

HENRY E. SMITH

Intellectual Property as Property: Delineating Entitlements in Information

ABSTRACT. This Article proposes that intellectual property's close relationship to property stems from the role that information costs play in the delineation and enforcement of exclusion rights. As theorists have emphasized, the nonrivalness of information causes exclusive rights to be more costly in terms of forgone use than in the law of tangible property. But if intellectual property does not solve a problem of allocation, it can play a role in allowing those who find and develop information to appropriate the returns from their rival inputs. It is on the cost side that exclusion emerges as a possible shortcut: exclusive rights in information are simple, indirect, and low-cost devices for solving the problem of appropriating the returns from these rival inputs. Building on a framework that identifies exclusion and governance as complementary strategies for defining property rights, the Article derives some propositions about which factors can be expected to push toward and away from exclusion in delineating entitlements to information. The role that exclusion plays in keeping the system of entitlements over information modular—allowing information to be hidden behind metaphorical boundaries—is both its strength and its weakness. Because exclusion is both more costly and potentially more beneficial as interconnected information becomes more valuable, it is an empirical question whether we would expect more exclusion—and whether it would be desirable. The Article uses this information-cost theory to explain some of the basic differences between the more tort-like copyright regime and the more property-like patent law. The information-cost theory also has implications for suggestive sources of empirical evidence on the structure of entitlements, such as rules within business organizations. Intellectual property, like property in general, can be seen as (at best) a second-best solution to a complex coordination problem of attributing outputs to inputs.

AUTHOR. Fred A. Johnston Professor of Property and Environmental Law, Yale Law School. For helpful comments, I would like to thank Barry Adler, Oren Bar-Gill, Bob Ellickson, Lee Fennell, James Grimmelmann, Bruce Johnsen, Scott Kieff, Tom Merrill, Eric Rasmusen, Carol Rose, Joe Sommer, Lior Strahilevitz, Katrina Wyman, and Todd Zywicki; participants in workshops at Boston University, Fordham, George Mason University, Harvard, NYU, and the University of Virginia law schools; the Korean Intellectual Property Association; and the participants at a session of the 2003 American Law and Economics Annual Meeting and at the Conference on Commercializing Innovation at Washington University in St. Louis School of Law. All errors are attributable to my inputs.



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INTRODUCTION

At the core of controversies over the correct scope of intellectual property lie grave doubts about whether intellectual property *is* property. Property covers a broad range of resources, from solid objects like land and cars to fugitive resources like water to intangibles like debts. But, as a resource, information is different from all of these. From the consumer's point of view, information is nonrival and nonexcludable: one person's enjoyment of the plot of *Hamlet* does not diminish another's (if anything, the opposite), and preventing people from using information is difficult.¹ Although information itself is a public good and once known would be consumed at zero marginal cost, discovering and making information useful requires inputs that *are* rival and are susceptible to efforts to exclude. Edison's labor in testing filaments for the light bulb (not to mention his lab equipment and working space) was as rival and excludable as the classic examples of shrimp salads or Blackacre.² On various theories, patent rights are said to give incentives to invent, develop, or commercialize inventions such as the light bulb.³ Other intellectual property regimes, like copyright, focus more on creation, and still others, like trademark, are more concerned with commercialization than with creation. Yet all of these regimes reflect a concern that, in their absence, people will have too little incentive to engage in certain activities with respect to information, whether discovering it, commercializing it, or using it to lower consumer search costs.

Intellectual property rights are conventionally said to solve an incentive problem but not an allocation problem. Regular property may serve to allocate resources to avoid use conflicts, but information can be used by more than one person (i.e., it is nonrival) and so need not be allocated to one person to the exclusion of another. Instead, intellectual property is supposed to encourage people to engage in the production or development of information. And if we want to encourage various activities, it would seem to follow that we should

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1. If access to information has snob appeal on the consumer side, or affords some advantage on the producer side, it is rival in that sense. In this Article, I assume the nonrivalness of information in order to show that exclusive rights can make sense even given this assumption.
 2. See *The Incandescent Lamp Patent*, 159 U.S. 465 (1895). On the involvement of shrimp salads in legal relations, see Wesley Newcomb Hohfeld, *Some Fundamental Legal Conceptions as Applied in Judicial Reasoning*, 23 YALE L.J. 16, 34-36 (1913) [hereinafter Hohfeld, *Some Fundamental Legal Conceptions*], reprinted in WESLEY NEWCOMB HOHFELD, *FUNDAMENTAL LEGAL CONCEPTIONS AS APPLIED IN JUDICIAL REASONING AND OTHER LEGAL ESSAYS* 23, 40-42 (Walter Wheeler Cook ed., 1923) [hereinafter HOHFELD, *LEGAL ESSAYS*].
 3. See, e.g., A. Samuel Oddi, *Un-Unified Economic Theories of Patents—The Not-Quite-Holy Grail*, 71 NOTRE DAME L. REV. 267 (1996) (discussing theories of patent law).

regulate or subsidize those activities. If there is an allocation problem connected with activities like invention or commercialization, it involves not the information itself but the inputs used to discover and enhance the value of this information.⁴ But the question still remains why we would provide for rights in information to solve this allocation problem when it would seem that we could simply give rights to appropriate the returns from these (rival) inputs like labor and lab space.

Although such questions are particularly pressing in intellectual property because of the special nature of information as a subject of property rights, these questions also arise in more familiar settings involving tangible property. In this Article, I argue that the information-cost problems solved by property rights carry over into intellectual property. Because exclusive rights have underappreciated benefits, the main questions in intellectual property are ultimately even more empirical than most commentators recognize. Furthermore, attending to both the benefits and the costs of exclusive rights as a second- (or third-) best solution to problems inherent in delineating entitlements will point to unexpected sources of data for resolving these empirical questions.

This Article proposes that intellectual property's close relationship to property stems from the role that information costs play in the delineation and enforcement of rights. Property differs from other areas like torts and contracts in its heavier reliance on what I have elsewhere called the exclusion strategy.⁵ The exclusion strategy protects rights-holders' interests in the use of resources indirectly, by using a simple signal for violations. The prototypical example is trespass to land, whereby the unauthorized crossing of a boundary serves as a (very) rough proxy for harmful use; any voluntary entry into the column of

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4. See Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265, 275-76 (1977) ("There is, however, a scarcity of resources that may be employed to use information, and it is that scarcity which generates the need for a system of property rights in information."). Recently, Christopher Yoo has argued that the real problem with the nonrivalness of information is, in accordance with Paul Samuelson's original treatment, that the same quantity of the good enters the consumption function of multiple individuals, giving them an incentive to underrepresent their willingness to pay; this incentive-incompatibility is the problem faced by regimes like copyright. See Christopher S. Yoo, *Copyright and Public Good Economics: A Misunderstood Relation*, 155 U. PA. L. REV. 635 (2007). In this Article, I focus on the rival inputs surrounding information and, for purposes of argument, adopt the conventional approach to nonrivalness in the intellectual property literature.
 5. See Henry E. Smith, *Exclusion and Property Rules in the Law of Nuisance*, 90 VA. L. REV. 965, 975-90 (2004) [hereinafter Smith, *Exclusion and Property Rules*]; Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. REV. 1719, 1791-93 (2004) [hereinafter Smith, *Property and Property Rules*].

space defined by the *ad coelum* rule counts as a trespass.⁶ By contrast, some rights are defined more directly in terms of proper use, under what I call a governance strategy: a person has a right to perform a certain action, and the action rather than some defined thing is the focus of delineation effort. Much of nuisance law is a classic example of this approach. Certain activities like emitting odors are the focus of attention, and contextual factors about the neighborhood and the relative benefits to society of the conflicting uses are directly relevant. Indeed, the relation of the core of property to adjacent areas such as torts reflects a shift from an exclusion to a governance strategy: examples would include the trespass- nuisance divide and, within nuisance, the mixture of *per se* boundary rules and balancing-style rules of proper use.⁷ Governance rules can refine and extend the basic rough exclusion strategy, but at ever greater cost, as we move along the spectrum from exclusion to governance. Building on this framework that identifies exclusion and governance as complementary strategies for defining property rights, I show that exclusion rights in information *outputs* may serve as a low-cost way to establish property rights in the rival *inputs* to invention and commercialization.

Paradoxically, the main advantage of exclusive rights is their indirectness, or the lack of direct fit between exclusion as a mechanism and the purposes that it serves. As some legal philosophers have argued, if the right to exclude is the basic feature of property, it nonetheless serves our interests in the use of things.⁸ Property rests on a foundation of simple rules like trespass that tell duty-holders to keep off. No direct reference need be made to information about either the duty-holder or the owner: if I am walking through a parking lot, I know not to drive off with others' cars, and I do not need to know who the owners are, how virtuous (or not) they are, or whether they are actual

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6. See Smith, *Exclusion and Property Rules*, *supra* note 5, at 992 & n.80, 993-96 ("The full statement of the maxim is *cujus est solum, ejus est usque ad coelum et ad inferos* (he who owns the soil owns also to the sky and to the depths). The maxim is routinely followed in resolving issues about ownership of air rights, building encroachments, overhanging tree limbs, mineral rights, and so forth, and is subject to certain limited exceptions for activities like airplane overflights."); see also *Brown v. United States*, 73 F.3d 1100, 1103-04 (Fed. Cir. 1996); Thomas W. Merrill, *Trespass, Nuisance, and the Costs of Determining Property Rights*, 14 J. LEGAL STUD. 13, 26-35 (1985).
 7. See, e.g., Merrill, *supra* note 6; Smith, *Exclusion and Property Rules*, *supra* note 5; see also *Victoria Park Racing & Recreation Grounds Co. v. Taylor* (1937) 58 C.L.R. 479 (Austl.) (Evatt, J., dissenting) (describing the law of nuisance as "an extension of the idea of trespass into the field that fringes property" (citing 1 THOMAS ATKINS STREET, THE FOUNDATIONS OF LEGAL LIABILITY (THEORY AND PRINCIPLES OF TORT) 211 (photo. reprint 1980) (1906))).
 8. See, e.g., J.W. HARRIS, PROPERTY & JUSTICE 24-27 (1996); J.E. PENNER, THE IDEA OF PROPERTY IN LAW 68-74 (1997).

people or corporations.⁹ Likewise, the owners of the autos need not know much about me or the vast crowd of other duty-holders—the “rest of the world” against whom in rem rights avail. Our interactions can be relatively anonymous precisely because they are mediated by a thing—in this instance, the cars. The right to exclude from a designated thing protects our interests in the use of things like cars or Blackacre; if no use could be made of a given thing, there would be no reason to exclude.

Furthermore, the focus on exclusion—for reasons of simplicity and cheapness—only makes sense because of positive transaction costs, here broadly taken to include the nonzero cost of delineating property rights.¹⁰ In a world of zero transaction costs, we might accept for all purposes the economists’ definition of a property right as a right to take one of a list of actions with respect to a thing—the thing being merely a backdrop to the direct specification of what actions are permissible as between any pair of individuals.¹¹ Of course we do not live in a zero-transaction-cost world, but it is easy to forget that positive delineation and information-processing costs are the precondition for the role identified by philosophers of the right to exclude—its indirect protection of various privileges to use. This indirection would not be necessary if more direct approaches were costless.

