

A Technological Theory of the Arms Race

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Although the “technological arms race” has recently emerged as a vogue-ish piece of legal terminology, scholarship has quite conspicuously failed to explore the phenomenon systematically. What are “technological” arms races? Why do they happen? Does the recent spike in scholarly attention actually reflect their novelty? Are they always inefficient? How do they differ from military ones? What role can legal institutions play in slowing them down?

In this Article I seek to answer these questions. I argue that copyright enforcement and self-help represent substitutable tactics for regulating access to expressive assets, and that the efficacy of each tactic depends on the particular audience profile consuming the relevant asset. Authors can most cost-effectively manage access through a mixture of these two tactics. Given the attributes of the parties competing over use of and access to expressive assets—authors and consumers—one should expect to observe sustained racing behavior. Such racing constitutes an undesirable exercise in inefficient wealth-redistribution, eroding the benefits of authors’ traditional ability to choose the lowest-cost, most effective mix of copyright enforcement and self-help. Although the proposition that copyright protection substitutes for self-help is not a new one, the precise ways in which it does so—as well as the inefficiencies associated with arms races—remains dramatically under-theorized.

Legal rules should seek to minimize wasteful investment in protection and circumvention measures, but citing the Digital Millennium Copyright Act (DMCA) as the first institutional attempt to do so is misleading. For some time, courts and legislatures have addressed racing behavior over a variety of intangible assets—copyrightable expression, patented inventions, and unprotected information. This sample of institutional responses reveals an identifiable pattern of controlling technological arms races, one to which the DMCA largely conforms.

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INTRODUCTION

Given the recent explosion in digital content’s cultural prominence, intellectual property scholarship has increasingly focused on how self-help (nonlegal modes of regulating access to and use of expressive assets)¹ figures in the decision making of authors and distributors, to whom I refer collectively as content providers.² This commentary yields at least two relatively incontrovertible but as-yet unconnected propositions. First, the literature has demonstrated that self-help represents a viable alternative to legal exclusion generally (by which I mean legal mechanisms for restricting use of and access to an asset), and intellectual property law in particular.³ Second, the literature has established that, under certain conditions, self-help can initiate wasteful “arms races” between providers and consumers of expressive assets.⁴ This Article seeks to accomplish what the scholarship has quite conspicuously failed to do—establish a rigorous, logical relationship between these two phenomena.

My overarching purpose is to connect these two ideas, and I do this in two steps. First, I explore the more general relationship between copyright law and technological arms racing. In so doing, I borrow methodology from international-relations literature in order to predict the frequency and intensity of technological arms races. Second, I position that phenomenon’s most conspicuous institutional response, the Digital Millennium Copyright Act (DMCA),⁵ in the broader context of legal rules mediating cultural access to intangible assets.

1. These are sometimes called “technological protection measures” (TPMs). See 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, 391–92 (2004). I resist this terminology because it inappropriately implies that there needs to be some sort of circuitry involved.

2. See, e.g., Trotter Hardy, *Property (and Copyright) in Cyberspace*, 1996 U. CHI. LEGAL F. 217 (1996) (exploring analogies to real property in cyberspace).

3. See, e.g., Dan L. Burk, *DNA Rules: Legal and Conceptual Implications of Biological “Lock-Out” Systems*, 92 CAL. L. REV. 1553, 1563 (2004) (noting the desirability of self-help in the copyright context); Llewellyn Joseph Gibbons, *Digital Bowdlerizing: Removing the Naughty Bytes*, 2005 MICH. ST. L. REV. 167, 186 n.112; Wendy J. Gordon, *Asymmetric Market Failure and Prisoner’s Dilemma in Intellectual Property*, 17 U. DAYTON L. REV. 853, 856 n.13 (1992) (“[I]f a policymaker were able to . . . decide that fencing was in fact more expensive than setting up and enforcing a system of intellectual property rights, that might justify adopting a copyright-like law even in the absence of author market failure.”); Sonja K. Katyal, *Privacy v. Piracy*, 7 YALE J.L. & TECH. 222, 227 (2005).

4. See, e.g., Dan L. Burk, *Muddy Rules for Cyberspace*, 21 CARDOZO L. REV. 121, 172–73 (1999); Hardy, *supra* note 2, at 251.

5. Pub. L. No. 105-304, 112 Stat. 2860 (codified as amended in scattered sections of 17 U.S.C.).

Part I is more of a synthesis of pertinent scholarship than are Parts II and III.⁶ Part I will crystallize the idea, already present in modern intellectual property literature, that copyright and self-help represent substitute tactics for excluding consumers from unauthorized access to and use of an expressive asset (and the one oft-overlooked corollary that one function of copyright is to displace the need for self-help). It will explore in detail the variables driving a content provider's selection of exclusionary tactics (these tactics collectively represent an "exclusionary strategy"), arguing that two variables, both relating to the ease of producing unauthorized substitutes for the asset, figure most prominently in that decision. Part II will explore carefully one of the more noteworthy developments of the digital era—the technological arms race. I will borrow methodology from international relations theory to structure analysis of technological arms races over assets, presenting more rigorously both the conditions under which such races occur and those under which one may expect a particular side to "win." I will argue that the primary harm of technological arms races is that they cannibalize the benefits associated with a given content provider's ability to selectively employ a variety of legal and nonlegal exclusionary tactics. Finally, Part III will argue that the most recent Congressional response to digital piracy, the allegedly "unprecedented" or "revolutionary" DMCA, actually fits very comfortably within a series of judicial and legislative reactions to older technological arms races.

I. THE SUBSTITUTABILITY OF COPYRIGHT AND SELF-HELP

A. *The Conventional Logic of Copyright*

Copyrightable expression is what economists call a "public good."⁷ Public goods exhibit two distinctive characteristics: (1) nonrivalrousness, meaning that one person's consumption of an asset does not diminish its availability for another;⁸ and (2) nonexcludability, meaning that the producer of an asset cannot restrict its benefits to

6. The exception is *infra* Part I.C, which discusses the factors driving a content provider to select a given mix of copyright enforcement and self-help.

7. The concept of "public goods" derives largely from the work of Nobel Laureate Paul Samuelson. See Paul A. Samuelson, *Aspects of Public Expenditure Theories*, 40 REV. ECON. & STAT. 332, 335–36 (1958); Paul A. Samuelson, *Diagrammatic Exposition of a Theory of Public Expenditure*, 37 REV. ECON. & STAT. 350 (1955); Paul A. Samuelson, *The Pure Theory of Public Expenditure*, 36 REV. ECON. & STAT. 387 (1954). Writings are generally considered public goods. See Stephen Breyer, *The Uneasy Case for Copyright: A Study of Copyright in Books, Photocopies, and Computer Programs*, 84 HARV. L. REV. 281, 281–82 n.4 (1970). Kenneth Arrow is usually credited with identifying the public goods problem in intellectual property. See Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY* 609 (Nat'l Bureau of Econ. Research ed., 1962).

8. For the canonical statement of nonrivalry, see Arrow, *supra* note 7, at 614–17. This proposition appears endlessly in intellectual property literature. See, e.g., Yochai Benkler, *An Unhurried View of Private Ordering in Information Transactions*, 53 VAND. L. REV. 2063, 2065–66 (2000); James Boyle, *Cruel, Mean, or Lavish? Economic Analysis, Price Discrimination and Digital Intellectual Property*, 53 VAND. L. REV. 2007, 2012 (2000); William W. Fisher III, *Reconstructing the Fair Use Doctrine*, 101 HARV. L. REV. 1659, 1700 (1988).

those who purchase it.⁹ More colloquially, a public good is one with benefits that cost little to *provide to* and cost a lot to *restrict from* an extra person.¹⁰ Ideas exhibit nonrivalrousness because one person's consumption of an idea does not diminish its value to others. They exhibit nonexcludability because (absent some means of exclusion) a content provider cannot restrict an idea's benefits to those who purchase it. I use the term "content provider" because it includes authors *and* distributors of expressive assets (a subset of ideas, or "intangible assets"), both of which make the choice with which I concern myself in this Article—that between copyright enforcement and self-help.

Absent some corrective mechanism, the private sector underproduces ideas because, whereas the nonrivalrousness of an idea suggests it should be produced and disseminated prolifically, its nonexcludability means that content providers will generally find themselves unable to recoup a return on it in the market. Copyright represents the state's attempt to correct for this market failure by defining property rights in original expression.¹¹

Allowing content providers to exclude potential competition and price supracompetitively¹² results in certain consumers being unable to transact, even though

9. Many textbooks now discuss the public goods problem exclusively in terms of free riding and excludability. *See, e.g.*, ROBERT S. PINDYCK & DANIEL L. RUBINFELD, MICROECONOMICS 672–76 (4th ed. 1998).

10. *See* Stigweb: The Stiglitz Internet Study Site, Glossary–P, <http://www.wwnorton.com/college/econ/stiglitz/glossp.htm> (last visited July 27, 2004) (defining a public good as one "that costs little or nothing for an extra individual to enjoy, and that it costs a great deal to prevent an extra individual from enjoying"). The two classic (but nonetheless disputed) examples of public goods are national defense and lighthouses. National defense is considered a nonrivalrous good because, having already provided it for one person, the producer (usually the government) can provide it to another at little to no incremental expense. *See, e.g.*, PINDYCK & RUBINFELD, *supra* note 9, at 638; JOSEPH E. STIGLITZ, ECONOMICS OF THE PUBLIC SECTOR 74–75 (2d ed. 1988); Breyer, *supra* note 7, at 281–82 n.4. Much of the same logic applies to lighthouses. *See* R. H. Coase, *The Lighthouse in Economics*, 17 J.L. & ECON. 357 (1974).

11. Many governments induce the private production of public goods by creating and delineating property rights over the good. *See* STEPHEN SHMANSKE, PUBLIC GOODS, MIXED GOODS, AND MONOPOLISTIC COMPETITION 17–20 (1991); James M. Buchanan & Milton Z. Kafoglis, *A Note on Public Goods Supply*, 53 AM. ECON. REV. 403 (1963). Copyright is itself an attempt to correct for just such a market failure. For a discussion of nonmarket failure and the four classic types of market failures, see Charles Wolf, Jr., *A Theory of Nonmarket Failure: Framework for Implementation Analysis*, 22 J.L. & ECON. 107, 107–12 (1979). Government can respond to market failures in at least two ways. First, it can more carefully delineate property rights. *See* R. H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960). Second, it can provide the good itself, such as is generally the case with national defense. *See supra* note 10.

12. By supracompetitive prices I mean prices that exceed marginal cost, with marginal cost being the price an author would have to set if he or she did not have exclusive rights to control access to and use of a creative asset. *See* Neil Weinstock Netanel, *Impose a Noncommercial Use Levy to Allow Free Peer-to-Peer File Sharing*, 17 HARV. J.L. & TECH. 1, 25 (2003). *But cf.* Edmund W. Kitch, *Elementary and Persistent Errors in the Economic Analysis of Intellectual Property*, 53 VAND. L. REV. 1727, 1730–38 (2000) (noting that not all copyrights enable supracompetitive pricing).

Copyright protection generally enables authors to charge a supracompetitive price for creative works by constraining arbitrage opportunities in secondary markets. Suppose, for example, that

they may value the incremental copy more than the sellers do.¹³ Economists refer to these foregone transactions as “dead-weight loss.”¹⁴ It is the tension between, on the one hand, providing sufficient creative incentives and, on the other, minimizing dead-weight loss, that animates much of the contemporary controversy in copyright law.¹⁵ The term “incentives-access paradigm” has come to refer to copyright’s uneasy attempt to reconcile the conflicting interests of retaining sufficient creative incentives and allowing socially desirable access.¹⁶ An economist might say that copyright law seeks to minimize the difference between the content provider’s expected return on the work and the fixed cost of creation, so as both to minimize the dead-weight loss and to retain sufficient incentives to produce the expressive asset.¹⁷

an author pens a copyrightable novel and sells it as an e-book to one consumer for \$10. Absent copyright protection, when the author tries to sell the book to another consumer for the same price, there is nothing to stop the first consumer from underpricing that offer by replicating the copy he originally purchased from the author. (Under the first sale doctrine, the purchaser of copyrighted material can resell the physical copy of that material. The purchaser may also lend or rent that physical copy. *See* 17 U.S.C. § 109(a) (2000).) In fact, an inability to control secondary distribution would prevent the author from being able to charge any price above the marginal cost of creating a copy of the work. Stated more rigorously, allowing third parties to underprice an original author forces the market price down to the marginal cost of producing the additional copy—which, for most digital works, is close to nothing.

If an author cannot charge a price that exceeds the marginal cost of the copy, then she can never amortize the fixed cost of producing the first copy of the work. And if she cannot expect to recover the fixed costs of creating the work, why would she create it in the first place? Anybody who doubts the rock-star status copyright protection enjoys in generating incentives for creative production need look no further than Lars Ulrich, Metallica’s self-appointed ambassador to the business world, who, in 2001, spearheaded an all-out legal and public relations assault on the filesharing network Napster. *See* Lisa J. Beyer Sims, *Mutiny on the Net: Ridding P2P Pirates of Their Booty*, 52 EMORY L.J. 1907, 1908–09 (2003).

13. *See* Abraham Bell & Gideon Parchomovsky, *Pliability Rules*, 101 MICH. L. REV. 1, 42 (2002).

14. *See id.*

15. *See* Sony Corp. of Am. v. Universal City Studios, Inc., 464 U.S. 417, 429 (1984) (describing copyright as requiring “a difficult balance between the interests of authors and inventors in the control and exploitation of their writings and discoveries on the one hand, and society’s competing interest in the free flow of ideas, information, and commerce on the other hand”); ROBERT COOTER & THOMAS ULEN, *LAW AND ECONOMICS* 128–29, 135 (3d ed. 2000); Burk, *supra* note 4, at 133 (“[T]he incentive to create the work is purchased at the expense of restricted availability.”); William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325, 326 (1989) (“Striking the correct balance between access and incentives is the central problem in copyright law. For copyright law to promote economic efficiency, its principal legal doctrines must, at least approximately, maximize the benefits from creating additional works minus both the losses from limiting access and the costs of administering copyright protection.”).

16. Copyright is a legal device for excluding market participants other than the content provider (and those she licenses), and the need for those entities to be able to recover the fixed costs of their creative investments is easily the most frequently advanced justification for copyright protection. *See* Christopher S. Yoo, *Copyright and Product Differentiation*, 79 N.Y.U. L. REV. 212, 226–36 (2004).

17. *See* COOTER & ULEN, *supra* note 15, at 128–29, 135; Lawrence Lessig, *The Law of the Horse: What Cyberlaw Might Teach*, 113 HARV. L. REV. 501, 527 (1999) (“[T]he concept of a restricted copyright [is] one that protects a copyrighted work to the extent necessary to induce

B. Copyright and Self-Help as Substitutes

As one might expect with most canonical legal theories, the incentives-access paradigm's ivory façade has drawn heavy fire.¹⁸ Arguments regarding what copyright is "really about" abound,¹⁹ but the incentives-access paradigm endures as the favored justification among scholars and judges, including the nine that matter most.²⁰ Although I ultimately cast my lot with the paradigm's apologists, whether the

creation, but no more."); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 868 (1990); Stewart E. Sterk, *Rhetoric and Reality in Copyright Law*, 94 MICH. L. REV. 1197, 1205 (1996) ("Any copyright protection beyond that necessary to compensate the author for lost opportunities would generate no additional incentive to create and would discourage production of additional copies even when the cost of producing those copies was less than the price consumers would be willing to pay.").

18. See, e.g., Tim Wu, *Copyright's Communications Policy*, 103 MICH. L. REV. 278, 279 (2004); Yoo, *supra* note 16, at 223 (arguing that the incentives-access paradox is not really a paradox because it does not take into account the economics of product differentiation).

19. See, e.g., Neil Weinstock Netanel, *Copyright and a Democratic Civil Society*, 106 YALE L.J. 283 (1996) (suggesting that copyright protection protects democratic societies from the dangers of government patronage); Wu, *supra* note 18, at 285–86 (contending that much of what is in Title 17 represents conflict-specific compromise on communications policy).

20. The Constitution states that Congress has the power to "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." U.S. CONST. art. I, § 8, cl. 8. The Supreme Court has interpreted this clause to mean that copyright represents an incentive for authors to produce creative works. See, e.g., *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 125 S. Ct. 2764, 2776 n.8 (2005) (noting that copyright can be justified as a means of encouraging creativity); *Eldred v. Ashcroft*, 537 U.S. 186, 207 (2003); *Fogerty v. Fantasy, Inc.*, 510 U.S. 517, 526 (1994) ("We have often recognized the monopoly privileges that Congress has authorized, while 'intended to motivate the creative activity of authors and inventors by the provision of a special reward,' are limited in nature and must ultimately serve the public good.") (quoting *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 429 (1984)); *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 449 U.S. 340, 349–50 (1991) ("To [the end of promoting the Progress of Science and useful Arts], copyright assures authors the right to their original expression, but encourages others to build freely upon the ideas and information conveyed by a work."); *Harper & Row, Publishers, Inc. v. Nation Enters.*, 471 U.S. 539, 558 (1985) ("[I]t should not be forgotten that the Framers intended copyright itself to be the engine of free expression. By establishing a marketable right to the use of one's expression, copyright supplies the economic incentive to create and disseminate ideas."); *Sony*, 464 U.S. at 429 ("The monopoly privileges . . . are neither unlimited nor primarily designed to provide a special private benefit. Rather, the limited grant . . . is intended to motivate the creative activity of authors and inventors by the provision of a special reward, and to allow the public access to the products of their genius after the limited period of exclusive control has expired."); *Goldstein v. California*, 412 U.S. 546, 555 (1973) (noting the Constitution outlines both the goal to be achieved and the means to achieve it). For that matter, legislative history suggests that Congress may have expressly considered the incentives-access idea when it enacted the Copyright Act of 1909:

The enactment of copyright legislation by Congress . . . is not based upon any natural right . . . but upon the ground that the welfare of the public will be served and progress of science and useful arts will be promoted by securing to authors for limited periods the exclusive rights to their writings.

H.R. REP. NO. 60-2222, at 7 (1909).

relationship between self-help and copyright enforcement is consistent with that theory is not my primary concern. I instead seek to explore how arms races create waste,²¹ irrespective of the degree to which one may cast the specific inefficiencies as conforming to the orthodox copyright theory.

Copyright enforcement is only one of several exclusionary tactics content providers may use to charge supracompetitive prices in exchange for use and access rights.²² If one assumes that content providers are economically motivated,²³ then they should favor copyright enforcement only when it is superior to other exclusionary tactics. I use the terms “unauthorized access” and “unauthorized use” together to refer generally to any unauthorized consumption (whether it be use or access) of a copyrightable asset, as well as unauthorized use of that asset as an input to follow-on creation.²⁴

Although a content provider has several alternatives that fit under the umbrella of “legal” protection (such as shrink-wrap licenses or trespass law),²⁵ for now assume that by the term “legal protection” I am referring to copyright enforcement. Self-help can also take any number of forms,²⁶ but perhaps the single most relevant and identifiable is encryption of digital content.²⁷

There is a noteworthy distinction between speaking in terms of the “substitutability” of copyright and self-help from the perspective of a government and that from the perspective of an individual content provider. I discuss the significance of the decision from each of these perspectives,²⁸ but the choice facing individual actors (which exclusionary tactic to use) should be considered separately from the institutional choice

21. See *infra* Part II.A.

22. See Hardy, *supra* note 2, at 223.

23. See David Chang, *Selling the Market-Driven Message: Commercial Television, Consumer Sovereignty, and the First Amendment*, 85 MINN. L. REV. 451, 528–29 (2000).

24. Copyright is ordinarily characterized as an attempt to provide incentives for creation and distribution. See, e.g., Justin Hughes, *Fair Use Across Time*, 50 UCLA L. REV. 775, 793 (2003) (“If one were to look for an overriding intent vis-à-vis copyright, it is surely that it creates incentives to produce and distribute public goods that otherwise would be underproduced. This is unquestionably the overriding purpose of the law as expressed, explained, and elaborated by the Constitution, Congress, and the Supreme Court.”) (internal citations omitted). For the sake of simplicity, however, I have omitted discussion of the distribution incentive, although much of the analysis as applied to authors applies with equal, if not more, force to distributors.

