, *supra* note 7.

distinguish between constructive and destructive tinkering. By reflecting on the socially desirable, welfare-building role of tinkering and recognizing its potential downsides, it may be possible to construct well-balanced policies that will deter bad actors without formulating rules so broad that they thwart welfare-enhancing tinkerers.

This Article explores the freedom to tinker and the often complex legal relationships it reflects among generations of creators and the objects they create. The Article begins by considering certain doctrinal flexibilities built into IP laws that have historically allowed tinkering to flourish in many contexts. Part I observes that users have considerable freedom to tinker with artifacts unencumbered by IP rights. In addition, trade secrecy, patent, and trademark laws have doctrines that generally provide user-innovators with considerable, although not complete, freedom to tinker. Copyright law has traditionally permitted a modest degree of tinkering with existing products, although less so than other IP laws.

With the extension of copyright protection to computer programs and the emergence of markets for technically protected digital information products, copyright law has come to impose significant restrictions on freedom to tinker. Part II explains the substantial constraints that copyright law and sometimes contract law place on users' rights to tinker with and modify computer programs. These constraints are of particular concern to tinkerers because computer programs are embedded in such a wide range of technologies these days. Part II also discusses a set of so-called anti-circumvention rules that severely burden freedom to tinker. Enacted in 1998, these rules outlaw most reverse engineering ("circumvention") of technically protected copyrighted works and the making or offering of tools to enable such reverse engineering.²¹

The Article concludes that tinkering with existing artifacts generally "promote[s] the progress of science and useful arts,"²² as well as other fundamental values. Because of this, IP rules should be interpreted, or if necessary, adapted, to permit user tinkering that achieves this constitutional goal. The Conclusion offers several suggestions about how IP rules might be shaped to accomplish this goal.

21 Circumvention of Copyright Protection Systems, 17 U.S.C. § 1201 (2012). Similar laws have been enacted in other countries. *See, e.g.*, 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, 426-36 (2004).

22 U.S. CONST. art. I, § 8, cl. 8.

I. FREEDOM TO TINKER WITH ANOTHER'S WORK

A great many human-made artifacts, whether they flow in the stream of commerce or not, are free from IP rights encumbrances, and hence understood to be in the public domain.²³ This includes many types of products in which IP rights were not sought, were invalidated, or have expired, and many other types of creations — garden designs, yoga postures, computer programming languages, business methods, and hair styles, just to name a few — that do not qualify for IP protections.²⁴

Anyone is free to make and distribute copies of public domain artifacts, to tinker with them, to adapt them to new uses, to sell these adaptations in the marketplace, and in the case of public domain works of authorship, to broadcast or perform music, dramatic plays, and motion pictures to the public.²⁵ The public domain has often been celebrated as a source of inspiration and a great boon for the public, although it, like the freedom to tinker, has been under siege and in need of strategies to preserve and protect the resources and social value that the public domain provides.²⁶ The public greatly benefits by the public domain status of these artifacts, as they foster competition and ongoing innovation, as well as cultural enrichment.

The rest of this Part reviews various IP doctrines that enable tinkering with existing artifacts, even when they are subject to IP rights and hence outside of the public domain. Section A considers how the permissibility of

23 The term “public domain” has been used and sometimes defined in a number of ways. *See, e.g.*, Pamela Samuelson, *Enriching Discourse on Public Domains*, 55 DUKE L.J. 783 (2006). For most IP professionals, the term is best understood as freedom from IP constraints. In another article, I sought to “map” the public domain so that its various constituent elements could better be conceptualized. *See* Pamela Samuelson, *Mapping the Public Domain*, 66 LAW & CONTEMP. PROBS. 147, 151 (2003).

24 In a series of cases, the Supreme Court has interpreted patent law as excluding many types of creations from patent subject matter. *See, e.g.*, *Alice Corp. v. CLS Bank Int'l*, 134 S. Ct. 2347 (2014) (computerized method of settling financial transactions); *Bilski v. Kappos*, 561 U.S. 593 (2010) (method of hedging risk of price fluctuations of commodities). I have recently written about limits on copyright subject matter. *See* Pamela Samuelson, *Evolving Conceptions of Copyright Subject Matter*, 77 U. PITT. L. REV. (forthcoming 2016).

25 The Supreme Court has recognized a general freedom to copy public domain works. *See, e.g.*, *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 146-49 (1989).

26 *See, e.g.*, JAMES BOYLE, *THE PUBLIC DOMAIN* (2008); *COLLECTED PAPERS, DUKE CONFERENCE ON THE PUBLIC DOMAIN* (James Boyle ed., 2003).

reverse engineering protects freedom to tinker in the context of trade secrecy law. Section B discusses the “first sale” or “exhaustion of rights” doctrines of patent, trademark, and copyright law, which to varying degrees provide a zone of freedom to tinker for those who own products that are encumbered with IP rights. Section C demonstrates ways in which the fair use doctrine of copyright law also allows some freedom to tinker with copies of copyrighted works, although the law is not completely straightforward. The discussion on copyright also considers user rights and interests as well as authorial moral rights in the context of non-U.S. copyright law as a comparison.

A. The Reverse Engineering Doctrine of Trade Secrecy Law Protects Freedom to Tinker

Many manufacturers of products distributed in the marketplace rely in part on trade secrecy law to provide some lead-time protection from those who would appropriate their innovations and thereby undermine their ability to recoup investments in developing the products. Generally speaking, trade secrecy law protects a broad range of confidential business information, prohibiting its acquisition through improper means and unauthorized disclosure or use.²⁷ Trade secrecy law, however, provides users with considerable freedom to tinker with products they own. It is quite common for people or firms to buy products, disassemble them, study their components, and test them in various ways to figure out how they work and of what they are made. This kind of activity, widely referred to as reverse engineering,²⁸ has been defined as “the

27 Uniform Trade Secrets Act (UTSA) § 1 (amended 1985), 14 U.L.A. 437 (2005). Under the UTSA, a “trade secret” is information, including a formula, pattern, compilation, program, device, method, technique, and process, that derives independent economic value by its secrecy and which the owner makes reasonable efforts to keep secret. *Id.* The term “improper means” includes theft, bribery, misrepresentation, breach or inducement of a breach of a duty to maintain secrecy, and espionage; it could also include otherwise lawful acts deemed improper by circumstance. *Id.* To date, the Uniform Trade Secrets Act has been adopted, though not uniformly, by forty-seven U.S. states. *See* Eric Goldman, *Congress Is Considering a New Federal Trade Secret Law. Why?*, FORBES (Sept. 16, 2014), <http://www.forbes.com/sites/ericgoldman/2014/09/16/congress-is-considering-a-new-federal-trade-secret-law-why/>. Federal trade secret disputes have been brought under the Economic Espionage Act, 18 U.S.C. §§ 1831-1839 (2012), and the Computer Fraud & Abuse Act, 18 U.S.C. § 1030 (2012). *See* Goldman, *supra*.

28 *See, e.g.*, JAMES POOLEY, TRADE SECRET LAW § 5.02 (1997) (discussing reverse engineering as a generally lawful way to acquire trade secret know-how that

process of extracting know-how or knowledge from a human-made artifact.²⁹ Trade secrecy law regards reverse engineering as a lawful way to acquire know-how that the product's manufacturer may claim as a trade secret.³⁰

There are several reasons why trade secrecy law allows reverse-engineers to tinker with existing products. From an economic standpoint, reverse engineering generally promotes competition and ongoing innovation while posing little risk of eroding lead-time advantages for producers who claim know-how embedded in their products as trade secrets.³¹ It generally takes considerable time, money, and energy for second-comers, including user-innovators, to reverse-engineer products to extract trade secrets from them.³² Reverse-engineers often perceive opportunities to innovate on top of the first comers' products, and when they do, this is likely to promote social welfare.³³ Reverse engineering is considered a fair way to acquire secrets, in part because one who purchases products embodying secrets obtains personal property rights in those products that justify efforts to discover the secrets through use or disassembly of the products.³⁴ By permitting users to reverse-engineer products, trade secrecy law also provides incentives for innovators to seek patents if they wish to obtain exclusive rights to exploit their inventions.³⁵

may be embodied in another firm's product). Other legitimate ways a trade secret may be acquired include through independent discovery or a search of public literature. *See id.* § 6.02(2)(a).

29 *See, e.g.*, Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse Engineering*, 111 *YALE L.J.* 1575, 1577 (2002).

30 *See, e.g.*, *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 490 (1974) (determining that federal patent law does not preempt state trade secrecy law because the latter provides weaker protection, in part because "trade secret law does not forbid the discovery of the trade secret by fair and honest means, e.g., independent creation or reverse engineering.").

31 Samuelson & Scotchmer, *supra* note 29, at 1582-90.

32 *Id.* at 1586-87. Some products are obviously easier to reverse-engineer than others.

33 *Id.* at 1588-89.

34 Uniform Trade Secrets Act § 1, cmt. 2, 14 U.L.A. 437, 438 (1990).

35 *Kewanee*, 416 U.S. at 489-90. If it were unlawful to reverse-engineer unpatented products, this would give the trade secret owner stronger rights over the innovation than a patent would confer and without the obligation that patent law requires to disclose the secret to get exclusive rights in the innovation. *See, e.g.*, *Chi. Lock Co. v. Fanberg*, 676 F.2d 400, 405 (9th Cir. 1982) (rejecting trade secret claim based on locksmiths' reverse engineering of lock secrets through work for clients who purchased them). Reverse engineering in other IP contexts is discussed below in Section II.A. (copyright-protected computer programs) and Section II.C. (reverse-engineering restrictions in licenses).

Tinkering and other acts of reverse engineering with existing artifacts may not, however, always be permissible as a matter of trade secrecy law. If someone enters into a negotiated contract that forbids reverse engineering or if someone uses improper means (e.g., burglary or deceit) to get access to products to reverse-engineer the secret, this may give rise to liability for trade secret misappropriation.³⁶ But in general, freedom to tinker is strongly protected by trade secrecy law.