This Article first argues that exclusion serves a similar function in intellectual property. Yes, we would prefer, in a world of zero or low delineation costs, to focus on what really matters to us—the use of information. In intellectual property this is all the more true because information is itself nonrival and so uses might not conflict. And, yes, if we are worried about creators, inventors, commercializers, and others not being able to appropriate

9. See PENNER, *supra* note 8, at 75-76.

10. See, e.g., Douglas W. Allen, *What Are Transaction Costs?*, 14 RES. L. & ECON. 1 (1991) (arguing that transaction costs are better defined broadly as the costs of establishing and maintaining property rights, in the economist’s sense of a de facto ability to derive utility from an action, rather than narrowly as the costs of exchange); Steven N.S. Cheung, *The Transaction Costs Paradigm*, 36 ECON. INQUIRY 514, 515 (1998) (“Transaction costs’ must be defined to be all the costs which do not exist in a Robinson Crusoe economy.”).

11. See, e.g., Armen A. Alchian, *Some Economics of Property Rights*, 30 IL POLITICO 816, 818 (1965), reprinted in ARMEN A. ALCHIAN, *ECONOMIC FORCES AT WORK* 127, 130 (1977) (“By a system of property rights I mean a method of assigning to particular individuals the ‘authority’ to select, for specific goods, any use from a nonprohibited class of uses.”); see also THRÁINN EGGERTSSON, *ECONOMIC BEHAVIOR AND INSTITUTIONS* 33 (1990) (stating that “[w]e refer to the rights of individuals to use resources as *property rights*,” and quoting Alchian’s definition); Steven N.S. Cheung, *The Structure of a Contract and the Theory of a Non-Exclusive Resource*, 13 J.L. & ECON. 49, 67 (1970) (“An exclusive property right grants its owner a *limited* authority to make decision[s] on resource use so as to derive income therefrom.”).

the returns from their activities, we might respond to these positive externalities with subsidies or rights to those inputs. But although these more direct solutions are obviously superior on the benefit side—and they have certainly for this reason garnered a lot of support in the form of proposals for rewards and compulsory licensing—they also by their very directness are more costly than exclusive rights. The alternative to these tailored solutions is to devise rights that rely on simple on/off signals and that will allow rights-holders to reap the returns from their inputs without officials' needing to value the uses to which the inputs are put—or even to know what those uses are.

From the point of view of government enforcers, such as judges, exclusive rights are a black box; because information about uses and users is made irrelevant to the resolution of a property dispute, this *modular* system manages the overall complexity of attributing returns to inputs. A modular system manages complexity because it has been decomposed into pieces (modules) so that interactions are intense within the module but sparse and standardized between modules.¹² A system is nearly decomposable if a set of boundaries can be found such that interactions are much more intense within these boundaries than across them, but the pieces function together to do what the system is supposed to do. For example, in a computer program, a “print” function could either be embedded in various parts of the program or be segregated into a module upon which other parts could draw in standard ways. Business organizations are often organized into modules for similar reasons.¹³

By contrast, a system is not decomposable and cannot take advantage of modularity if no boundaries for such modules can be drawn; if each element must in principle interact with every other, no lines of interaction can be ruled

12. See HERBERT A. SIMON, *THE SCIENCES OF THE ARTIFICIAL* 195-200 (2d ed. 1981).

13. See, e.g., 1 CARLISS Y. BALDWIN & KIM B. CLARK, *DESIGN RULES: THE POWER OF MODULARITY* (2000); *MANAGING IN THE MODULAR AGE: ARCHITECTURES, NETWORKS AND ORGANIZATIONS* (Raghu Garud et al. eds., 2003); Richard N. Langlois, *Modularity in Technology and Organization*, 49 J. ECON. BEHAV. & ORG. 19 (2002); Ron Sanchez & Joseph T. Mahoney, *Modularity, Flexibility, and Knowledge Management in Product and Organization Design*, 17 STRATEGIC MGMT. J. (SPECIAL ISSUE) 63 (Winter 1996); see also Erich Schanze, *Legalism, Economism, and Professional Attitudes Toward Institutional Design*, 149 J. INSTITUTIONAL & THEORETICAL ECON. 122, 127-38 (1993) (outlining and evaluating the strengths of lawyers' and economists' styles of identifying “institutional modules”). The “patches” of adaptive complex systems applied by J.B. Ruhl to the administrative state are much like the modules adopted here. See J.B. Ruhl, *The Fitness of Law: Using Complexity Theory To Describe the Evolution of Law and Society and Its Practical Meaning for Democracy*, 49 VAND. L. REV. 1407, 1469-74 (1996); see also A.C. Pritchard & Todd J. Zywicki, *Finding the Constitution: An Economic Analysis of Tradition's Role in Constitutional Interpretation*, 77 N.C. L. REV. 409, 455 & n.180 (1999) (identifying the degree of decentralization as one variable relevant to whether institutional structures will tend toward efficiency).

out. (In a well-modularized system, breaking a module into further modules leads to this problem.) In a modular system, interactions within modules can be intense without the need to foresee how given decisions or actions might affect the insides of other modules (beyond the implications for the spare interface between modules). Between modules, much information is hidden and therefore irrelevant, making decisions more manageable. It is this information-hiding that I take as a starting point for showing that exclusion can play a role in intellectual property.

Second, this Article begins to set exclusion in its proper place by developing and applying a theory of the factors that push away from exclusion, either toward a public domain on the one hand or toward more finely articulated use-based rights on the other. Whether or not exclusion is the essence of property, exclusion's central role in property follows from its indirectness. But this means that exclusive rights are both underinclusive and (especially) overinclusive, and when the stakes are high, resource conflicts call for governance rules—i.e., rules of proper use. Depending on the relative size of contracting costs and administrative costs, these more tailored rules should be supplied by contracting parties (e.g., covenants), courts (e.g., nuisance), or agencies (e.g., zoning and pollution controls). Nuisance law as a refinement to the basic regime of trespass is the paradigmatic case. I argue that certain aspects of intellectual property, such as fair use, are like the law of nuisance in attempting to refine and supplement the basic exclusionary regime when its simplicity and indirectness are inadequate to accommodate multiple uses cost-effectively. The Article traces a fundamental difference between copyright and patent to the greater cost-effectiveness of governance regimes in copyright, a feature that goes some way toward explaining copyright's more regulatory and less property-like character as compared to patent law.

Third, the law's reliance on exclusion and governance need not, and does not, remain static. Exclusion and governance are complementary strategies because focusing on things in the case of exclusion and on activities in the case of governance will be more or less cost-effective depending on the nature of the creative inputs and informational outputs that are involved. If so, we should expect some shifts of emphasis between the two strategies over time. Thus, as important areas of copyright law have emerged, various governance rules in the form of compulsory licenses have appeared.

Both fans and skeptics of strong intellectual property rights, however, tend to pose the question of the evolution of rights too narrowly. Both sides explicitly or implicitly make the property question turn on the Demsetz thesis: as a resource becomes more valuable and externalities become worse, we expect

property rights to emerge.¹⁴ Many, apparently including Harold Demsetz himself, assume that “more” property means more exclusion. But in many settings, greater delineation in the presence of greater conflict takes the form of refinement of the basic exclusion regime through fine-grained governance rules.¹⁵ What should we expect in the case of intellectual property? Pro-intellectual property theorists, on the one hand, assume that greater exclusion is appropriate because the appropriability problem is more important. Intellectual property skeptics, on the other hand, believe that we should have less exclusion because as information becomes more valuable, its nonrival aspect and the concomitant costs of exclusion come to dominate.

I argue that both views are incomplete and make the question of intellectual property rights insufficiently empirical. As mentioned, sometimes in intellectual property, high stakes seem to have led to greater reliance on governance at the margin, as in the case of copyright compulsory licenses. But one reason that information, especially information that is potentially patentable, is so valuable is that it is subject to multiple uses that interact with the uses of other inputs and information. If this interactivity becomes more important, then exclusion becomes both more and less costly at the same time. In forgoing the benefits of access (and use) by multiple parties, exclusion in such a setting becomes more costly. But in an interactive-use setting, the shortcut aspect of exclusion also becomes more valuable: delegating to rights-holders the coordination and development of these uses, alone or through contracting, can be easier to accomplish when authorities can treat the rights system like a modular “black box.” Which effect dominates is an empirical question, and pointing to the importance of incentives on the one hand or to the nonrivalness of information on the other does not provide an answer. In the absence of good information we must make empirical rough guesses. It is the search for this type of empirical information that should drive our search for “analogies” to the problem of rights in information. I suggest that the kinds of structures created within firms might shed some light on the circumstances in which various combinations of exclusion and governance make sense.

Part I begins with the theoretical world, which might be termed both Coasean and Hohfeldian, in which legal relations are perfectly tailored. To deal with the overwhelming costs of such a hypothetical system, entitlements tend to employ modularity through the exclusion strategy: information is partly blocked across the legal boundaries of assets, thereby making decision-making

14. See Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. (PAPERS & PROC.) 347 (1967).

15. See Henry E. Smith, *Exclusion Versus Governance: Two Strategies for Delineating Property Rights*, 31 J. LEGAL STUD. S453 (2002).

more manageable. In both the law of accession and intellectual property, exclusion partakes of modularity, making its simplicity and indirectness both a strength and a weakness.

Part II then sets forth a simple model of two strategies for delineating rights. It proposes that exclusion is a shortcut (over the full Hohfeldian world) that uses rough and simple signals to establish modular exclusion rights that only indirectly protect uses. Governance rules then refine the basic exclusion regime by capturing, at greater cost, the benefits of use by multiple parties. Several propositions about the evolution of property rights follow from this simple model, which can be tested on basic features of intellectual property regimes. This framework turns out to apply surprisingly well in intellectual property once we realize what functions exclusion does—and does not—serve in both property and intellectual property. Only empirical evidence can decide whether the benefits of exclusion outweigh the costs.

I then apply the framework to patent and copyright in Part III and show that some of the basic but puzzling differences between the two regimes can be explained in terms of information costs. Part IV highlights some dynamic implications of the model.

I. MODULARITY AND THE PROBLEM OF RIGHTS IN INFORMATION

All the potential interactions between pairs of individuals in society constitute a complex system. Direct specification of legal relations in a world where such delineation is costless would in principle make all of this information directly relevant, but in our world it would overwhelm all involved, including judges and duty-holders. If we think of the system of input contributors and information users as forming one large system, we can compare three methods of allocating resources (as well as methods in between). I focus on one aspect that has been underappreciated in the literature: how decomposable the system is and the extent to which modularity can help manage the complexity involved in allocating resources to developing, commercializing, and using information. The law of accession is a particularly dramatic example of modularity in the service of maintaining simple exclusion-based rights.

A. Intellectual Property and a Hohfeldian World of Unfair Competition

Intellectual property rights are one method of solving certain coordination problems—problems not unlike those solved by regular property and tort law. The major difference between the resources involved—that information is nonrival and other resources are rival—points to the costliness of intellectual

property rights but does not prove that they are less cost-effective than the alternatives (which include doing nothing).

Consider rights to exclude in property law. These are far from costless or ideal. Whether or not one takes the right to exclude as fundamental to property, it is useful to distinguish between the right to exclude and the interests in use that it indirectly protects.¹⁶ We do not recognize rights to exclude, and people do not seek them, based on some inherent good in excluding others.¹⁷ Exclusion, without more, denies possibilities of use by multiple parties (e.g., growing fruit trees and hunting), and nothing about exclusion requires owners to exclude other users. Instead, we recognize rights to exclude because people have an interest in use, and the right to exclude, based as it is on a simple on/off signal of violation by boundary crossing, is a very low-cost way to protect these interests.