25. See Burke, *supra* note 3; Hardy, *supra* note 2, at 226.

26. Again, I eschew the term “technological protection measure” in favor of “self-help” because the former term obscures the fact that many protection measures are quite crude. The most common forms of digital self-help, however, are digital watermarks, encryption, and digital rights management (DRM) technology. See Besek, *supra* note 1, at 444–49. These protections and the associated circumvention measures are assuming a larger and larger role, as they have prominently figured in the distribution of some of the most financially successful and popular media in recent memory. See *infra* note 69.

27. See Kenneth W. Dam, *Self-Help in the Digital Jungle*, in EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 107–08 (Rochelle Cooper Dreyfuss et al. eds., 2001).

28. For the discussion of the choice faced by the individual actor, see *infra* notes 29–41 and accompanying text. For the discussion of the choice face by institutional actors, see *infra* Part III.

facing legislatures and courts (how to set up rules encouraging individual actors to make the most socially desirable choices). In this Part, when I discuss the substitutability of copyright and self-help, I refer exclusively to the menu of options facing individual actors.

An individual content provider has at least three viable strategies for releasing a work. To be fair, these strategies are actually points on a continuum, but representing them as three discrete choices simplifies my descriptive task considerably. First, a content provider could create the work and “protect” the document from certain kinds of use and copying (*creation with self-help*).²⁹ Second, she could rely entirely on copyright enforcement to dictate behavior with respect to use and copying (*creation without self-help*).³⁰ Third, she could decline to create the work at all (*no creation*).

Historically, scholars have depicted content providers as facing a binary choice between creation without self-help and no creation (“the binary model”). Copyright scholarship does not depict self-help as an option upon which content providers historically relied. Content providers were presented as having an abridged menu of options—one that omitted the possibility of creation with self-help—for at least three reasons. First, some argue that content providers rarely pursued creation with self-help because the costs *individual actors bore* in developing and deploying effective self-help devices remained high relative to those they bore in association with copyright enforcement.³¹ In the words of one noted copyright scholar:

29. The choice of protection obviously lies along a spectrum ranging from investment in minimal protection to investment in more extravagant protection. In reality, then, a content provider faces an almost infinite number of options: create (or distribute, for distributors), do not create, create with low intensity protection, create with slightly higher intensity protection, etc. Again, it is important to note this simplification, but incorporating it into my textual explanation would render the idea too unwieldy for this paper.

30. Strictly speaking, there is really no conceptual baseline for “no protection.” If one believes that protection includes things like sending manuscripts through the mail in opaque envelopes, it becomes clear that things we think of as “no protection” are nothing more than nontechnological protection measures that have been incorporated into the norms of creation and distribution. Nonetheless, the commonsense meaning of “no protection” is a sufficient definition for the purposes of understanding this explanation.

31. See Besek, *supra* note 1, at 391–92. With respect to the Internet, technological solutions can be implemented at any of several logical layers: at the level of the copyrighted work, the operating system, or the network. See BRUCE A. LEHMAN, INFORMATION INFRASTRUCTURE TASK FORCE, INTELLECTUAL PROPERTY AND THE NATIONAL INFORMATION INFRASTRUCTURE: THE REPORT OF THE WORKING GROUP ON INTELLECTUAL PROPERTY RIGHTS 178 (1995), available at <http://www.uspto.gov/web/offices/com/doc/ipnii/ipnii.pdf>.

The advent of new, inexpensive means of controlling access to creative works—digital barbed wire—dramatically reduces the costs of fencing off creative material and calibrating access. Cf. Burk, *supra* note 4, at 146 (noting the argument that “cyberspace offers conditions under which demarcation is cheap”); Netanel, *supra* note 19, at 285 (noting that “digital technology provides copyright owners with the technical means to restrict access to, and uses of, digitized works to a far greater extent than is possible in the analog and hard copy world” and that the “deployment of such technological fences would raise the specter of all-consuming copyright control”). For example, the Secure Digital Music Initiative (SDMI), see Secure Digital Music Initiative, <http://www.sdmi.org> (last visited Aug. 8, 2004), and the Content Protection System Architecture (CPSA), see INTEL CORP., IBM CORP., MATSUSHITA ELECTRIC INDUSTRIAL CO., & TOSHIBA CORP., CONTENT PROTECTION SYSTEM ARCHITECTURE: A COMPREHENSIVE

Until very recently, a copyright holder had no means to instruct a book that it should sprout wings and fly back to its publisher after it had been read *N* times, crumble into unusability on a date certain, or reveal only indecipherable script until a designated reader shouted, “Open sesame!”³²

Second, content providers infrequently opted for *creation with self-help* because the high costs of copying severely limited the need for nonlegal complements to legal exclusion (in other words, content providers simply did not need self-help because copying was too expensive).³³ Mark Stefik puts it quite succinctly:

Arguments about fair use for digital works sometimes tacitly (and incorrectly) assume that publishing risks in the digital medium are similar to those in the paper medium. However, while it is . . . unlikely that an infringer will make and distribute thousands of paper copies of a work, he or she can copy and mail a thousand digital copies with a single keystroke at no expense whatsoever.³⁴

Whereas the first two reasons suggest the binary model is more a practical simplification than an error, the third attacks that model more directly. Commentators failed to discern instances where a content provider in fact deployed a “protection measure” because those protection measures did not look much like “technology” at

FRAMEWORK FOR CONTENT PROTECTION (2000), <http://www.4centity.com/data/tech/cpsa/cpsa081.pdf>, each represent rights management initiatives that, if utilized, may exclude certain types of use far more effectively than does enforcement through court action. See Lydia Pallas Loren, *Technological Protections in Copyright Law—Is More Legal Protection Needed?*, BILETA, Apr. 9, 2001, <http://www.bileta.ac.uk/> (follow “Conference Papers” hyperlink; then scroll down to “16th BILETA Annual Conference 2001”; then scroll down to link for Loren article and follow hyperlink). The most prominent example of such barbed wire is DRM technology. See generally Julie E. Cohen, *DRM and Privacy*, 18 BERKELEY TECH. L.J. 575 (2003) (discussing the relationship between DRM and privacy).

I highlight the importance of the individual actor’s perspective because what drives the selection of exclusionary mode is not the cost of exclusion, but the cost of exclusion borne by the actor making the choice. Irrespective of the degree to which exclusion costs are concentrated in the actor making the choice between exclusionary modes, however, nonlegal protection measures were, for some time, prohibitively costly.

32. Jessica Litman, *Reforming Information Law in Copyright’s Image*, 22 U. DAYTON L. REV. 587, 601 (1997).

33. The absence of perfect digital copying devices (and other perfect or near-perfect ones) made illegal copying less attractive to consumers, and the loss associated with *creation without self-help* was smaller. Cf. Besek, *supra* note 1, at 391 (noting that improvements in digital technology and the Internet have facilitated easy and widespread reproduction of copyrighted materials, and copyright owners have responded by developing new protection technologies); Hardy, *supra* note 2, at 235–36 (identifying an inverse relationship between cost of copying devices and incidence of self-help). Consumers could not download a film or copy a novel at the click of a button, so authors relied less on self-help for maintaining supracompetitive prices. As the costs of copying plummeted, however, the stakes for authors rise because arbitrage opportunities for consumers increase.

34. MARK STEFIK, *THE INTERNET EDGE: SOCIAL, LEGAL, AND TECHNICAL CHALLENGES FOR A NETWORKED WORLD* 96–97 (1999).

all. Self-help instead generally assumed the form of specialized, but culturally familiar, intermediaries.³⁵

These intermediaries took the form of “the movie theater, video store, broadcast licensee’s studio, or music store down the street.”³⁶ This phenomenon derives largely from the other two—creators and distributors favored these “tollbooths”³⁷ both because they were efficient, coordinated self-help, and because they imposed significant copying costs on potential infringers. While characterizing these intermediaries as “substitutes” for legal exclusion does not entirely capture their social or economic significance, understanding the role they play in constraining unauthorized use and access remains important. A public library controls dissemination of potential market substitutes by requiring that people return books after they read them and movie theatres do the same by presenting films to audiences without distributing physical copies. Many commentators are therefore guilty of too readily characterizing self-help as the unique byproduct of sophisticated digital locks, neglecting the presence of more conventional institutions that perform largely the same function.

For the sake of explanatory simplicity I have thus far described the interaction between copyright and self-help as though the two are mutually exclusive. While the two are substitutes in a strict economic sense—that is, an increase in the price of one will increase demand for the other—³⁸ content providers often deploy both tactics together. As long as the return on a particular mode of exclusion is positive,³⁹ content providers should be expected to deploy it. In light of the recent technological developments altering the cost structure of protection and circumvention, the choice between self-help and copyright enforcement has assumed greater significance.

A content provider’s incentive to deploy protection measures varies inversely with her return on copyright enforcement. In a world with no copyright protection, self-help would be the only means of constraining unauthorized use and access; in a world where a copyright conferred complete exclusionary power, self-help would be unnecessary. We occupy a point on the legal continuum somewhere in between these two poles—copyright protection is available but incomplete and, even for those things that it purports to protect, enforcement is imperfect. Copyright enforcement and self-help are substitutes, and where traditional copyright provides only low-value protection, the incentives to pursue *creation with self-help* remain.

From the perspective of a content provider, one should conceptualize two distinct elements as comprising the “legal force” of copyright law—scope and compliance. When copyright entitlements capture a content provider’s every conceivable financial interest and when compliance with those rules is complete, a creator will not deploy self-help (because such measures provide no marginal exclusion). Although (arguably) copyright scope has not undergone revolutionary changes over the last several

35. See *id.* These entities also foreshadow the appearance of highly specialized intermediaries after the DMCA’s passage. See Katyal, *supra* note 3.

36. Yochai Benkler, *Free as the Air to Common Use: First Amendment Constraints on Enclosure of the Public Domain*, 74 N.Y.U. L. REV. 354, 422 (1999).

37. See *id.*

38. See ROBERT B. EKELUND, JR. & ROBERT D. TOLLISON, *ECONOMICS* 19–20 (3d ed. 1991).

39. See David Rosenberg, *Mandatory-Litigation Class Action: The Only Option for Mass Tort Cases*, 115 HARV. L. REV. 831, 866 n.71 (2002); PINDYCK & RUBINFELD, *supra* note 9, at 184. For a more precise statement of the conditions in equilibrium, see *infra* note 47.

decades,⁴⁰ the advent of the digital medium has certainly precipitated a dramatic decline in compliance.⁴¹

Response to this phenomenon may take the form of either increased self-help or increased copyright enforcement. Identifying the variables driving this response represents a central concept in the rest of this Article. The remainder of Part I will explore *why* an individual content provider may favor a particular mix of exclusionary tactics and Part III will consider the related institutional responses.

C. Selecting Exclusionary Strategies

In a recent *Yale Law Journal* article, Pamela Samuelson and Suzanne Scotchmer criticize the DMCA for incentivizing shoddy encryption.⁴² Why, they ask, would we *want* content providers to utilize inferior protection measures? My answer, that primitive self-help is desirable for intangible assets consumed by certain audience profiles,⁴³ requires a more nuanced understanding of self-help's comparative advantages. For now I seek merely to lay a theoretical foundation for my ultimate

40. It has undergone revolutionary changes in the sense that copyright continues to protect works that are authored, original, and fixed. Moreover, the DMCA does not purport to alter the existing scope of copyright protection. See 17 U.S.C. § 1201(c) (2000).

41. See Raymond Shih Ray Ku, *The Creative Destruction of Copyright: Napster and the New Economics of Digital Technology*, 69 U. CHI. L. REV. 263, 296 (2002) ("As the costs of copying decrease and more individuals are able to afford the technology necessary to copy, one can assume that there will be a greater number of potential copiers. So even though the copying costs for initial distributors will decrease as well, they will be forced to compete with a greater number of copiers and copies."); John M. Williamson, *Rights Management in Digital Media Content: A Case for FCC Intervention in the Standardization Process*, 3 J. TELECOMM. & HIGH TECH. L. 309, 321 (2005) ("Due to the ease with which digital media files can be copied, stored, and . . . distributed, . . . many consumers have shown a propensity to abuse the technological environment by stealing the copyrighted media content.").

42. See Pamela Samuelson & Suzanne Scotchmer, *The Law and Economics of Reverse-Engineering*, 111 YALE L.J. 1575, 1641 (2002).

43. Professors Samuelson and Scotchmer may have even alluded to this dynamic unintentionally. In their evaluation of the effect of the DMCA on anti-circumvention technology, Samuelson and Scotchmer examine both its effect on "[e]xpenditures on technical protection measures for content providers" and "[w]asted costs," with the latter presumably incurred by content producers and content distributors during an "arms race" with content consumers. *Id.* at 1639 tbl.4, 1641. However, they concede that "in some sense" all costs are "wasted" in that they would be unnecessary if content consumers were entirely compliant with the copyright laws. See *id.* at 1641. The authors likely insist on putting the "in some sense" gloss on the status of technical protection measures because they presume that one hundred percent copyright compliance is unlikely and that some residual circumvention may always necessitate anti-circumvention. Although Samuelson and Scotchmer do not furnish a useful means of distinguishing between technology that is "really" wasteful and that which is merely wasteful in "some sense," my intuition is that they mean to imply that the latter is comprised of those measures designed to prevent copying by unsophisticated circumventors. They do not, however, seem to openly embrace the idea that the substitutability of technology for copyright depends on the *type of people* one aims to protect against. See *id.* ("We contend that if Congress wants to strengthen criminal penalties for copyright infringement, then it should do it straightforwardly, rather than through the back door of the DMCA.").

answer to Professors Samuelson and Scotchmer. Part III explores their claim in the specific context of the DMCA.⁴⁴ I focus now more generally on the factors that drive content providers to favor self-help.

These factors together predict how likely dissemination of what I call an “associated end product” is to furnish consumers with potential market substitutes for the original asset, given that a content provider must secure a return on her creative labor. To clarify, if a story or a musical composition is the “expressive asset” then a book or a compact disc is the “associated end product.” With respect to copyrightable assets, the volume and mix of exclusionary strategies depends on (1) the inherent complexity of reverse engineering the asset from its associated end product, and (2) the sophistication of the “audience” against which an author must direct her exclusionary tactics. By “audience” I mean the set of potential infringers, follow-on creators, and consumers of the asset.⁴⁵

Entitlement owners often opt for crude technological exclusion. For example, landowners continue to use short wooden fences or barbed wire to exclude others from real property. Trespass law and fences are both exclusionary tactics that prevent people from making unauthorized use of the land. The interesting property (and copyright) question is *why* a content provider settles on a particular exclusionary strategy—a specific mix of barbed-wire fences, trespass law, and security guards.⁴⁶

Content providers will generally seek to maximize the value of their mix of legal protection and self-help, just as do landowners. In other words, they are most likely to rely on the lowest-cost, highest-return mix of exclusionary tactics. A content provider will devote resources within an exclusionary strategy in a way that should come as little surprise to those with a background in economics. Content providers will select a mix

44. See *infra* notes 170–187.

45. Several scholars have recently undertaken a more careful parsing of what I call the “audience” for an intellectual asset. See, e.g., Clarisa Long, *Information Costs in Patent and Copyright*, 90 VA. L. REV. 465, 489–95 (2004) (dividing audience into avoiders, transactors, and builders); Glen O. Robinson, 71 U. CHI. L. REV. 1449, 1485 n.130 (2004) (identifying the phenomenon of recent property “audience” scholarship); Henry E. Smith, *The Language of Property: Form, Context, and Audience*, 55 STAN. L. REV. 1105, 1141–47 (2003) (dividing audience into purchasers, successors in interest, third party enforcers, and violators in general).

46. The “fencing” metaphor now crops up frequently in copyright literature. See, e.g., Benkler, *supra* note 36, at 420 (“Why is a prohibition on circumvention a restriction on speech? Why is it anything but a rule against picking locks? After all, one might say, the anticircumvention provision does not say that you cannot read a work or quote it in a critical review. It is a rule about using decryption software, not about accessing information. It says no more than, if the owner has set up a fence, you cannot break down the fence.”); Mark A. Lemley, *What’s Different About Intellectual Property?*, 83 TEX. L. REV. 1097, 1100 (2005) (using the concept of physical fence identification to clarify differences between tangible and intangible assets); Michael L. Rustad & Thomas H. Koenig, *Rebooting Cybertort Law*, 80 WASH. L. REV. 335, 356–57 (2005) (“The Internet is being enclosed by legally backed digital fences, lengthened copyright terms and increased penalties.”) (internal citations omitted); Smith, *supra* note 45, at 1175 (“In the case of land, fences and other boundaries must be easily processed by a lay audience—anyone might stray onto the land—but, in the case of patents the possibility of a nonexpert inadvertently ‘trespassing’ on a patent is less likely. Highly detailed and patent-specific information is not only indispensable, but the limited audience of potential violators can be expected to process it.”).

of self-help and copyright enforcement such that the returns on an additional dollar of each are equivalent.⁴⁷ A content provider does not want to waste exclusionary resources enforcing laws where self-help is more efficient, and vice-versa. As the marginal benefits of self-help increase relative to those of copyright enforcement, one would expect to observe content providers shifting their limited resources accordingly.

The question that logically follows from the preceding observations is, quite colloquially, what is copyright law good at, and what is self-help good at? For copyrightable assets, two factors largely determine the volume and mix of exclusionary investment:⁴⁸ (1) the inherent complexity of reverse engineering the asset from the associated end product (the asset’s “inherent reverse engineerability,” holding the audience’s sophistication constant); and (2) the technological sophistication of potential consumers,⁴⁹ infringers,⁵⁰ and follow-on innovators (the capacity of an audience to reverse engineer an asset, holding the asset’s inherent reverse engineerability constant).⁵¹ With respect to (1), the greater an asset’s inherent reverse engineerability, the more likely a content provider is to invest heavily in some form of exclusion and,⁵² with respect to (2), the less sophisticated the audience, the more likely a content provider is to use those exclusionary resources on self-help.⁵³ If an asset is

47. To be more precise (but far more confusing), the marginal rate of subjective substitution between self-help and copyright enforcement will be equal to their price ratio. *See* W. STANLEY JEVONS, *THEORY OF POLITICAL ECONOMY* 138–39 (4th ed. 1931).

48. Trade secrecy changes the equation somewhat, but that is rarely an option for copyrightable assets.

49. This group encompasses those who merely wish to use or avoid the good subject to the appropriate legal restrictions.

50. This group encompasses those who wish to gain unauthorized access to the good.

51. This group encompasses those who wish to use the good as a creative input to the generation of a follow-on good. It maps roughly on to Clarisa Long’s category of “builders.” *See* Long, *supra* note 45, at 494.

52. Another way of stating this argument is that where the asset in question bears a complicated relationship to the end-product, most of the infringement is going to be facilitated by “sophisticated circumventors” who are more responsive to legal penalties than they are to self-help.

53. One should distinguish between the relative and absolute desirability of legal protection. The desirability of self-help might increase, in an absolute sense, with the sophistication of an asset’s audience but, *on average*, under such circumstances its desirability increases less than does that of copyright enforcement. The following diagram might most cogently present the relationship between the two variables and investment in exclusion:

		Audience sophistication			
		Low		High	
Inherent reverse engineerability	High	Volume of exclusionary investment	Medium	Volume of exclusionary investment	High
		Fraction devoted to self-help	Higher	Fraction devoted to self-help	Lower
	Low	Volume of exclusionary investment	Low	Volume of exclusionary investment	Medium
		Fraction devoted to self-help	Higher	Fraction devoted to self-help	Lower

distributed to a highly sophisticated audience capable of reverse engineering the asset irrespective of its complexity, then self-help is less desirable than if the audience is unsophisticated.

With respect to the first variable, copyrightable assets are traditionally easy to reverse engineer from their associated end products and therefore necessitate significant exclusionary investment in order to maintain supracompetitive pricing.⁵⁴ Furnishing someone with a copy of a content provider's novel, absent some sort of exclusionary mechanism, furnishes that consumer with a market substitute for the asset itself (the expression in the novel).⁵⁵ Such circumstances frustrate efforts to maintain supracompetitive pricing for the novel because consumers can easily generate substitutes for that expression by replicating their physical (or electronic) copies.