B. The Exhaustion of Rights Doctrine of IP Laws Protects Freedom to Tinker

The most significant IP rule that facilitates the freedom to tinker is known as the “first sale” or “exhaustion” limit on IP rights.³⁷ This rule allows those who have acquired products in the marketplace considerable freedom to use, modify, and resell those products as they wish, even if the products are

36 See, e.g., RESTATEMENT (THIRD) OF UNFAIR COMPETITION § 43 (1995).

37 The first sale rule has not been codified in the patent statute, but has a long pedigree in the case law. See, e.g., *Adams v. Burke*, 84 U.S. (17 Wall.) 453 (1873) (affirming judicially created first sale limit on patent rights). The first sale doctrine has also been recognized at common law in trademark cases. See, e.g., *NEC Elec. v. CAL Circuit ABCO*, 810 F.2d 1506, 1509 (9th Cir. 1987). Copyright’s first sale rule was first recognized at common law. See, e.g., *Bobbs-Merrill Co. v. Straus*, 210 U.S. 339 (1908) (affirming the right of a purchaser to resell books without permission of the copyright owner). It is now codified at 17 U.S.C. § 109(a). Aaron Perzanowski and Jason Schultz have written a series of articles exploring copyright’s first sale doctrine. See, e.g., Aaron Perzanowski & Jason Schultz, *Copyright Exhaustion and the Personal Use Dilemma*, 96 MINN. L. REV. 2067 (2012) [hereinafter Perzanowski & Schultz, *Copyright Exhaustion*]; Aaron Perzanowski & Jason Schultz, *Digital Exhaustion*, 58 UCLA L. REV. 889 (2011) [hereinafter Perzanowski & Schultz, *Digital Exhaustion*]; Aaron Perzanowski & Jason Schultz, *Reconciling Intellectual and Personal Property*, 90 NOTRE DAME L. REV. 1211 (2015). Judges continue to grapple with application of the first-sale doctrine in a variety of commercial and IP subject matter contexts, as recent U.S. Supreme Court decisions demonstrate. See, e.g., *Bowman v. Monsanto Co.*, 133 S. Ct. 1761 (2013) (genetically modified seeds (patent)); *Kirtsaeng v. John Wiley & Sons, Inc.*, 133 S. Ct. 1351 (2013) (gray-market textbooks (copyright)); *Quanta Computer, Inc. v. LG Elec., Inc.*, 553 U.S. 617 (2008) (computer technology methods embodied in microprocessor products (patent)). Also still to be resolved is whether first sale applies to digital works.

protected in whole or in part by IP rights.³⁸ That is, IP owners have the right to control the first sale (or other transfer of ownership) of products embodying the innovation in the market, but subsequent sales or reuses of those products will generally be free from the IP owners' control. Put another way, the first authorized transfer of ownership of a product embodying an IP-protected innovation "exhausts" the right of the IP owner to control further distribution of that product.³⁹

The IP exhaustion doctrine serves many positive functions.⁴⁰ It promotes broader public access to products, in part because it enables the existence of secondary markets in which used products may become more affordable to some buyers. It enables preservation of products whose manufacturers may have ceased to produce them or withdrawn them from the market. It protects privacy and autonomy interests of consumers by limiting the IP rights-holders' control over the products once ownership of a particular

38 Patent law also fosters the development of innovative modifications to existing products by allowing follow-on creators, such as user-innovators, to patent their inventions. This right to innovate on top of existing patents has, however, important boundaries. If it is necessary to incorporate an underlying invention to make products embodying the follow-on invention, the follow-on innovator will need a license from the other patentee. In general, this situation leads to good outcomes because when the follow-on innovator patents her invention, she will often be in a good bargaining position to negotiate for a cross-license that will enable her, as well as the original patentee, to make such products. *See, e.g.,* Lemley, *supra* note 9, at 1009-10. The non-patenting user-innovators that interest von Hippel do not benefit from the right to patent follow-on innovations because they prefer to freely share their innovations with others. *See* VON HIPPEL, *DEMOCRATIZING*, *supra* note 2, at 2, 77-91; *see also* SUZANNE SCOTCHMER, *INNOVATION AND INCENTIVES* 127-59 (2004) (economic analysis of cumulative innovation).

39 *See, e.g.,* Molly Shaffer Van Houweling, *Touching and Concerning Copyright: Real Property Reasoning in MDY Industries, Inc. v. Blizzard Entertainment, Inc.*, 51 SANTA CLARA L. REV. 1063, 1064 (2011). Nations vary in the scope they give to the exhaustion right. The exhaustion of IP rights applies throughout the European Union, but not beyond E.U. borders. Some countries have international exhaustion of rights rules. U.S. law is somewhat unsettled about whether exhaustion applies to products lawfully made outside the United States. *See, e.g.,* John Rothchild, *Exhausting Extraterritoriality*, 51 SANTA CLARA L. REV. 1187 (2011).

40 *See, e.g.,* Ariel Katz, *The First Sale Doctrine and the Economics of Post-Sale Restraints*, 2014 BYU L. REV. 55, 109-17; Perzanowski & Schultz, *Digital Exhaustion*, *supra* note 37, at 894-901. Katz describes how the first sale doctrine helps preserve the space necessary for user innovation. Katz, *supra*, at 112-17 (citing Torrance & von Hippel, *supra* note 10, and referring to their discussion of the "innovation wetlands").

instance has transferred to a member of the public. It fosters transactional clarity and market efficiency, as purchasers are able to know their rights in the products they buy and order their affairs accordingly. It may also result in more innovation, as consumers find new uses for the products or modify them to better serve their needs. In the digital environment, some have argued that exhaustion also advances platform competition and lessens the ability of platform providers to lock customers into their systems.⁴¹

In the realm of patent law, the exhaustion doctrine provides a considerable zone of freedom to tinker with patented products. However, user modifications to patented products have occasionally been challenged. Some patent owners have claimed that users of their products have engaged in unauthorized “reconstructions” of their patented inventions, which infringes patent law’s exclusive right to make products embodying their inventions. Defendants typically respond to such claims by asserting they are just “repairing” products they owned.⁴² Because repairs are typically narrower in scope and character than reconstructions, these types of post-sale uses of products embodying protected inventions do not run afoul of patent rights, but are instead permitted under patent law’s exhaustion doctrine.

An exemplary mid-nineteenth century case is *Wilson v. Simpson*, which involved a patentee who challenged a user’s replacement of cutting knives for a machine that was covered by a patent.⁴³ The knives tended to become dull or to break every sixty to ninety days, although the patented machine in which they were used generally lasted several years. The U.S. Supreme Court ruled Wilson’s replacement of knives was a repair, not a reconstruction, and hence did not infringe Simpson’s patent.

More than a century later, the Supreme Court considered the lawfulness of modifications to patented machines in *Wilbur-Ellis Co. v. Kuther*.⁴⁴ Wilbur-Ellis had refurbished and made substantial modifications to patented fish-canning machines, including the resizing of several parts. The Court observed that “in adapting the old machines to a related use [Wilbur-Ellis was] doing more than repair in the customary sense; but what they did was akin to repair for it bore on the useful capacity of the old combination, on which the royalty had been paid.”⁴⁵ Hence, Wilbur-Ellis’ modifications to the machine did not infringe Kuther’s patent.

41 See, e.g., Perzanowski & Schultz, *Digital Exhaustion*, *supra* note 37, at 900-01.

42 See, e.g., *Aro Mfg. Co. v. Convertible Top Replacement Co.*, 365 U.S. 336, 346 (1961) (distinguishing between lawful repairs and unlawful reconstructions).

43 *Wilson v. Simpson*, 50 U.S. (9 How.) 109 (1850).

44 *Wilbur-Ellis Co. v. Kuther*, 377 U.S. 422 (1964).

45 *Id.* at 425.

The *Wilson* and *Wilbur-Ellis* cases are only two of a long line of precedents that have treated modifications of patented products, whether to extend the life of products embodying patented inventions or to adapt the products to new uses, as permissible repairs.⁴⁶ Thus, patent law promotes freedom to tinker substantially through the exhaustion doctrine.

Trademark law protects owners against certain forms of unfair competition.⁴⁷ User-innovators generally do not have to worry about trademark law as an impediment to their freedom to tinker because this law does not regulate what people do with products they purchase; it only regulates marketplace conduct that would cause consumers to be confused about who made the products. To be sure, a user who alters a product and tries to resell it as though it emanated from the original maker might well infringe the latter's trademark rights.⁴⁸ But it has traditionally been lawful for a user to modify a product and resell modified versions so long as he makes clear that the product now being offered in the marketplace, although originally made by X, has been modified by Y.⁴⁹

Under copyright law, freedom-to-tinker issues rarely arose until quite recently. Tinkering has largely been done to technologies,⁵⁰ which copyright law has traditionally not protected.⁵¹ Some tinkering has been protected by

46 See, e.g., *Bottom Line Mgmt., Inc. v. Pan Man, Inc.*, 228 F.3d 1352 (Fed. Cir. 2000) (reapplication of non-stick coating was lawful repair of cooking pans); *Hewlett-Packard Co. v. Repeat-O-Type Stencil Mfg. Corp.*, 123 F.3d 1445 (Fed. Cir. 1997) (modification of unused printer cartridges was akin to repair); *Sage Prods., Inc. v. Devon Indus., Inc.*, 45 F.3d 1575 (Fed. Cir. 1995) (replacing inner container for medical waste product was lawful repair).

47 See, e.g., *Two Pesos, Inc. v. Taco Cabana, Inc.*, 505 U.S. 763, 782 n.15 (1992) (noting the dual purpose of trademark law: to protect the public from deception and to protect the trademark owner from misappropriation (citing S. Rep. No. 1333, 79th Cong., 2d Sess., 3, 4 (1946))).

48 See, e.g., *Bulova Watch Co. v. Allerton Co.*, 328 F.2d 20 (7th Cir. 1964) (affirming trademark infringement ruling because of likelihood of confusion about source of altered products).

49 See, e.g., *Prestonettes, Inc. v. Coty*, 264 U.S. 359, 368 (1924) (reversing trademark infringement claim based on sale of altered products where second producer accurately informed consumers about its alteration of the original product). *But see Au-Tomotive Gold, Inc. v. Volkswagen of Am., Inc.*, 603 F.3d 1133, 1136 (9th Cir. 2010) (marquee license plates infringed trademarks notwithstanding the defendant's purchase of emblems from the plaintiffs).

50 See, e.g., VON HIPPEL, *DEMOCRATIZING*, *supra* note 2, at 20 (identifying eight categories of technology fields in which user innovation has been common).

51 See, e.g., Pamela Samuelson, *Why Copyright Excludes Systems and Processes from the Scope of Its Protection*, 85 TEX. L. REV. 1921, 1928-42 (2007) (explaining why copyright law does not protect technologies or technological designs).

copyright's exhaustion doctrine.⁵² In the few litigated cases, U.S. courts have generally found tinkering with one's own copy of a copyrighted work to be unproblematic. Repainting and reselling a hobby horse originally created by another artist was protected by the first sale doctrine,⁵³ for instance, as was making bedsheets out of copyrighted fabric.⁵⁴

However, tinkering with purchased copies of copyrighted works poses a risk in some jurisdictions of violating an author's moral right of integrity. This right, which is more broadly developed in countries other than the United States, protects the noneconomic interests of authors in the continued existence of their works in unmodified form.⁵⁵ The United States has long resisted adoption of moral rights, in part because of its more utilitarian approach to copyright law.⁵⁶ Eventually, Congress passed the Visual Artists Rights Act of 1990 (VARA), which grants authors of only a narrowly defined category of works of visual art the right "to prevent any intentional distortion, mutilation, or other modification of the work which would be prejudicial to his or her honor or reputation."⁵⁷ Very little litigation has thus far challenged tinkering

52 Limitations on Exclusive Rights: Effect of Transfer of Particular Copy or Phonorecord, 17 U.S.C. § 109 (2012).

53 See *Blazon v. DeLuxe Game Corp.*, 268 F. Supp. 416 (S.D.N.Y. 1965).

54 See *Precious Moments, Inc. v. La Infantil, Inc.*, 971 F. Supp. 66 (D. P.R. 1997). But see *Mirage Editions, Inc. v. Albuquerque A.R.T. Co.*, 856 F.2d 1341 (9th Cir. 1988) (purchaser of art book held to infringe copyright by reselling pictures from the book pasted onto ceramic tiles).