Furthermore, society can protect these interests in uses without even knowing what these interests are, and in this sense rights to exclude contribute to the modularity of property. Rights to exclude allow use entitlements to be treated largely as Hohfeldian privileges. A privilege does not allow me to sue others for interference; it only means that I cannot be sued for exercising it.¹⁸ Owners may feel that their privileges to use are like “rights to use” because the right to exclude provides such robust protection, but the protection is very much simpler than if we had to separately delineate (even *ex post*) a list of affirmative rights to use resources.¹⁹ At the same time, the indirectness of exclusion rights means that property rights cause losses when exclusion, in conjunction with high transaction costs, precludes some use of positive value. (As we will see, a more extreme form of this “indirectness” characterizes intellectual property rights.) But it is the very simplicity and indirectness of the relationship between the mechanics of exclusion and the interests (in use) that exclusion serves that allow property to conserve on information costs and to achieve the high degree of modularity discussed below.

We could imagine a world in which property looked very different. If delineation were costless, we would not have this heavy reliance on broad exclusion rights in the law of property. Instead of delineating things, and recognizing owners’ rights to exclude others from those things, we would build everything from the ground up, based on interests in use and on the specific

16. See HARRIS, *supra* note 8, at 63-64; PENNER, *supra* note 8, at 68-74; Smith, *Exclusion and Property Rules*, *supra* note 5, at 972-73, 1011-12.

17. See PENNER, *supra* note 8, at 70-71.

18. See Hohfeld, *Some Fundamental Legal Conceptions*, *supra* note 2, at 36-44.

19. See Henry E. Smith, *Self-Help and the Nature of Property*, 1 J.L. ECON. & POL’Y 69, 78-79 (2005).

types of actions that either constitute uses or interfere with uses. We could specify in a grand tort- or contract-like scheme a list of all the actions (i.e., uses of resources) that each person is entitled to take or to veto.²⁰ Each legal relation (dealing with a narrowly defined type of use) between every pair of individuals would be drawn up in this gigantic list. We don't live in this hyperrealist, ultra-Hohfeldian world because the cost would far outstrip any benefit. Instead, Blackstonian exclusion rights are recognized and then modified when obviously necessary, as in the case of airplane overflights.²¹ More subtle modifications are supplied by the law directly (as in nuisance and zoning) or by contract (as in covenants, leases, etc.).

The modifications of property law shade off into torts. Thus, some of nuisance law is bright-line and reminiscent of trespass: violations turn on invasions and injunctions are available.²² At other times, nuisance law calls for balancing or at least a softening of the hard-edged exclusionary regime. Similarly, first possession can be recognized in the interest of establishing rights over things, but the law of first possession also regulates the competitive process of establishing such rights.²³ Indeed some of the cases traditionally

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20. Many (post-)realists and law-and-economics commentators share this vision. See Thomas W. Merrill & Henry E. Smith, *What Happened to Property in Law and Economics?*, 111 YALE L.J. 357 (2001).
21. See *supra* note 6. Airplane overflights do not count as trespasses, but a landowner can sue if she can show actual injury in a style reminiscent of nuisance. See, e.g., *Hinman v. Pac. Air Transp.*, 84 F.2d 755 (9th Cir. 1936). Much has been made of Justice Douglas's statement in *United States v. Causby*, 328 U.S. 256, 261 (1946), that the *ad coelum* "doctrine has no place in the modern world," but this is rhetorical excess: the *ad coelum* principle does apply to the lower reaches of airspace, and it may even apply in a weakened form (i.e., requiring the owner to be in actual possession) to airspace beyond that. At cruising altitudes the navigation servitude will win out one way or another, and there are multiple doctrinal routes to get there. See THOMAS W. MERRILL & HENRY E. SMITH, *PROPERTY: PRINCIPLES AND POLICIES* 13-15 (2007). Interestingly, analogies to airplane overflights, and to *Causby* in particular, have been invoked in the argument over whether to attenuate copyright in favor of the Google Print library project. Compare Lawrence Lessig, *Google Sued*, Lessig Blog, Sept. 22, 2005, <http://www.lessig.org/blog/archives/003140.shtml> (analogizing Google Print to airplane overflights), with James DeLong, *Google Print & the Airspace Analogy: Lessig's Counterfactual History*, IPCentral Weblog, Nov. 8, 2005, http://weblog.ipcentral.info/archives/2005/11/google_print_th.html (criticizing the aptness of the analogy). The controversy continues in Lawrence Lessig, *This Is Very Funny*, Lessig Blog, Nov. 9, 2005, <http://www.lessig.org/blog/archives/003202.shtml>, and James DeLong, *Wednesday Morning Fights: DeLong vs. Lessig*, IPCentral Weblog, Nov. 9, 2005, http://weblog.ipcentral.info/archives/2005/11/wednesday_morni_1.html.
22. See Smith, *Exclusion and Property Rules*, *supra* note 5, at 1005-07.
23. One way to view the difference between a first possession regime and the governance regimes protecting a common pool resource is that the former regulates the process of

thought to concern possession are really more about unfair competition. Thus, when someone scares off ducks from another's duck decoy, a tort may be found, even if the ducks were not yet in anyone's possession.²⁴ And if interference with the duck decoy by operating another duck decoy (or perhaps even by conventional hunting) is allowed, it becomes clear that the focus in this area of law is on the actions people take and their possible interferences, along with motivations such as productive business activity or spite. Unfair competition, like tort law generally, focuses its analysis on activities rather than on the "things" of property law.

Much of intellectual property has its origins in unfair competition. Indeed, even core areas like patent law originated in efforts to define the competitive process, originally in favor of guilds and other producers.²⁵ Trademark is a direct outgrowth from unfair competition. And expansive approaches to unfair competition such as that implicit in *International News Service v. Associated Press*²⁶ would be potential incubators of intellectual property rights. The Court in *International News* held that a competing wire service could not pick up news and immediately retransmit it while it still retained news value. On one reading, the case stands for a reap-what-you-sow or anti-free-riding principle. On a narrower reading, which is consistent with Justice Brandeis's dissent and which has more commonly prevailed, the holding is limited to hot news, or free-riding when information is time-sensitive.²⁷ If *International News* had been taken as doing more than establishing a quasi-property interest in hot news (in a manner fairly close to unfair competition), by making free-riding a general predicate for liability, it would have been a major step toward the creation of whole new classes of intellectual property rights.²⁸

establishing rights to stocks, while the latter regulate the acquisition of rights in flows. See Dean Lueck, *The Rule of First Possession and the Design of the Law*, 38 J.L. & ECON. 393 (1995).

24. See *Keeble v. Hickeringill*, (1707) 103 Eng. Rep. 1127 (Q.B.).
25. See Thomas B. Nachbar, *Monopoly, Mercantilism, and the Politics of Regulation*, 91 VA. L. REV. 1313 (2005) (arguing that *The Case of Monopolies*, (1602) 77 Eng. Rep. 1260 (K.B.), and the 1624 Statute of Monopolies, 21 Jac., c. 3, were the product of a political victory won by the parliamentary party and the guilds against various monarchs and their friends).
26. 248 U.S. 215 (1918).
27. See *id.* at 248 (Brandeis, J., dissenting); see, e.g., *Nat'l Basketball Ass'n v. Motorola, Inc.*, 105 F.3d 841 (2d Cir. 1997); *Cheney Bros. v. Doris Silk Corp.*, 35 F.2d 279 (2d Cir. 1929).
28. Some jurisdictions have expanded the misappropriation right of *International News* more than others. See Thomas W. Merrill & Henry E. Smith, *Optimal Standardization in the Law of Property: The Numerus Clausus Principle*, 110 YALE L.J. 1, 19-20 (2000); see also *Bd. of Trade v. Dow Jones & Co.*, 456 N.E.2d 84 (Ill. 1983); Douglas G. Baird, *Common Law Intellectual Property and the Legacy of International News Service v. Associated Press*, 50 U. CHI. L. REV. 411, 422 (1983) ("[C]ourts have not used it as a license to cut rough justice wherever they find competitive practices they do not like.").

To get from unfair competition to full-blown property rights, we need to define a thing to be the object of exclusive rights against the world. I have argued elsewhere that the “thing” here, whether it is culturally or legally defined, can be regarded as the byproduct of delineating exclusion rights.²⁹ If *A* has the right to exclude from Blackacre, the boundary and the column of space under the *ad coelum* rule help define the thing over which *A* exercises the gatekeeper right.³⁰ Nowhere is this clearer (and more controversial) than in intellectual property. “Invention space” and original expressions do not come pre-carved into things. That is, we are implicitly treating an invention as a thing when the interest in its use—the various activities—are described at a high level of generality not tied directly to the activity itself. Thus, if patent law protects the rights-holder from the unauthorized making, using, or selling of the invention, it is noteworthy that any use of the product or process described element-by-element in the claims is an infringement. Although there is some indeterminacy around the edges (especially with doctrines such as prosecution history estoppel and the doctrine of equivalents), the element-by-element approach partakes of the exclusion strategy.³¹ In copyright law, the treatment of expression as a thing occurs largely *ex post* in negotiation and litigation, but even there copyright does not arise until fixation in a tangible medium of expression.³² In the process of describing and claiming the invention, or in specifying protectable expression in litigation, a claimant implicitly defines a thing from which the rights-holder can exclude others.

Before turning to the costs and benefits of this type of delineation, it is worth pointing out the relationship of torts, such as unfair competition, to property law. The realists and their successors are property skeptics. Rather than regard property as a right to a thing good against the world (*in rem*), they favor the bundle-of-sticks approach to property.³³ The bundle-of-sticks picture follows Wesley Hohfeld in breaking down property rights into the smallest

29. See Smith, *Property and Property Rules*, *supra* note 5; Smith, *supra* note 19.

30. See *supra* notes 6, 21.

31. For the Supreme Court’s latest pronouncement on the subject and its adoption of the flexible bar, see *Festo Corp. v. Shoketsu Kinzoku Kogyo Kabushiki Co.*, 535 U.S. 722 (2002). See also R. Polk Wagner, *Reconsidering Estoppel: Patent Administration and the Failure of Festo*, 151 U. PA. L. REV. 159 (2002) (arguing that prosecution history estoppel is of wider significance than the Court realized).

32. 17 U.S.C. § 102(a) (2000).

33. See Merrill & Smith, *supra* note 20; see also J.E. Penner, *The “Bundle of Rights” Picture of Property*, 43 UCLA L. REV. 711, 724-31 (1996) (criticizing the bundle of rights picture as missing the key role of the right to exclude in property).

analyzable pieces³⁴ and then asking how these can be mixed and matched to achieve social objectives. There is no baseline of entitlements – much less rights to exclude – that would form the definitional core for property. By emphasizing that property rights hold between persons and only incidentally involve things, the realists were drawn to a view of property resembling unfair competition law. Direct regulation of activities – in this case, use of resources – would take the place of (to them) mystical and unjustified rights to exclude.³⁵ Accordingly, the realists seem to have taken unfair competition, and its direct reference to activities, as a model.³⁶ Whether the label “property” was attached to any of these clusters of rights, privileges, powers, and immunities was arbitrary.³⁷ When it came to property, the realists were nominalists.

Interestingly, critiques of intellectual property share a great deal of the realists’ motivations and proposed solutions. Skeptics of intellectual property rights criticize unjustified formalistic use of property metaphors and doctrines and advocate fewer exclusive rights and greater tailoring of the legal regime around valued uses.³⁸ On the skeptical view, what intellectual property rights

34. These legal relations may be infinitely divisible, but Hohfeld was interested in the smallest pieces that retained certain characteristics, and the realists would in pragmatic fashion stop dividing when there was no longer any benefit to be gained. See Joseph William Singer, *The Legal Rights Debate in Analytical Jurisprudence from Bentham to Hohfeld*, 1982 WIS. L. REV. 975, 992.