For stories and similar kinds of expressive assets, creators may not exclude through secrecy (a form of self-help) because securing a return depends on their audience obtaining what is essentially a copy of the asset itself. One can hardly conceive of, for example, a commercially successful record whose musical contents must remain tightly guarded under lock and key.⁵⁶

Certain intangible assets, however, do not necessitate circulation to capture a return (and hence their inherent reverse engineerability is low). For these types of assets, inventors (think patents) and content providers (think copyrights) are more likely to rely on secrecy because audiences need not have unobstructed access to the actual asset in order to use it. For example, creators of patentable industrial processes need not circulate the processes themselves to earn a return on their inventive labor; they need circulate only the process's associated end product.⁵⁷ That is not to say that *all patentable* assets enjoy such an attenuated relationship to their associated end products. For example, one could hardly imagine Theophilus van Kannel securing his return on his idea for the revolving door without directly disclosing the mechanical specifications of his idea to those purchasing it.⁵⁸

With respect to the second variable, the sophistication of the audience against which exclusionary tactics are directed, self-help is a more effective means of constraining accidental or inept copying—copying engaged in by “unsophisticated circumventors.” An unsophisticated circumventor is a content consumer or a follow-on content provider

54. This generalization obviously excepts software.

55. Copyright law actually grants to the consumer a limited right to market substitutes. The “first-sale doctrine” allows the owner of a particular copy to, “without the authority of the copyright owner, . . . sell or otherwise dispose of the possession of that copy” *See* 17 U.S.C. § 109(a) (2000). The first-sale doctrine, however, does not entitle a consumer to distribute anything other than her physical copy. *See id.*

56. In order for a listener to derive benefit from the asset she must receive a physical copy of the record. That record will disclose a perfect copy of the asset itself (forget for a moment the Copyright Act's differential treatment of musical compositions and sound recordings, *see* 17 U.S.C. § 106(6) (2000)), a copy that may spawn perfect or near perfect substitutes for that asset, depending on the musical format.

57. *See, e.g., infra* Part III.B.1 (discussing trade secrets).

58. Van Kannel patented the revolving door on August 7, 1888. *See* Cynthia Blair, *1899: NYC's First Revolving Door Installed in Times Square Restaurant*, *NEWSDAY* (N.Y.), http://www.newsday.com/features/custom/ithappened/newyork/ny-ihiny061504story,0_7435899.htmlstory?coll=ny-rightrail-bottompromo (last visited Oct. 22, 2005).

that would not infringe the protected asset but for either her ignorance of the law or the ease with which she may acquire infringing material.

Consider the analogy to wooden fences. They signal to legally ignorant but law-abiding people where public property ends and where private property begins. With respect to these people, extravagant self-help would represent an additional cost without a corresponding benefit. Building state-of-the-art fences—and state-of-the-art encryption—is not desirable because it represents a gratuitous protection expenditure with respect to unsophisticated circumventors.⁵⁹ Stationing sentinels in twenty-yard increments around the perimeter of a chicken farm would hardly be worth the cost. In the copyright context, crude technological fences are generally sufficient to prevent “accidental” unauthorized uses of copyrightable assets. They might, for example, deal effectively with those who do not realize they are making a “copy” by emailing a digital file to a friend.⁶⁰

Self-help, however, is relatively less effective against the activities of seasoned hackers and highly organized businesses—copying engaged in by “sophisticated circumventors.”⁶¹ Such entities are generally willing and able to fight through any protection, but there is no reason to believe they are less averse to severe civil and criminal sanctions than are average consumers. For assets with sophisticated audience profiles, therefore, legal sanctions remain the more desirable exclusionary tactic.⁶²

59. See *infra* notes 267, 279 and accompanying text. Later, I argue that the presence of economically irrational hackers, coupled with cheap distribution channels, undermines this assumption.

60. This copyright phenomenon is called the “RAM copy doctrine.” See *Stenograph L.L.C. v. Bossard Assocs.*, 144 F.3d 96, 101–03 (D.C. Cir. 1998); *MAI Sys. Corp. v. Peak Computer*, 991 F.2d 511, 518 (9th Cir. 1993).

61. See *Besek*, *supra* note 1, at 392 (“[I]t is widely recognized that TPMs can be broken quickly by the technologically able[—]these individuals can then create and distribute tools to those with less technological sophistication, allowing them to circumvent protection measures[—and] that TPMs could not be effective without legal sanctions against circumventing them or circulating circumvention tools.”). This is not a historical novelty, as industry failed to appreciate that hackers could defeat other forms of restrictions on digital content. See *Williamson*, *supra* note 41, at 319.

62. I do not mean to claim that just because self-help is more effective against unsophisticated circumventors than against sophisticated ones that it is necessarily the strategy content providers will use. I do mean to argue that one would expect more resources to be devoted to self-help where an audience of an asset is comprised largely of *unsophisticated* circumventors than one where the audience is comprised of *sophisticated* ones. Copyright penalties, however, do indeed appear to be the favored strategy for dealing with sophisticated circumventors. Although sophisticated circumventors (mostly programmers) are probably more adept at masking their identity, see Dorothy E. Denning, *Protection and Defense of Intrusion*, <http://www.cs.georgetown.edu/~denning/infosec/USAFSA.html> (last visited Oct. 22, 2005) (noting that malicious codes can be attached to electronic mail), the costs associated with copyright enforcement against them are relatively similar to those associated with enforcement against unsophisticated circumventors. Although sophisticated circumventors may be able to hide better (thereby raising the costs of enforcing laws against them to a higher level than the costs of enforcing laws against unsophisticated circumventors), the need to police a smaller pool of people may counteract the increased per-capita burden on law enforcement associated with savvy evasion.

For example, famed Russian software engineer Dmitri Sklyarov was arrested after giving a

II. THE ROLE OF TECHNOLOGICAL ARMS RACES

A. A Simple Arms-race model

The term “arms race” inevitably evokes the portentous specter of each of the Cold War principals investing furiously to stockpile weapons armaments exceeding those of its adversary.⁶³ Discussion of the causes and consequences of the Cold War arms race is voluminous to say the least,⁶⁴ but the term “arms race” has acquired a meaning that transcends its military heritage⁶⁵ and has colonized political,⁶⁶ legal,⁶⁷ and economic discourse⁶⁸ having nothing to do with intercontinental ballistic missiles or nuclear warheads. The more abstract meaning of “arms race” denotes the presence of (at least) two antagonistic parties acquiring similar resources or devices, where each party’s “armaments” are designed to undermine the objectives of its opponent.

A military arms race is one in which the parties are (usually) nation-states and the stockpiled devices are weapons. Recent copyright scholarship speaks in terms of an arms race that similarly pits two groups against each other, with each group deploying

speech about encryption at an annual hacker convention in Las Vegas. See Robert Lemos, *Russian’s Arrest Latest in Copyright Fight*, CNET NEWS.COM, July 18, 2001, <http://news.com.com/2100-1001-270129.html>. The case against Skylarov and his company, Elcomsoft, became the first in which a federal court announced that the DMCA did not conflict with the First Amendment. See *United States v. Elcom Ltd.*, 203 F. Supp. 2d 1111 (N.D. Cal. 2002).

63. See, e.g., RONALD E. POWASKI, *RETURN TO ARMAGEDDON: THE UNITED STATES AND THE NUCLEAR ARMS RACE, 1981–1999* (2000).

64. See, e.g., MATTHEW EVANGELISTA, *INNOVATION AND THE ARMS RACE: HOW THE UNITED STATES AND THE SOVIET UNION DEVELOP NEW MILITARY TECHNOLOGIES* (1988). Likewise, there has been an explosion in arms-race modeling, catalyzed by Lewis F. Richardson’s posthumously published *Arms and Insecurity* (1960). See, e.g., ROBERT M. AXELROD, *THE EVOLUTION OF COOPERATION* (1984); PARTHA CHATTERJEE, *ARMS, ALLIANCES, AND STABILITY* (1975); GEORGE W. DOWNS & DAVID M. ROCKE, *TACIT BARGAINING, ARMS RACES, AND ARMS CONTROL* (1990); ROBERT JERVIS, *PERCEPTION AND MISPERCEPTION IN INTERNATIONAL POLITICS* (1976); KENNETH A. OYE, *COOPERATION UNDER ANARCHY* (1986); DINA A. ZINNES, *CONTEMPORARY RESEARCH IN INTERNATIONAL RELATIONS* (1976); W. Ladd Hollist, *An Analysis of Arms Processes in the United States and the Soviet Union*, 21 INT. STUD. Q. 503 (1977); Andrew Kydd, *Arms Races and Arms Control: Modeling the Hawk Perspective*, 44 AM. J. OF POL. SCI. 222 (2000); Stephen J. Majeski & David L. Jones, *Arms-race modeling: Causality Analysis and Model Specification*, 25 J. CONFL. RESOL. 259 (1981).

65. See, e.g., Richard Delgado, *The Language of the Arms Race: Should the People Limit Government Speech?*, 64 B.U. L. REV. 961, 968 (1984) (discussing how arms-race terminology has colonized the way we think about a number of other issues); Andrew C. Geddis, *Campaign Finance Reform After McCain-Feingold: The More Speech-More Competition Solution*, 16 J.L. & POL. 571, 599 (2000) (discussing arms races in the context of elections).

66. See, e.g., MARTIN OPPENHEIMER, *THE URBAN GUERRILLA* 154 (1970) (referring to a “racial arms race”).

67. See *supra* note 4 and *infra* note 74.

68. This is somewhat misleading. Economic methodology, insofar as it explains human behavior, was brought to bear on arms race theory before arms race theory was self-consciously brought to bear on economic methodology. See Michael P. Leidy & Robert W. Staiger, *Economic Issues and Methodology in Arms Race Analysis*, 29 J. CONFL. RESOL. 503, 504 (1985).

either protection or circumvention measures so as to defend or acquire “territory,” or access to/use of expressive assets. Although this Article will refer to these scenarios as “technological arms races,” the races do not always involve technology in the strictest sense, but rather a more expansive conception of protection and circumvention, including use of a lock or a crowbar, or release of a blockbuster film simultaneously across the world.⁶⁹ Technological arms races may take place between government regulators and the private subjects of regulation (what is called “regulatory competition”)⁷⁰ or, more importantly for my purposes, between private parties that are poised to benefit from a particular allocation of use- and access-rights.⁷¹

Technological arms races, however, are not perfectly analogous to military ones. While the two share characteristics such as antagonistic parties and “weaponry,”⁷² they diverge sharply in terms of how prominently elements such as deterrence and politics figure into each party’s decision making.⁷³ Additionally, arms-race modeling concerns itself with predicting the incidence of two primary negative outcomes—inefficient military investment and violent military conflict. Technological arms-race modeling concerns itself with the inefficiencies that inhere in pure wealth-redistributive behavior—but “war” possesses no meaningful analogue in the copyright context. The analogy between competition over expressive assets and competition over military ones

69. *The Matrix Revolutions* opened simultaneously across the world—9 a.m. in New York, 2 p.m. in London, 5 p.m. in Moscow, and 11 p.m. in Tokyo—ostensibly to cement the film’s status as the cutting edge of motion pictures. Unless one fails to question the wisdom of opening a film somewhere at three in the morning, that explanation seems incomplete. What the “zero hour simultaneous opening of ‘Revolutions’” really represented was a protective counter-maneuver in response to the ease of unauthorized digital replication and distribution. To have released the film at a normal time in Tokyo would have guaranteed that dozens of file-sharing networks would have been saturated with digital, albeit imperfect, copies before most Americans woke up for breakfast. See *Real Time Challenge for Matrix*, BBC NEWS, Oct. 2, 2003, <http://news.bbc.co.uk/1/hi/entertainment/film/3158232.stm>.

A similar scenario unfolded when J.K. Rowling refused to release *Harry Potter and the Order of the Phoenix* (2003) as an e-book. Avid fans took exception and divided up responsibility for scanning and proofreading the book. After they had finished, the scanned, proofread pieces were reassembled and posted on the Internet. See Jeff Kirvin, *Digital Prohibition: Here’s Why the Proposed Laws Against File Sharing Won’t Work*, WRITING ON YOUR PALM, July 23, 2003, <http://www.writingonyourpalm.net/column030721.htm>.

70. See Tim Wu, *When Code Isn’t Law*, 89 VA. L. REV. 679, 704–05 (2003) (discussing how regulated and beneficiary groups may invest and reinvest in mechanisms of influence, leading to a full-fledged regulatory competition).

71. The race will generally involve somebody trying to protect the default (those deploying protection measures) and those that are trying to use circumvention measures to destabilize the default allocation of entitlements.

72. By “weaponry,” I only mean that the two parties simultaneously pursue a common instrumentality (weapons or protective/circumventive technology) in the process of winning the game.

73. For example, military arms races also have deterrent and geopolitical consequences that figure prominently in response and counter-response, see Colin S. Gray, *The Arms Race Phenomenon*, WORLD POLITICS, Oct. 1971, at 39, 58, whereas those dynamics are largely absent from technological arms races. For a discussion on cognitive limitations of analogies, see M.J. Peterson, *The Use of Analogies in Developing Outer Space Law*, 51 INT’L ORG. 245, 248–52 (1997).

is appropriate to the extent that the winner-take-all character of the “game,”⁷⁴ one that is played in rounds,⁷⁵ renders economically wasteful investment in military or technical one-upsmanship rational for each individual player.⁷⁶

So how would a technological arms race unfold in a world with no copyright protection? Imagine that a content provider releases each volume of a five-volume e-book series such that she distributes one installment every two years—so she distributes a single volume in each of years one, three, five, seven, and nine. Also imagine a group of 100 people “consuming” those volumes—the “audience”—during each of years two, four, six, eight, and ten. Each of the 100 people values every volume at \$20, so every other year there are \$2000 in rents to be captured either by the content provider (if she is able to exclude perfectly and charge each member of the group \$20) or by content consumers (if the content provider’s exclusionary tactics fail, her audience can copy freely).⁷⁷ Assume for each period that both the content provider and consumers can invest freely in technology either to protect (encrypt) the e-book (in the content provider’s case) or to circumvent (decrypt) the content provider’s protection (in the audience’s). Finally, assume “winner-take-all conditions”—that (1) if the content provider is “ahead” in technological expenditure, then she is able to charge the full \$20 for the e-book and (2) if the two groups are “tied” or if the consumers are ahead, then the group may access and reproduce the work at will.⁷⁸ Table 1 represents one admittedly unlikely but pedagogically useful behavioral sequence:

Table 1. Hypothetical behavior sequence

Year	Content consumers’		Total cumulative dollars spent on protection and circumvention
	Content provider’s incremental investment in protection	incremental investment in circumvention	
1 (write volume 1)	10	–	10
2 (consume volume 1)	–	10	20
3 (write volume 2)	20	–	40
4 (consume volume 2)	–	20	60
5 (write volume 3)	30	–	90
6 (consume volume 3)	–	30	120
7 (write volume 4)	40	–	160
8 (consume volume 4)	–	40	200
9 (write volume 5)	50	–	250
10 (consume volume 5)	–	50	300

Each time the content provider writes a volume she invests in newer protection measures to try to ensure that he can sell her e-book for \$20 per copy and each time the group consumes a volume it invests in an attempt to circumvent that protection

74. The “winner-take-all” character of electioneering certainly accounts for the prevalence of arms races on the campaign trail. *See* Geddis, *supra* note 65, at 598–99.

75. By “rounds,” I mean to suggest that the players alternate decisions regarding military/technological spending. This is an assumption imported from the arms race literature. *See infra* notes 114–16 and accompanying text.

76. *See generally* ANDREW M. COLMAN, GAME THEORY AND EXPERIMENTAL GAMES: THE STUDY OF STRATEGIC INTERACTION (1991); Richardson, *supra* note 64.

77. It might be helpful to think of the audience’s “rents” as units of utility derived from consuming the good.

78. I state these conditions more rigorously *infra* Part II.B.

measure. After ten years and five volumes, the content provider and her audience will have collectively spent \$300 on the “arms race.” This wasteful wealth-redistributive behavior could conceivably go on for quite some time, as each side continues to invest in a protection or a circumvention measure that allows it to capture all of the rents flowing from a given work. Assuming winner-take-all conditions, the cycle would only stop either (1) once the incremental cost of the content provider’s protection measure exceeds the available rents from releasing it (\$2000),⁷⁹ or (2) once the incremental cost of the consumer’s circumvention measure exceeds that surplus (also \$2000).⁸⁰ Each maneuver does nothing to create value; it merely redistributes wealth between content providers and content consumers.

Two noteworthy inferences follow from the presence of these ceilings, with the second being much more important for my present purposes. First, *ceteris paribus*, arms races where the parties must split the rents are likely to end at smaller expenditure outlays than those subject to winner-take-all conditions. Dividing the rents lowers, for both content providers and content consumers, the acceptable cost ceiling of the “maneuver.”⁸¹ When one side is no longer willing to undertake such maneuvers, the wealth redistributive race is over. Second, the more extensive the arms race, the less the incentive to create an expressive asset in the first place.⁸² From an *ex ante* perspective, then, arms races lessen creative incentives, generating a significant negative externality.⁸³

79. One of the central arguments of this paper is that people cease to rely on self-help at all because such exclusionary tactics would be less efficient than copyright enforcement. Assume for now, however, that the content provider is limiting herself to the decision about whether or not to create or not under conditions where copyright protection is very thin or absent.

80. If the cost of this surplus (the sum of the rents flowing from the asset) is distributed evenly across the audience, this is just the cost of the book.

81. Consider the example in this paper. The content provider and her audience can capture or share a \$2000 surplus. Under winner-take-all conditions each side is willing to spend up to \$2000 on protection or circumvention measures if it is confident that it will win as a result of such expenditure. If, on the other hand, victory produces only a fraction, say 50% of the surplus, then each side would be willing only to spend up to \$1000 on an incremental self-help or circumvention measure.

82. See Loren, *supra* note 31, at 2 (“Depending on the level of control these technological protections can provide, technology may allow a copyright owner to feel confident that allowing authorized distribution of her work in digital form, will not result in a complete loss of control and correlating loss of revenue.”).

83. Paula Samuelson and Suzanne Scotchmer argue that, given the way the DMCA structures liability, content developers and distributors will have incentives to create and deploy only weak anti-circumvention technology. See Samuelson and Scotchmer, *supra* note 42, at 1640 (“The DMCA gives no incentive for the authors to moderate their prices, and it gives little incentive to employ effective technical measures.”). The specific ways in which the DMCA does this is beyond the scope of this Part, but the implication that there may be significant benefits to more extravagant spending on nonlegal protection measures is not. Most commentary arguing that technological arms races generate positive externalities focuses on spillovers related to national security. See *id.* at n.310 (quoting e-mail from Peter Swire, Visiting Professor of Law, George Washington Law School, to Pamela Samuelson, Professor of Law and Information Management, University of California at Berkeley (Sept. 14, 2001)) (“After [the destruction of the World Trade Center towers by hijacked airplanes], it is less tolerable to have a legal regime that encourages weak computer security and makes it illegal to push companies toward stronger

It is worth pausing to note that arms races need not *necessarily* create net economic losses. Arms races can have not only direct benefits and costs, but also positive and negative externalities. Arms races are economically undesirable *only* if the sum of the direct costs plus negative externalities exceeds the sum of the direct benefits plus positive externalities. At various points in this Article I argue: (1) that arms races are essentially rent-seeking behavior—investment that does not create value, but merely transfers it among different parties—and therefore have significant direct costs;⁸⁴ (2) that contending that arms races have significant direct benefits requires highly contentious normative assumptions regarding distributive fairness;⁸⁵ (3) that arms races diminish the expected return on creative investment for all future content providers, creating a significant negative externality;⁸⁶ and (4) that commentators severely overstate the positive externalities associated with racing.⁸⁷ Although I touch on all four of these values (some more extensively than others), I generally operate under the assumption that racing behavior is undesirable and that institutional actors should seek to minimize it.

security . . .”). The argument that the law should encourage advanced protection technology by excluding weaker protection measures from 17 U.S.C. § 1201(a)(2) and § 1201(b)(1) (2000) coverage is not persuasive. First, it is not obvious why DRM programs, devices designed to govern access and replication of copyrighted works, necessarily spill over into national security or antiterrorist infrastructure. Second, to the extent that DRM technology could contribute to U.S. digital security, the need for the latter is more than enough to sustain demand for the former.

84. See *supra* notes 64–83 and accompanying text.

85. If one argues that such welfare-redistributive behavior is desirable in spite of efficiency losses, then that contention must rest upon the normative appeal of redistribution itself. I decline to engage this thorny subject, although the ultimate allocation of use rights between content consumers and content producers remains an academic lightning rod. See Besek, *supra* note 1, at 469–70; cf. Loren, *supra* note 31, at 3 (“From the standpoint of copyright policy, this technological arms race is wasteful, at best. . . . A state of affairs which results in copyright owners investing substantial resources in the development of technological protections does not further that goal. Even in countries in which copyright protections is founded [sic] on labor or natural rights theories, the technological arms race is not within the goals of such systems. Instead of creating and disseminating works of authorship to the public, resources are spent on building bigger fences and the costs of such fence building is passed on to users.”).