55 See ROBERTA ROSENTHAL K WALL, *THE SOUL OF CREATIVITY: FORGING A MORAL RIGHTS LAW FOR THE UNITED STATES* (2010) (explaining the rationale for moral rights). In a Canadian case, *Snow v. Eaton Centre Ltd.* (1982), 70 C.P.R. 2d 105 (Can. Ont. H.C.J.), a sculptor successfully sued Eaton Centre for violating his integrity right when during the winter holiday season Eaton put red ribbons around the necks of Snow's sculpted geese. But see *Théberge v. Galerie d'Art du Petit Champlain, Inc.*, [2002] 2 S.C.R. 336, ¶ 22 (Can.) ("[R]espect must be given to the limitations that are an essential part of the moral rights created by Parliament. Economic rights should not be read so broadly that they cover the same ground as the moral rights, making inoperative the limits Parliament has imposed on moral rights.").

56 See, e.g., Amy M. Adler, *Against Moral Rights*, 97 CALIF. L. REV. 263 (2009). The U.S. Register of Copyrights has identified moral rights as an issue that warrants closer study. See *The Register's Perspective on Copyright Review: Hearing Before the H. Comm. on the Judiciary*, 114th Cong. (2015) (statement of Maria A. Pallante, Register of Copyrights) [hereinafter Pallante Testimony].

57 Visual Artists Rights Act (VARA), Pub. L. 101-650, 104 Stat. 5128 (1990) (codified at 17 U.S.C. § 106A (2012)). The term "work of visual art" is narrowly defined. *Id.* § 101. This VARA right is, however, subject to fair use (e.g., putting

with, or other modifications to, visual art in the United States as a violation of this right,⁵⁸ but tinkering with visual art in the United States is now riskier than it was before VARA.

Moreover, user modifications to copyrighted works may sometimes run afoul of copyright's exclusive right to prepare derivative works,⁵⁹ which is, strictly speaking, not subject to the exhaustion doctrine as codified in the Copyright Act of 1976 (hereinafter 1976 Act).⁶⁰ For example, rearranging copyrighted music, which is one form of tinkering, is a statutorily recognized type of derivative work that requires copyright owner permission.⁶¹ It is easy to see, then, that various significant considerations are involved in thinking about whether and how copyright law allows a zone of freedom to tinker. Another important doctrine in cases involving modifications made to a copyrighted work is the fair use doctrine, as the next Section explains.

C. Copyright's Fair Use Doctrine Allows Some Freedom to Tinker

Freedom to tinker may also be protected by U.S. copyright law's fair use doctrine.⁶² Fair use provides a barrier against infringement claims and is partly grounded in the notion that copyright's purpose is to promote the ongoing progress of authorship, with each work building upon the creativity of preexisting

a mustache on a painting to make fun of the portrait) and other limitations on the scope of the right. *Id.* § 106A(a). The integrity right is also not violated where the modification is "the result of the passage of time or the inherent nature of the materials" or is "the result of conservation, or of the public presentation, including lighting and placement." *Id.* § 106A(c).

58 See, e.g., *Chapman Kelley v. Chi. Park District*, 635 F.3d 290 (7th Cir. 2011) (rejecting an integrity right claim based on Chicago's modifications to a garden planted by a conceptual artist).

59 Exclusive Rights in Copyrighted Works, 17 U.S.C. § 106(2) (2012).

60 The statutory first-sale provision acts as an explicit limit on the distribution right. 17 U.S.C. § 109 (2012). However, a cogent argument can be made for expanding exhaustion principles beyond this. See, for example, the articles written by Perzanowski & Schultz, cited *supra* note 37.

61 Definitions, 17 U.S.C. § 101 (2012) (definition of "derivative work" listing "musical arrangement" as an example). For a discussion of the proper scope of the derivative work right, see, for example, Pamela Samuelson, *The Quest for a Sound Conception of Copyright's Derivative Work Right*, 101 GEO. L.J. 1505 (2013).

62 Limitations on Exclusive Rights: Fair Use, 17 U.S.C. § 107 (2012). For a discussion of the multiple roles that fair use plays in U.S. copyright law, see, for example, Pamela Samuelson, *Unbundling Fair Uses*, 77 FORDHAM L. REV. 2537 (2009).

works. One example of fair use tinkering is 2Live Crew's rap parody version of the popular Roy Orbison song, *Pretty Woman*, in which the rappers met with success in claiming fair use for their tinkering with that song.⁶³ A second example involves an artist who dressed Barbie dolls in sadomasochistic outfits and sold them to customers over Mattel's objection.⁶⁴ Fair use also protected an artist who took and sold photographs of nude Barbie dolls positioned as if they were about to be attacked by vintage household appliances.⁶⁵ Protesters who made a colorfully satirical T-shirt of a photograph of their city's mayor to make fun of his effort to shut down a street fair similarly defeated the photographer's infringement suit by claiming fair use.⁶⁶

Fair use tinkering with works of art has been more controversial. In *Cariou v. Prince*, for example, a well-known appropriation artist, Richard Prince, incorporated some of Patrick Cariou's photographs in a series of art works that sold for millions of dollars.⁶⁷ The district court found that the works had infringed and ordered their impoundment and destruction, but the Second Circuit reversed and ruled that most of the uses were fair, finding twenty-five out of thirty of Prince's images had transformed Cariou's photographs into a new expression with a fundamentally different aesthetic.⁶⁸ More recently, Richard Prince once again made headlines by using photos made and posted to Instagram by others in his art (which reportedly sold for as much as \$90,000 each).⁶⁹ Whether a particular act of tinkering is within or beyond the bounds of fair use can sometimes be a difficult fact-based inquiry. Fair-use analysis would balance the user's interests in tinkering with the copyright owner's interests in preventing tinkering.

The fair use doctrine should generally allow tinkering with copies of copyrighted works insofar as this would facilitate achieving copyright's primary goal of benefiting the public by promoting the creation and dissemination

63 *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569 (1994).

64 *Mattel, Inc. v. Pitt*, 229 F. Supp. 2d 315 (S.D.N.Y. 2001).

65 *Mattel, Inc. v. Walking Mountain Prods.*, 353 F.3d 792 (9th Cir. 2003).

66 *Kienitz v. Sconnie Nation, LLC*, 766 F.3d 756 (7th Cir. 2014).

67 *Cariou v. Prince*, 714 F.3d 694 (2d Cir. 2013), *rev'g* 784 F. Supp. 2d 337 (S.D.N.Y. 2011).

68 *Id.* at 708-10, 712.

69 *See, e.g., Christopher Buccafusco, Appropriation Art Meets Instagram: Is Copyright Law Ready?*, MSNBC (May 26, 2015), <http://www.msnbc.com/msnbc/appropriation-art-meets-instagram-copyright-law-ready>; Christopher Sprigman, *Richard Prince, Instagram, and Authorship in a Digital World*, BLOOMBERGBUSINESS (June 17, 2015), <http://www.bloomberg.com/news/articles/2015-06-17/richard-prince-instagram-and-authorship-in-a-digital-world>.

of learning.⁷⁰ Fair uses that advance knowledge thus should be construed as “user rights,” not just defenses to claims of infringement.⁷¹ Some copyright professionals might consider the user rights concept for fair use to be a radical notion, since copyright law has been understood by many first as a law of authors’ rights.⁷² However, this is not as radical as it might seem, for the 1976 Act itself speaks of “the right of fair use” in the section that sets forth special library privileges.⁷³ One day perhaps the U.S. Supreme Court will follow in the steps of the Supreme Court of Canada, which has interpreted its copyright law’s fair dealing provision as explicitly recognizing “user rights.”⁷⁴ Subsequent copyright cases in Canada have affirmed this characterization.⁷⁵

Furthermore, U.S. courts and policymakers could learn from Canada’s example in its consideration of user interests within a range of activities. By

70 See, e.g., *Sony Corp. of Am. v. Universal*, 464 U.S. 417, 575 (1984).

71 See, e.g., L. RAY PATTERSON & STANLEY W. LINDBERG, *THE NATURE OF COPYRIGHT: A LAW OF USERS’ RIGHTS* (1991); David Vaver, *Copyright Defenses as User Rights*, 60 J. COPYRIGHT SOC’Y U.S.A. 661 (2013).

72 See, e.g., Julie E. Cohen, *The Place of the User in Copyright Law*, 74 *FORDHAM L. REV.* 347, 348 (2005).

73 *Limitations on Exclusive Rights: Reproduction by Libraries and Archives*, 17 U.S.C. § 108(f)(4) (2012).

74 See, e.g., *CCH Canadian Ltd. v. Law Soc’y of Upper Can.*, [2004] 1 S.C.R. 339, ¶ 48 (Can.) (“The fair dealing exception, like other exceptions in the *Copyright Act*, is a user’s right. In order to maintain the proper balance . . . it must not be interpreted restrictively.”); see also Abraham Drassinower, *Taking User Rights Seriously*, in *IN THE PUBLIC INTEREST: THE FUTURE OF CANADIAN COPYRIGHT LAW* 462, 467 (Michael Geist ed., 2005) (summarizing the *CCH* court’s position that the fair dealing defense “be understood and deployed not negatively, as a mere exception, but rather positively, as a user right integral to copyright law”). U.S. courts have been less forthcoming in articulating a user right. *But see*, e.g., *Bateman v. Mnemonics, Inc.*, 79 F.3d 1532, 1542 n.22 (11th Cir. 1996) (Birch, J.) (“[S]ince the passage of the 1976 Act, . . . it is logical to view fair use as a right.”); *Suntrust Bank v. Houghton Mifflin Co.*, 268 F.3d 1257, 1260 n.3 (11th Cir. 2001) (Birch, J.).