35. See Felix S. Cohen, *Transcendental Nonsense and the Functional Approach*, 35 COLUM. L. REV. 809, 815-17 (1935).

36. See *id.* at 814-17 (arguing that unfair competition law creates wealth and property, not necessarily to the benefit of society, and that the “thingification” of property serves only to mystify and obscure the process).

37. This view has gained a wide currency. See, e.g., A.L.C. [Arthur Linton Corbin], *Taxation of Seats on the Stock Exchange*, 31 YALE L.J. 429, 429 (1922) (“Our concept of property has shifted ‘[P]roperty’ has ceased to describe any *res*, or object of sense, at all, and has become merely a bundle of legal relations—rights, powers, privileges, immunities.”); Thomas C. Grey, *The Disintegration of Property*, in NOMOS XXII: PROPERTY 69 (J. Roland Pennock & John W. Chapman eds., 1980); Edward L. Rubin, *Due Process and the Administrative State*, 72 CAL. L. REV. 1044, 1086 (1984) (“[P]roperty is simply a label for whatever ‘bundle of sticks’ the individual has been granted.”); Joan Williams, *The Rhetoric of Property*, 83 IOWA L. REV. 277, 297 (1998) (“Labeling something as property does not predetermine what rights an owner does or does not have in it.”).

38. See, e.g., LAWRENCE LESSIG, *THE FUTURE OF IDEAS: THE FATE OF THE COMMONS IN A CONNECTED WORLD* 161 (2001) (contending that the process of enclosure, in which media and software companies propertize information, is stifling innovation in the new economy); SIVA VAIDHYANATHAN, *COPYRIGHTS AND COPYWRONGS: THE RISE OF INTELLECTUAL PROPERTY AND HOW IT THREATENS CREATIVITY* (2001); 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, 386-412 (1999) (arguing against expanding copyright at the expense of the public domain); James Boyle, *The Second Enclosure Movement and the Construction of the Public*

remain would be closer to those defined in areas like unfair competition than to the more property-like intellectual property rights we have today.

We are left with a range of approaches from the more tort-like to the more property-like. None of them is costless. The exclusion or property-like approach entails the costs of forgone use mentioned above as well as the costs of boundary maintenance and enforcement. But these are by no means restricted to intellectual property. For tangible resources, fences and locks consume resources. Sometimes rights are established by consuming some of the very resource to be protected (as in the case of dehorning rhinos, which, despite making them less appealing in the wild, decreases their appeal even more to otherwise hard-to-deter poachers).³⁹ In a world of no property violations, all of this protective activity would of course be wasteful.

At the same time, fine-grained tort-like approaches can in theory allow for uses that would be precluded by a combination of property rights and high transaction costs. In regular property law, this failure is the motivation for qualifying property rights by reducing their scope (as with airplane overflights) or lowering their protection to liability rules (as in some cases of necessity⁴⁰). Under a liability rule, a would-be taker or user can violate the entitlement and pay officially determined damages, as opposed to facing injunctions or punitive damages under a property rule that protects an owner's right to insist on a voluntary transaction or no transaction at all.⁴¹ But not all such qualifications

Domain, 66 LAW & CONTEMP. PROBS., Winter/Spring 2003, at 33 [hereinafter Boyle, *Second Enclosure*] (arguing against increased propertization of intellectual property law at the expense of the public domain); Jessica Litman, *Breakfast with Batman: The Public Interest in the Advertising Age*, 108 YALE L.J. 1717, 1725 (1999) (lamenting the inexorable pressure to treat things of value as property); Tom G. Palmer, *Are Patents and Copyrights Morally Justified? The Philosophy of Property Rights and Ideal Objects*, 13 HARV. J.L. & PUB. POL'Y 817, 855-65 (1990) (arguing for a private property system that does not recognize copyrights or patents); Mark A. Lemley, *Romantic Authorship and the Rhetoric of Property*, 75 TEX. L. REV. 873, 895-904 (1997) (reviewing JAMES BOYLE, *SHAMANS, SOFTWARE, AND SPLEENS: LAW AND THE CONSTRUCTION OF THE INFORMATION SOCIETY* (1996) [hereinafter BOYLE, *SHAMANS*]) (criticizing the trend of propertization of intellectual property law, including the coinage of the phrase "intellectual property"); see also BOYLE, *SHAMANS*, *supra* (criticizing some expansions of intellectual property); cf. Kitch, *supra* note 4, at 275 (describing previous commentators' suspicion of property rights in information as stemming in part from the fact that information can be used without limit and that intellectual property rights, instead of solving a problem of scarcity, actually create an artificial scarcity).

39. See Douglas W. Allen, *The Rhino's Horn: Incomplete Property Rights and the Optimal Value of an Asset*, 31 J. LEGAL STUD. S339 (2002); Smith, *supra* note 15, at S464-67, S478-86.
40. See, e.g., *Vincent v. Lake Erie Transp. Co.*, 124 N.W. 221 (Minn. 1910); see also W. PAGE KEETON ET AL., *PROSSER AND KEETON ON THE LAW OF TORTS* § 24, at 145-48 (5th ed. 1984).
41. See Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972).

aimed at capturing the additional benefits of multiple use will be cost-justified. Tailoring entails higher administrative costs and higher processing costs for duty-holders.

Where does this leave intellectual property rights? Clearly they do not serve to prevent overuse by consumers of information; a nonrival resource cannot be overused. But the resources used to develop and commercialize the information *are* rival. They cannot be used by more than one person and are often nonrenewable. The question then becomes which regime, if any, to choose.⁴² At one end of the spectrum are open source regimes, under which exclusion rights are used to promote free access.⁴³ Somewhat more exclusionary in effect are tailored use rights—reminiscent of the tort of unfair competition—that wring out more benefits of use by multiple parties but at the cost of delineating in detail. Or one might have broad-brush exclusion rights, which may preclude some beneficial use in the presence of high transaction costs but which are much simpler to define. I argue below that exclusion employs modularity and information-hiding in solving the problem of appropriating the returns from inputs to the process of inventing and commercializing valuable information. One could always avoid enforcement costs by adopting open access, and one could always prevent the waste of forgone use by narrowly tailoring whatever rights are provided for. The question is whether any degree of exclusion is cost-effective and, if so, which is best: the nature of the problem is allocating returns to contributions of inputs at the cost of enforcement efforts and the precluded use of information.

The information-cost theory allows us to draw out the fundamental similarity among property, intellectual property, and organizations. Indeed,

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42. Sometimes no property rights will be called for, except to allow the unorganized public to use a resource, see Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711 (1986), or, in more specialized contexts of modular tasks (such as those involved in open source software), to produce a resource, see, e.g., Yochai Benkler, *Coase's Penguin, or, Linux and The Nature of the Firm*, 112 YALE L.J. 369 (2002); Greg R. Vetter, *The Collaborative Integrity of Open-Source Software*, 2004 UTAH L. REV. 563.
43. Open source regimes, like common and public property regimes, use exclusion rules to enforce openness. See, e.g., Niva Elkin-Koren, *What Contracts Cannot Do: The Limits of Private Ordering in Facilitating a Creative Commons*, 74 FORDHAM L. REV. 375, 390-92, 397-407 (2005); Josh Lerner & Jean Tirole, *The Scope of Open Source Licensing*, 21 J.L. ECON. & ORG. 20 (2005); Alan MacCormack et al., *Exploring the Structure of Complex Software Designs: An Empirical Study of Open Source and Proprietary Code* (Harvard Bus. Sch., Working Paper No. 05-016, 2004), available at <http://www.people.hbs.edu/cbaldwin/DR2/MRBDesignStructure17thSep1.pdf>. In this way, they are also like certain forms of producer-owned, consumer-owned, and unowned business organizations such as various cooperatives and nonprofits. See HENRY HANSMANN, *THE OWNERSHIP OF ENTERPRISE* (2000).

organizations can be thought of as “entity” property.⁴⁴ Organizations are modular, in that interactions may be intense within the organization but this information is largely hidden to those on the outside. Interface conditions specify what information is relevant to the outside. For example, Henry Hansmann and Reinier Kraakman’s theory of asset partitioning⁴⁵ suggests that the essential role of organizational law is to make information irrelevant: information about the firm owners’ credit situations is irrelevant to the firm’s creditors, and in corporations, information about the firm’s creditors is of limited relevance to the creditors of the firm owners. Information is blocked across modules, and this allows economization on information and the substitution of structures without massive ripple effects.

Among economists, the structure of organizations has been studied in detail with a view to explaining why we have organizations in addition to market contracting.⁴⁶ Some theorists locate the basic reason for having both organizations and markets in a certain type of information cost—the problem of metering.⁴⁷ Consider outputs like grain or cars. When outputs are relatively easy to measure, they will be traded in markets. But when individual inputs are easier to measure than individual outputs, transactions are likely to occur within a firm. This is particularly true when the organization is engaged in *team production*, in which the contributions of the inputs to make the output are complex and synergistic rather than additive. If two people are moving a piano (a relatively simple example of team production), the effort of each increases the productivity of the other, and it is hard to attribute portions of the output to each input solely by observing the total output.⁴⁸

Why is the firm like property? Because in the “nexus of contracts” that is the firm,⁴⁹ these contracts are not all specified one by one as if they were freestanding, but rather make reference to firm boundaries. In particular, the delineation of the residual claim can be economized on because it relies on the

44. See MERRILL & SMITH, *supra* note 21, at 684-85.

45. See Henry Hansmann & Reinier Kraakman, *The Essential Role of Organizational Law*, 110 YALE L.J. 387 (2000).

46. The starting point for this literature is R.H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

47. See Armen A. Alchian & Harold Demsetz, *Production, Information Costs, and Economic Organization*, 62 AM. ECON. REV. 777, 779-83 (1972).

48. *Id.* at 779.

49. Michael C. Jensen & William H. Meckling, *The Theory of the Firm: Managerial Behavior, Agency Costs, and Ownership Structure*, 3 J. FIN. ECON. 305, 310-11 (1976).

“outer boundary” of the firm; its value is everything owned by the firm after all lesser interests (separately delineated) have been paid off.⁵⁰

But if the reason for firms is the cost of metering inputs versus outputs, the cost of metering each will vary depending on the proxies used to measure them.⁵¹ Thus, in a firm one can pay by the hour or by certain subtasks. Coarse measures of inputs are cheaper and may be more cost-effective than more precise measures even if there is some evasion. For example, if a sales force is on a commission system, it may be cheapest to assign exclusive territories in order to monitor output (roughly) even though it makes no difference to the overall enterprise who makes any particular sale; monitoring territories may be cheaper than tracking individual sales efforts and other inputs and activities.⁵² Another problem is that if the task is multidimensional, incentives that are too high-powered can lead to inefficient substitution away from relatively unrewarded margins.⁵³ For example, if teachers are expected to teach facts and (harder-to-measure) analytical techniques, then incentives based on test scores that reflect the former can cause a substitution away from effort at the latter, hard-to-measure margin, leading to suboptimal effort.⁵⁴ One solution, then, is to use coarser performance measures.

The same is true on the output side, where intellectual property is most like property. Consider the broader accession principle, which addresses the problem of carving up the external world into the things relevant to property law. We could treat each input as the unit for property, but this is difficult when the inputs are not additive—just as in team production. In fact, we could say that property solves a problem like team production. If an asset can be regarded as a collection of attributes (for example, the texture, color, and taste of an apple), sometimes it is easier to give coarse rights over some collection of attributes rather than to measure each attribute separately or even to monitor

50. See Alchian & Demsetz, *supra* note 47, at 781-83; see also Yoram Barzel, *The Entrepreneur's Reward for Self-Policing*, 25 *ECON. INQUIRY* 103 (1987) (presenting a theory of residual claim based on information costs, under which the entrepreneur as the provider of the most difficult-to-measure input receives the residual claim).