The arms races I discuss here should be distinguished from some of the arms-race literature in the patent context, which refers to a different phenomenon entirely. In much patent scholarship, “racing” does not refer to competition over access to an already-created asset, but instead to competition to create the patentable asset in the first place. In that context, therefore, racing behavior does have direct benefits because it may diminish the time it takes to create the asset and to place it in the public domain. See, e.g., David C. Hoffman, *A Modest Proposal: Toward Improved Access to Biotechnology Research Tools by Implementing a Broad Experimental Use Exception*, 89 CORNELL L. REV. 993, 1027 (2004) (arguing that the patent system has triggered an “arms race” that has inflated the costs of biotechnology innovation). However, scholarship is beginning crude arms-race-type theorizing with respect to patentable assets, insofar as certain types of bioengineered goods can be created with encoded restrictions on reproduction. See Burk, *supra* note 3.

86. See *supra* notes 82–83 and accompanying text. See also *Rockwell Graphic Sys. v. DEV Indus.*, 925 F.2d 174 (7th Cir. 1991) (discussing this phenomenon in the context of inventive incentives).

87. See *supra* note 83.

B. Do Technological Arms Races Have Predictable Winners?

The preceding Part presents a simple arms race scenario,⁸⁸ but in so doing it only illustrates concepts—it does not capture empirically the behavior of content providers and content consumers. The content-provider and content-consumer “players” together represent what is called, in game-theoretic parlance, a “dyad.”⁸⁹ At least three variables, borrowed from international relations theory, predict the dyad’s racing behavior. Before delineating these variables, however, I pause to articulate specifically the spatial elements of the arms race metaphor and how they apply to expressive assets.

Military arms race theories describe a relationship between regimes associated with territories (we usually call these combinations “states”). The analogue to the “regime” is obviously the relevant player, but what is the “territory” each regime seeks to defend or acquire? One might assign territory according to who is entitled by law to make what use of an intellectual asset.⁹⁰ In other words, the use- and access-rights reserved to copyright holders under Title 17 (the portion of the U.S. Code housing the copyright laws)⁹¹ represent content providers’ “territory” and the use- and access-rights reserved to the public under that Title represent consumers’ “territory.”⁹² Defining the set of statutorily delineated use- and access-rights as the content providers’ “territory” is no doubt an imperfect conceptual maneuver,⁹³ but it does have the virtue of allowing *both*

88. See *supra* Part II.A.

89. See, e.g., Toshio Yamagishi, *The Structural Goal/Expectation Theory of Cooperation in Social Dilemmas*, in 3 *ADVANCES IN GROUP PROCESSES* 51, 70 (E. Lawler ed., 1986) (speaking in game theoretic parlance of a dyad). One should keep in mind that each “player” is really a group of constituents, either content providers or content consumers.

90. These are the use- and access-rights to copyrighted works as delineated in 17 U.S.C. §§ 101–122 (2000) (Chapter 1—Subject Matter and Scope of Copyright).

91. *Id.*

92. This methodology labors under the realist interpretation of property as a bundle of inter-subjective use-rights which define the relationships of an owner of a “thing” with the rest of the world. For the seminal statement of and virtually compulsory citation to realist property theory, see WESLEY NEWCOMB HOHFELD, *FUNDAMENTAL LEGAL CONCEPTIONS AS APPLIED IN JUDICIAL REASONING AND OTHER LEGAL ESSAYS* 96–97 (Walter Wheeler Cook ed., 1923). I, however, seek largely to steer clear of the debate about whether nonrealist conceptions of property are “vulgar.” See, e.g., *United States v. Gen. Motors Corp.*, 323 U.S. 373, 377 (1945) (deriding as “vulgar” the property-as-thing theory); Long, *supra* note 45, at 540 (discussing the persistence of “thingness” in property theory). Suffice it to say that 17 U.S.C. §§ 101–122 are defined largely in terms of a copyright-holder’s and the public’s entitlements to do certain things with an intellectual asset.

93. For example, this particular adaptation of the arms-race metaphor, specifying “territory” according to the use-rights reserved for authors and those reserved for consumers, is arguably premised on a preexisting allocation of use-rights, contained in 17 U.S.C. §§ 101–122, that is somewhat arbitrary. Moreover, there are questions surrounding practices such as fair use, where characterizing a given use as provider or consumer territory may turn on contested issues such as whether the practice is actually a right or a privilege. See Besek, *supra* note 1, at 415. For cases that have declined to speak in terms of a fair use “right,” see *Universal City Studios, Inc. v. Corley*, 273 F.3d 429, 458 (2d Cir. 2001), and *United States v. Elcom Ltd.*, 203 F. Supp. 2d 1111, 1131 (N.D. Cal. 2002).

There exists a particularly problematic circularity if I do not further specify these use- and access-rights to which I refer under Title 17. That circularity exists because, through the DMCA,

players' behavior to be characterized as either offensive or defensive, depending on the legal status of the contested use or access.⁹⁴

The volume of behavioral literature exploring arms races is staggering⁹⁵ and there is considerable disagreement on the most accurate models for predicting military conflict.⁹⁶ There are, however, at least three variables that not only best predict when military races occur (as opposed to the war that they result in),⁹⁷ but also happen to map quite conveniently onto a technological arms-race model: (1) relative power, the ratio of resources one state can convert into military assets to the resources another has for that same purpose;⁹⁸ (2) the offense-defense balance, the cost ratio of conquering a territory to defending it;⁹⁹ and (3) the amount of information available to a state regarding the characteristics of its adversary.¹⁰⁰ One may fairly easily convert several of these military variables into technological ones: (1) the players' relative power, represented by the ratio of resources available to content providers to those available to content consumers; (2) the ratio of the resources necessary to acquire a certain access or use capability to the resources necessary to restrict it; and (3) the information available to content providers (consumers) regarding the characteristics of consumers (content providers).

I first identify the variables themselves, and then I discuss how different *instances* of these variables affect the character of racing behavior.¹⁰¹ Generally speaking, these

Title 17 now technically allocates use-rights based on a content provider's decision to use self-help; in other words, use-rights are themselves determined by reference to what the content provider seeks to defend.

94. Some commentators speak of technological arms races as though content providers are only capable of defensive maneuvers and, conversely, as though content consumers are only capable of offensive ones. See, e.g., Kenneth W. Dam, *Self-Help in the Digital Jungle*, 28 J. LEGAL STUD. 393, 402 (1999) ("The warfare analogy of a race between offense and defense comes readily to mind. For those who sympathize with content providers, one can view the copier as the attacker, with the content provider responding to copying by using 'defensive' self-help systems. Then offensive techniques will arise to overcome the defenses to copying (or to alteration) not authorized by the content provider."). The alternative is to refuse to identify "territory," in which case the terms "offensive" and "defensive" lose meaning.

95. See *supra* notes 63–64 and accompanying text.

96. There is disagreement at an even higher level of abstraction over whether or not arms races increase or decrease security. See JERVIS, *supra* note 64, at 58–113; Charles L. Glaser, *Political Consequences of Military Strategy: Expanding and Refining the Spiral and Deterrence Models*, 44 WORLD POL. 497 (1992).

97. See Charles L. Glaser, *When Are Arms Races Dangerous? Rational Versus Suboptimal Arming*, INT'L SECURITY, Spring 2004, at 44, 51–57.

98. See *id.* at 52 (citing JOHN J. MEARSHEIMER, THE TRAGEDY OF GREAT POWER POLITICS ch. 3 (2001)).

99. See Glaser, *supra* note 97, at 52 (citing STEPHEN VAN EVERA, CAUSES OF WAR: POWER AND THE ROOTS OF CONFLICT ch. 6 (1999)); Stephen Biddle, *Rebuilding the Foundations of Offense-Defense Theory*, 63 J. POL. 741 (2001); Charles L. Glaser & Chaim Kaufmann, *What Is the Offense-Defense Balance and Can We Measure It?*, INT'L SECURITY, Spring 1998, at 44; Keir A. Lieber, *Grasping the Technological Peace: The Offense-Defense Balance and International Security*, INT'L SECURITY, Summer 2000, at 71; Sean M. Lynn-Jones, *Offense-Defense Theory and Its Critics*, 4 SECURITY STUD. 660 (1995).

100. See Glaser, *supra* note 97, at 55–57.

101. An "instance" is simply an observed or hypothesized value for a variable. I forego the term "value" because it misleadingly suggests a quantitative character.

variables operate as follows. First, the greater a player's (relative) power¹⁰²—its ability to invest in technology—the more likely it is to so invest because that investment is more likely to yield victory.¹⁰³

Second, a lower offense-defense ratio will lower the incidence of racing.¹⁰⁴ Racing is less likely because, given equivalent resources, both parties will know that one player can defend at a lower cost than that at which the other can attack. Offense is irrational if it would be easily and inexpensively repelled by a more efficient defense. As Charles Glaser argues in a recent article on the danger of military arms races:

A state that suffers a power disadvantage will be able to preserve its defensive capability if this disadvantage is smaller than the extent of defense advantage. Under these conditions, the more powerful state should recognize its poor prospects for acquiring an offensive capability and therefore the limited value in pursuing an arms buildup. Arms levels should stabilize and races should be relatively short.¹⁰⁵

Finally, information about an adversary's motives can push a player towards either arms buildup or reduction.¹⁰⁶ If a player is a security seeker—if it seeks only to retain the use- and access-rights conferred upon it by the copyright statute—and it believes its adversary is also a security seeker, then the consequences of running a technological deficit are less severe and the advantages of communicating one's own benign motives (by not arming) are larger than if one player thinks greed motivates its opponent.¹⁰⁷

As I note in this subpart's introduction,¹⁰⁸ the most important distinction between military and technological arms-race models is that the military variety are concerned with how well variables predict not only racing behavior, but also armed conflict. Because warfare possesses no analogue in the technological arms race, I evaluate these variables only in terms of how they predict the persistence of wasteful wealth-redistributive maneuvers.¹⁰⁹

102. Note that the product of the two players' power levels should always be equal to one because they are reciprocals. If there are two players, *A* and *B*, in the dyad, then *A*'s power is Potential Investment(*A*)/Potential Investment(*B*) and *B*'s power is Potential Investment(*B*)/Potential Investment(*A*) where Potential Investment represents a state's (player's) ability to invest in arms (technology).

103. See Glaser, *supra* note 97, at 52. One countervailing consideration is that increasing arms (technology) expenditures from a position of power diminishes a player's ability to signal benign motives. See *id.*

104. See *id.* at 52–53. Of course, I have defined the concept of “territory” precisely to avoid the problem alluded to in note 94, *supra*, whereby the race is defined such that authors may only play defense and consumers may only play offense. A more rigorous and accurate statement of this principle (one that was too involved for the text), is that low offense-defense ratios mean that both sides are more likely to invest in defensive maneuvers. Such a scenario, however, likely causes races to decelerate because defensive buildups have less threat value. Threat value is not as necessary if the adversary is not arming offensively.

105. Glaser, *supra* note 97, at 53.

106. See *id.* at 55–58.

107. See *id.* at 55–56.

108. See *supra* notes 72–76 and accompanying text.

109. And, given the significant negative externality associated with diminished creative

The content-provider/content-consumer dyad exhibits characteristics suggesting that, absent legal rules, sustained technological arms races are likely, for at least four reasons: (1) neither side enjoys a considerable power advantage, meaning that in the early stages of the race each side invests resources in maneuvers with a reasonable expectation that it might win;¹¹⁰ (2) the two players possess cognitive shortcomings that perpetuate racing;¹¹¹ (3) transaction costs, in the form of coordination and identification problems, limit the ability of the two sides to bargain effectively or to engage in meaningful acts of reciprocity;¹¹² and (4) the offense-defense ratio is low, so technological maneuvers tend to be decisive and yield, for each side, a payoff matrix that lends itself to racing.¹¹³ Before I explore each of these, I briefly present a short methodological framework for arms-race modeling.

The most developed military arms-race models incorporate “repeated prisoner’s dilemmas” (RPDs).¹¹⁴ An RPD model theorizes an arms race as a repetition of prisoner’s dilemma games,¹¹⁵ where a *noncooperative* equilibrium represents “racing” and a *cooperative* one represents “control.”¹¹⁶ Undesirable *noncooperative* equilibria occur where, although it is in the dyad’s interest not to “race” (i.e., it is in the *collective* players’ interest to “cooperate,” in traditional prisoner’s dilemma terminology), the payoff matrix renders investing in arms (“defection”) the superior strategy for each player.¹¹⁷ The game repeats itself every round, leading to highly inefficient expenditures on, in the case of intellectual assets, protection and circumvention and, in the case of military assets, weapons.

1. Power Ratio May Approach One

Mutual uncertainty about the identity of the victor means that neither player, content provider nor content consumer, is likely to concede during the early stages of an unchecked arms race.¹¹⁸ Each player will find investment in “arming” rational unless

incentives, the arms races may have social costs that extend well beyond wasteful wealth redistribution. *See supra* notes 82–83 and accompanying text.

110. *See infra* Part II.B.1.

111. *See infra* Part II.B.2.

112. *See infra* Part II.B.3.

113. *See infra* Part II.B.4. Once prevention and circumvention technology exists, it is rapidly disseminated. *See Loren, supra* note 31, at 1.

114. Andrew Kydd, *Arms Races and Arms Control: Modeling the Hawk Perspective*, 44 AM. J. POL. SCI. 228, 229 (2000).

115. *See* AXELROD, *supra* note 64; DOWNS & ROCKE, *supra* note 64; OYE, *supra* note 64.

116. Kydd, *supra* note 114, at 228.

117. *See* Leo F. Smyth, *International Mediation and Capitulation to the Routine*, 108 PENN. ST. L. REV. 235, 253–54 (2003).

118. For discussions of attempts to evaluate one’s own relative power, see Stephen Van Evera, *Why States Believe Foolish Ideas: Non-Self-Evaluation by States and Societies* (Jan. 10, 2002), (unpublished manuscript, on file with author), available at <http://web.mit.edu/polisci/faculty/S.VanEvera.html> (follow “Why States Believe Foolish Ideas” hyperlink). For how organization theory figures into player decision making, see T.N. DUPUY, *A GENIUS FOR WAR: THE GERMAN ARMY AND GENERAL STAFF, 1807–1945* (1977); BARRY R. POSEN, *THE SOURCES OF MILITARY DOCTRINE* (1984); JACK SNYDER, *THE IDEOLOGY OF THE OFFENSIVE: MILITARY DECISION MAKING AND THE DISASTERS OF 1914* (1984).

both sides predict the same winner with the same certainty.¹¹⁹ The ratio of the ability of content providers to channel these resources to the ability of consumers to do so is the technological analogue of the power ratio in the arms race literature.¹²⁰

Although this Article has thus far spoken in terms of two “players,” each player is itself a large, heterogeneous group.¹²¹ Because both content providers and content consumers are competing for the same rents (those flowing from distribution and use of the asset, respectively),¹²² determining which side is more “powerful” reduces to the question of which group can more effectively channel its dispersed resources into efficient maneuvers. The content-provider player’s power is easier to analyze because its organization and investment tends to be transparent and corporate in nature,¹²³ whereas consumer power flows from technological activity that is both opaque and ideologically motivated.¹²⁴ The opacity and economic irrationality of the consumer player renders its component of the power ratio very difficult for observers to quantify and even more difficult for the content-provider player to counter.

Content providers are repeat players and tend to have contacts with sophisticated distributors in possession of broad, cheap licenses to use protection measures (such as encryption).¹²⁵ Content consumers, on the other hand, are a large, disorganized bunch that must overcome more significant organizational costs.¹²⁶ An inexhaustive list of their organizational disadvantages includes more difficulty in: identifying other consumers in the same medium (with the same interest in circumvention), contacting

119. Additionally, the two players would probably have to perceive similar payoff matrices.

120. See *supra* notes 102–103 and accompanying text.

121. See SNYDER, *supra* note 118.

122. See *supra* Part I.C.

123. See *supra* Part I.C.

124. See *infra* note 127. The hacker movement may be further subdivided into those hackers who seek to steal and those who operate with a genuine sense of moral duty to flout copyright restrictions. See Brendan I. Koerner, *License to Wardrive*, LEGAL AFF., May–June 2005, at 68, 68; The Progress & Freedom Foundation, *Apple’s iTunes & the Digital Free Lunch: Steve Jobs, Others Force Clarity in Content Debate* (June 3, 2003), <http://www.pff.org/news/news/2003/060303apple.html> (“Who are the ‘resisters’? There are the ‘morally obtuse’ who want free stuff or feel a ‘vandalistic itch’, and there is the ‘more complex, more ideological and more important’ group who ‘assert not only a right but a duty to make all systems for enforcing intellectual property rights untenable, and regard breaking protections as a public service.’”).

125. See Christopher Jensen, Note, *The More Things Change, the More They Stay the Same: Copyright, Digital Technology, and Social Norms*, 56 STAN. L. REV. 531, 543–44 (2003).

126. See Ann Bartow, *Electrifying Copyright Norms and Making Cyberspace More Like a Book*, 48 VILL. L. REV. 13, 23 (2003) (quoting Julie E. Cohen, *A Right to Read Anonymously: A Closer Look at “Copyright Management” in Cyberspace*, 28 CONN. L. REV. 981, 995–96 (1996)); Julie E. Cohen, *Lochner in Cyberspace: The New Economic Orthodoxy of “Rights Management”*, 97 MICH. L. REV. 462, 527–33 (1998); Paul Ganley, *Digital Copyright and the New Creative Dynamics*, 12 INT’L J.L. & INFO. TECH. 282, 294 (2004) (“[C]o-ordinating a large number of seemingly innocuous consumer demands requires a considerable effort, the inertia of which must contend with the relative efficiency of producer collective action.”); Jensen, *supra* note 125, at 544 (noting that consumers are unsocialized to “copyright culture”). Moreover, content consumers consistently confront the collective action problem, whereby free-riding forestalls activity that would be in the group interest. See MANCUR OLSON, *THE LOGIC OF COLLECTIVE ACTION* 59–60 (1965) (making this argument in general, not with content consumers in mind); Wu, *supra* note 70, at 748.

such consumers, setting up a communications infrastructure, fairly distributing the costs and benefits among members of the group, defining group preferences, and maintaining adequate technological distribution channels.

These transaction costs are similar to the impediments that handicap consumers in the legislative process, but consumers overcome them in the technological arena more effectively than they do in the political one.¹²⁷ Ideologically motivated hackers may be willing to incur costs in developing circumvention measures that far exceed their individual valuation of access to a work.¹²⁸ More persuasively, however, many of the disadvantages cited above derive from precisely the condition that this analysis suspends—the presence of law.¹²⁹ If one could assume away vicarious penalties for producing otherwise infringing technology, one should expect considerably more coordination on the part of consumers and, although the content-provider interest would remain more concentrated, the infrastructural and organizational gap between the two players would diminish significantly. Because so many variables are in play, predicting which side—content providers or consumers—would prevail in a lawless world is very difficult. And, as noted above, arms races arise where there exists uncertainty regarding the economic ability of each antagonist to sustain its competitive participation in the race.¹³⁰

2. Cognitive Limitations

What may matter most to a given player in a given round, however, is that round's *perceived* payoff matrix.¹³¹ A fully rational actor might be capable of incorporating the *future* behavior of its adversary into its current “maneuver” (decision whether or not to race), but neither the group of content providers nor the group of content consumers is such a monolithic, rational actor.¹³² Shortsighted and impatient players are more likely to precipitate arms races because, by considering their adversaries' behavior only in

127. See Wu, *supra* note 70, at 747–50 (arguing that technological strategies are superior because they do not require collective action that their political counterparts do); Williamson, *supra* note 41, at 319 (noting that market structure no longer stands as a barrier to a commercially significant illicit market).

128. One particularly amusing account of the hacker ideology explains that hackers range along an axis of good and evil, with the ones engaged in illegal hacking considered “dark side hackers,” and their law-abiding counterparts considered “an elite force of Jedi Knights.” See Michael L. Rustad, *Private Enforcement of Cybercrime on the Electronic Frontier*, 11 S. CAL. INTERDISC. L.J. 63, 73 n.88 (2001).

129. One of my central arguments is that copyright law constrains arms races that would otherwise persist unchecked. In order to analyze whether arms races would persist unchecked in the absence of copyright law, I must, of course, suspend the existence of that legal right. See *infra* Part II.C.1.