75 See, e.g., *Soc’y of Composers, Authors & Music Publishers of Canada (SOCAN) v. Bell Canada*, [2012] 2 S.C.R. 36, ¶ 11 (Can.); *Alberta (Educ.) v. Canadian Copyright Licensing Agency (Access Copyright)*, [2012] 2 S.C.R. 345, ¶ 22 (Can.). These cases are discussed further *infra* text accompanying notes 77-80. Five Supreme Court of Canada decisions from 2012, including *SOCAN* and *Alberta (Educ.)*, form the so-called Copyright Pentalogy, representing a significant attempt to judicially clarify copyright’s role in the digital environment. See generally *THE COPYRIGHT PENTALOGY: HOW THE SUPREME COURT OF CANADA SHOOK THE FOUNDATIONS OF CANADIAN COPYRIGHT LAW* (Michael Geist ed., 2013).

incorporating user interests in its fair dealing analysis, the Canadian Supreme Court has reconfigured copyright's scope in a way that encourages tinkering. Rather than keeping to narrowly defined exceptions, recent Canadian case law has expansively interpreted fair dealing activities for purposes such as "research" and "private study." For example, in *Society of Composers, Authors & Music Publishers of Canada (SOCAN) v. Bell Canada*,⁷⁶ the Court reiterated a broad interpretation of "research" in finding that song previews offered by online music services could be characterized as a type of research conducted by consumers to identify which music to purchase.⁷⁷ In *Alberta (Education) v. Canadian Copyright Licensing Agency (Access Copyright)*,⁷⁸ a case involving photocopies of educational materials made by teachers for classroom use, the Court ruled that a teacher shares a "symbiotic purpose" with a student engaged in research or private study and that "private study" should not be construed narrowly.⁷⁹ Just prior to the *SOCAN* decision, the Canadian Parliament passed the Copyright Modernization Act (CMA), which amended its Copyright Act to expand fair dealing to include education, satire, and parody as favored purposes.⁸⁰ CMA also added specific exceptions for other permissible uses, including user-generated content (UGC) and copies for private purposes, such as format- and time-shifting, and for backup copies.⁸¹

Although the 1976 Act does not include a specific provision for a private or personal use exception as the Canadian Act does,⁸² there is some evidence in

76 *SOCAN*, 2 S.C.R.

77 *Id.* ¶ 30. The Court relied heavily on *CCH*, noting, for example, that the "research" exception "must be given a large and liberal interpretation in order to ensure that users' rights are not unduly constrained." *See id.* ¶ 15 (quoting *CCH*, 1 S.C.R. ¶ 51).

78 *Alberta (Educ.)*, 2 S.C.R.

79 *Id.* ¶¶ 23, 27.

80 Copyright Modernization Act, S.C. 2012, c. 20, ss. 21-22 (Can.), http://laws-lois.justice.gc.ca/eng/annualstatutes/2012_20/FullText.html, amending Copyright Act, R.S.C. 1985, c. C-42, s. 29 (Can.).

81 *Id.* Although the CMA created and expanded copyright exceptions, it has been criticized for including anti-circumvention provisions with seemingly widespread application even over copyright-excepted activities. *See* Copyright Modernization Act, S.C. 2012, c. 20, s. 47 (Can.), http://laws-lois.justice.gc.ca/eng/annualstatutes/2012_20/FullText.html, amending Copyright Act, R.S.C. 1985, c. C-42, s. 41 (Can.). *See, e.g.,* Carys Craig, *Locking Out Lawful Users: Fair Dealing and Anti-Circumvention in Bill C-32*, in FROM "RADICAL EXTREMISM" TO "BALANCED COPYRIGHT": CANADIAN COPYRIGHT AND THE DIGITAL AGENDA 177 (Michael Geist ed., 2010). *See also infra* Section II.D. for a discussion of technical protection measures and tinkering.

82 However, the library provisions in the Copyright Act specify that copying on

the legislative history of the 1976 Act that Congress did not intend to regulate personal use copies.⁸³ Some notable copyright cases have shown an interest in characterizing private, noncommercial uses as beyond copyright's intended scope.⁸⁴ An important facet of U.S. copyright law, then, particularly its fair use provision, is a continuing concern for maintaining boundaries beyond which users are free to engage, improve, and be enriched by the work of others.

II. IS FREEDOM TO TINKER UNDER SIEGE?

Since the advent of the digital age, the challenging interrelationship between copyright law and freedom to tinker has become even more complex. Four digital-related developments have made tinkering with copies of copyrighted works more legally risky now than in the past. For one thing, copyright now protects an important form of technology, namely, computer programs. Although copyright law permits some tinkering with software, there are significant constraints on the extent to which this technology can lawfully be modified. Second, digital tools have made it much easier than ever before to tinker with copies of copyrighted works. In digital form, movies and sound recordings can be remixed and mashed up to create user-generated content for posting on sites such as YouTube. Some lawsuits have challenged the legality of digital manipulation tools and works altered through their use on copyright grounds. Third, copyright owners have sometimes used contractual restrictions to augment copyright restraints on user tinkering with their copies of protected works. Fourth, tinkering with technical protection measures (TPMs) used by copyright owners to protect their works from unauthorized access has become risky as a result of Congress's adoption in 1998 of rules

behalf of the patron does not infringe if done for the purposes of private study, scholarship, or research. 17 U.S.C. §§ 108(d)(1)-(e)(1) (2012).

- 83 See Jessica Litman, *Campbell at 21/Sony at 31*, 90 WASH. L. REV. 651, 657-63 (2015). Moreover, the Latman fair use study, which informed the Register's recommended codification of fair use, identified private and personal use copies as among the uses that might find shelter under the codified fair use umbrella. See ALAN LATMAN, *FAIR USE OF COPYRIGHTED WORKS* 11 (1958), reprinted in *STUDIES PREPARED FOR THE SUBCOMM. ON PATENTS, TRADEMARKS & COPYRIGHTS, S. JUDICIARY COMM., 81ST CONG., COPYRIGHT OFFICE STUDY NO. 14, COPYRIGHT LAW REVISION* (1960).
- 84 See, e.g., *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 454-56 (1984); see also Jessica Litman, *Lawful Personal Use*, 85 TEX. L. REV. 1871, 1883-93 (2007) (reviewing copyright cases that considered personal use interests).

prohibiting acts of circumvention of these TPMs, as well as making tools for circumvention, as part of the Digital Millennium Copyright Act (DMCA).⁸⁵ Each of these restrictions on freedom to tinker is discussed below.

A. Copyright Law Restrains Tinkering with and Modifying Computer Programs

The U.S. Congress first extended copyright protection to a technology when it added computer programs to copyright subject matter.⁸⁶ Although some nations considered creating a different form of legal protection for software,⁸⁷ copyright for computer programs became an international norm in 1994.⁸⁸ Protection extends not only to human-readable source code expressions of program instructions, but also to machine-executable forms of programs.⁸⁹

One potential threat to freedom to tinker with software was thwarted by court rulings that allow unlicensed second-comers to reverse-engineer a first-comer's copyrighted program, as long as this is done for a legitimate purpose, such as gaining access to information necessary to develop a second program that will interoperate with the first program.⁹⁰ Reverse engineering of programs inevitably requires making copies of them and converting machine-executable code into an approximation of the program's source code. In one of these cases, the Ninth Circuit held such intermediate copies to be fair uses in part because it recognized that

85 Digital Millennium Copyright Act, Pub. L. No. 105-304, § 103, 112 Stat. 2860, 2863-76 (1998) (codified at 17 U.S.C. §§ 1201-1205).

86 Act of Dec. 12, 1980, Pub. L. No. 96-517, 94 Stat. 3015 (codified at 17 U.S.C. §§ 101, 117); *see, e.g.*, Pamela Samuelson, *The Uneasy Case for Software Copyrights Revisited*, 79 GEO. WASH. L. REV. 1746 (2011) [hereinafter Samuelson, *Uneasy Case*] (explaining why the case for extending copyright protection to software in the 1970s was fairly weak). Technologies have conventionally been patent subject matter, while expressive writings have been copyright's conventional subject matter. *See generally* Samuelson, *supra* note 24.

87 *See, e.g.*, Dennis S. Karjala, *Lessons from the Computer Software Protection Debate in Japan*, 1984 ARIZ. ST. L.J. 53, 61-70 (describing a Japanese proposal for sui generis protection of software that would have narrowed the scope of protection and shortened the duration of rights as compared with copyright).

88 Agreement on Trade-Related Intellectual Property Rights, art. 10(1), Apr. 15, 1994, 33 I.L.M. 1197, 1869 U.N.T.S. 300.

89 *Id.*

90 *See, e.g.*, *Sega Enter. Ltd. v. Accolade, Inc.*, 977 F.2d 1510 (9th Cir. 1992) (fair use to disassemble object code to extract interface information).

[i]f disassembly of copyrighted object code is per se an unfair use, the owner of the copyright gains a de facto monopoly over the functional aspects of his work — aspects that were expressly denied copyright protection by Congress. In order to enjoy a lawful monopoly over the idea or functional principle underlying a work, the creator of the work must satisfy the more stringent standards imposed by the patent laws.⁹¹

In some countries, legislators have adopted specific exceptions to allow reverse engineering for purposes of extracting information necessary to create an interoperable program.⁹²

Some tinkering with software is also permitted by a statutory provision that allows owners of copies of computer programs to modify their copies for particular purposes.⁹³ Congress recognized that consumers might, for example, need to be able to adapt their programs for legitimate reasons, such as to fix bugs, integrate that software into an existing computer system, create new fields for inputting data into a computer database, and the like.⁹⁴ However, buying another firm's proprietary software, customizing it for additional uses,

91 *Id.* at 1525.

92 In the European Union, a Directive requires E.U. member states to adopt such an exception. *See* Council Directive 91/250/EEC of 14 May 1991 on the Legal Protection of Computer Programs, art. 6. The 1991 version of the Software Directive was recently replaced by a codified (i.e., consolidated) version, European Parliament and Council Directive 2009/24/EC of 23 April 2009.

93 17 U.S.C. § 117(a) (2012); *see, e.g.*, Pamela Samuelson, *Modifying Copyrighted Software: Adjusting Copyright Doctrine to Accommodate a Technology*, 28 JURIMETRICS 179 (1988). There is also a special copyright exception to allow modifications to architectural works, so that owners can renovate them. *See* 17 U.S.C. § 120(b) (2012).