51. See Yoram Barzel, *Measurement Cost and the Organization of Markets*, 25 *J.L. & ECON.* 27, 28 & n.3 (1982).

52. See, e.g., Richard A. Posner, *Antitrust Policy and the Supreme Court: An Analysis of the Restricted Distribution, Horizontal Merger and Potential Competition Decisions*, 75 *COLUM. L. REV.* 282, 292-93 (1975); Richard A. Posner, *The Next Step in the Antitrust Treatment of Restricted Distribution: Per Se Legality*, 48 *U. CHI. L. REV.* 6, 6 (1981).

53. See Bengt Holmstrom & Paul Milgrom, *Multitask Principal-Agent Analyses: Incentive Contracts, Asset Ownership, and Job Design*, 7 *J.L. ECON. & ORG. (SPECIAL ISSUE)* 24 (1991).

54. *Id.* at 25.

the actions of multiple actors in increasing value from the asset.⁵⁵ Treating a collection of attributes as a lumpy asset is more likely when the attributes are complementary and the actions of those with access to it affect each other (e.g., *A*'s action increases or decreases the productivity of *B*'s action, just as in team production). In the case of information, then, intellectual property rights allow for a middle-level decentralization: within the module, one can have an owner or a collection of owners, but this is largely irrelevant outside the module where it interacts, possibly in a market. It is an empirical question when this middle-level decentralization is the most cost-effective method of attributing returns to inputs in the team-production-like problem of developing information.⁵⁶

Team production and the complementarity of resource attributes (and the actions people take to use or enhance them) present a complex problem. One method used in the law and practice of both organizations and, I argue, property is to employ modular structures,⁵⁷ a device to which I now turn.

B. Managing Complex Systems with Modularity

Modularity is a method for dealing with complexity in systems. A complex system is one characterized by numerous internal interactions or interdependencies, or, in the words of Herbert Simon, who pioneered the theory of bounded rationality,

one made up of a large number of parts that interact in a nonsimple way. In such systems the whole is more than the sum of the parts, not in an ultimate, metaphysical sense but in the important pragmatic sense that, given the properties of the parts and the laws of their interaction, it is not a trivial matter to infer the properties of the whole.⁵⁸

Modularity involves information-hiding, which allows encapsulated components to interconnect only in specified ways. This allows work to go on in parallel and facilitates certain kinds of innovation and evolution for a simple

55. See Barzel, *supra* note 51, at 30-32, 37-39.

56. If the benefits stemming from nonrivalness are assumed to dominate, then "full" decentralization through the public domain, see Brett N. Frischmann & Mark A. Lemley, *Spillovers*, 107 COLUM. L. REV. 257 (2007), or high centralization through narrowly tailored rewards, see, e.g., Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 123-24 (2003); Steven Shavell & Tanguy van Ypersele, *Rewards Versus Intellectual Property Rights*, 44 J.L. & ECON. 525, 534-45 (2001), might well be superior.

57. See sources cited *supra* note 13.

58. SIMON, *supra* note 12, at 195.

reason: adjustment can happen within modules without causing major ripple effects. Human minds can understand a modular system as a whole better than a less modular system, and modularization can facilitate specialization in that work on subparts of the system can proceed in partial ignorance of what is going on in other modules. Only the most radical changes require a remodularization. Simon's parable of the watchmakers illustrates the benefits of modularity:

There once were two watchmakers, named Hora and Tempus, who manufactured very fine watches. Both of them were highly regarded, and the phones in their workshops rang frequently—new customers were constantly calling them. However, Hora prospered, while Tempus became poorer and poorer and finally lost his shop. What was the reason?

The watches the men made consisted of about 1000 parts each. Tempus had so constructed his that if he had one partly assembled and had to put it down—to answer the phone, say—it immediately fell to pieces and had to be reassembled from the elements. The better the customers liked his watches, the more they phoned him and the more difficult it became for him to find enough uninterrupted time to finish a watch.

The watches that Hora made were no less complex than those of Tempus. But he had designed them so that he could put together subassemblies of about ten elements each. Ten of these subassemblies, again, could be put together into a larger subassembly; and a system of ten of the latter subassemblies constituted the whole watch. Hence, when Hora had to put down a partly assembled watch to answer the phone, he lost only a small part of his work, and he assembled his watches in only a fraction of the man-hours it took Tempus.⁵⁹

Simon demonstrated that if the probability of being interrupted while a part is being added to an incomplete assembly is p , then each interruption costs on average the time to assemble $1/p$ parts, and the probability that Tempus will finish is $(1 - p)^{1000}$, which is very small for $p > .001$.⁶⁰ If p is about .01, then Tempus will take on average 4000 times as long as Hora.⁶¹ The modular structure of Hora's watches insulates many parts of the watch from the damage of an interruption.

59. *Id.* at 200.

60. *Id.* at 201.

61. *Id.* at 201-02.

The benefits of modularity are familiar from the development of computer software and hardware. One early experiment with a nonmodular process provided a crucial turning point in software development; on one famous project, within six weeks the central log grew to be five feet thick and continued growing at 150 interfiled pages a day.⁶² More recently, object-oriented programming has taken major advantage of modularity.⁶³ Organizational theorists are building on the role of modularity in design teams in the computer industry to explore the benefits of modularity in business organizations more generally.⁶⁴

To this one might add that one of the reasons that organizational law provides for modularity is asset partitioning. Off-the-rack organizational law delimits the interactions between assets so that creditors of the owners need not monitor the business, and business creditors need not monitor the owners' credit dealings.⁶⁵ This property-like aspect of organizational law is one of its most modular features, which is to be expected if property law itself is highly modular. To reiterate, in property, officials need not know much about the individual uses that owners plan and undertake, and duty-holders likewise need not know much about the owner and her uses of the asset—they mostly need to know how to keep off the owner's property. In another work, I have analogized contract drafting to modular computer programming.⁶⁶ Contractual boilerplate in particular is highly modular: precisely because its interdependencies with other parts of the contract and the business environment are minimal and stereotyped, boilerplate is easier for sophisticated parties to use, and to reuse.

The problem of organizing research and development and its commercialization can also benefit from modular structures. Sometimes the structure of a problem will come pre-modularized, thereby obviating the need for elaborate organizational structures or property rights. Tasks like proofreading, checking certain NASA data, or components of some software

62. FREDERICK P. BROOKS, JR., *THE MYTHICAL MAN-MONTH: ESSAYS ON SOFTWARE ENGINEERING* 77 (1975).

63. See, e.g., GRADY BOOCH, *OBJECT-ORIENTED ANALYSIS AND DESIGN: WITH APPLICATIONS* 58-59 (2d ed. 1994); EDWARD YOURDON, *OBJECT-ORIENTED SYSTEMS DESIGN: AN INTEGRATED APPROACH* (1994).

64. See sources cited *supra* note 13.

65. Hansmann & Kraakman, *supra* note 45, at 424. For an application of asset partitioning to the organizational aspect of patent law, see Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473 (2005).

66. See Henry E. Smith, *Modularity in Contracts: Boilerplate and Information Flow*, 104 MICH. L. REV. 1175, 1177-78 (2006).

are easily modularized at a very fine grain.⁶⁷ Thus, in some cases, problems are structured in such a way that people can work collaboratively with minimal coordination efforts.⁶⁸ Exclusion works best when legal structures can break a system into mid-sized modules: within the module, interaction may be coordinated by an owner (as with private property and corporations) or decentralized among many owners (as with common property and partnerships), but the information about these interactions is hidden from the outside. If a collection of attributes is highly complementary and subject to interactive and uncertain use, this is a reason to segregate them into a property module rather than to create smaller modules for each attribute, i.e., to move further toward the Hohfeldian extreme. The question of how lumpy, or exclusion-like, the modules should be is an empirical one—as is the question of how many problems are like the subset of software that is suited to open source development. Despite the open source option, many situations in which market contracting or the coordination of a firm is required seem to remain.

Like other property rights, intellectual property rights provide simple ground rules as well as a platform for further contracting and for forming organizations.⁶⁹ Officials and duty-holders need not know much unless they choose to contract with the rights-holder. Consider how much information is hidden behind the boundaries of an intellectual property right. As with other assets, someone must decide which combination of uses of the rival inputs to develop the information is best. For a set of n uses taken r at a time, the number of combinations is $n!/((n-r)!r!)$, but we may not know ex ante which uses are compatible with which. If some uses are compatible only in certain sequences (in the case of land, this might be grain-growing and then hunting, but not vice versa), then the number of permutations (ordered combinations) is the even greater $n!/(n-r)!$. With intellectual property rights that delegate to owners the development of information about uses and the choice among them, outsiders (e.g., officials and duty-holders) need not know the exact makeup of the set; all they need to know are the “interface” conditions of when a violation of the right has occurred (as by crossing a boundary or practicing a

67. See Benkler, *supra* note 42, at 433-36.

68. See sources cited *supra* note 42; see also Yochai Benkler, *Sharing Nicely: On Shareable Goods and the Emergence of Sharing as a Modality of Economic Production*, 114 YALE L.J. 273 (2004) (setting forth a theory of peer production, and asserting its wide applicability in the economy).

69. One of the roles of property rights is to serve as a platform for further contracting. For an exploration of this in connection with precontractual liability and enforcement flexibility, see Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477 (2005).

patented invention).⁷⁰ Through use or subsequent transfer, the owner enjoys the fruits or the losses that flow from these complex choices.

Much of property law can be thought of as specifying the interface conditions between property modules. Thus, the exclusionary strategy sets up basic modules and hides a great deal of information about uses and features of the owner, but we do make exceptions for overflights, and nuisance law does balance some high-stakes use conflicts (for example, those involving noise and odors). These refinements add to the interface and solve problems at the price of reduced modularity. In addition, sometimes use on multiple scales becomes important enough to allow for overlapping modules containing some of the same attributes. A semicommons exists where private and common property regimes overlap and physically interact; property law must then tolerate or address the strategic behavior made possible by the enhanced access from the overlap.⁷¹ In the medieval open fields, the access afforded by throwing open the entire set of privately owned strips as a grazing common during fallow periods and right after harvest allowed for strategic behavior, such as enriching one's own parcel with manure or trashing others' parcels with excessive trampling by sheep.⁷² Because access to information is more difficult to prevent and impeding access to nonrival information is presumptively undesirable, this type of overlap is even more likely in intellectual property.⁷³ Doctrines like fair use in copyright can be regarded as overlapping between private rights and the public domain, and also as a very complicated interface between the two.

The interface conditions provided by intellectual property law make the complexity entailed by this multiple use easier to manage. Those who in a world of zero transaction costs might contract with commercializing "input" providers can do so while focusing their attention on low-cost, narrow, and indirect proxies instead. For example, someone who uses labor and lab space to make an invention more attractive to consumers or to producers of

70. For the role of delegation to owners in an information-cost theory of property, see, for example, Smith, *Exclusion and Property Rules*, *supra* note 5, at 1021-45.