130. Kydd, *supra* note 114, at 229.

131. However, the perceived payoff matrix may be highly correlated to the actual payoff matrix.

132. See OLSON, *supra* note 126, at 59–60 (“In a large, latent group there will be no tendency for the group to organize to achieve its goals through the voluntary, rational action of the members of the group, even if there is perfect consensus.”).

that round, they distort their perceived payoff matrix in favor of uncooperative defection.¹³³ Some have termed this myopia “the fallacy of the last move.”¹³⁴

The ideological bent of the hacker movement suggests that content consumers may be more susceptible to the fallacy of the last move than content providers,¹³⁵ but because both “players” are actually comprised of a large, highly differentiated set of individual actors—each constituent of which is also subject to that fallacy¹³⁶—the proposition that either player has the cognitive capacity to incorporate its adversary’s future behavior into its spending decisions is a dubious one.¹³⁷

Cognitive limitations may figure more prominently in technological arms races than they do in military ones because, as opposed to content providers or consumers, governments are centralized decision makers. Centralized decision makers are far more likely than their decentralized counterparts to consider systematically both an adversary’s response and their own positioning in subsequent rounds. These cognitive limitations should be distinguished from the third concept discussed below, informational deficiencies, because they concern the players’ inability to *analyze strategies and potential payoffs* rather than their ability to *acquire information about opponents’ intentions*.

3. Impediments to Cooperation/Reciprocity

Military arms races can result in a number of outcomes—some of them, such as war, more disfavored than others. A subset of these outcomes is composed of products of cooperative strategies—including agreed termination at parity,¹³⁸ resolution of political differences,¹³⁹ and reciprocity,¹⁴⁰—that require levels of coordination and communication, both between and within players, that is unobtainable in the copyright context. Each of these outcomes requires that both players—again, themselves comprised of an enormous set of people with heterogeneous preferences—coordinate and enforce their collective will. This is an unlikely scenario in light of (1) difficulties and transaction costs that inhere in coordinating and monitoring such a large group¹⁴¹ and (2) the presence of ideologically motivated, uncooperative hackers.¹⁴²

133. See Kydd, *supra* note 114, at 230.

134. See Herbert F. York, *Military Technology and National Security*, SCIENTIFIC AM., August 1969, at 26.

135. This is so because hackers may not be exhibiting economically rational behavior. See *supra* note 124.

136. There is also reason to believe that each constituent of the set is unnecessarily optimistic with respect to the ultimate probability of success (possessing an “optimism bias”), increasing the likelihood that the groups will continue to race. See Kyle D. Logue, *Legal Transitions, Rational Expectations, and Legal Progress*, 13 J. CONTEMP. LEGAL ISSUES 211, 223–24 (2003).

137. See RUSSELL HARDIN, *COLLECTIVE ACTION* 42–49 (1982) (discussing the effects of group scale on achieving political objectives).

138. See Colin S. Gray, *The Arms Race Phenomenon*, 24 WORLD POL. 39, 69 (1971).

139. See *id.* at 70.

140. See Kydd, *supra* note 114, at 240.

141. See *supra* notes 125–127 and accompanying text.

142. See Loren, *supra* note 31, at 2–3 (“The level of cracking that occurs results in a greater investment in stronger technological protections. In turn, this higher level of protection translates into even more efforts expended to crack those technological protections. For some in

Moreover, these cooperative outcomes would require that each player possess an unrealistic set of information about the motives of the other. Even though a player might favor defection when facing its normal payoff matrix, both might together pursue a cooperative strategy in order to increase the expected payoff. This scenario is most likely if the collective inferiority of repeated defection becomes apparent to both players. Informational deficiencies,¹⁴³ as distinguished from cognitive limitations in the preceding Subpart,¹⁴⁴ contribute significantly to players' likely failures to reach these types of cooperative outcomes.

Arms race theory predicts that racing and conflict are less likely the more confident each player is that the other is behaving defensively rather than greedily.¹⁴⁵ The organizational dynamics of each player in the content-provider/content-consumer dyad, however, render distilling a singular motive practically impossible. First, different constituents of each group will self-evidently possess different motives. Where some consumers may seek statutorily protected use and access, such as to reverse engineer copyrighted material for interoperability,¹⁴⁶ others may seek access to reproduce that material illegally.

Second, and of equal importance, identifying whether a given move is greedy or defensive is difficult, even for an individual content provider or content consumer. For example, if a content provider deploys a technological protection measure that constrains copying, then that device may both restrain unauthorized reproduction in violation of 17 U.S.C. § 106(1)¹⁴⁷ (defensive) *and* constrain fair use that is authorized under § 107¹⁴⁸—such as time shifting (offensive).¹⁴⁹ Conversely, if a consumer acquires a decryption program to gain access to a work (defensive), then that program may both enable access to uncopyrightable material and unlock expression at the core of Title 17 protection (offensive).¹⁵⁰ The inability of players to acquire reliable information, coupled with their inability to coordinate a response once they have it, dramatically reduces the incidence of cooperative strategies in technological arms races.

the hacker community, utilizing stronger protections merely constitutes a greater challenge to determine if someone can crack the heightened security.”).

143. See *supra* notes 106–107 and accompanying text.

144. See *supra* Part II.B.2.

145. See Glaser, *supra* note 97, at 56–58.

146. See, e.g., *Sega Enters. Ltd. v. Accolade, Inc.*, 977 F.2d 1510, 1527–28 (9th Cir. 1992) (establishing that reverse engineering for the purposes of achieving interoperability constitutes fair use).

147. 17 U.S.C. § 106(1) (2000 & Supp. II 2002).

148. *Id.* § 107 (2000).

149. See *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 442 (1984) (failing to find contributory infringement because the primary activity in question, time shifting, is fair use). An author would also be acting “offensively” if it sought to use technological protection measures to lock up works in the public domain. See Loren, *supra* note 31, at 3 (“For example, nothing prohibits the use of technological protections for works that are in the public domain. *Hamlet*, *The Tale of Genji*, *The Iliad*, and *The Odyssey* could all be distributed in encrypted form utilizing these technological protections with coding for read-only, copy-never.”).

150. See Williamson, *supra* note 41, at 311–12. 17 U.S.C. § 102 (2000) sets forth the specific subject matter of copyright protection.

4. The Undamped Quality of the Race

Perhaps the most important predictor of racing behavior is how “damped” a race is. Military arms races are “damped”¹⁵¹ when the cost of forces necessary to conquer a piece of territory far exceeds the cost of forces necessary to defend it.¹⁵² Under these conditions, effective offensive maneuvers become more expensive than effective defensive ones, considerably arresting the velocity of the race.¹⁵³ When significant investment in armaments (or technology) adds little to the ultimate probability of victory,¹⁵⁴ one can expect to observe very slow-moving, less inefficient races.¹⁵⁵

At least in the digital era, the race between content providers and content consumers is largely undamped, a condition that serves to magnify the benefits of defecting (racing).¹⁵⁶ In real-space, one must generally pay for each lock and each crowbar, meaning that marginal investment in *developing* either of those items guarantees neither unrestricted access to the resource (in the case that the crowbars outnumber the locks) nor perfect exclusion (in the case that the locks outnumber the crowbars). In the digital environment, however, the conditions are close to winner-take-all. Reproduction of digital locks and crowbars is generally so inexpensive that the costs of developing the device, rather than the costs of rebuilding it (digitally replicating it), constitute most

151. See Gray, *supra* note 138, at 56–57. This phenomenon is captured by what many academics term the “offense-defense balance.” The pioneering work on the offense-defense balance is Robert Jervis, *Cooperation Under the Security Dilemma*, 30 *WORLD POL.* 167 (1978).

152. See Glaser, *supra* note 97, at 52. I adopt Glaser’s precise definition of offense-defense balance. Glaser & Kaufmann, *supra* note 99, at 46 (“[T]he offense-defense balance should be defined as the ratio of the cost of the forces that the attacker requires to take territory to the cost of the defender’s forces.”).

153. See Glaser & Kaufmann, *supra* note 99, at 55–57.

154. Although all definitions of the offense-defense balance attempt to capture the relative likelihood of “offensive” success, the precise ratios vary by author. See, e.g., ROBERT GILPIN, *WAR AND CHANGE IN WORLD POLITICS* 60–63 (1981) (defining alternate conditions of offensive advantage as obtaining where (1) the defense must spend more to defend a territory than offense must spend to acquire it and (2) where the cost of capturing the territory is less than the value of the territory itself); Jervis, *supra* note 151, at 178 (stating that offense enjoys the advantage when one player’s offensive maneuvers are cheaper than its defensive ones); Jack S. Levy, *The Offensive/Defensive Balance of Military Technology: A Theoretical and Historical Analysis*, 28 *INT’L STUD. Q.* 219, 222–30 (1984) (defining offensive advantage in terms of the characteristics of the weaponry the principals possess); Stephen W. Van Evera, *Causes of War* 78 (unpublished Ph.D. dissertation, University of California, Berkeley, 1984) (arguing that offensive advantage exists where a significant amount of territory is likely to change hands as a result of the war). These definitions are catalogued in Glaser and Kaufmann, *supra* note 99, at 50.

155. I say “less inefficient” not only to double negate myself unnecessarily, but to avoid the phrasing “more efficient,” which might mislead one to believe that arms racing is, in some absolute sense, socially desirable. High velocity races are less efficient because each side expends considerable resources on maneuvers and counter-maneuvers in a relatively short period of time. See Jervis, *supra* note 151, at 172–74.

156. When the advantage of offense increases (maneuvers are more likely to be decisive), military stability diminishes (inapplicable here), states cannot simultaneously enjoy considerable stability and racing, and arms races intensify because offensive maneuvers necessitate more expensive defensive maneuvers to counteract the race. See Glaser & Kaufmann, *supra* note 99, at 47–49.

of the overall outlay for the “maneuver.” One decryption program can defeat three encrypted files about as cheaply as it can defeat three million.

And if the race is winner-take-all, then even mildly increased spending on maneuvers or counter-maneuvers can dramatically affect the payoff matrix and, hence, affect both the desirability of defection and the incidence of racing. Players are willing to defect in order to invest in *decisive* maneuvers—in much the same way that players defected to invest in decisive weapons systems such as Dreadnought battleships before World War I and atomic weapons during the Cold War.¹⁵⁷

C. An Intermodal Division of Labor

Now I turn to the most important element of this Article—the relationship between copyright law and arms races. I argue that this relationship exhibits two distinctive characteristics, with the second remaining, up until now, unarticulated in the copyright literature. First, copyright law constrains the magnitude, if not the velocity,¹⁵⁸ of technological arms races. Second, arms races are inefficient because they cannibalize any benefits flowing from an author’s ability to select an optimal mix of copyright enforcement and self-help. I refer to the dynamic whereby copyright more effectively excludes sophisticated circumventors and self-help more effectively excludes unsophisticated ones as an “intermodal division of labor.” An exclusionary portfolio’s “division of labor” is “intermodal” because it is comprised of the two dominant modes of regulating access- and use-rights over an expressive asset—copyright protection and self-help.

1. Copyright Protection Constrains Arms Races

The preceding Subpart identifies four conditions suggesting that, in a copyright-less world, a protection and circumvention measures race could persist indefinitely until either content providers’ investment in self-help (scenario one) or content consumers’ investment in circumvention (scenario two) exceeds the rents flowing from the creative work. In scenario one, a content provider, when facing a decision regarding whether or not to create a work, would be indifferent—she could either forfeit the rents by not creating it or she could spend an amount equal to that sum by restricting access to it. In scenario two, a content consumer is indifferent between circumventing the protection measure and purchasing the work in its protected state.

Now relax the assumption that there exists no copyright protection. A content provider will not invest prodigiously in self-help (rent-seek) beyond the value of the available rents, but she *will* invest up until the point where she is indifferent between expending resources on another technological protection measure and privately enforcing her Title 17 rights. Copyright law therefore provides a ceiling on the amount a content provider, *ex ante*, may expect to expend on self-help. She can always be expected to pursue the lowest cost method of exclusion, and if the cost of copyright enforcement is equal to or less expensive than that of self-help, she will cease to make incremental investments in the latter.

157. See Kydd, *supra* note 114, at 230.

158. By “velocity,” I mean the *rate* of investment per unit of time.

In other words, once the incremental costs of a self-help strategy reach the incremental costs of copyright enforcement, an arms race ends because content providers will always favor the less expensive exclusionary tactic. Content consumers will likewise cease investing in circumvention because buying the asset legally becomes less expensive than circumventing protection measures.¹⁵⁹ Copyright rules, then, place a ceiling on the wealth-redistributive inefficiencies that technological arms races create.¹⁶⁰

2. Dividing Labor

Recall from the introduction to this Subpart that self-help and copyright protection constitute what I term an “intermodal division of labor”—each exclusionary mode operates most effectively against a different audience profile. The audience for copyrightable goods is comprised of a large group of unsophisticated circumventors and a much smaller group of sophisticated ones. Loosely speaking, copyright enforcement is effective at excluding exceptional, sophisticated infringers, and self-help is effective at excluding average, unsophisticated ones.¹⁶¹ For ideologically motivated, sophisticated circumventors, stiff legal penalties are a much stronger deterrent than is the next generation of encryption. For unsophisticated circumventors, the first generation is more than sufficient.¹⁶²

159. In fact, if the penalties are large enough, one would expect that content consumers would not race at all. This is because the “cost” of circumvention is actually the cost of the maneuver plus its expected penalty.

160. This is not entirely true because one would expect authors to spend on self-help when copyright protects their interests imperfectly, but they would only spend on self-help up until the point where that expenditure, added to the cost of copyright enforcement, equals the magnitude of the surplus that the author may capture from producing and disseminating the work.

Some would argue that a pure self-help regime might preserve sufficient creative incentives to encourage content providers to place works in the public domain. The supplemental investment necessary to maintain the effectiveness of self-help, however, would eventually undermine this argument. Copyright law, then, both constrains the inefficiencies arising from the races themselves and limits the corrosive effect the races can have on creative incentives.

161. An inventor’s choice between patent protection and self-help may be distinguished because that decision is driven primarily by the inherent reverse engineerability of the patentable asset. In other words, an inventor chooses between self-help and patent protection based on the degree to which distribution of end-products discloses the intellectual asset. See Paul Veravanich, *Rio Grande: The MP3 Showdown at Highnoon in Cyberspace*, 10 *FORDHAM INTELL. PROP. MEDIA & ENT. L.J.* 433, 472 (2000) (“However, it is conceivable that a sophisticated hacker could invent around a copy protection measure and distribute the music online in the same manner that is occurring today with unauthorized MP3s. Physical deterrents to unauthorized copying of original recordings will prevent the average consumer from distributing unauthorized copies of original works.”).

162. A brief digression on the unique dynamics of the “circumventor” interest may be in order at this point. Each audience member is willing to spend up to the value she gets from her access to creative works on circumvention technology. Each individual audience member, however, does not create circumvention devices on her own because such efforts would be grossly redundant. Instead, consumers pool resources for and share the benefits of developing the device. The devices themselves, however, are created by a distinct and dramatically smaller pool of people (generally by hackers, but sometimes by less negatively stereotyped groups) and

Arms races undermine the intermodal division of labor because they effectively null the set of accidental and unsophisticated circumventors. Hackers outfit formerly unsophisticated circumventors with state-of-the-art crowbars,¹⁶³ and the cost of excluding these newly armed content consumers using self-help bears a direct relationship to their level of access to sophisticated circumvention tools. The formerly unsophisticated circumventor, equipped with state-of-the-art circumvention devices, effectively becomes a sophisticated one. Therefore, as the costs of nonlegal exclusion rise, content providers will, even for unsophisticated circumventors previously cost-effectively excluded by self-help, eventually favor copyright enforcement. Content providers will no longer be able to divide labor by cost-effectively directing self-help against one set of people and copyright enforcement against another.

Arms races, then, tend to cannibalize the benefit of having a two-track system for ensuring supracompetitive pricing. They entirely eliminate self-help's comparative advantages, so laws aimed at constraining arms races represent attempts at ensuring that society efficiently exploits nonlegal protection measures for controlling unsophisticated circumventors.

III. DOCTRINAL AND STATUTORY EVIDENCE

In this Part, I develop two major institutional themes. Both will emerge as I explore arms races in three different contexts: those over copyrightable assets, over patentable assets, and over access to information as adjudicated in what I refer to collectively as the "digital trespass cases."¹⁶⁴ Although each theme is distinct enough to warrant identification and discussion, neither one finds categorical historical support.

are distributed to consumers.

163. See Loren, *supra* note 31, at 2 ("First, a technological arms race results from the interaction of copyright owners employing technological protections and the hacker community seeking to, and succeeding in, cracking through those protections."); Veravanich, *supra* note 161, at 472 ("If the past is any indicator of future developments, diligent hackers and pirates will ultimately circumvent anti-copying technology.").

164. These cases are *Ticketmaster Corp. v. Tickets.Com, Inc.*, [2002–2003 Transfer Binder] Copyright L. Dec. (CCH) ¶ 28,607 (C.D. Cal. Mar. 7, 2003), available at 2003 WL 21406289; *eBay Inc. v. Bidder's Edge, Inc.*, 100 F. Supp. 2d 1058 (N.D. Cal. 2000); *Am. Online, Inc. v. IMS*, 24 F. Supp. 2d 548, 550 (E.D. Va. 1998); *CompuServe Inc. v. Cyber Promotions, Inc.*, 962 F. Supp. 1015 (S.D. Ohio 1997); *Intel Corp. v. Hamidi*, 71 P.3d 296 (Cal. 2003); *Thrifty-Tel, Inc. v. Bezenek*, 54 Cal. Rptr. 2d 468 (Cal. Ct. App. 1996).

Similar situations arise under statutes that seek to control access to information, such as under the Computer Fraud and Abuse Act (CFAA), 18 U.S.C. § 1030 (2000 & Supp. II 2002). See, e.g., *Am. Online, Inc. v. Nat'l Health Care Dis., Inc.*, 121 F. Supp. 2d 1255, 1275 (N.D. Iowa 2000); *Hotmail Corp. v. Van\$ Money Pie, Inc.*, 47 U.S.P.Q.2d 1020, 1024 (N.D. Cal. 1998), available at 1998 WL 388389, at *5 ("The evidence supports a finding that plaintiff will likely prevail on its [CFAA] claim and that there are at least serious questions going to the merits of this claim in that plaintiff has presented evidence that . . . defendants took such actions [utilizing system capacity] knowing the risks caused thereby to Hotmail's computer system and online services, which include risks that Hotmail would be forced to withhold or delay the use of computer services to its legitimate subscribers; that defendants' actions caused damage to Hotmail; and that such actions were done by defendants without Hotmail's authorization.").

Concerns about controls used to restrict access to information also inhere in the relatively recent jurisprudence associated with the Controlling the Assault of Non-Solicited Pornography

First, I argue that, although the DMCA does represent a significant development with respect to copyrightable goods, the DMCA actually conforms very neatly to a series of legislative and judicial responses to competition over a variety of other intangible assets.¹⁶⁵ In many of these contexts, the relevant court opinions and legislation dovetail predictably. The dominant institutional reactions to arms race phenomena are what I call “damping responses”—responses that depress the offense-defense ratio by diminishing offensive payoffs and increasing defensive ones.¹⁶⁶ Courts and Congress, however, also adjust other variables, including power ratios and informational deficiencies, to arrest the velocity of arms races.¹⁶⁷

and Marketing Act of 2003 (the “CAN-SPAM Act” or the “Act”), 15 U.S.C.A. §§ 7701–7713 (2005). A recent Fifth Circuit decision, *White Buffalo Ventures, L.L.C. v. Univ. of Tex. at Austin*, 420 F.3d 366 (5th Cir. 2005), addresses the constitutionally permissible self-help in which a university may engage to protect access to its proprietary servers. The University was, of course, trying to restrict use of a very important piece of information—the University community’s email addresses.

165. The “arms race,” while the vogue-ish object of recent scholarly attention, has for some time influenced rules in copyright and in other legal contexts. Although technological arms races are increasingly frequent, the following examples should illustrate that they are an older phenomenon than the explosion of post-DMCA arms race references would lead one to believe. For example, earlier technological protections used printed paper that blurred when someone photocopied from it. Early distributors of VHS technology used tracking codes that made VHS tapes grainy when people copied them. *See Loren, supra* note 31, at 8 n.8. We think of arms races as “device-centric” (rather than “strategy-centric”), but self-help tactics have historically come as much in the form of crude monitoring strategies as they have in the form of “technology.”

166. The term “damped” implies that the payoffs to *either* offense or defense are such that one of those strategies is clearly inferior. In this discussion, however, when I allude to “damping responses,” I refer primarily to those that favor defense.