94 *See, e.g.*, *Krause v. Titleserv, Inc.*, 402 F.3d 119 (2d Cir. 2005) (permitting these kinds of modifications). The Free Software Foundation (FSF) advocates a worldwide software culture that would respect users' freedom to tinker. *See* FREE SOFTWARE FOUNDATION, <http://www.fsf.org/about/> (last visited Jan. 28, 2016). FSF defines free software as consisting of four essential freedoms:

- The freedom to run the program as you wish, for any purpose (freedom 0).
- The freedom to study how the program works and change it to make it do what you wish (freedom 1). Access to the source code is a precondition for this.
- The freedom to redistribute copies so you can help your neighbor (freedom 2).
- The freedom to distribute copies of your modified versions to others (freedom 3). By doing this you can give the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.

or translating it into a different programming language, and then selling or otherwise disseminating modified versions would almost certainly run afoul of copyright's exclusive right to control the making of derivative works.⁹⁵

Freedom to tinker with computer programs has also become technically less feasible in an era of cloud computing and the rise of software-as-a-service insofar as the software resides on remote servers to which users have only specified access.⁹⁶ A putative reverse engineer's efforts to gain enough unauthorized access to the software on those servers to tinker with them puts the engineer at risk of civil and criminal liability.⁹⁷

B. Tinkering Through Add-on and Filtering Programs Has Been Challenged

It is, of course, possible to modify the functionality of another firm's program without tinkering directly with its code, as add-on programs typically do. Add-ons might, for instance, offer a complementary feature to an existing program (e.g., a spell-checking program that runs in conjunction with another firm's word processing program) or alter the first program's functionality in other ways.⁹⁸

Free Software Foundation, *What Is Free Software?*, GNU OPERATING SYSTEM, <http://www.gnu.org/philosophy/free-sw.html> (last updated Jan. 1, 2016). For a discussion of the open software movement, see, for example, Wendy Seltzer, *The Imperfect Is the Enemy of the Good: Anticircumvention Versus Open User Innovation*, 25 BERKELEY TECH. L.J. 909, 930-33 (2010).

95 17 U.S.C. § 106(2) (2012). The term "derivative work" is defined as "a work based upon one or more preexisting works, such as a translation, musical arrangement, dramatization, fictionalization, motion picture version, sound recording, art reproduction, abridgement, condensation, or any other form in which a work may be recast, transformed, or adapted." *Id.* § 101.

96 See, e.g., Samuelson, *Uneasy Case*, *supra* note 86, at 1778-79.

97 The Computer Fraud & Abuse Act (CFAA) makes it illegal to gain unauthorized access to federally protected computers or to exceed authorized access to them. Computer Fraud & Abuse Act, 18 U.S.C. § 1030 (2012). Criminal penalties for violation are set forth *id.* § 1030(c). The CFAA is one of the laws that Edward Felten was referring to. See *supra* note 12 and accompanying text. Section II.D. below discusses the very similar risks that anti-circumvention rules pose for those who would bypass access controls to tinker with software in the cloud or available only as a service.

98 See, e.g., Edward Black & Michael Page, *Add-on Infringements: When Computer Add-ons and Peripherals Should (and Should Not) Be Considered Infringing Derivative Works Under Lewis Galoob Toys, Inc. v. Nintendo of Am., Inc., and Other Recent Decisions*, 15 HASTINGS COMM. & ENT. L.J. 615 (1993).

The first add-on program to be challenged on copyright grounds was a videogame enhancement program known as the Game Genie. It was designed to allow owners of Nintendo videogames to make a small number of temporary changes to the play of these games (e.g., to extend the life of a favorite character). Nintendo argued that the Game Genie directly infringed derivative work rights in its games because the software modified the play of Nintendo games. It further argued that the Game Genie contributorily infringed Nintendo's derivative work rights because it provided consumers with a tool designed to enable them to make unauthorized derivative works of Nintendo games. The Ninth Circuit Court of Appeals rebuffed both claims in *Lewis Galoob Toys, Inc. v. Nintendo of America, Inc.*⁹⁹

The Ninth Circuit noted that the Game Genie did not make any permanent changes to the Nintendo code; it merely substituted its own signals for some that the Nintendo games would have supplied, as directed by game users.¹⁰⁰ The court was consequently uncertain about whether the Game Genie resulted in a derivative work.¹⁰¹ But because the Game Genie allowed consumers to make only a small number of changes to the play of the Nintendo games, the court thought it enabled only fair uses.¹⁰² The Game Genie did not undercut the market for Nintendo games because the only people likely to purchase the Genie were consumers who already owned Nintendo games.¹⁰³ The Game Genie had no utility except in conjunction with the games. The *Galoob* decision upheld freedom to tinker by means of add-on program development.¹⁰⁴

In reliance on *Galoob*, a company called ClearPlay developed a computer program to enable owners of copies of DVD movies to make these movies more “family-friendly” by bypassing scenes and filtering out objectionable sex, violence, and dialogue.¹⁰⁵ Directors and producers of the films objected to

99 *Lewis Galoob Toys, Inc. v. Nintendo of Am., Inc.*, 964 F.2d 965 (9th Cir. 1992).

100 *Id.* at 967.

101 *Id.* at 968.

102 *Id.* at 971-72.

103 *Id.* Nintendo also brought copyright infringement and moral rights claims against the manufacturer of the Game Genie in Canada. *See Nintendo of Am. Inc. v. Camerica*, [1991] 34 C.P.R. 3d 193 (F.C.T.D.), *aff'd*, [1991] 36 C.P.R. 3d 352 (F.C.A.) (Can.). The court dismissed Nintendo's application for an interlocutory injunction against Camerica, finding that the plaintiff was unable to demonstrate loss of a single sale and thus had failed to prove irreparable harm.

104 *But see Micro Star v. Formgen, Inc.*, 154 F.3d 1107 (9th Cir. 1998) (infringement to compile user-generated variations on the Duke Nukem game).

105 ClearPlay asked the court for a declaratory judgment that its filtering program did not infringe copyrights. *See Huntsman v. Soderbergh*, No. 02-M-1662 (D. Colo., filed Aug. 29, 2002).

this tinkering as an infringement of their derivative work rights in the movies. During the pendency of this lawsuit, Congress created a special exception to copyright law to affirm the lawfulness of creating this type of program, thus mooting the lawsuit.¹⁰⁶

More direct tinkering with DVD movies was, however, held unlawful in *Clean Flicks of Colorado v. Soderbergh*.¹⁰⁷ After purchasing copies of DVD movies, Clean Flicks edited the movies to omit sex, violence, and objectionable language and then sold DVDs containing the modified movies. When copyright owners sued for infringement, Clean Flicks raised an exhaustion of rights defense, for it had purchased as many DVDs of the movies as it had altered.¹⁰⁸ The court decided, however, that uploading DVD movie contents into a database, from which the movies were edited and then reinstalled on DVD disks, was an infringement of the movie reproduction rights not subject to the first sale doctrine.¹⁰⁹ This kind of tinkering with copyrighted digital content is thus illegal under U.S. copyright law.

C. Licensing as a Way to Restrict Tinkering

Many copyright owners who do not want users to tinker with their works have supplemented the legal protection that copyright law provides by adopting mass-market licenses that forbid users from reverse-engineering or modifying their copies of protected works.¹¹⁰ If enforceable, these licenses would restrict considerably freedom to tinker with copies of copyrighted works. The case law on the enforcement question is somewhat mixed and the issue has been hotly debated.¹¹¹

106 Family Movie Act of 2005, codified at 17 U.S.C. § 110(11).

107 *Clean Flicks of Colo. v. Soderbergh*, 433 F. Supp. 2d 1236 (D. Colo. 2006).

108 *Id.* at 1238-39, 1242.

109 *Id.* at 1242. The court did not consider whether ClearPlay's editing infringed the motion picture derivative work rights. Because abridgments and condensations are derivative works within the statutory definition of that term, 17 U.S.C. § 101 (definition of "derivative work"), the editing probably did infringe that right. A strict constructionist would observe that the statutory first sale rule limits the distribution right, but not the derivative work right. *See* 17 U.S.C. § 109(a).

110 *See, e.g., Julie E. Cohen, Lochner in Cyberspace: The New Economic Orthodoxy of "Rights Management,"* 97 MICH. L. REV. 462 (1998).

111 Some commentators question the enforceability of mass market license restrictions that would override default rules of copyright. *See, e.g.,* JASON MAZZONE, COPYFRAUD AND OTHER ABUSES OF INTELLECTUAL PROPERTY LAW 81, 96 (2011); J.H. Reichman & Jonathan A. Franklin, *Privately Legislated Intellectual Property Rights: Reconciling Freedom of Contract with Public Good Uses of Information*, 147

In *Vault Corp. v. Quaid Software Ltd.*, one appellate court refused to enforce mass market license restrictions on reverse-engineering and backup copying of software.¹¹² Vault had developed a copy-protection software, PROLOK, intended for commercial distribution to software developers who would then use it as a TPM to stop consumers from making unauthorized copies of the developers' products. Quaid developed a computer program called Ramkey that enabled consumers to bypass the PROLOK copy-prevention feature. Quaid reverse-engineered PROLOK to find out how it worked. Vault asserted that this reverse engineering, which involved copying of PROLOK code, infringed copyright and also violated terms of the shrinkwrap license that accompanied PROLOK. The license forbade reverse engineering as well as modification of program code. The court ruled that Quaid had not infringed copyright; moreover, to the extent that the mass-market license prohibited acts such as reverse engineering, modifications, and backup copying, the license was unenforceable because it interfered with rights that consumers had under copyright law. More recently another appellate court decided to enforce an anti-reverse engineering clause, at least when the reverse-engineer also infringed the other firm's copyright by copying expression from its program.¹¹³

The more general question about the enforceability of mass-market license restrictions on rights of users as to purchased copies of computer programs was addressed in an appellate court decision in *Vernor v. Autodesk, Inc.*¹¹⁴ The Ninth Circuit ruled that neither Vernor nor the architectural firm from which he bought copies of Autodesk software were actually "owners" of copies of the Autodesk programs. They were instead only licensees who were bound by restrictive terms in the mass-market licenses through which Autodesk distributed its computer programs. Because of this, Autodesk's right to control distribution of copies had not been exhausted.¹¹⁵ This ruling meant that

U. PA. L. REV. 875, 877 (1999). Others believe such license restrictions should be enforceable. See, e.g., Robert W. Gomulkiewicz, *The License Is the Product: Comments on the Promise of Article 2B*, 13 BERKELEY TECH. L.J. 891 (1998); Raymond T. Nimmer, *Breaking Barriers: The Relation Between Contract and Intellectual Property Law*, 13 BERKELEY TECH. L.J. 827 (1998). The most extensive treatment of the enforceability (or not) of anti-reverse engineering clauses is addressed in David McGowan, *Free Contracting, Fair Competition, and Article 2B: Some Reflections on Federal Competition Policy, Information Transactions, and "Aggressive Neutrality,"* 13 BERKELEY TECH. L.J. 1173 (1998).

112 *Vault Corp. v. Quaid Software Ltd.*, 847 F.2d 255 (5th Cir. 1988).

113 See *Bowers v. Baystate Tech.*, 320 F.3d 1317 (Fed. Cir. 2003).

114 *Vernor v. Autodesk, Inc.*, 621 F.3d 1102 (9th Cir. 2010).

115 17 U.S.C. §§ 109(a), 117(a) (2012) (permitting owners of copies to redistribute those copies).