71. See Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131, 131-32, 138-44 (2000).

72. See *id.* at 134-38, 144-54.

73. Like tangible property rights, intellectual property rights are not absolute. See Michael A. Carrier, *Cabining Intellectual Property Through a Property Paradigm*, 54 DUKE L.J. 1, 4 (2004). Multiple overlapping regimes can sometimes fill in the edges. See, e.g., Robert A. Heverly, *The Information Semicommons*, 18 BERKELEY TECH. L.J. 1127, 1164-83 (2003); Peter K. Yu, *Intellectual Property and the Information Ecosystem*, 2005 MICH. ST. L. REV. 1, 11-12; see also Ellen P. Goodman, *Spectrum Rights in the Telecosm To Come*, 41 SAN DIEGO L. REV. 269, 379-403 (2004); Henry E. Smith, *Governing the Tele-Semicommons*, 22 YALE J. ON REG. 289 (2005) (applying the semicommons theory to problems in telecommunications).

downstream products need only focus on her contribution and on the claims of others (supplemented by whatever contractual license terms are considered worthwhile), and the owners of the claims can likewise attend only to a subset of the information that the input owner's property claims cover (supplemented by license terms). This is the asset partitioning advantage of intellectual property rights.⁷⁴ Asset partitioning is the property-like aspect of organizational law, and like property, it contributes to modularity.

C. *Rights in Information Through the Lens of Accession Law*

The wider problem of allocating or appropriating returns from inputs to innovation and commercialization (as well as from information-related outputs) has an analog in the world of regular property—the law of accession.⁷⁵ The law of accession deals with situations in which one person mixes her labor or other inputs with someone else's property. Generally, innocent improvers can purchase the owner's interest in the improved property (i.e., the owner's entitlement protection drops from a property rule to a liability rule), but if the owner's property is more valuable than the improvement, the improver can demand payment for the added value but cannot keep the improved property. Wendy Gordon has argued that giving inventors and other creators of information a right to compensation is consistent with the common law of restitution.⁷⁶

In this Article, I argue that the form such compensation takes (if any at all) has some similarity to the solutions offered by the law of accession. As discussed earlier, rights to exclude derive their characteristic advantages and drawbacks from their simplicity and indirectness. The law of accession is somewhat extreme in that it sometimes takes title away from an input owner and gives an improver the right to exclude. Accession law employs this unusual solution in part to avoid the valuation problems of more direct approaches to compensating improvers for their inputs. In a sense, intellectual property, with all the familiar problems of potential underuse of a nonrival resource, makes a

74. Paul Heald has developed the similarity between patent law and the asset-partitioning function of organizational law. See Heald, *supra* note 65.

75. The law of accession is closely related to the law of possession. See 2 WILLIAM BLACKSTONE, COMMENTARIES *404 (“The doctrine of property arising from *accession* is also grounded on the right of occupancy.”). Richard Epstein invoked the law of accession in his discussion of Lockean theories of first possession. See Richard A. Epstein, *Possession as the Root of Title*, 13 GA. L. REV. 1221, 1227 (1979).

76. See Wendy J. Gordon, *On Owning Information: Intellectual Property and the Restitutory Impulse*, 78 VA. L. REV. 149 (1992).

similar sacrifice to achieve the simplicity, indirectness, and (I argue) modularity that property law—and the law of accession in particular—achieves through transfers of ownership to mistaken improvers.

Before turning to the details of accession, it is worth emphasizing that the analogy to accession highlights the forms that intellectual property might take. Usually, the award of intellectual property rights is taken to parallel the law of first possession, and the analogy is used, or misused, in order to show whether it is a good idea to have intellectual property rights and, if so, how people should be allowed to claim them. Implicit in such an analogy is the idea that there is a commons—or even an open-access resource—of which private parties might claim pieces. Accession is related to first possession in that, in many contexts, it too governs acquisition, original and otherwise. The broader principle (as opposed to the doctrine) of accession is concerned with the scope of claims in general and is implicit in discussions of first possession, even those like Locke's that seem to shift the focus away from things and onto the labor that one mixes with things in the commons.⁷⁷ Thus, Robert Nozick's famous objection to Locke's labor-mixing theory of private property—that on Locke's theory one might gain ownership of the sea by pouring a can of tomato juice into it⁷⁸—actually highlights the fact that Locke implicitly adopted a notion of accession to decide which instances of labor (and other inputs) would give rights over some larger thing in the commons. Likewise Richard Epstein's puzzle, that Lockean theory does not tell us whether the laborer should get ownership of the improved item from the commons or should instead get some kind of lien,⁷⁹ also points to the need for an accession theory. Indeed, Locke's answer is, as we will see, exactly one of those offered by the law of accession—that ownership is given to the improving laborer when the “labour makes the far greatest part of the value of [the asset].”⁸⁰

The accession analogy is offered here for two reasons. First, any discussion of the merits and demerits of intellectual property must come to grips with the public domain. In accession law, there is a specific identified private owner on the other side of the interaction. Likewise, I treat the public as having rights,

77. See JOHN LOCKE, *The Second Treatise of Government*, in TWO TREATISES OF GOVERNMENT 265, 287-302 (Peter Laslett ed., Cambridge Univ. Press 1988) (1690).

78. ROBERT NOZICK, ANARCHY, STATE AND UTOPIA 174-75 (1974).

79. Epstein, *supra* note 75, at 1222-23.

80. LOCKE, *supra* note 77, at 297 (emphasis omitted). For discussions of the role of accession in Locke's theory, see Brian R. Callanan, Understanding Locke Through the Lens of Accession Law (May 1, 2006) (unpublished manuscript, on file with author). On the “enough and as good” proviso in the context of intellectual property, see, for example, Wendy J. Gordon, *A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 YALE L.J. 1533, 1565-66 (1993).

not mere privileges, in information and opportunities to discover information lying in the public domain.⁸¹ It is true that the public is a diffuse “owner,” and for some purposes this is critical: we have every reason to be cautious about public-to-private transfers of resources with strong network effects, just as with the public trust doctrine in regular property.⁸² Thus, in adopting accession for present purposes, I am assuming strong public rights—rights that might require protection from the expansion of private rights through rent-seeking.

Second, accession is more apt than first possession as a source for analogy because accession directly addresses the question of the scope and contours of rights. First possession does, as just argued, rest implicitly on some notion of accession, and it is accession that is doing the work in deciding what type of rights to grant, as opposed to whether they are justified in the first place.⁸³ Nevertheless, if information costs and the analogy to accession can point to advantages that exclusion rights possess, this result has some relevance to the justification of intellectual property. Intellectual property rights are only justified if any of the possible modes—liens with damages or property rights and injunctions—is better than doing nothing to promote appropriation by developers of information. To the extent that exclusion rights are more cost-effective than usually thought, they become more plausible candidates. Further, the conventional wisdom that the nonrival aspect of information makes intellectual property’s exclusion rights inherently suspect or undesirable appears too hasty. Such arguments look only at the costs of exclusion rights and tend to overlook their advantages as devices for allowing those who develop information to appropriate the returns from their *rival* inputs of time, equipment, and the like.

81. For a recent argument that concerns over the public domain can be expressed with the tools of property, see Hanoch Dagan, *Property and the Public Domain*, 18 YALE J.L. & HUMAN. (SPECIAL ISSUE) 84 (2006).

82. Suspicion of political failure and capture in public-to-private transfers is characteristic of a wide variety of approaches to the public trust. See, e.g., Richard A. Epstein, *The Public Trust Doctrine*, 7 CATO J. 411, 422-26 (1987); Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 491-556 (1970); see also Joseph D. Kearney & Thomas W. Merrill, *The Origins of the American Public Trust Doctrine: What Really Happened in Illinois Central*, 71 U. CHI. L. REV. 799, 805-11 (2004) (discussing the common capture theory element of the theories of Epstein and Sax); Carol M. Rose, *Joseph Sax and the Idea of the Public Trust*, 25 ECOLOGY L.Q. 351, 357-58 (1998) (discussing capture).

83. Interestingly, Blackstone considered accession to be a type of occupancy. See 2 BLACKSTONE, *supra* note 75, at *404 (“The doctrine of property arising from *accession* is also grounded on the right of occupancy.”).

Accession law addresses the situation in which someone adds her labor (and possibly other inputs) to property owned by another. In such situations we need to know who will get title to the combined asset and whether the one who does not get title will receive monetary compensation for her input. Three factors may be considered to decide the title question.⁸⁴ Under the physical transformation test, if the improver has so transformed the object physically that retrieving or tracing the original object is difficult, the improver will gain title but will have to compensate the owner of the transformed thing. For example, making wine out of another's grapes, oil from olives, or bread from wheat will cause the title to go to the "new operator," to use Blackstone's phrase.⁸⁵ In cases of lesser transformations, such as turning wood or metal into utensils, the owner of the worked-upon material can keep the thing⁸⁶ but may have to compensate the improver for her labor and other inputs (but perhaps not if the improver acted in bad faith).

Similarly, under the disparity-of-value test, if the ratio of the value of the labor (and other inputs of the improver) to the value of the owner's input—or, in another formulation, the value of the improved thing relative to the unimproved thing—is high enough, then the improver keeps the object subject to a claim for damages to compensate the original owner. If the ratio is not so high (especially if the improver's contribution to final value is less than 50%), the original owner keeps the thing and may have to compensate a good-faith improver. In *Wetherbee v. Green*, for example, George Wetherbee mistakenly cut trees worth \$25 on another's land and made them into barrel hoops. The resulting hoops were worth \$700, for a ratio of 28 to 1.⁸⁷ The court held that Wetherbee was entitled to offer testimony that he cut the timber in good faith and that if he proved good faith, the plaintiffs could only sue him for damages because of the transformation of the timber.⁸⁸

Finally, for some courts and commentators, the improver's bad faith is disqualifying: the owner of the acted-upon input will keep the resulting asset and the improver will get nothing, on a punitive theory that encourages intermeddlers not to bypass the markets for improving services and for inputs.

84. Roman law was quite similar to the common law on this point. See BARRY NICHOLAS, AN INTRODUCTION TO ROMAN LAW 133-38 (3d ed. 1962).

85. 2 BLACKSTONE, *supra* note 75, at *404.

86. *Id.* at *405.

87. 22 Mich. 311, 312 (1871).

88. See *id.* at 320. Six years later, in *Isle Royale Mining Co. v. Hertin*, 37 Mich. 332 (1877), then-Chief Justice Cooley penned another opinion in a similar case of mistaken tree-cutting, in which the trees had been cut but not otherwise transformed, for a before-versus-after value ratio of 1.875 to 1. The court denied the claim for restitution.

The law of accession promotes a high degree of modularity. There are two stages to accession: the court determines who gets the entitlement and performs the minimal valuation to compensate the other party. The end result is that the law seeks to give title either to the improver or to the owner of the acted-upon input and avoids making them co-owners. One or the other of them will be delegated the choice of uses (rather than the court's undertaking the evaluation of uses), and the owner will not have to negotiate with a nonconsensual partner. Further, in the compensation question, both the transformation test and the disparity-of-value test allow the court to concentrate on valuing the lesser contribution, which perhaps is thought to be the one that can be valued more easily and at lower error cost. For the disparity-of-value test, the value of the overall object need only be established in a rough way.

One of the goals in accession law more generally is to furnish defaults for what counts as a thing subject to ownership. If the association between two things is great enough, it makes sense to put them on the same side of a property boundary. Otherwise, there are likely to be interdependencies across the boundary that will require contractual or off-the-rack governance. David Hume's psychological theory of property puts great emphasis on accession. Possession piggybacks on the psychological association of objects and their owners, but what counts as an object is also psychological. After introducing the law of accession by which, for example, the fruits of land or the offspring of cattle belong to the owner of the "large" object, Hume emphasized the psychological basis for this relationship:

This source of property can never be explain'd but from the imagination [F]rom an object, that is related to us, we acquire a relation to every other object which is related to it, and so on, till the thought loses the chain by too long a progress. However the relation may weaken by each remove, 'tis not immediately destroy'd; but frequently connects two objects by means of an intermediate one, which is related to both. And this principle is of such force as to give rise to the right of *accession*, and causes us to acquire the property not only of such objects as we are immediately possess'd of, but also of such as are closely connected with them.⁸⁹

89. DAVID HUME, A TREATISE OF HUMAN NATURE 327 n.75 (David Fate Norton & Mary J. Norton eds., Oxford Univ. Press 2000) (1739).