167. As discussed in Part II.A, one may conceptualize an arms race as a game where in each period, the previously inferior group develops enough technology to displace the technological superiority of the previously dominant group. In the next period, the formerly dominant group is inferior and must itself invest enough in technology to defeat the superiority of the formerly inferior group.

Congress or the judiciary may interrupt this potentially endless cycle by prohibiting (1) the use of exclusionary measures (technology that would be deployed by owners to constrain access and copying), (2) the use of circumvention measures (technology that would be deployed by content consumers to enable access and copying), or (3) the use of both (1) and (2). Congress could also employ at least two other strategies that I do not discuss here. They could proscribe nothing, or they could favor consumer offense and defense. Strategy one would tip the scale dramatically in favor of the consumer player, as both the content provider player’s payoffs for defense (self-help to preserve its (non-DMCA) Title 17 rights) and offense (self-help to limit fair use and access to uncopyrightable material) diminish. Strategy two would have precisely the opposite effect—to tip the scale in favor of content providers, increasing the payoff to content provider offense and content provider defense. Strategy three would be most akin to complete elimination of power at parity. Neither side may (legally) invest in offense or defense. One could argue that strategy three slows the velocity of the race by forcing players to adopt less decisive maneuvers. By prohibiting “protection” and “circumvention” measures, Congress would inevitably refocus the attention of content providers on cruder, less cosmetically “technological” protection measures, such as ushers at movie theatres.

Second, I argue that the prevailing wisdom, that Congress aligns with content providers and the courts with content consumers,¹⁶⁸ is a gross oversimplification. Although this characterization may be directionally correct, it is, as a categorical matter, unjustified. Courts have actually left content providers with quite a bit of doctrinal weaponry and Congress does not get enough credit for its generosity towards consumers. In fact, in the context of copyrightable and other intangible assets, courts have in the past done precisely what the DMCA does—allocate certain use and access rights to an asset on the basis of what an owner does with it, rather than on the basis of that asset’s content or the use the circumventor seeks to secure.¹⁶⁹ In these contexts, however, courts and legislatures have confronted competition between two corporate entities, rather than along a corporate-consumer axis. A more precise statement of the DMCA’s novelty, then, is that it contains the only arms race rule that allocates access- and use-rights *as between creator and consumer* categorically.

A. Copyrightable Assets¹⁷⁰

1. The DMCA¹⁷¹

The DMCA—enacted in 1998—represents copyright law’s most conspicuous institutional response to arms race phenomena. It contains provisions prohibiting, with

168. See, e.g., *Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.*, 125 S.Ct. 2764, 2780 (2005) (allowing a cause of action for vicarious copyright liability against one who distributes a device with the object of promoting its use to infringe copyright, as shown by clear expression or other affirmative steps taken to foster infringement); *Sony Corp. of Amer. v. Universal City Studios, Inc.*, 464 U.S. 417 (1984) (failing to find contributory infringement because the primary activity in question, time shifting, is fair use); Jane C. Ginsburg, *Copyright and Control over New Technologies of Dissemination*, 101 COLUM. L. REV. 1613, 1626 (2001) (“In many of the new technology cases, courts faced with what appeared to be all-or-nothing attempts at copyright enforcement preferred to interpret the statute in a way that would leave the copyright owners with nothing. Congress, however, has often readjusted the balance by imposing a compulsory license scheme that permitted continued distribution of the new technology, while assuring payment to copyright owners.”) (footnote omitted).

169. I do not mean to imply that there are no substantive requirements for the underlying asset. Trade secret law protects only economically valuable material, and DMCA protection cannot be triggered unless a content provider has sought to protect a portfolio of assets, at least one of which must be copyrightable. See 17 U.S.C. § 1201(a)(1)(2000).

170. I omit discussion of one particular example of an “arms race,” involving concert bootlegging, where only some of the maneuvers are “technological” in any meaningful sense. Though not a perfect substitute, recorded performances can displace demand for live attendance. Advances in digital technology have decreased the cost of producing and distributing the substitute. Faced with activity that threatened to curb dramatically the demand for live performances, musicians sought to control access to the substitute’s primary input—the concerts themselves.

Congress formulated a sui generis form of protection in 17 U.S.C. § 2319 (2000) by imposing criminal penalties for illegally bootlegging live performances.

171. 170 Pub. L. No. 105-304, 112 Stat. 2680 (1998) (codified as amended in scattered sections of 17 U.S.C.).

very narrow exceptions,¹⁷² two types of behavior. First, the DMCA prohibits circumvention of “access controls,” defined as “technological measure[s] that effectively control[] access to a work protected under [Title 17]” (I will refer to these as the “anti-circumvention” provisions).¹⁷³ The DMCA also prohibits trafficking in certain *devices* whose primary purpose is either to circumvent those access controls¹⁷⁴ or to circumvent rights controls,¹⁷⁵ with “rights” defined as those entitlements incorporated under 17 U.S.C. § 1201(b) (I will refer to these vicarious liability rules as the “anti-trafficking” provisions).¹⁷⁶ Although these provisions are more nuanced than the following skeletal description may suggest,¹⁷⁷ generally speaking, if a content provider deploys technological self-help, then she becomes entitled to a cause of action delineated in the DMCA. Professors Samuelson and Scotchmer, in an article to which I refer in Part I,¹⁷⁸ attack the DMCA as creating irrational incentives for more primitive anti-circumvention measures,¹⁷⁹ but such incentives make sense in light of the intermodal division of labor I describe in Part II.C. The DMCA properly encourages cheap self-help because the marginal costs of more sophisticated encryption do not significantly enhance control over unsophisticated circumventors—less extravagant measures are sufficient.¹⁸⁰ In other words, incentivizing cheap self-help makes sense given the audience that content providers must exclude from access to and use of expressive assets.

If the costs of copyright enforcement stay relatively constant over the spectrum of audience sophistication (which I argue they do)¹⁸¹ and if the cost of self-help declines along with the sophistication of circumventors, then a regime that facilitates cost-effective self-help is preferable to one in which content providers may use only copyright enforcement—that is, as long as arms races do not inflate the costs of self-help. Legal rules that do not constrain arms races ultimately render self-help an inefficient exclusionary tactic. The DMCA addresses this problem through its anti-circumvention rules and its secondary liability provisions.

Although there is little empirical data on the distribution of technological sophistication across content consumers,¹⁸² the DMCA implements a regime that squares nicely with some intuitions about what that distribution probably looks like. If the vast majority of content consumers are unsophisticated circumventors, then a

172. A party may circumvent an access control if: it is a nonprofit library determining whether to acquire a work; it is engaged in law enforcement activities or security testing; it is engaged in reverse engineering to achieve interoperability; it is engaged in encryption research; it is attempting to prevent access of minors to certain material on the Internet; it is uncovering and disabling an undisclosed information-gathering feature. 17 U.S.C. § 1201(d)–(i) (2000).

173. *Id.* § 1201(a)(1).

174. *Id.* § 1201(a)(2).

175. *Id.* § 1201(b)(1).

176. *Id.* § 1201(b).

177. For example, there is a complex rule-making procedure prescribed for creating exceptions to § 1201 liability. *See id.* § 1201(a)(1)(C).

178. *See supra* notes 42–43 and accompanying text.

179. *See Samuelson & Scotchmer, supra* note 42, at 1641.

180. *See Veravanich, supra* note 161, at 472; *cf. infra* Part III.B (discussing this principle of sufficient, less extravagant measures in the context of patentable assets).

181. *See supra* note 62.

182. *See Burk, supra* note 4, at 173–75.

regime that incentivizes more primitive, less expensive protection can inexpensively constrain mass infringement as long as the government can effectively impede the flow of circumvention technology from hackers to consumers.¹⁸³ That regime remains effective because moderate self-help constrains the dominant source of infringement for that asset: unsophisticated circumventors.

The main critique of the DMCA is that, although it eliminates arms races, it does so at the public's expense by punishing circumvention of *almost any* technological protection measure, even if that measure restricts access to "territory" not belonging to content providers under (non-DMCA) Title 17.¹⁸⁴ Congress, in effect, made it easier for content providers to engage in both offense *and* defense—the DMCA's anti-circumvention and secondary liability provisions furnish a license both to prevent consumers from infringing and to restrict activity such as fair use to which the copyright laws had previously privileged the public.¹⁸⁵

The DMCA is therefore a damping response, albeit an unusual one. Congress damped the race for content-provider territory by significantly diminishing the payoff (increasing the penalty) for consumer offense. It provides causes of action and penalties for using crowbars to get around digital locks. The development to which many scholars take exception is how dramatically the DMCA tips the scales in favor of content-provider offense against consumer territory.¹⁸⁶ While this circumstance indeed

183. *See id.* § 1201(a)(2), (b)(1). The DMCA also allocates the institutional burdens of ensuring supracompetitive pricing between the public and private sector, and it does so in a predictable way. In furnishing legal protection for the installation of protection measures, *see* § 1201(a)–(b) (prohibiting circumvention of technological protection measures), as with wooden fences, the DMCA effectively asks the private sector to bear the costs of containing unsophisticated circumvention. Congress does not *require* content providers to adopt protection measures the way it does with the Audio Home Recording Act (AHRA), *see* 17 U.S.C. § 1002(a) (2000), but Congress provides sufficient legal penalties for breaking such protection measures that it is strongly in the interest of most content providers to include these protection measures rather than to rely on copyright protection. In providing severe sanctions for compromising these protection measures, as the government does with burglary and more severe trespass laws (that violate circumvention of the fence rather than trespass itself), the government assumes much of (but not all of) the cost of enforcing copyright-type rules against sophisticated infringers. The government also provides stiff criminal penalties of up to ten years for deliberate infringement meeting some financial thresholds. *See* 18 U.S.C. § 2319(b)(2) (2000).

184. *See* SIVA VAIDHYANATHAN, COPYRIGHTS AND COPYWRONGS: THE RISE OF INTELLECTUAL PROPERTY AND HOW IT THREATENS CREATIVITY 177–79 (2001); Besek, *supra* note 1, at 466–69, 475–78 (detailing criticisms of the DMCA); Laura N. Gasaway, *Anti-circumvention: A View from Librarians and Educators*, in ADJUNCTS AND ALTERNATIVES TO COPYRIGHT: PROCEEDINGS OF THE ALAI CONGRESS, JUNE 13–17, 2001, at 103 (Jane C. Ginsburg & June M. Besek eds., 2002); Pamela Samuelson, *Intellectual Property and the Digital Economy: Why the Anti-Circumvention Regulations Need To Be Revised*, 14 BERKELEY TECH. L.J. 519 (1999) (arguing that the DMCA needs to be modified to accommodate fair use privileges).

185. The DMCA lacks any broad fair use defense, instead providing a number of specific, narrower exemptions. *See* 17 U.S.C. §§ 1201–1205 (2000).

186. In fairness to Congress, however, one should not be too quick to dismiss the DMCA as a piece of special interest legislation, as it does include a variety of mechanisms, including rule-making procedures, that appear designed to preserve some access- and use-rights. These exceptions, however, tend to be worded as privileges to circumvent, rather than rights to do so, and therefore run the risk of sparking the arms races discussed in Part II.

merits serious attention, these commentators overstate the novelty of the DMCA's liability provisions. They do so first by ignoring DMCA provisions that protect consumer territory¹⁸⁷ and, second, by failing to recognize a legal precedent in the relationship between patent and trade-secret law.¹⁸⁸ I explore the latter failure further in Part III.B.

2. Contributory Infringement

Under *Sony Corp. of America v. Universal City Studios, Inc.*,¹⁸⁹ a copyright holder possesses a cause of action against those who manufacture certain goods incapable of substantial noninfringing uses.¹⁹⁰ *Sony* synthesized and updated what is called the "contributory infringement" doctrine, a form of a secondary copyright liability. The *Sony* Court, however, held that recording broadcast television qualified as time-shifting within copyright law's fair use exception.¹⁹¹ The *Sony* Court, therefore, agreed with Universal City Studios in principle only—a manufacturer could be guilty of infringement on the basis of what people do with its product—but found that what people actually did with the VCR was not infringement.

Under *Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.*,¹⁹² the Court reaffirmed the viability of contributory infringement doctrine. The Court confronted a situation where programmers designed the Grokster peer-to-peer network to evade precisely the various "knowledge" standards maturing in the circuits' contributory infringement cases. Network architects were, in effect, designing around the individuated knowledge requirements that cases like *Napster* imposed.¹⁹³ In *Grokster*, the Court held that evidence of substantial lawful use alone cannot save a network from vicarious liability because "one who distributes a device with the object of promoting its use to infringe copyright, as shown by clear expression or other affirmative steps taken to foster infringement, is liable for the resulting acts of infringement by third parties."¹⁹⁴ *Grokster* thereby affirmed the vicarious liability principle synthesized in *Sony* and, unlike its predecessor, assessed liability against the technology's creator. *Grokster* represents, as much as anything, the principle that content providers will not have to resort to self-help when content consumers are able to design around the formal strictures of contributory infringement doctrine.¹⁹⁵ In other words, content providers will retain a legal alternative to self-help even in the peer-to-peer era.

187. See, e.g., 17 U.S.C. § 1201(d)–(g) (detailing exceptions to liability).

188. See *infra* Part III.B.

189. 464 U.S. 417, 442 (1984) (failing to find contributory infringement because the primary activity in question, time shifting, is fair use).

190. See *id.*

191. See 17 U.S.C. § 107 (2000).

192. 125 S. Ct. 2764 (2005).

193. *A&M Records, Inc. v. Napster, Inc.*, 239 F.3d 1004 (9th Cir. 2001). Napster was vicariously liable for its users' infringements because it had (actual) knowledge of specific acts of infringement. Napster could confirm the constituents of exchanged information packets, including those containing copyrighted works, and it failed to prohibit such exchanges on its system. *Id.* at 1021–22.

194. *Grokster*, 125 S. Ct. at 2780.

195. The opinion in *Grokster* is actually extraordinarily splintered, and I do not mean to

Forget for a moment the specific facts involved in the *Sony* and *Grokster* cases and focus on the contributory infringement rule itself. In the absence of a penalty for the dissemination of staple goods without substantial noninfringing uses,¹⁹⁶ content providers would have two options, with only the first being economically sustainable: (1) a self-help strategy and (2) legal action against direct, rather than secondary, infringers.¹⁹⁷ And, if content providers were forced to resort to a self-help strategy, then that strategy would ultimately confront a consumer counterstrategy, precipitating an arms race. And, recalling the analysis from Part II.B, that arms race would ultimately render self-help an economically implausible exclusionary option.

Contributory infringement doctrine constrains racing because it affords a content provider a cause of action as an alternative to increased spending on technological countermeasures.¹⁹⁸ By imposing legal liability for disseminating circumvention technology, contributory liability effectively increases the input costs of consumer offense by increasing the expected penalty. Moreover, by interrupting the flow of technology to unsophisticated circumventors, contributory infringement doctrine preserves the audience composition necessary for self-help to remain cost-effective.¹⁹⁹

misrepresent it as a straightforward holding. Although it revealed several fault lines on the Court, those are too nuanced to warrant significant discussion here.

196. The current circuit equivocation regarding “willful blindness,” *compare* *In re Aimster Copyright Litig.*, 334 F.3d 643, 650 (7th Cir. 2003) (reasoning that willful blindness toward infringing uses may constitute the knowledge required for contributory infringement), *with* *Metro-Goldwyn-Mayer Studios, Inc. v. Grokster, Ltd.*, 380 F.3d 1154, 1161 (9th Cir. 2004) (reasoning that the copyright owner must show knowledge of specific infringing files), has spawned a number of network counterstrategies that seek to shield the identities of community members. *See* Brian Krebs, *Copyright in the Digital Age: Online Piracy Spurs High-Tech Arms Race*, WASHINGTONPOST.COM, June 26, 2003, <http://www.washingtonpost.com/ac2/wp-dyn/A34439-2003Jun26> (“In the past six months alone, no fewer than 50 new versions of ‘peer-to-peer,’ or P2P file-trading software programs have emerged on the Internet. Unlike some of the most popular services like Kazaa and Grokster, many of them try to shield the identities of their users with password-protected networks, encryption and other tools.”). The Supreme Court’s *Grokster* rule to some degree clarifies the ambiguity with a requirement relating to the *ex ante* knowledge of the article’s capacity for facilitating direct infringement.

197. *See supra* Part I.B.

198. *See* Hardy, *supra* note 2, at 250–51. Some commentators have suggested that contributory infringement has occupied this self-help intermediary role only since the DMCA. *See, e.g.*, Katyal, *supra* note 3, at 275–78. My argument obviously suggests that contributory infringement has actually occupied this role for a far longer time.

199. 35 U.S.C. encodes very similar secondary liability rules. *See* 35 U.S.C. § 271(b)–(c) (2000).

As the *Sony* facts²⁰⁰ and the rash of recent peer-to-peer file-sharing cases²⁰¹ illustrate, the development and dissemination of circumvention technology has been an engine behind mass infringement.²⁰² It is no accident that, for the most part, the wording of the DMCA's vicarious liability provisions echoes that of the *Sony* decision.²⁰³ Unlike the DMCA's treatment of circumvention, however, the *Sony* and *Grokster* contributory infringement rule represents a more conventional damping response. It disfavors consumer offense and, using penalties, dramatically decreases the net payoff for infringement. It does not, like the DMCA, *increase* the offense-defense ratio for consumer territory.

200. See *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417 (1984) (failing to find contributory infringement because the primary activity in question, time shifting, is fair use).

201. See, e.g., *Metro-Goldwyn-Mayer Studios Inc. v. Grokster, Ltd.*, 125 S. Ct. 2764 (2005) (allowing a cause of action for vicarious copyright liability where one distributes a device with the object of promoting its use to infringe copyright, as shown by clear expression or other affirmative steps taken to foster infringement); *In re Aimster*, 334 F.3d 643 (finding that willful blindness associated with deliberately encrypted communications was tantamount to constructive knowledge for contributory infringement analysis); *A&M Records v. Napster*, 239 F.3d 1004 (9th Cir. 2001) (reviewing an appeal of a preliminary injunction where an Internet service was alleged to have infringed copyrights by facilitating filesharing through a client-server model network).

202. In *Sony*, the Court found that the primary activity, time shifting, did not constitute infringement. See *Sony*, 464 U.S. at 443–56. With respect to *Sony*, then, this proposition should read “allegedly infringing.” This fact does not diminish the claim here, however, because the focus of my inquiry is on the formulation of the contributory infringement doctrine rather than its specific application to facts.

The *Sony* facts further illustrate the ways in which the arms-race model set forth in Part II.A is something of an oversimplification. Just as every consumer with a VCR did not invest the resources in developing the technology herself (she just bought it), contributory infringement doctrine represents a publicly owned, low-cost legal countermeasure. Of course the copyright owner still has to pay for her own litigation, just as a circumventor may have to license (even if very cheaply) circumvention technology.

203. The wording is slightly different, with the DMCA promulgating a considerably lower threshold for a finding of vicarious liability. Compare *Sony*, 464 U.S. at 418 (“The sale of copying equipment, like the sale of other articles of commerce, does not constitute contributory infringement if the product is widely used for legitimate, unobjectionable purposes, or, indeed, is merely capable of substantial noninfringing uses.”), with 17 U.S.C. § 1201(a)(2) (2000) (“No person shall manufacture, import, offer to the public, provide, or otherwise traffic in any technology, product, service, device, component, or part thereof, that—(A) is primarily designed or produced for the purpose of circumventing a technological measure that effectively controls access to a work protected under this title; (B) has only limited commercially significant purpose or use other than to circumvent a technological measure that effectively controls access to a work protected under this title; or (C) is marketed by that person or another acting in concert with that person with that person's knowledge for use in circumventing a technological measure that effectively controls access to a work protected under this title.”).

3. The Audio Home Recording Act of 1992 (AHRA)²⁰⁴

Much has been made of the DMCA's access and copyright control provisions as evidence of Congress's fidelity to content providers,²⁰⁵ but Congress adopted consumer-friendly arms race legislation well before the passage of the DMCA. During the early 1990s many industry insiders expected digital audio tape (DAT) recording machines, devices playing cassette tapes delivering digital sound quality, to displace the audiocassette as the dominant music format.²⁰⁶ The recording industry voiced considerable concerns regarding the recorder's ability to make perfect, but potentially unauthorized, digital copies.²⁰⁷

Recall that in *Sony* the Court reformulated the contributory infringement doctrine, but declined to impose liability because it declared that VHS recording of broadcast content fell within copyright's fair use exception.²⁰⁸ Fearing a fate worse than *Sony*, content owners, in conjunction with hardware manufacturers, developed the Serial Copy Management System (SCMS) for use with DAT machines.²⁰⁹ The SCMS was a self-help measure that restricted consumers to first-generation copying only.