Autodesk could sue Vernor for copyright infringement when he sold “used” copies of Autodesk programs on eBay, infringing Autodesk’s exclusive right to control distribution of copies of its software. Although the case did not involve the enforceability of restrictions on tinkering with Autodesk code, the court’s willingness to enforce Autodesk’s license restriction on resales suggests that it might also be willing to enforce anti-tinkering provisions.¹¹⁶

Of course, the *Vernor* decision may not stop purchasers of licensed software from tinkering with it insofar as their tinkering cannot be detected by the software’s developer. If someone reverse engineers and then modifies Autodesk software and uses the modified version only within his firm, Autodesk is unlikely to know about any breach of an anti-reverse engineering or an anti-modification clause. Even if Autodesk did know about the modifications, it might not take steps to control use of the modified software as long as the tinkering firm wasn’t public about it or engaged in selling modified versions. However, a user-innovator who wanted to share with others what he learned by tinkering with a digital work may be at risk if his actions are inconsistent with mass-market license restrictions, even if his tinkering might not fall afoul of copyright law.¹¹⁷

Now that computer software has become embedded in such a wide array of products — automobiles, coffee makers, medical devices, just to name a few — the public policy question about whether people who purchase these products are “owners” or mere “licensees,” whose rights to tinker with the products can be circumscribed by restrictive license terms, has become more acute. This is not just a hypothetical issue. In recent filings with the Copyright Office, vehicle manufacturers have asserted that consumers have only licensed the software embedded in cars and tractors they have purchased and have no right to access the embedded software or tinker with it.¹¹⁸

116 *But see* Perzanowski & Schultz, *Digital Exhaustion*, *supra* note 37, at 935-37 (arguing that the common law exhaustion of rights doctrine should be of broader scope than the statutory first sale rule).

117 *See* MDY Indus., Inc. v. Blizzard Entm’t, Inc., 629 F.3d 928 (9th Cir. 2010) (enforcing contractual restriction on use of bots to play a video game). The *MDY* case is of particular concern because it presages the near impossibility of tinkering with digital content in the cloud. There is a controversy about whether breach of a licensing agreement can give rise to a breach of the CFAA’s rule against exceeding authorized access to a protected computer. *See, e.g.*, Orin S. Kerr, *Vagueness Challenges to the Computer Fraud and Abuse Act*, 94 MINN. L. REV. 1561, 1571-72 (2010).

118 *See, e.g.*, Long Comments Regarding a Proposed Exemption to 17 U.S.C. 1201 (Proposed Class 21) at 4, submitted by the Alliance of Automobile Manufacturers to the U.S. Copyright Office, Docket No. 2014-07, Exemption to Prohibition of

If, as predicted, the Internet of Things¹¹⁹ becomes ubiquitous, some fear that the licensed embedded software will mean “the end of ownership.”¹²⁰ However, recently introduced legislation would protect purchasers as owners, not just licensees, of products they buy.¹²¹ This would promote freedom to tinker based on the property rights that purchasers acquire when they buy products in the marketplace. The U.S. Copyright Office has promulgated a Notice of Inquiry asking for comments on whether this or similar legislation should be adopted.¹²²

D. Technical Measures and the DMCA Anti-Circumvention Rules Constrain Tinkering

Technically protecting copyrighted software or other digital content is generally a more effective way than licensing to restrict what users can and cannot do with the products they buy. Ordinary users rarely have the technical expertise or the inclination to spend time trying to bypass TPMs to tinker with products,

Copyright Protection Systems for Access Control Technologies, <http://copyright.gov/1201/2015/comments-032715/>; see also Kyle Wiens, *We Can't Let John Deere Destroy the Very Idea of Ownership*, WIRED.COM (Apr. 21, 2015), <http://www.wired.com/2015/04/dmca-ownership-john-deere/> (discussing the comment submitted by John Deere, a leading manufacturer of agricultural equipment, asserting that farmers do not own and instead receive an implied license to operate the tractors they purchase).

- 119 The “Internet of Things” (IoT) is defined as “[t]he interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.” *Internet of Things*, OXFORD DICTIONARIES, http://www.oxforddictionaries.com/us/definition/american_english/internet-of-things (last visited June 22, 2016); see also Sean Gallagher, *The Future Is the Internet of Things — Deal with It*, ARS TECHNICA (Oct. 29, 2015, 5:00 AM), <http://arstechnica.com/unite/2015/10/the-future-is-the-internet-of-things-deal-with-it/> (discussing the implications and potential hazards of IoT).
- 120 See, e.g., AARON PERZANOWSKI & JASON SCHULTZ, *THE END OF OWNERSHIP* (forthcoming 2016).
- 121 The bill proposes amending the Copyright Act, 17 U.S.C. § 109, to provide that the first sale doctrine applies to computer programs that enable machines to operate. See *You Own Devices Act*, H.R. 862, 114th Cong. (2015).
- 122 See *Software-Enabled Consumer Products Study: Notice and Request for Public Comment*, 80 Fed. Reg. 77668 (Dec. 15, 2015). In response to its notice, the Copyright Office received twenty-six comments, which are available at *Software-Enabled Consumer Products Study*, REGULATION.GOV, <http://www.regulations.gov/#!docketBrowser;rpp=25;po=0;D=COLC-2015-0011;dct=PS> (last visited June 22, 2016).

although they may become the beneficiaries of others' creative tinkering.¹²³ But more technically proficient people may well have both the skill and motivation to tinker with and circumvent TPM controls.

Unfortunately, tinkering with technically protected software and other digital content may be illegal under the Digital Millennium Copyright Act (DMCA), which Congress enacted in 1998 in response to copyright industry groups' claims that this was necessary to protect digital copies of their works from widespread infringement.¹²⁴ The DMCA rules outlaw bypassing TPMs that copyright owners are using to control access to their works¹²⁵ and also the making or offering to the public of any technology primarily designed to circumvent TPMs used by copyright owners to protect their works.¹²⁶ Under the DMCA rules, for instance, Quaid's making and distributing Ramkey to bypass Vault's PROLOK TPM would now be illegal.¹²⁷ The fact that Ramkey had substantial non-infringing uses (e.g., to enable consumers to make backup copies of their software) would no longer shield it from liability. Oddly enough, tinkerers who plan to make non-infringing uses of technically protected works are more likely to be deterred by the anti-circumvention laws than those who tinker to infringe. After all, the payoff of infringement may be large, and it

123 For example, Sony sold Aibo robot dogs to the public, and some enthusiasts reverse engineered Aibo dogs in order to develop new tricks for the dogs to perform. See David Labrador, *Teaching Robot Dogs New Tricks*, SCI. AM. (Jan. 21, 2002), <http://www.scientificamerican.com/article/teaching-robot-dogs-new-t/>. A website made these tricks available to others. See AIBOHACK, <http://www.aibohack.com/> (last visited Jan. 28, 2016); see also Engadget Staff, *How-to: Get the Most Out of Your Sony Aibo*, ENGADGET (June 21, 2005, 3:58 PM), <http://www.engadget.com/2005/06/21/how-to-get-the-most-out-of-your-sony-aibo/>. For a time, Sony threatened these hackers with lawsuits alleging violations of the anti-circumvention rules, before discontinuing the product altogether. See, e.g., Phillip Torrone, *Sony's War on Makers, Hackers, and Innovators*, MAKE (Feb. 24, 2011, 12:30 PM), <http://makezine.com/2011/02/24/sonys-war-on-makers-hackers-and-innovators/>.

124 See Digital Millennium Copyright Act, Pub. L. No. 105-304, § 103, 112 Stat. 2860, 2863-76 (1998) (codified at 17 U.S.C. §§ 1201-1205). For a discussion of the legislative history of these provisions and some conundrums about their scope, see, for example, Pamela Samuelson, *Intellectual Property and the Digital Economy: Why the Anti-Circumvention Regulations Need to Be Revised*, 14 BERKELEY TECH. L.J. 519 (1999).

125 17 U.S.C. § 1201(a)(1)(A) (2012).

126 *Id.* §§ 1201(a)(2), (b)(1).

127 See *supra* note 112 and accompanying text.

is often easy for destructive tinkerers to hide in the darknet.¹²⁸ Constructive tinkerers, by contrast, tend to be more open about what they are doing and willing to explain why it is in society's interest that they be free to tinker and share the results of what they have learned with the world.¹²⁹

The first major case to interpret the anti-circumvention rules was *Universal City Studios, Inc. v. Reimerdes*.¹³⁰ Reimerdes was one of several computer hackers who posted a program known as DeCSS on their websites. A Norwegian programmer had developed the DeCSS software to bypass the Content Scramble System (CSS), a TPM that is ubiquitously installed on DVD movie disks as well as in DVD players. Motion picture producers had been using CSS in order to make it technically difficult for users to make unauthorized uses of their DVD movies, such as copying them onto computer hard drives. Universal sued the three hackers who posted DeCSS on their websites for violating the anti-circumvention rules, claiming that CSS was an effective access control that Universal was using to protect its movies, that DeCSS was designed for the purpose of bypassing CSS, and that by posting DeCSS on their websites, these hackers had offered an illicit circumvention tool to the public. This, Universal asserted, violated the DMCA. The hackers challenged the constitutionality of this law, saying the anti-circumvention rules were overbroad because they effectively made it illegal to engage in fair or other privileged uses of technically protected digital content and thus suppressed free speech.¹³¹

128 See, e.g., Peter Biddle et al., *The Darknet and the Future of Content Distribution*, in PROCEEDINGS OF THE 2002 ACM WORKSHOP ON DIGITAL RIGHTS MANAGEMENT (2002), <http://crypto.stanford.edu/DRM2002/prog.html>.

129 See, e.g., Statement on Legal Impediments to Cybersecurity Research (updated May 21, 2015), <http://www.ischool.berkeley.edu/files/cybersecurity-statement-rev9.pdf>. The statement was included in Reply Comments submitted by the Center for Democracy & Technology on behalf of computer security researchers in support of a Section 1201 exemption for software security research. See *Section 1201 Exemptions to Prohibition Against Circumvention of Technological Measures Protecting Copyrighted Works: Second Round of Comments*, U.S. COPYRIGHT OFFICE (Mar. 27, 2015), <http://copyright.gov/1201/2015/reply-comments-050115/>.

130 *Universal City Studios, Inc. v. Reimerdes*, 111 F. Supp. 2d 294 (S.D.N.Y. 2000), *aff'd sub nom.*, *Universal City Studios, Inc. v. Corley*, 273 F.3d 429 (2d Cir. 2001).

131 The hackers claimed that they had a First Amendment right to express themselves by publishing the DeCSS program. They also claimed that the anti-circumvention rules were unconstitutionally overbroad because they inhibited too many lawful uses of copyrighted content. Although both the trial and appellate courts regarded software as a form of expression that the First Amendment protects, the courts soundly rejected the constitutional claims.