When complementarities and interdependencies are great we tend to put objects together in one module—here an owned thing—and outsiders can treat the thing as an undifferentiated whole.⁹⁰

The system of actors, uses, and resources is a nearly decomposable system, in Simon's sense: subcomponents can be identified within which interactions are great but across which interactions are minimal.⁹¹ Complex systems with this feature of near-decomposability can benefit from modular organization in which information flows across the interface between modules only in certain limited and stereotyped ways. Notice that Hume's theory can be regarded as part of the instructions on where the lines of decomposition should run.

Now consider intellectual property. In the case of inventors (and other creators), one could regard the innovator as an improver. The other input could be either information in the public domain or the option in the public to invent and use what the inventor has invented. The stronger one's notion of the public domain, the more it is like the acted-upon input in situations governed by the law of accession.⁹² By mixing her labor with this something else, the inventor has created a useful invention. The inventor gets to keep the invention and becomes the owner, but she compensates the public with disclosure (in the case of patents) and with dedication to the public of the invention (or original work) at the end of the limited term of the intellectual property right. This is like the compensation that a good-faith improver must give in accession law.

Some doctrines in intellectual property law are quite close to accession and cause what I call governance rules to be somewhat closer to exclusion than they otherwise would be. Thus, as we will see, fair use involves much ex post evaluation and balancing of uses and so is much like the law of nuisance in being a governance regime. One category of fair use, transformative use, involves use of the copyrighted material that is sufficiently different and not a

90. See Smith, *supra* note 15, at S470-71; see also Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129, 169-70 (1998) (discussing the perils of partial propertization).

91. See SIMON, *supra* note 12, at 193-229.

92. See, e.g., Boyle, *Second Enclosure*, *supra* note 38, at 52 (asking, rhetorically, "Who needs a public domain if you can create out of nothing?"); Gordon, *supra* note 80, at 1559-60 (arguing that the public domain is a source of rights in the public); Jessica Litman, *The Public Domain*, 39 EMORY L.J. 965, 968 (1990) ("The public domain should be understood not as the realm of material that is undeserving of protection, but as a device that permits the rest of the system to work by leaving the raw material of authorship available for authors to use."); A. Samuel Oddi, *The Tragicomedy of the Public Domain in Intellectual Property Law*, 25 HASTINGS COMM. & ENT. L.J. 1 (2002) (discussing visions of the public domain as bases for rights in the public).

substitute for the original that it is not a violation of the copyright.⁹³ The transformative work may be eligible for a copyright as well.⁹⁴ When the later creator adds enough, there is an attempt to place her actions outside the original copyright module and perhaps into their own module. Unlike in the law of accession, though, there is no one-time payment of damages, because unlike wood or grapes, information is nonrival. The information has not been diminished. Similarly, the reverse doctrine of equivalents in patent law, though rarely successful, would exempt from literal infringement a second invention that was sufficiently different from a prior patent.⁹⁵ Although some kind of lump-sum permanent damages or a compulsory license could be imagined, the reverse doctrine of equivalents is all-or-nothing.⁹⁶

Now consider what accession law has to say in general about intellectual property law and its alternatives. Accession law provides restitution as one intermediate solution to the problem of intertwined inputs. Restitution in the form of damages is but one of several possibilities ranging from giving title to the creator (with some compensation to other input owners, i.e., the public), to giving the creator a claim to compensation for her labor and other inputs, to denying any claim of the creator at all.⁹⁷ At any rate, the law of accession

93. See, e.g., *Suntrust Bank v. Houghton Mifflin Co.*, 268 F.3d 1257, 1271 (11th Cir. 2001) (holding that the critical parody *The Wind Done Gone* was likely a transformative use of *Gone with the Wind* under the fair use doctrine); Pierre N. Leval, *Toward a Fair Use Standard*, 103 HARV. L. REV. 1105, 1111-12 (1990).

94. See Stephen R. Wilson, *Rewarding Creativity: Transformative Use in the Jazz Idiom*, 6 U. PITT. J. TECH. L. & POL'Y 1, 2, 8 n.64 (2003) (noting that author Alice Randall registered an independent copyright for *The Wind Done Gone* after successfully asserting a fair use defense against the owners of the copyright on *Gone with the Wind*).

95. See, e.g., 5B DONALD S. CHISUM, CHISUM ON PATENTS: A TREATISE ON THE LAW OF PATENTABILITY, VALIDITY AND INFRINGEMENT § 18.04[4][c] (2007); Robert Merges, *Intellectual Property Rights and Bargaining Breakdown: The Case of Blocking Patents*, 62 TENN. L. REV. 75, 91-102 (1994); Robert P. Merges & Richard R. Nelson, *On the Complex Economics of Patent Scope*, 90 COLUM. L. REV. 839, 862-68 (1990); see also *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 608-09 (1950) (noting that an article that literally is within the scope of a claim may nonetheless not be infringing if it is "so far changed in principle from a patented article that it performs the same or a similar function in a substantially different way"); *Scripps Clinic & Research Found. v. Genentech, Inc.*, 927 F.2d 1565, 1581 (Fed. Cir. 1991) (denying summary judgment because of unresolved factual issues concerning the reverse doctrine of equivalents).

96. See Merges, *supra* note 95, at 101.

97. Interestingly, Gordon has used restitution as a lens through which to examine the impulse to compensate inventors and other creators. See Gordon, *supra* note 76; see also Wendy J. Gordon, *Of Harms and Benefits: Torts, Restitution, and Intellectual Property*, 34 MCGEORGE L. REV. 541 (2003) (reconciling intellectual property with general judicial reluctance to order

suggests that sometimes it is easier to give the improver property rights to an output—even at the cost of undermining the conflicting rights of the original owner—rather than always to give the improver tailored damages. If accession sometimes gives title to improvers in this indirect and counterintuitive way, it is probably because this indirect method minimizes the costs of delineating rights to the improver’s labor and other inputs.

If inventors and authors can be regarded as analogous to improvers in the law of accession, the question becomes which other actors involved in the chain from creation to marketable product can also be treated as “improvers” with a claim to “title” to the information asset that results from their efforts. Some have argued that strong patent rights provide needed incentives to commercialize inventions.⁹⁸ This theory has entered the debate over copyright extension, but it is even more controversial there.⁹⁹

Here I concentrate on the possibility that commercialization can furnish a rationale for accession-like intellectual property rights. Employing property rights to encourage commercialization is more controversial than doing so to promote invention, because often commercialization will take place after the creation of what we might naturally call “the information asset.”¹⁰⁰ The range of actions that a patentee or its licensee may take to develop an invention into a product and to create a market for it is likely to involve activities that are quite difficult for officials to evaluate (and more so than in the area covered by copyright).¹⁰¹ If so, the system of coordination, through firms or contracting, that needs to take place around information assets that are being commercialized is quite complex. The modularity of property rights is one

restitution for unbargained-for benefits). Again, my concern is with the form that such compensation will take.

98. See, e.g., F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697 (2001) (arguing that the commercialization function requires property rule protection for patents); Giles S. Rich, *The Relation Between Patent Practices and the Anti-Monopoly Laws*, 24 J. PAT. OFF. SOC’Y 159, 177-81 (1942) (arguing that promoting the commercialization of inventions is the most important function of patent law); see also Kitch, *supra* note 4, at 276-77, 284 (discussing, *inter alia*, the role of patent prospects in giving “the patent owner . . . an incentive to make investments to maximize the value of the patent,” including investments in manufacture, distribution, and market development).
99. See Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. CHI. L. REV. 129 (2004); see also Wendy J. Gordon, *Authors, Publishers, and Public Goods: Trading Gold for Dross*, 36 LOY. L.A. L. REV. 159, 170 n.38 (2002) (“Moreover, the centralization argument [of the prospect theory] has little force when applied to copyright, a field whose merit is diversity rather than centralization.”).
100. See Lemley, *supra* note 99; see also Merges & Nelson, *supra* note 95, at 842-43 (noting the role of post-invention actions in determining the open question of patent scope).
101. See *infra* Section III.A.

factor making them an attractive solution to this complex coordination problem.¹⁰²

Before turning to the modularity of the property rights solution, it is useful to recognize that property rights and competing alternative solutions correspond closely to different accession scenarios. The range of solutions to the accession problem corresponds to the various methods we might use to solve the appropriability problem in the area of information assets. If someone mixes her inputs (materials, labor, etc.) and either invents or commercializes an invention, we can reward the contribution more or less directly, or not at all. There is a spectrum of methods running from governance-like rewards, through liens and liability rules, to exclusion-based property rights and property rules, to a pure public domain. Exclusion must be compared with its alternatives. If the materials acted upon are not so transformed or the value ratio is not so great, we can give the improver a mere claim for restitution. If what is in the public domain is more important than what the inventor-improver adds, or if the improvement is done in bad faith, the public can retain title. For skeptics of intellectual property, this would be the normal case.

Of these three solutions to the appropriability problem, the most direct (and correspondingly least reliant on treating the information involved as a thing) would be for these inputs to be priced, publicly or privately, and rewarded directly in a governance scheme. One might think of this as an accession situation in which the public as the “other input owner” compensates the inventor-improver for her contribution but retains title to the improved information. Those who would like to use the information could then use it at zero cost.

The drawback is that singling out every improver input and attributing value to it is likely to be very costly and possibly subject to manipulation. Without more, this is a very complex task in that multiple actions can affect the value of information. In the area of innovation, the spillovers from research and development even in the presence of an intellectual property regime are the subject of an extensive economic literature.¹⁰³ Isolating and valuing significant spillovers in the absence of an intellectual property regime would be much more complex.¹⁰⁴ Moreover, when it comes to commercialization, the number

102. See *supra* Section I.B.

103. See, e.g., Morton I. Kamien et al., *Research Joint Ventures and R&D Cartels*, 82 AM. ECON. REV. 1293 (1992); Kotaro Suzumura, *Cooperative and Noncooperative R&D in an Oligopoly with Spillovers*, 82 AM. ECON. REV. 1307 (1992).

104. See, e.g., GORDON V. SMITH & RUSSELL L. PARR, *VALUATION OF INTELLECTUAL PROPERTY AND INTANGIBLE ASSETS* (3d ed. 2000); Robert S. Bramson, *Valuing Patents, Technologies and Portfolios: Rules of Thumb*, 635 PLI/PAT 465 (2001); Scott D. Phillips, *Patent & High*

of actions and their likely interactions and effects would be very hard to determine.