The AHRA, passed in 1992, requires that all digital audio recording devices be equipped with SCMS²¹⁰ and, like the DMCA, it prohibits circumvention of a technological protection measure.²¹¹ Whereas the DMCA ultimately privileges the interests of content providers,²¹² in the AHRA Congress promulgated an arms-race-preclusive scheme that in some ways favors consumers.²¹³ First, the AHRA requires that the SCMS system prevent only "serial copying,"²¹⁴ allowing users to make first-

204. 17 U.S.C. §§ 1001–1010 (2000).

205. See, e.g., Matthew Scherb, *Free Content's Future: Advertising, Technology, and Copyright*, 98 NW. U. L. REV. 1787, 1821–22 (2004) ("Regardless of the anticircumvention provisions in the [DMCA] that might keep the deep linkers and framers from defeating content owners' measures, is the cat and mouse game, the software arms race, a desirable outcome?"); Philip J. Weiser, *The Internet, Innovation, and Intellectual Property Policy*, 103 COLUM. L. REV. 534, 564 (2003) ("The complications arise, nonetheless, because companies may be able to use encryption technology in an 'arms race' to make it more difficult for rivals to gain access to their protected standard or pursue litigation under the DMCA to combat legitimate reverse-engineering.").

206. See Veravanich, *supra* note 161, at 450.

207. See *id.* (citing H.R. REP. NO. 102-873, pt. 2, at 2 (1992)).

208. *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417, 454–55 (1984) (failing to find contributory infringement because the primary activity in question, time shifting, is "fair use").

209. See ROBERT A. GORMAN AND JANE C. GINSBURG, *COPYRIGHT CASES AND MATERIALS* 807 (6th ed. 2002).

210. See 17 U.S.C. § 1002(a)(1)–(2) (2000).

211. See *id.* § 1002(c).

212. See *supra* note 205 and accompanying text.

213. The express purpose of the AHRA was to allow the consumers to access the new media format without jeopardizing the legitimate rights of the recording industry. See Veravanich, *supra* note 161, at 451 (citing Statement by President George Bush upon Signing S. 1623, 28 WEEKLY COMP. PRES. DOC. 2188 (Oct. 28, 1992)).

214. See 17 U.S.C. §§ 1001(11), 1002(a)(2) (2000).

generation copies. Traditional copyright law²¹⁵ privileges nothing about first-generation copying—it must qualify under some other part of the statute as noninfringing reproduction. Second, the AHRA prohibits content providers from initiating infringement actions based on the manufacture and use of DAT machines, effectively shielding manufacturers from judicially developed contributory liability rules.²¹⁶ It also bestowed upon consumers immunity from certain types of noncommercial copying.²¹⁷ These provisions meant that consumers and equipment manufacturers faced few impediments to engaging in what would have been, under traditional copyright law, fairly clear cases of direct and contributory infringement.²¹⁸

In arms-race terminology, the AHRA mandated content-provider defense both by *requiring* installation of self-help devices and by articulating a standard of legal protection for those deploying them.²¹⁹ In so doing, Congress acknowledged that leaving copyright protection to be determined by the efficacy of protection and circumvention measures may lead to wasteful arms races.²²⁰ Rather than leaving the devices to fend for themselves, Congress imposed dramatic punitive costs on countermeasures.

What is exceptional about the AHRA is that it addresses one piece of territory—first-generation copying—by dramatically favoring consumer offense over provider defense. Technological arms races will be slow-moving not only when offense-defense ratios are very low, but also when they are very high. Situations with extraordinarily high offense-defense ratios are not treated extensively in military arms race literature because it is fairly obvious that, if the offensive player is inclined to attack, then a rational defensive player will simply cede the territory. The AHRA, in fact, creates just such an offense-defense ratio. The *sine qua non* at the heart of the AHRA's legislative compromise is what amounts to a compulsory license for consumer occupation of content-provider territory: the first-generation digital reproduction of musical compositions.²²¹

The DAT recorder and the AHRA now amount to no more than a footnote in the history of digital music distribution, as the DAT became obsolete shortly after Congress passed the relevant legislation.²²² The AHRA nonetheless remains an

215. By “traditional” I simply mean non-*sui generis* forms of copyright protection.

216. See 17 U.S.C. § 1008 (2000).

217. See Besek, *supra* note 1, at 452 n.252 (citing 17 U.S.C. § 1008).

218. The AHRA implements a system that is actually a little more complicated. It taxes the manufacture and importation of DAT machines and storage media and distributes these levies to copyright owners according to a complicated royalty rate. See 17 U.S.C. §§ 1003–1007. This amounts to a crude compulsory license, as the royalty scheme reimburses copyright owners for estimated infringement of their copyrights. Nonetheless, the AHRA appears quite pro-consumer on the whole.

219. See Jane C. Ginsburg, *Copyright and Control Over New Technologies of Dissemination*, 101 COLUM. L. REV. 1613, 1628 (2001).

220. See *id.* at 1628–29 (“[L]eaving copyright entirely up to technological fixes may simply produce a neverending ‘arms race.’”). That same term Congress also outlawed “black boxes,” devices used to decode encrypted satellite and cable transmissions. See 47 U.S.C. § 605(e)(4) (2000).

221. Of course consumers ultimately foot part of the bill in the form of increased component prices, but statutory immunity is effectively a compulsory license for consumer offense.

222. See Veravanich, *supra* note 161, at 451 (citing Wayne Bledsoe, *Consumer Graveyard*

important legislative artifact because it, along with anti-cable-descrambling legislation,²²³ was perhaps the first Congressional protection for a mass-media “control” device. Its influence on the DMCA is undeniable: (1) it is the only DMCA antecedent to use the word “circumvent” in its statutory text,²²⁴ and (2) both the DMCA Senate and House Reports explicitly cite the AHRA as statutory precedent for the anti-circumvention model.²²⁵ The two pieces of legislation remain connected, as several recent amici briefs have cited the AHRA as anti-circumvention legislation superior to the DMCA.²²⁶

4. The Cable Communications Policy Act (CCPA)²²⁷

A fourth example of a technological arms race involves the evolution of cable programming during the 1970s, ‘80s, and ‘90s.²²⁸ The back-and-forth between the players in this provider-consumer dyad is particularly illustrative because (1) lawmakers were extremely hesitant to use copyright law to mediate broadcast communications (so we can observe racing behavior over an extended period of time),²²⁹ and (2) the race proceeded in discreet, identifiable “rounds.” During the late 1970s and early 1980s the cable dish emerged as an attractive means of receiving satellite media transmissions.²³⁰ Many dish owners eluded monthly cable charges by intercepting signals intended for local cable affiliates.²³¹ Responding with a famous technological counter-maneuver, programmers deployed “descramblers” (or “black boxes”) and broadcast their content in a form visually unintelligible to any consumer without one.²³²

Scrambled programming quickly begat unauthorized black boxes, at which point Congress finally interrupted the technological escalation with the Cable Communications Policy Act (CCPA),²³³ a set of rules governing broadcast and

Filled with Fossils of Technology, SAN DIEGO UNION-TRIB., Nov. 17, 1998, at 5).

223. See *infra* Part III.A.4.

224. See Besek, *supra* note 1, at 437 (“[The AHRA] is also the only federal statute we found among those cited that uses the term ‘circumvent.’”).

225. See *id.*

226. See, e.g., Brief of Amici Curiae Professor Yochai Benkler and Professor Lawrence Lessig in Support of Appellants and Reversal of the Judgment Below, *Universal City Studios v. Corley*, 273 F.3d 429 (2d Cir. 2000).

227. It is worth noting that although the object of the race was copyrightable cable content, the Cable Communications Policy Act was not treated as a creature of copyright policy, as evidenced by its placement in Title 47, rather than Title 17. See Cable Communications Policy Act of 1984, Pub. L. No. 98-549, 98 Stat. 2779 (codified as amended in scattered sections of 47 U.S.C.).

228. See Samuel Rosenstein, *The Electric Communications Privacy Act of 1986 and Satellite Descramblers: Toward Preventing Statutory Obsolescence*, 76 MINN. L. REV. 1451, 1459–62 (1992).

229. This hesitation was further evident in the ultimate legislative solution which, again, does not appear in Title 17. See 47 U.S.C. § 553 (2000).

230. See Rosenstein, *supra* note 228, at 1459.

231. See *id.* at 1460.

232. See *id.* at 1461.

233. Cable Communications Policy Act of 1984, Pub. L. No. 98-549, 98 Stat. 2779 (codified as amended in scattered sections of 47 U.S.C.).

interception of scrambled content.²³⁴ The statute states that nobody “shall intercept or receive or assist in intercepting or receiving any communications service offered over a cable system, unless specifically authorized to do so by a cable operator.”²³⁵ The statute specifically defines “assisting” as “manufactur[ing] or distribut[ing] [] equipment intended . . . for unauthorized reception.”²³⁶

The CCPA contains elements that should now be familiar: (1) a rule against direct circumvention and (2) a secondary liability provision. The CCPA’s secondary liability rule resembles those in the DMCA,²³⁷ the AHRA,²³⁸ and contributory infringement doctrine.²³⁹ With respect to this Part’s first major theme, that the DMCA’s anti-circumvention provisions are not quite so “unprecedented;” the CCPA generally, and its vicarious liability provisions in particular, self-evidently foreshadow the DMCA’s anti-trafficking provisions.

With respect to the second theme, the alleged Congressional favoritism towards content providers, the CCPA’s set of cosmetically content-provider-friendly rules may be a red herring. The CCPA’s secondary infringement rule has less bite than does its DMCA counterpart,²⁴⁰ as it contains an additional intent requirement.²⁴¹ The CCPA, moreover, is not housed in Title 17, and it does not appear that Congress thought in terms of the provider-consumer axis that animates many of the institutional responses in copyright law. Owners of the cable content were squared off not against consumers, but against satellite dish distributors. Congress was more likely concerned with which *corporate* interest was going to steward the dissemination of audio-visual content, rather than with whether the CCPA’s allocation of use- and access-rights was sufficiently favorable to consumers.

B. Patentable Assets

1. The Relationship Between Patent and Trade Secret

The relationship between patent and trade secret protection almost mirrors the post-DMCA relationship between copyright and self-help. The distinction between paradigmatic patentable and copyrightable assets has blurred slightly in recent years but, generally speaking, patent law protects inventions²⁴² and copyright law protects expression.²⁴³ Although the degree of similarity exhibited by the two intellectual

234. *See id.*

235. 47 U.S.C. § 553(a)(1) (2000).

236. *Id.* § 553(a)(2).

237. 17 U.S.C. § 1201(a)(2) (2000).

238. 17 U.S.C. § 1002(c) (2000).

239. *Sony Corp. of Am. v. Universal City Studios, Inc.*, 464 U.S. 417 (1984) (dealing with the contributory infringement doctrine).

240. *See* 47 U.S.C. § 553(a) (2000).

241. *See id.* § 553(b) (detailing the penalties for a “willful” violation).

242. *See* 35 U.S.C. §§ 101, 103(a) (2000) (requiring that an invention be “new and useful” and nonobvious in order to receive patent protection).

243. *See* 17 U.S.C. §§ 102, 107–122 (2000) (requiring copyright protection for “original works of authorship fixed in any tangible medium of expression” but with various limitations on exclusive rights).

property forms remains a matter of considerable academic dispute,²⁴⁴ both represent a grant of exclusionary authority to promote private creation.²⁴⁵ Many describe patent as a “bargain” between the public and the inventor, affording the latter limited exclusive rights in exchange for placing an invention in the public domain.²⁴⁶ The academic consensus is that copyright represents an incentive to do the same with expressive assets.²⁴⁷

Patentable assets vary dramatically with respect to their inherent reverse engineerability. Although a number of patents issue for things such as the revolving door—where the circulated product inherently discloses the patentable asset (the idea)—some issue for assets, such as industrial processes, that do not.²⁴⁸ Where a patentable asset is more technically complex and difficult to reverse engineer (distributing the end-product does not enable the audience to reproduce substitutes for the patentable asset easily), one can expect inventors of that asset to forsake patent prosecution²⁴⁹ in favor of trade-secret protection, an alternative exclusionary regime whereby inventors actually trigger legal protection by engaging in a modicum of self-help.²⁵⁰ In other words, the absence of the need to distribute easily reverse engineerable substitutes for certain patentable assets accounts for the greater incidence of secrecy as a mode of exclusion in that context.²⁵¹

244. See, e.g., Long, *supra* note 45 (comparing information cost profiles of copyright and patent).

245. See *United States v. Paramount Pictures*, 334 U.S. 131, 158 (1948) (“The copyright law, like the patent statutes, makes reward to the owner a secondary consideration. . . . It is said that reward to the author or artist serves to induce release to the public of the products of his creative genius.”).

246. See *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 150–51 (1989) (“The federal patent system thus embodies a carefully crafted bargain for encouraging the creation and disclosure of new, useful, and nonobvious advances in technology and design in return for the exclusive right to practice the invention for a period of years.”).

247. For a catalogue of Supreme Court cases describing copyright in this fashion, see *supra* note 20.

248. See *Diamond v. Diehr*, 450 U.S. 175, 191–93 (1981) (holding that a patent could issue for an industrial process incorporating computer program control based upon an algorithm). Software notwithstanding, most copyrightable assets, on the other hand, are easily reverse engineered. Securing a return on copyrightable assets almost always requires the content provider to circulate copies disclosing the original expression, so another important variable—the sophistication of the asset’s consumers—dictates the content provider’s optimal mix of self-help and copyright protection.

249. The term “prosecution” merely describes the process of procuring a patent from the Patent and Trademark Office.

250. When securing a return does require disclosure of the asset itself, however, one can expect an inventor to favor patent protection over self-help when dealing with sophisticated audiences. See Smith, *supra* note 45, at 1174–75 (“In the case of land, fences and other boundaries must be easily processed by a lay audience—anyone might stray onto the land—but, in the case of patents and the possibility of a nonexpert inadvertently ‘trespassing’ on a patent is less likely. Highly detailed and patent-specific information is not only indispensable, but the limited audience of potential violators can be expected to process it.”).

251. It is worth noting that an asset need not meet all the technical requirements for patentability (e.g., novelty, nonobviousness, and utility) in order to remain squarely within the scope of trade secret protection.

What is nonetheless striking about the relationship between patent and trade secret law is that their complementarity almost mirrors that of copyright and self-help after Congress passed the DMCA.²⁵² The DMCA does not, technically, delineate copyright violations,²⁵³ but instead imposes liability for circumventing a technological protection measure restricting access to a copyrightable asset.²⁵⁴

While the analogy is imperfect,²⁵⁵ the DMCA is copyright's digital trade secret law. An inventive asset qualifies for trade-secret protection after its creator takes "reasonable" measures to ensure its secrecy. One difference worth noting, however, is that only economically valuable material may be protected under trade secret law (although I should not overstate this difference, as a content provider cannot invoke the DMCA without the presence of some copyrightable constituent in the set of protected material). Much like the allegedly "unprecedented" anti-circumvention provisions of the DMCA,²⁵⁶ trade secret law defines legal obligations not mainly by reference to an asset's underlying contents, but primarily by reference to what the inventor does to protect them.²⁵⁷

252. For a more in-depth discussion of the DMCA, see *infra* Part III.A.1.

253. One may best conceptualize the DMCA instead as legal protection from technological protection. See Loren, *supra* note 31 ("Adequate legal protections for technological protections also reduce the likelihood for an 'arms race,' avoiding the wasteful investment in bigger and better technology. While providing legal protections for these technological protections will not completely end the technological arms race—there will always be hackers—it should slow the pace of the arms build-up.").

254. See 17 U.S.C. § 1201 (2000).

255. Trade secrets actually protect any intellectual asset where the conditions of "secrecy" have been met, irrespective of whether it is patentable or not. See UNIF. TRADE SECRETS ACT §§ 1–5 (amended 1985), 14 U.L.A. 433 (Supp. 1990). At least some portion of the protected material must be copyrightable, however, for circumvention to trigger the penalties of the DMCA. This distinction, however, is less significant than it might first appear because the determination of whether something may be copyrighted is generally made only after the initiation of litigation (authors need not register copyrights). See 17 U.S.C. § 411 (2000). In practice the DMCA serves to protect a significant amount of material that may not satisfy the requirements of the copyright laws, such as the idea/expression dichotomy. See 17 U.S.C. § 102(b) (2000) ("In no case does copyright protection for an original work of authorship extend to any idea, procedure, process, system, method of operation, concept, principle, or discovery, regardless of the form in which it is described, explained, illustrated, or embodied in such work.").

256. The anti-circumvention provisions are found in 17 U.S.C. § 1201(a)–(b).

257. Trade secret rules are exclusively a creature of state law, primarily because there is no enumerated constitutional authority for Congress to legislate. In 1979, the legal community produced a set of nonbinding, model trade secret laws, called the Uniform Trade Secrets Act (UTSA). UNIF. TRADE SECRETS ACT §§ 1–5 (amended 1985), 14 U.L.A. 433 (Supp. 1990). Currently, the District of Columbia and forty-one states have adopted some form of legislation modeled after the UTSA. See RESTATEMENT (THIRD) OF UNFAIR COMPETITION § 39 statutory note (1995).

A trade secret, as defined by the UTSA, is something of "economic value . . . from not being generally known . . . and is the subject of efforts that are reasonable under the circumstances to maintain secrecy." See UNIF. TRADE SECRETS ACT § 4. This definition is quite broad and can encompass almost anything. See *id.*

For example, in *E.I. DuPont deNeours & Co. v. Christopher*,²⁵⁸ DuPont, the plaintiff, had developed a highly secret but unpatented process for producing methanol.²⁵⁹ Securing a return on the process did not require DuPont to place the process itself in the public domain.²⁶⁰ The defendants were aerial photographers hired to take fly-over photographs of Dupont's methanol plant.²⁶¹ Because the inventive asset (the process for producing methanol) was not easily reverse engineered from the associated end product (methanol), Dupont had taken steps to keep the process secret, but did not patent it.²⁶² In a colorful opinion characterizing the defendant's activity as "cloak and . . . dagger" industrial espionage, the Fifth Circuit found for DuPont on the grounds that the defendants had used "improper means" to obtain the trade secret.²⁶³ Revealing concerns that allowing such activity would damp innovation, the court quipped acerbically, "[p]erhaps ordinary fences and roofs must be built to shut out incursive eyes, but we need not require the discoverer of a trade secret to guard against the unanticipated, the undetectable, or the unpreventable methods of espionage now available."²⁶⁴ If that remark were made in reference to copyrightable material rather than a trade secret, it could have been ripped straight from transcripts of congressional hearings on the DMCA.²⁶⁵

In a passage remarkably evocative of my argument that self-help is inefficient for certain audience profiles,²⁶⁶ the *DuPont* court concluded that

[a]lthough after construction the finished plant would have protected much of the process from view, during the period of construction the trade secret was exposed to view from the air. To require DuPont to put a roof over the unfinished plant to guard its secret would impose an enormous expense to prevent nothing more than a school boy's trick.²⁶⁷

The notion that extravagant protection measures represent inefficient wealth-redistributive expenditures reappears in subsequent trade secret jurisprudence.

In *Rockwell Graphic Systems v. DEV Industries*,²⁶⁸ Judge Richard Posner embarks on an even more explicit articulation of the way trade secret law checks technological arms races. Rockwell Graphic Systems manufactured printing presses and some

258. 431 F.2d 1012 (5th Cir. 1970).

259. *Id.* at 1013.

260. *Id.* at 1016.

261. *Id.* at 1013.

262. See RESTATEMENT OF TORTS § 757 (1939) ("One who discloses or uses another's trade secret, without a privilege to do so, is liable to the other if (a) he discovered the secret by improper means, or (b) his disclosure or use constitutes a breach of confidence reposed in him by the other in disclosing the secret to him.").

263. *DuPont*, 431 F.2d at 1013, 1015–16.

264. *Id.* at 1016.

265. See S. REP. NO. 105-190, pt. 3 (1998); H.R. REP. NO. 105-551, pt. 1 (1998); H.R. Rep. No. 105-551, pt. 2 (1998) For an extended treatment of this legislative history, see David Nimmer, *Appreciating Legislative History: The Sweet and Sour Spots of the DMCA's Commentary*, 23 CARDOZO L. REV. 909 (2002).