The trial judge agreed with Universal that posting this program on the Internet violated the anti-circumvention rules. Eric Corley, the only defendant who went to trial in this case, argued that owners of copies of DVD movies should be able to decrypt CSS because their purchases of these movies entitled them to exercise first sale rights over their copies. DeCSS, in Corley's view, was a tool that allowed this lawful decryption. Judge Kaplan characterized this argument as "a corruption of the first sale doctrine."¹³² Judge Kaplan also rejected Corley's argument that the DMCA rules were overbroad because they would prohibit too many fair uses, claiming that Congress had considered and rejected proposals to allow circumvention for fair use purposes.¹³³ Under Judge Kaplan's interpretation of the DMCA, it was immaterial whether any copyright infringement had ever occurred as a result of a violation of the anti-circumvention rules. The DMCA, in his view, had "fundamentally altered the landscape" of copyright.¹³⁴

By characterizing CSS as an access control,¹³⁵ the judge implicitly accepted that any user who bypassed CSS was in violation of the act-of-circumvention provision of the DMCA, even if the user was intending to make fair use of the movie's contents. Consider, for instance, "Brokeback to the Future," a user-generated video that took clips from "Brokeback Mountain" and "Back to the Future" to suggest that two characters (Doc and Marty) from the latter movie sexually longed for each other.¹³⁶ The user who generated this content almost certainly did so by using DeCSS or a similar program to tinker with CSS so that he/she could create this video.

Although a very strict interpretation of the anti-circumvention rules and of copyright's derivative work right might suggest this video is unlawful, most commentators on user-generated content (UGC) have argued that videos such as this should be lawful.¹³⁷ The availability of "Brokeback to the Future" and many thousands of similar noncommercial UGC videos that include clips from movies, TV shows, and sound recordings on sites such as YouTube are

132 *Reimerdes*, 111 F. Supp. 2d at 317 n.137.

133 *Id.* at 319, 337-38.

134 *Id.* at 323.

135 *Id.* at 317. For a discussion of why CSS and other widely deployed TPMs should not be considered access controls within the meaning of the DMCA, see R. Anthony Reese, *Will Merging Access Controls and Rights Controls Undermine the Structure of Anticircumvention Law?*, 18 BERKELEY TECH. L.J. 619 (2003).

136 See Gillian Smith, *Brokeback to the Future*, YOUTUBE (Feb. 1, 2006), <http://www.youtube.com/watch?v=8uwuLxrv8jY>.

137 See, e.g., Edward Lee, *Warming Up to User-Generated Content*, 2008 U. ILL. L. REV. 1459; Molly Van Houweling, *Distributive Values in Copyright*, 83 TEX. L. REV. 1535 (2005).

examples of what may well be fair use tinkering with TPMs, notwithstanding Judge Kaplan's restrictive interpretation of the DMCA.¹³⁸

The *Reimerdes* decision initially had a severe chilling effect on the activities of computer security researchers who wanted to study how and how well TPMs worked. More than a decade ago, computer scientist Edward Felten and some colleagues and students decided to take up a recording industry challenge to try to break certain TPMs the industry was considering adopting for music. Rather than accept the \$10,000 prize for successfully breaking the TPMs, Felten et al. decided to write a paper about what they had learned from the exercise. When representatives of the recording industry learned about this, they threatened to sue Felten, his colleagues, his university, members of the program committee for the conference at which the paper was scheduled for presentation, and those committee members' home institutions. The industry's claim was that Felten's paper was an illegal circumvention tool because it provided so much detail — a virtual recipe — for bypassing these TPMs. If this paper was published, any technically proficient would-be infringer could use information from it to cause massive infringements of copyrights. The interpretation of the DMCA rules in the *Reimerdes* decision made this claim seem plausible.¹³⁹ Because of these threats, Felten and his colleagues withdrew the paper from that conference. However, they later asked a federal court to declare that publishing this paper would not violate the anti-circumvention rules. To moot this lawsuit, the recording industry withdrew its objection to the paper. The paper was then presented and published by its authors.¹⁴⁰ Still, the threat of litigation against Felten and his colleagues cast a chill on research in this field for some time.¹⁴¹

138 The Library of Congress seems to agree that some fair use tinkering should be permitted, for it has exempted bypassing CSS for purposes of making fair use clips of movies to teach film classes. See *Statement of the Librarian of Congress Regarding Section 1201 Rulemaking*, U.S. COPYRIGHT OFFICE (July 26, 2010) <http://www.copyright.gov/1201/2010/Librarian-of-Congress-1201-Statement.html>.

139 See, e.g., Pamela Samuelson, *Anti-Circumvention Rules: Threat to Science*, 293 SCIENCE 2028 (2001).

140 Scott A. Craver et al., *Lessons from the SDMI Challenge*, Paper Presented at the Proceedings of the 10th USENIX Security Symposium (Wash. D.C., Aug. 13-17, 2001), <http://www.princeton.edu/step/people/faculty/edward-w.-felten/research/Reading-Between-the-Lines.pdf>.

141 For a discussion of other types of research tinkering with TPMs that under *Reimerdes* might be unlawful, see Samuelson, *supra* note 124. A National Academy of Sciences study committee published a report pointing to some "significant flaws" in the DMCA anti-circumvention rules for the field of computer

Freedom to tinker with TPMs and TPM-protected digital content got a boost, however, from a subsequent appellate court ruling in *Chamberlain Group, Inc. v. Skylink Technologies, Inc.*¹⁴² Chamberlain sued Skylink for violating the DMCA because its replacement garage door opener (GDO) bypassed an authentication code that Chamberlain asserted was an access control to the program on its GDO devices. The appellate court found Chamberlain's arguments to be unpersuasive. It construed the anti-circumvention rules far more narrowly than *Reimerdes*. Without proof of a nexus between the tool being challenged and some copyright infringement resulting from its use, this court said there could be no violation of the DMCA rules.¹⁴³ The court gave credence to the interests of consumers in being able to purchase a GDO of their choice and to do with it as they wished; they were, after all, the owners of the GDOs. The court perceived the DMCA to have been carefully drafted to balance the interests of copyright owners and the public, and even to leave room for lawfully circumventing a TPM for fair use and other legitimate purposes.¹⁴⁴ *Chamberlain* was an important precedent suggesting a willingness to recognize a greater freedom for those who tinker with TPMs and TPM-protected digital content as long as this tinkering was not intended to facilitate copyright infringement. Unfortunately, at least one subsequent case has questioned *Chamberlain*'s conclusion of the need for a nexus between circumvention and infringement.¹⁴⁵

Recognizing the possibility that the anti-circumvention rules might sometimes thwart non-infringing uses of technically protected content, Congress established a triennial review procedure so that those who wished to make such uses could offer evidence in support of their claims and obtain exemptions from the act-of-circumvention rule.¹⁴⁶ Over the years the exemption

security research. See COMPUT. SCI. & TELECOMM. BD., THE DIGITAL DILEMMA: INTELLECTUAL PROPERTY IN THE INFORMATION AGE 311-21 (1999).

142 *Chamberlain Grp., Inc. v. Skylink Tech., Inc.*, 381 F.3d 1178 (Fed. Cir. 2004).

143 *Id.* at 1204.

144 *Id.* at 1196-97.

145 See, e.g., *MDY Indus. v. Blizzard Entm't, Inc.*, 629 F.3d 928 (9th Cir. 2010) (rejecting the nexus to infringement requirement set forth in *Chamberlain*). The anti-circumvention provisions of the DMCA can thus produce a legal ecosystem in which user innovation may be threatened or impeded. See, e.g., Seltzer, *supra* note 94, at 919, 970-71; ELEC. FRONTIER FOUND., UNINTENDED CONSEQUENCES: SIXTEEN YEARS UNDER THE DMCA (2014), <https://www.eff.org/wp/unintended-consequences-16-years-under-dmca> (providing numerous examples of attempts to stifle legitimate innovative activity).

146 Circumvention of Copyright Protection Systems, 17 U.S.C. §§ 1201(a)(1)(B)-(C) (2012).

procedure has been controversial and subject to criticism, and it has increasingly kindled the ire of consumers. For example, the provisions of the DMCA prohibit circumventing technical locks on cell phones, restricting customers to a particular mobile network provider. Although the Librarian of Congress granted an exemption for cell phone unlocking in the 2006 rulemaking cycle and again in 2010, the exemption was not renewed in 2012. A public outcry followed, with more than 114,000 people signing a White House petition demanding change. The White House voiced its support and the Federal Communications Commission pressured the wireless industry to voluntarily adopt relaxed rules. Congress also responded, passing the Unlocking Consumer Choice and Wireless Competition Act.¹⁴⁷

In the latest round of rulemaking, twenty-seven classes of exemptions were sought. They fell into three main categories: one set aimed to enable fair or otherwise privileged uses of technically protected audiovisual or literary works;¹⁴⁸ a second set aimed to allow “unlocking” or “jailbreaking” of TPMs embedded in specific devices;¹⁴⁹ a third set aimed to permit certain non-infringing uses of computer programs.¹⁵⁰ In late October 2015, the Librarian of Congress issued a final rule adopting numerous exemptions, albeit with

147 Pub. L. 113-144, 128 Stat. 1751 (2014). See Jonathan Band, *The End of the Cell Phone Unlocking Saga?*, INFOJUSTICE.ORG (July 30, 2014), <http://infojustice.org/wp-content/uploads/2014/08/band08042014-2.pdf>.

148 The classes of proposed exemptions are available at *Section 1201 Exemptions to Prohibition Against Circumvention of Technological Measures Protecting Copyrighted Works: Comments*, U.S. COPYRIGHT OFFICE, <http://copyright.gov/1201/2015/comments-020615/> (last visited Dec. 1, 2015). Five of the ten fair use-oriented classes of proposed exceptions focus on educational uses that teachers want to make of technically protected audiovisual works for their classes; two focus on enabling format- or space-shifting of technically protected content; two aim to allow derivative uses in films or noncommercial remix video; and one would legitimize the use of assistive technologies for print-disabled persons.

149 Five of the ten proposed exemptions would legitimate “unlocking” of devices so that consumers can use competitive wireless providers. The other five would allow “jailbreaking” so that consumers can load application programs on their devices from sources other than the one that the software’s developer wants (e.g., get apps from other than the Apple App Store).

150 Of the seven proposed exemptions, three would legitimize security research into devices embedded in cars, medical, and other equipment; two concern the ability to use abandoned software; one would allow bypassing TPMs to enable owners of cars and tractors to repair or modify them; and one would allow more competition in 3D printing.

several caveats.¹⁵¹ Opponents of the proposed exemptions included not only copyright industry stalwarts, such as the DVD Copy Control Association (which licenses CSS for DVD movies) and the Business Software Alliance, but also General Motors, John Deere, and various associations representing the automobile, medical device, and manufacturing industries.