266. See *supra* notes 161–62 and accompanying text.

267. *DuPont*, 431 F.2d at 1016.

268. 925 F.2d 174 (7th Cir. 1991).

printing press parts for newspapers.²⁶⁹ Rockwell, however, did not always manufacture the parts and would routinely subcontract the manufacturing of the “piece parts” to third-party vendors.²⁷⁰ In so doing, Rockwell necessarily divulged to the relevant vendor the specifications for the piece part. Rockwell had employed two employees in more senior positions where they had access to piece part drawings.²⁷¹ Those employees both left Rockwell and joined DEV in the mid-1970s.²⁷² Rockwell brought a trade secret suit in 1984 when it discovered that DEV possessed one hundred of Rockwell’s drawings.²⁷³ The central issue in the case was whether Rockwell tried to keep the piece part designs secret “hard enough” to warrant trade secret protection.²⁷⁴ The magistrate and district judges both held that the piece part drawings did not constitute trade secrets because, by distributing piece part drawings to the vendors, Rockwell made only minimal efforts to keep them secret.²⁷⁵

In overturning the district court, Judge Posner catalogues Rockwell’s process for restricting access to the piece part drawings to authorized personnel only.²⁷⁶ Citing *DuPont*, Posner elaborates on a conception of trade secret protection that protects socially valuable information against otherwise lawful conduct.²⁷⁷ That conception, Posner notes, “emphasizes the desirability of encouraging inventive activity by protecting its fruits from efforts at appropriation that are . . . sterile wealth-redistributive—not productive—activities.”²⁷⁸ The activity that Posner derisively characterizes as “wealth redistributive” is the same activity that public choice literature derisively characterizes as rent-seeking, and it is the same activity to which I refer when I speak of inefficient arms racing over access to intellectual assets.

Concluding his opinion, Posner directly echoes the reasoning of the *DuPont* passage cited above, as well as the underlying logic of why copyright law may seek to encourage minimal, but only minimal, levels of self-help.

Patent protection is at once costly and temporary, and therefore cannot be regarded as a perfect substitute. If trade secrets are protected only if their owners take extravagant, productivity-impairing measures to maintain their secrecy, the incentive to invest resources in discovering more efficient methods of production will be reduced, and with it the amount of invention.²⁷⁹

In this short passage, Judge Posner captures directly the problems with protection and circumvention races over patentable assets, and his analysis applies with equal force to races over copyrightable ones. Arms races over any intellectual asset impose direct

269. *Id.* at 175.

270. *Id.*

271. *Id.*

272. *Id.* at 176.

273. *Id.*

274. *Id.* at 175.

275. *Id.* at 176.

276. *Id.* at 177.

277. *Id.* at 178.

278. *Id.*

279. *Id.* at 180.

costs in the form of “sterile” wealth-redistributive activities and impose negative externalities in the form of diminished incentives to create.

The *DuPont* and *Rockwell* decisions reinforce one of this Part’s major themes and refine another. First, these opinions both represent judicial attempts to constrain unnecessary self-help expenditures by punishing circumvention of even primitive protection measures. Moreover, they both damp racing behavior by imposing considerable costs on consumer offense.

Second, although the *DuPont/Rockwell* arms race approach is pro-inventor, it is hardly anti-consumer. In a copyright context public choice theorists might decry such a categorical allocation of access- and use-rights, triggered by even rudimentary protection, as naked special interest legislation.²⁸⁰ In the patent/trade secret context, however, such vitriol is not forthcoming. In that context, the race may pit two corporate interests against each other, rather than a corporate steward against consumers. Industrial espionage lacks the normative appeal of fair use, so one might explain *DuPont/Rockwell*’s categorical approach to access- and use-rights by noting that, in the trade secret context, there exists no *direct* consumer interest to protect.

2. Genetically-Embedded Self-Help

Professor Dan L. Burk recently published an article in the *California Law Review* in which he explored Genetic Use Restriction Technologies (GURTs).²⁸¹ Although Professor Burk concerns himself primarily with the ways in which GURTs and DRM technologies should modify our modern understanding of certain contract and property doctrines,²⁸² GURTs also represent a significant appearance of “technological” self-help on the patent stage. GURTs are technological use restrictions embedded in genetic code. Professor Burk notes the relationship between startup and duplication costs for gene-splicing techniques, and that relationship mirrors that of digitally reproducible assets:

The economic challenge to the development of such plant varieties is that new varieties of plant may be relatively expensive to create, but are often trivially inexpensive to propagate once they are in existence—indeed, they may propagate even when intended not to do so. Plants reproduce and multiply . . . even without human intervention.²⁸³

This represents, as Professor Burk notes, the classic public goods problem because the marginal cost of distribution approaches zero.²⁸⁴ Inventors and legal institutions mediating control of biological assets therefore face the same set of economic

280. See, e.g., Eugene R. Quinn, Jr., *Unconstitutional Patent in Disguise: Did Congress Overstep Its Constitutional Authority in Adopting the Circumvention Provisions of the Digital Millennium Copyright Act?*, 41 BRANDEIS L.J. 33, 39 (2002) (“The Copyright Act is increasingly becoming a piece of special interest legislation with specialized provisions to please almost every special interest group and lobbyist.”).

281. See Burk, *supra* note 3.

282. *Id.* at 1554–55.

283. *Id.* at 1556.

284. *Id.*

constraints as do content-owners and legal institutions mediating control of expressive ones.

Until recently, society has relied primarily upon legal rules to protect these biological assets.²⁸⁵ Unsurprisingly, as the effectiveness of legal protection—both statutory and judicial—diminished, the demand for effective self-help agents increased. GURTs introduce into plants toxin-producing genetic elements after the plant has matured, forcing the user (farmer) to re-purchase the seeds the following year.²⁸⁶ Additionally, there is no logical reason to believe that GURTs, or other types of genetically encoded self-help, will be limited in application to plants.²⁸⁷

The stunning resemblance between the economic conditions giving rise to GURTs in the copyright context and those giving rights to TPMs in the copyright context is not lost on Professor Burk, as he exhausts considerable space scrutinizing the evolution of both forms of self-help.²⁸⁸ While the interchangeability of intellectual property protection and self-help is notable in both patent and copyright forms, the more interesting observations involve the forms' analogical failure. As Part II explains at length, we can expect to observe sustained racing behavior over copyrightable assets because, in part, content consumers are organized enough to engage in economically viable counter-maneuvers.

No such symmetry exists in the patented seed context. Almost no ordinary consumer could hack through a genetically encoded restriction, and there is no ideologically-motivated group of bio-hackers organized enough to circulate the circumvention tools necessary to defeat the controls GURTs impose on biological assets.²⁸⁹ The consequence of the asymmetry between protectors and circumventors in this context presents just the type of under-theorized scenario (to which I allude in Part III.A.3), where offense-defense ratios are extraordinarily high and the consumer simply “cedes” the contested territory. There will be no racing behavior because, having no economically viable response, consumers of genetically protected biological material will simply have to accept the access- and use-terms of the genetic provider.

Differences in producers' and consumers' capacity to act collectively, depending on the intellectual context, drives differences in institutional responses. While concerns that the DMCA may unnecessarily jeopardize free speech are credible, Congress seems to feel comfortable with the notions both that consumers can partially fend for themselves and that the statute is flexible enough to respond to any serious encroachment on fair use.²⁹⁰ Neither form of safety net exists for GURT-restricted genetic material.

285. *Id.* at 1557–58. *See also* Plant Variety Protection Act, 7 U.S.C. § 2402 (2000) (bestowing upon developers significant control over use and access to certain varieties of sexually reproducing plants); 35 U.S.C. § 161 (2000) (implementing the plant patent, preventing unauthorized reproduction of asexually reproducing plant varieties); *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980) (noting that utility patents cover “anything under the sun that is made by man”).

286. *See* Burk, *supra* note 3, at 1558–59.

287. *Id.* at 1559.

288. *Id.* at 1561–65.

289. *Id.* at 1571.

290. *See supra* Part III.A.1.

GURTs implicate not fair use, but international food supply.²⁹¹ The high stakes combined with the inability of consumers to vie for them will yield an institutional response that differs significantly from that embedded in the DMCA. That response could take two forms: (1) a “right to hack”²⁹² or (2) up-front rules about the sorts of restrictions genetic scripts could encode (a genetic fair use *requirement!*). For reasons I identify above, a “right to hack” would be a practical nullity, as there is little reason to believe in the development of any significant bio-hacking movement.²⁹³ The more appealing response resembles that embedded in the AHRA—requiring producers of genetic material to use genetic protection devices that allow certain types of use.²⁹⁴ Consumers would, of course, have to pay for that term in the form of increased prices, but it would nonetheless amount to the same sort of “compulsory” license as the AHRA contains. Such a federal law would also pre-empt state contract law to the contrary.

No matter what resolution Congress and the courts ultimately adopt, GURTs are significant because they are the patent analogue of DRM technology. Moreover, the inventive assets that GURTs protect—as well as the audience who consumes them—illustrate the ways in which institutional responses must differ with respect to asset characteristics and audience sophistication.

C. Other Informational Assets—“Digital Trespass” Cases

Courts have had to confront races over access to intangible assets on fronts other than that of intellectual property. In one particular context, involving what I refer to collectively as the “digital trespass cases,” courts wrestled with the degree to which racing justifies allowing network owners to regulate access to information contained on and passed through private servers.²⁹⁵

Section 217 of the Second Restatement of Torts delineates two sources of liability for trespass to chattels: either for “dispossessing another of the chattel” or for “using or intermeddling with a chattel in the possession of another.”²⁹⁶ More importantly for my purposes, the Restatement affords to the chattel-holder “a privilege to use force to

291. Burk, *supra* note 3, at 1570.

292. *Id.* at 1571.

293. *Id.*

294. *Id.* at 1571–74.

295. These cases are *eBay, Inc. v. Bidders Edge, Inc.*, 100 F. Supp. 2d 1058 (N.D. Cal. 2000); *CompuServe Inc. v. Cyber Promotions, Inc.*, 962 F. Supp. 1015 (S.D. Ohio 1997); *Intel Corp. v. Hamidi*, 71 P.3d 296 (Cal. 2003); and *Thrifty-Tel, Inc. v. Bezenek*, 54 Cal. Rptr. 2d 468 (Ct. App. 1996). Although I limit my discussion to those cases, I do so only in order to be succinct. A more comprehensive list of these cases would also include *Ticketmaster Corp. v. Tickets.Com, Inc.*, No. CV997654HLHVBKX, 2003 WL 21406289 (C.D. Cal. Mar 7, 2003); *America Online, Inc. v. LCGM, Inc.*, 46 F. Supp. 2d 444 (E.D. Va. 1998); and *America Online, Inc. v. IMS*, 24 F. Supp. 2d 548 (E.D. Va. 1998). A thorough summary of this case law is somewhat conspicuously (and derisively) presented in *White Buffalo Ventures, L.L.C. v. University of Texas at Austin*, 420 F.3d 366, 377 n.24 (5th Cir. 2005).

296. RESTATEMENT (SECOND) OF TORTS § 217 (1965).

defend his interest in its exclusive possession.²⁹⁷ The Restatement, however, does not vest in an owner a cause of action for harmless intermeddling with his chattels.²⁹⁸

The Restatement distinguishes between a possessory interest in real property and a possessory interest in a chattel by furnishing a real property holder an action for nominal damages and a chattel-owner a limited self-help privilege. The Restatement treats these interests differently because it regards the self-help privilege as a sufficient means of protecting the inviolability of a chattel.²⁹⁹ The Restatement's selective use of the self-help privilege obviously reflects one of this Article's central academic conceits—that institutions do and should encourage self-help when that is the more efficient means of regulating access to and use of an asset.

*CompuServe Inc. v. Cyber Promotions, Inc.*³⁰⁰ announced the arrival of the digital trespass to chattels theory. Cyber Promotions sent unsolicited spam, over the CompuServe network, to CompuServe customers.³⁰¹ A number of these customers began to complain and subsequently terminated their relationship with CompuServe.³⁰² CompuServe attempted a self-help measure by blocking the spam, but that maneuver failed.³⁰³ CompuServe then sued Cyber Promotions. The court held that a plaintiff could properly state a claim for trespass to chattels over electronic signals, even if the server could bear the increased traffic-load associated with the spam.³⁰⁴ The *CompuServe* court also held that, since Cyber Promotions's activity compromised CompuServe's reputation and customer goodwill, CompuServe could identify sufficient economic losses to sustain the trespass to chattels claim.³⁰⁵

The *CompuServe* court issued an injunction against Cyber Promotions, justifying that legal remedy by reference to the failure of CompuServe's exercised self-help privilege.³⁰⁶ The court specifically stated that, where reasonable measures could be effective, self-help was "particularly appropriate in this type of situation and should be exhausted before legal action is proper."³⁰⁷ This remedy obviously reflects the same logic as do the DMCA's provisions granting a cause of action against infringers if they circumvent a content provider's self-help. The *CompuServe* court, echoing the appeal of an intermodal division of labor,³⁰⁸ explicitly endorsed the notion that self-help should be used where it is cost-effective.

Nonetheless, in *CompuServe*, the court nominally justified exercise of the self-help privilege by reference to defense of a tangible asset—the servers. Consistent with the judiciary's historical aversion to propertizing information,³⁰⁹ the *CompuServe* court

297. *Id.* § 217 cmt. a.

298. *Id.*

299. *Id.* § 218 cmt. e.

300. 962 F. Supp. 1015 (S.D. Ohio 1997).

301. *Id.* at 1017.

302. *Id.* at 1019, 1023.

303. *Id.* at 1019.

304. *Id.* at 1023. The precedent for the "reduced economic efficiency" argument comes from *Intel Corp. v. Hamidi*, 71 P.3d 296 (Cal. 2003).

305. *Id.*

306. *CompuServe Inc.*, 962 F. Supp. at 1027.

307. *Id.*

308. *See supra* Part II.C.

309. *See, e.g., Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 345–47 (1991).

seemed weary of positing a proprietarian relationship between CompuServe and its customers' email addresses.³¹⁰

Whether or not this historical trend explains why the *Compuserve* court came out the way it did is subject to debate, but several years later, in the now-famous *eBay, Inc. v. Bidder's Edge, Inc.*³¹¹ case, a federal district court strained even further to avoid positing a proprietarian relationship between the owner of a network and the information housed on it. *eBay* confronts, much as did the intellectual property law in the preceding Parts, arms races over intangible property. What is so interesting about the case is that, because courts so intensely disfavor finding property rights in factual information, the *eBay* court addressed the arms race phenomenon without speaking in terms of the intangible property interest actually at stake.

Scholarship has characterized the parties' behavior in *eBay* as a wasteful "game of cat and mouse,"³¹² another way of expressing the arms-race dynamic. eBay is perhaps the Internet's best-known auction site, and Bidder's Edge was an auction aggregator.³¹³ In other words, Bidder's Edge did not itself administer auctions, but instead maintained information on current prices across a number of auction sites.³¹⁴ Bidder's Edge attempted to negotiate access to query the eBay site, but the negotiations languished when the two sides could not agree on the frequency with which Bidder's Edge was to execute the queries.³¹⁵ Bidder's Edge nonetheless continued to query the site, and eBay responded by identifying and blocking 169 IP addresses they believed to be Bidder's Edge servers.³¹⁶ Bidder's Edge, in turn, resorted to using proxy servers—a technique allowing them to circumvent the IP Address restrictions imposed by eBay.³¹⁷ eBay then sued Bidder's Edge on a trespass to chattels theory.³¹⁸

The *eBay* court granted a preliminary injunction on the likely success of that theory, but did so without acknowledging a proprietarian relationship between eBay and the bid information.³¹⁹ The case was not ultimately tried because the parties settled after the preliminary injunction issued.³²⁰ The court, however, did remark in its decision issuing the injunction that "the gravamen of the alleged irreparable harm is that if [Bidders Edge] is allowed to continue to crawl the eBay site, it may encourage frequent and unregulated crawling."³²¹ Although the court seemed to contemplate that such activity might result in irreparable harm to eBay's site,³²² one might just as easily expect eBay

310. Congress responded to the problem of unsolicited spam in the Controlling the Assault of Non-Solicited Pornography and Marketing Act of 2003 ("CAN-SPAM Act"), Pub. L. No. 108-187, 117 Stat. 2699, 2719 (codified at 15 U.S.C. §§ 7701-7713 (2004)).

311. 100 F. Supp. 2d 1058 (N.D. Cal. 2000).

312. David McGowan, *Website Access: The Case for Consent*, 35 LOY. U. CHI. L.J. 341, 350 (2004).

313. *eBay*, 100 F. Supp. 2d at 1061.

314. *Id.* at 1061-62.

315. *Id.* at 1062-63.

316. *Id.*

317. *Id.*

318. *Id.* at 1069.

319. *Id.* at 1067, 1072.

320. *Id.*

321. *Id.* at 1067.

322. *Id.*

to use increasingly sophisticated technology to block IP addresses and, in turn, other meta-auction sites to use increasingly sophisticated proxy server technology to circumvent eBay's restrictions.

The *eBay* court identifies the property interest at stake as one in the future integrity of eBay's servers.³²³ In so doing, it obscures what Bidder's Edge was really trying to acquire and what eBay was really trying to protect—information about the items for which Bidder's Edge was seeking to query the site. The *eBay* court was not in a position to be frank about the factual, intangible character of the property over which the parties were racing, but it was in a position to stop the racing itself—provided it could articulate an alternative property interest. Seizing on the *CompuServe* court's rationale, at least one commentator has suggested that the *eBay* court should have instead premised its injunction on the failure of eBay's self-help efforts.³²⁴

Such a position may well have been more honest, because it appears as though that was precisely what the *eBay* court was doing—stemming the escalating measures and countermeasures race between eBay and Bidder's Edge over bid information. It was only the doctrinal impracticality of owning up to the actual, intangible property interest at stake that prevented the *eBay* court from confronting the arms race issue explicitly.

The digital trespass cases are yet another context in which legal institutions have had to confront racing behavior. More importantly, the *eBay* rule, like the DMCA, allocates entitlements to information without reference to the content of the information or reference to the use for which the circumventor seeks it. Nonetheless, the *eBay* rule, like the CCPA and trade secret law, resolves issues along a corporate-corporate axis, rather than a corporate-consumer one. The most interesting revelation of the digital trespass cases is that, as opposed to competition over access to the previously discussed assets, they represent a unique situation where the interest of constraining arms races does not dovetail with the traditional protection of a conventional creative or inventive asset. Courts generally have either constitutional or statutory authority to protect creative and inventive assets, but not information. Perhaps this splintered interest accounts for why courts so obviously strain under the weight of existing doctrine and why legislatures, precedentially unconstrained, can act so decisively.³²⁵

CONCLUSION

The "technological arms race" is a classic example of terminology that became accepted legal wisdom before it was sufficiently scrutinized. The sheer number of arms race references in the DMCA literature alone would cause any casual observer to

323. *Id.*

324. See McGowan, *supra* note 312, at 351.

325. For examples of statutory protection of the sort I argue that the digital trespass cases "strain" to provide, see the legislation cited *supra* note 164. *White Buffalo Ventures L.L.C. v. University of Texas at Austin*, 420 F.3d 366 (5th Cir. 2005), presents an interesting situation because the Fifth Circuit held that a spammer's content was *legal* under the Act, but declined to impose restraints on measures the University of Texas took to restrict White Buffalo's access to its servers. There, a court interpreted a statute so as to *allow*, rather than *discourage*, TPMs (although this was obviously not the court's primary concern, which involved a First Amendment question).

presume the phenomenon had been theorized to death, but in fact that scholarship is nonexistent. Few academics have explored the more general relationship between copyright law and arms racing, and none have either (1) attempted to set forth a rigorous theory analyzing racing behavior or (2) sought to position the phenomenon's most conspicuous institutional response in the broader context of legal rules governing other intangible assets.

Despite the lack of serious academic consideration given to technological arms races, rigorous analysis bears out several of the crucial scholarly assumptions. Most importantly, an analytic framework borrowed from international relations theory indeed suggests that, in the absence of legal rules constraining them, the twenty-first-century creative marketplace would be beset by inefficient, wealth-redistributive arms races.

Confirming that which the literature assumed, however, was only one-half of my task. I also sought to contextualize the DMCA, first by arguing that one of copyright's most fundamental functions is to constrain technological arms races and, second, by comparing its enactment to other institutional developments where courts and legislatures have confronted arms racing over other intangible assets.