In her recent testimony to Congress, the Register of Copyrights observed that the anti-circumvention debates now involve these kinds of unconventional players. Moreover, she noted that there seems to be a “disconnect” between the purposes for which the anti-circumvention rules were adopted (i.e., to stop widespread infringement) and the nature of restrictions these rules are now imposing on other kinds of uses, including frustrating consumers who want to understand or repair their cars.¹⁵² The Register suggested that it may be “time for a broader review of the impact and efficacy of Section 1201 and its exemption process.”¹⁵³ This review seems appropriate given that the proposed exemptions are for uses that pose virtually no risk of enabling infringement of commercially exploited copyrighted works.¹⁵⁴ As the unlocking and jailbreaking requests demonstrate, TPMs are being used to thwart competition in certain industry sectors, with the anti-circumvention rules as reinforcements.

The DMCA anti-circumvention rules should not be used and should not stand as a threat to those whose uses of technically protected works are for non-infringing purposes. Allegations of harms to public safety or battery life of devices that appear in the objections of manufacturers of cars and medical devices should be recognized as types of harms for which the anti-

151 *See* Exemption to Prohibition on Circumvention of Copyright Protection Systems for Access Control Technologies, 80 Fed. Reg. 65944 (Oct. 28, 2015) (to be codified at 37 C.F.R. pt. 201); *see also* Pamela Samuelson, *Legally Speaking: New Exemptions to Anti-Circumvention Rules*, COMM’NS ACM, Mar. 2016, at 24.

152 Pallante Testimony, *supra* note 56, at 23.

153 *Id.* at 24. Policy analyst Jonathan Band has suggested that the Office “could take a more pragmatic approach toward exemptions for embedded software. For example, it could consider, and ultimately grant, a broad exemption for all software essential to the operation of hardware in the lawful possession of the user.” Jonathan Band, *What’s Missing from the Register’s Proposals*, ARL POLICY NOTES (Apr. 30, 2015), <http://policynotes.arl.org/?p=1024>.

154 As this Article is going to press, the Copyright Office has initiated a study of Section 1201 and solicited public comment. *See* Section 1201 Study: Notice and Request for Public Comment, 80 Fed. Reg. 81369 (Dec. 29, 2015); Section 1201 Study: Extension of Comment Period, 81 Fed. Reg. 8545 (Feb. 19, 2016).

circumvention rules provide no remedy.¹⁵⁵ In addition, cybersecurity research that identifies vulnerabilities in devices and infrastructure, which if exploited by the “bad guys” would cause widespread harm to the public, should be allowed to proceed free from risks that the anti-circumvention rules would penalize those who are trying to ensure that the vulnerabilities are known and fixed so the harms will not occur.¹⁵⁶

CONCLUSION

This Article has explicated several key doctrines of IP laws, such as the public domain, exhaustion of rights, and the fair use doctrines, that have traditionally enabled freedom to tinker to flourish. This freedom is, however, under siege in the modern era, largely owing to the risks that developers of digital works — not only software, but also digital music, movies, and other works — perceive as threatening to their interests. Advances in information technologies and the ability to share digital information via global networks have heightened the perception that clamping down on freedom to tinker is in developers’ best interests.¹⁵⁷ Developers have looked to copyright’s derivative work right, mass-market license restrictions on what purchasers can do with products they buy, technical protection measures, and the anti-circumvention rules to confine freedom to tinker in significant ways.

Notwithstanding these efforts to restrict freedom to tinker, people are likely to keep doing it anyway. Users are pushing back against some efforts to restrict activities they believe to be fair.¹⁵⁸ Witness the 114,000 people who supported a petition in support of legislation to allow them to “unlock” their

155 Both houses of Congress have introduced bills proposing reforms of the anti-circumvention rules that would ameliorate some concerns about the anti-circumvention rules. *See* Breaking Down Barriers to Innovation Act of 2015, H.R. 1883, S. 990, 114th Cong. (2015).

156 *See, e.g.,* Candice Hoke et al., *Comment Regarding a Proposed Exemption Under 17 U.S.C. Section 1201 for Software Security Research (Class 25)*, COPYRIGHT.GOV (Feb. 6, 2015), http://copyright.gov/1201/2015/comments-020615/InitialComments_LongForm_StallmanEtAl_Class25.pdf.

157 *See, e.g.,* Fisher, *supra* note 4, at 1446-55 (discussing rights-holders’ rationales for imposing constraints on tinkering with existing products).

158 *See, e.g.,* Felten, *supra* note 7. Felten also mentions the U.S. Supreme Court decision in *Kirtsaeng v. John Wiley & Sons, Inc.*, 133 S. Ct. 1351 (2013), as affirming the importance of a “you bought it, you own it” approach to copyright. *Id.*

cell phones to use on alternative networks.¹⁵⁹ These voices were clearly heard in the White House and on Capitol Hill.¹⁶⁰ This overwhelming response by everyday users has not escaped the attention of those who argue for greater protection over their works. Hopefully, a meaningful dialogue will emerge about how to maintain a viable ecology of creativity, progress, and innovation for the benefit of all.¹⁶¹ The maker movement and DIY communities indicate that the next generation of users will likely be more engaged than ever in tinkering-type activities, particularly in the digital environment.

A symposium dedicated to the idea of an emerging “Constitution of Information”¹⁶² has provided a welcome opportunity to articulate why freedom to tinker is important. Yes, it often makes competition and ongoing innovation more possible. But it also enables freedom of thought, study, inquiry, self-expression, diffusion of knowledge, and building a community of highly skilled tinkerers. In addition, freedom to tinker fosters privacy, autonomy, human flourishing, and skills-building interests of tinkerers. Freedom to tinker is an essential component of the innovation wetlands that Torrance and von Hippel have urged us to recognize and protect.

Unfortunately, courts and policymakers have yet to recognize some important dimensions of this freedom, such as the imagination it requires, the privacy and autonomy interests of tinkerers especially when operating in their own premises, the need to tailor the artifacts to serve the tinkerer’s own needs, the skills-building function of letting people tinker with existing artifacts, and the self-actualization that tinkerers are likely to experience.

Occasionally, though, there is some acknowledgement that a tinkerer’s property interests in their artifacts justify tinkering for purposes such as to repair what’s broken.¹⁶³ Occasionally, courts do understand that tinkering may be

159 See, e.g., Brendan Sasso, *House Passes Cell Phone Unlocking Bill*, NAT’L J. (Feb. 25, 2014), <http://www.nationaljournal.com/tech/house-passes-cell-phone-unlocking-bill-20140225>.

160 See *supra* note 147 and accompanying text.

161 See, e.g., Alfonso Gambardella, Christina Raasch & Eric von Hippel, *The User Innovation Paradigm: Impacts on Markets and Welfare* (Working Paper, 2015), <http://ssrn.com/abstract=2079763> (positing that user innovation benefits both users and producers and also increases social welfare).

162 Symposium, *supra* note 5.

163 See, e.g., *Bureau of Nat’l Literature v. Sells*, 211 F.379 (W.D. Wash. 1914) (right to repair (copyright)); *Wilson v. Simpson*, 50 U.S. (9 How.) 109 (1850) (right to repair (patent)). The Copyright Act includes a provision authorizing owners of copies of computer programs to modify them for certain purposes. 17 U.S.C. § 117(a) (2012).

necessary to learn important lessons about how things work.¹⁶⁴ Sometimes courts endorse the freedom of tinkerers to share what they've learned with others.¹⁶⁵ Sometimes, courts also recognize that tinkering may lead to ongoing innovation that increases the number of non-infringing products in the marketplace.¹⁶⁶

Going forward, it would greatly facilitate user innovation if courts construed copyright's derivative work right more narrowly than they have sometimes done.¹⁶⁷ The reproduction right too should be narrowly construed when tinkerers transpose their copy of a work without multiplying copies of it.¹⁶⁸ Because tinkering will generally be transformative, fair use should be interpreted broadly when users have been tinkering with their own copies of copyrighted works and developing new creations that serve different market segments.¹⁶⁹ The right to repair doctrines of patent and copyright laws should generally shield tinkerers, especially those who engage in this activity for noncommercial purposes.¹⁷⁰ Improvements that result from tinkering should also be given some deference in resolving IP disputes.¹⁷¹

It would also help if courts recognized that the exhaustion of rights principle provides users with some rights to tinker with and modify their copies of copyrighted content for personal and other non-infringing purposes.¹⁷² Courts and legislatures should be willing to affirm the ownership interests of

164 *See, e.g.,* *Sega Enters. Ltd. v. Accolade, Inc.*, 977 F.2d 1510, 1522, 23 (1992) (reverse engineering was necessary to extract information so unlicensed party could create an interoperable program).

165 *See, e.g.,* *Chi. Lock Co. v. Fanberg*, 676 F.2d 400, 405 (9th Cir. 1982) (lawful to publish information about lock combinations that lock manufacturer claimed as a trade secret).

166 *See, e.g.,* *Sega*, 977 F.2d at 1523 (recognizing that reverse engineering can foster competition and innovation); *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.* 489 U.S. 141, 151 (1989) (recognizing that reverse engineering fosters competition and innovation, and endorsing freedom to copy publicly disclosed functional designs unprotected by patent law).

167 *See, e.g.,* *Samuelson*, *supra* note 62 (in keeping with Congressional intent, copyright's derivative work right should be interpreted narrowly).

168 *See, e.g.,* *Théberge v. Galerie d'Art du Petit Champlain, Inc.*, 2002 S.C.C. 34, [2002] 2 S.C.R. 336 (Can.) (reproduction right held not infringed when owner of a print transposed it onto another medium); *C.M. Paula Co. v. Logan*, 355 F. Supp. 189 (N.D. Tex. 1973) (finding reuse of an original image on a ceramic plaque not a reproduction).

169 *Fisher*, *supra* note 4, at 1474.

170 *Id.* at 1475.

171 *See, e.g.,* *Lemley*, *supra* note 9.

172 *See, e.g.,* *Fisher*, *supra* note 4, at 1475; *Perzanowski & Schultz, Copyright Exhaustion*, *supra* note 37.

purchasers of digital content that should not be overridden by mass-market license restrictions.¹⁷³ Also important may be judicial decisions or legislative policies that decline to enforce license terms that restrict user tinkering and the development of follow-on innovations that result from this tinkering.¹⁷⁴ The First Amendment should also generally protect the right of tinkerers to share what they've learned with other interested users.¹⁷⁵ User-innovator tinkering with existing artifacts should also be protected against anti-circumvention claims by following *Chamberlain's* lead in recognizing the legitimacy of fair use circumventions. Under a Constitution of Information that recognizes the importance of freedom to tinker, IP rules should be interpreted, or as necessary adapted, so that they are applied flexibly in a manner that promotes the ongoing progress of science and useful arts and other legitimate interests of those who expand horizons of knowledge through tinkering and sharing the results of their tinkering with others.

173 See *supra* notes 111-112 and accompanying text.

174 See, e.g., Fisher, *supra* note 4, at 1475-76; Mark A. Lemley, *Beyond Preemption: The Law and Policy of Intellectual Property Licensing*, 87 CALIF. L. REV. 111 (1999) (suggesting possible doctrinal avenues to achieving this end).

175 Fisher, *supra* note 4, at 1475.