Ultimately, reward systems would be like central planning, unless some way to simplify the task could be found. Interestingly, reward proposals seek simplification and a form of modularity in using average-value information.¹⁰⁵ Like the liability rule literature that seeks correct ex ante incentives by pricing classes of actions according to average harm (in an ex ante probabilistic sense),¹⁰⁶ rewards could be given for the best prediction. If it is unbiased, then incentives will be correct. Elsewhere I argue that, like some liability rules, rewards systems are likely to be subject to opportunism because the actuarial classes will not be stable in the face of manipulation by potential rewardees.¹⁰⁷

Less direct than rewards would be a regime giving rights in information in the nature of a lien: the inventor-improver would be entitled to compensation from those using the information but would not be able to veto its use. Again, this would be like the accession case in which the value of the acted-upon input exceeded the improver's added value. But in the lien solution, the users of the information would fund the compensation to the inventor-improver. In intellectual property terms, the "improver" would get intellectual property rights but subject to compulsory licenses at some positive compensation (a liability rule). The use of the lien-like device would prevent holdouts but might well price some consumers out of using the information. Once created, the information could be used at zero marginal cost, but here the idea would be to recoup costs through liability rules. Compulsory licenses also require courts or other officials to engage in costly and context-dependent evaluation.¹⁰⁸ Because

Technology Licensing: Evaluation of Patent Portfolios, 652 PLI/PAT 57 (2001); Lauren Johnston Stiroh & Richard T. Rapp, *Modern Methods for the Valuation of Intellectual Property*, 532 PLI/PAT 817 (1998).

105. See, e.g., Abramowicz, *supra* note 56, at 124 (“[I]f the government gives a reward for taking an action to reduce deadweight loss, even if we are sure that the government’s decisions will be haphazard, the prediction of what an average governmental decisionmaker will do in a particular case may be quite close to optimality.”); Shavell & van Ypersele, *supra* note 56, at 534-35.

106. See, e.g., Ian Ayres & Paul M. Goldbart, *Correlated Values in the Theory of Property and Liability Rules*, 32 J. LEGAL STUD. 121, 135-36 (2003) (providing a model showing that liability rules based on the average victim harm, conditional on the plaintiff’s actual value, are more efficient than property rules); Louis Kaplow & Steven Shavell, *Property Rules Versus Liability Rules: An Economic Analysis*, 109 HARV. L. REV. 713 (1996) (presenting a model in which liability rules based on average expected harm are more efficient than property rules).

107. See Henry E. Smith, *Property Rules in Intellectual Property* (Jan. 22, 2007) (unpublished manuscript, on file with author).

108. See *id.*

ex post efficiency requires a price of zero, this solution is not ideal, in contrast to the perfectly tailored reward.

Finally, and most indirectly, we can give exclusion rights to the contributors of the inputs. This strategy saves on delineation costs but at the price of more initial inaccuracy in terms of allocation. The downside is clear and well explored in the literature. Owners of such rights could hold out and price further above the zero marginal cost of distribution than they could under the liability rule. And in those cases in which transaction costs precluded licensing, some use with positive value would be precluded altogether. But before we can conclude that property rights and exclusion are necessarily inferior to liens or rewards, we have to know how the minimum necessary complexity in each of the three solutions factors into its overall cost-effectiveness.

It is here that exclusion has its strong point in its use of modularity as a method of managing complexity. Because of these advantages of property rights in dealing with complexity, the case against (or for) intellectual property rights cannot be derived from economic reasoning alone—as the emphasis on the nonrivalness of information or on incentives sometimes implies. As the simplest and most modular of the three solutions, intellectual property rights not tailored to narrow classes of uses have particular advantages to which I now turn.

The accession problem in coordinating activity around assets, including information, is a complex one, and I argue that the solutions in both property and intellectual property employ modular exclusion rights as a method of managing complexity. First consider accession in regular property. The law of accession is complex but could be much more so. First of all, the law designates either the original owner or the improver to take title to the asset. It does not make them co-owners or divide the asset among them. Nor does it give the one not gaining title a continuing lien; rather, it settles up the accounts once and for all. The rules of accession are quite sweeping. For example, in the rule of increase awarding a calf to the owner of the mother cow, the law makes no special exception for calves sired by prize-winning bulls.¹⁰⁹ The tests of severability and transformation can be seen as proxies for situations in which the interdependencies between the contributions to the combined thing are complex. By contrast, if the contributions can be physically separated, a property boundary can be drawn between them. The system is nearly decomposable, in Simon's sense.

109. Felix S. Cohen, *Dialogue on Private Property*, 9 RUTGERS L. REV. 357, 366 (1954).

More generally, through the exclusion strategy, the law of property seeks boundaries around sets of complementary attributes.¹¹⁰ If it did not, intense interdependencies would straddle property boundaries, making them less of an information-hiding interface and less of a contribution to modularity. Boundaries cannot be chosen to eliminate such interactions entirely. We still need interface conditions and in some cases may even require what can be thought of as overlapping modules: the same attribute can be subject to private and common rights, as in the semicommons. Particularly large events may require some modification of a regime that is geared toward important uses on a smaller scale.¹¹¹

From economic actors' point of view, the least modular system for controlling spillovers is a commons in which everyone's activities are of potential relevance to everyone else.¹¹² To the extent that these uses are heterogeneous, and the actors numerous and socially distant, the transaction costs of negotiating solutions to these complex interactions will be high.¹¹³ But, given that boundaries may allow owners to specialize in assets and to deal with fewer negotiating partners,¹¹⁴ one can argue that property boundaries also allow information about uses and users to be hidden and largely irrelevant to outsiders, somewhat to neighbors, and even more so to strangers.

D. Managing Complexity in Rights to Information

Consider now the accession-like problem in the arena of valuable information. Recall that accession allows solutions involving retention of ownership by the public with compensation to the improver by the public (rewards), some limited lien-like right in the improver (comprehensive compulsory licenses), or property rights for the improver with compensation

110. See *supra* note 90 and accompanying text.

111. See, e.g., Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1323-36 (1993); Dean Lueck, *The Economic Nature of Wildlife Law*, 18 J. LEGAL STUD. 291, 301-02 (1989).

112. Open access without any norms or rules could be quite simple, and the least modular system would be one giant commons subject to collective governance.

113. See, e.g., GARY D. LIBECAP, CONTRACTING FOR PROPERTY RIGHTS 19-28 (1989) (setting out factors that impede contracting for property rights).

114. See Demsetz, *supra* note 14, at 354-56; Ellickson, *supra* note 111, at 1330-31. Also reminiscent of the modular benefits of property is F.A. Hayek's argument that property, by establishing boundaries over things over which decision-makers would be free to take action and prevent interference by others, was the best and only workable method to achieve a coincidence of expectations among members of society. See 1 F.A. HAYEK, LAW, LEGISLATION AND LIBERTY: RULES AND ORDER 106-10 (1973).

to the other input owner (the public). Intermediate solutions and mixtures of these are also possible.

The direct method of rewards is the least modular. Under it, dependencies between any two pieces of information or their uses are possible in principle. Some public authority must come up with correct prices, considering all the possible uses of inputs and their interactions, and must take into account the effect of responses to any rules of thumb by those regulated. Likewise, a generalization of unfair competition law and *International News*-style quasi-property would involve at least an industry-by-industry (if not an activity-by-activity) evaluation of value creation and free-riding. This relatively unconstrained inquiry would be much less modular than current intellectual property law.

The intermediate liability rule method is somewhat more modular than rewards because it can focus on a predefined entitlement. But these entitlements can be very narrow, provisional, or even ad hoc, making them less modular than the typical exclusion right protected by a property rule.¹¹⁵ Thus, if liability is decided as use conflicts arise, in the manner envisioned by Ronald Coase in his evaluation of nuisance law as a method for solving the “economic problem” of maximizing the value of production,¹¹⁶ the liability system does not rule out much in the way of interdependencies between uses. (Indeed, part of Coase’s pessimism about intervention of any kind in externality problems stemmed from the difficulty of tracing all the effects of dealing with the consequences of any given activity.) Using averages, as in much of the recent liability rule literature,¹¹⁷ is more modular because there are fewer interdependencies between average values than between actual values in varieties of scenarios. The very fact that an average contains less information means that problems treated by liability rules can be dealt with somewhat more in isolation. But nothing in the liability rule method really requires broad entitlements, and the liability rule method invites courts to treat entitlements not as predefined but as allocated when use conflicts arise.¹¹⁸ This more fine-grained valuation of use is consistent with fairly nonmodular approaches to use. In sum, liability rules can be more or less modular, although they tend to open the door to nonmodular approaches.

115. For an information-cost theory of the pairing of broad exclusion rights with property rules, see Smith, *Property and Property Rules*, *supra* note 5.

116. R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 15, 19 (1960); see Merrill & Smith, *supra* note 20, at 369-70.

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

118. See Smith, *Property and Property Rules*, *supra* note 5, at 1791-93.

A system of intellectual property rights is the most modular of the three methods for coordinating the financing and development of information. Across intellectual property boundaries, it only requires monitoring a simple on/off signal. In the case of patent law, the signal is whether someone not licensed by the patentee is making, using, or selling the invention.¹¹⁹ A right to exclude is beneficial to its holder because she has an interest in the privilege of use that is indirectly protected by that right.¹²⁰ If I have a right to exclude others from Blackacre, my privilege to farm, park my car, etc., is more valuable to me than if others could interfere. In property, rights to exclude typically protect a broad and indefinite class of uses, thus delegating the choice among them to the owner. The breadth of the exclusion right, compared to the use privileges it protects, helps property become more modular. Only the owner and those with whom the owner chooses to deal have to know much about the range of uses and their development.

The indirectness of the right to exclude in relation to the interests in uses that it protects is also characteristic of intellectual property. With a right to exclude others from a wide and indefinite range of uses, the intellectual property owner can take a correspondingly wide range of actions and can appropriate the returns (positive or negative) from these efforts without any need for outsiders—potential violators, officials, and to some extent contractual partners—to know much about these uses. If the uses delegated in this way were all *nonrival* with the uses that might be prevented under the right to exclude, the case *against* intellectual property could not be clearer. However, the inputs (e.g., labor and equipment) needed to develop the information *are* rival. The uses of these inputs and the returns from them are indirectly swept up in the right to exclude.

Whether it would be better to value each input separately (and to trace its contribution to the overall returns on the information asset) is an empirical question. On the benefit side, unlimited tracing of this sort would allow

119. See 35 U.S.C. § 271 (2000); *Bloomer v. McQuewan*, 55 U.S. (14 How.) 539, 549 (1852) (“The franchise which the patent grants, consists altogether in the right to exclude every one from making, using, or vending the thing patented, without the permission of the patentee. This is all that he obtains by the patent.”); *id.* (noting that the right to use a machine after purchase from the patentee is not within the scope of patent law and is governed by state property law); see also Charles Eliot Mitchell, *Birth and Growth of the American Patent System*, in CENTENNIAL PROCEEDINGS OF THE UNITED STATES PATENT SYSTEM 1891, at 43, 51 (Executive Comm. of the Patent Centennial Celebration ed., Clark Boardman 1990) (1891) (noting that claims are important for “set[ting] definite walls and fences about the rights of the patentee”); Craig Allen Nard, *Certainty, Fence Building, and the Useful Arts*, 74 IND. L.J. 759, 759 (1999) (“Patent law is about building fences.” (citing Mitchell, *supra*, at 51)).

120. See PENNER, *supra* note 8, at 68-74.

consumers unimpeded use of the information asset, in accordance with its nonrival nature. On the cost side, the tracing would be far costlier than lumping these uses within the functional scope of the exclusion right. By exercising the right to exclude, the interest in using these more causally “remote” rival inputs and appropriating their returns is captured automatically—without the need for a third party to delineate or even identify these uses and inputs. In regular property, the right to exclude indirectly protects use privileges, but the presence of positive transaction costs does prevent some beneficial, nonharmful—and in that sense nonrival—uses. The analogous rights in intellectual property likewise benefit from their indirectness but at the price of forgone use. The right to exclude is both the greatest strength and the greatest weakness of intellectual property rights, as it is in regular property. In a way, the difference between property and intellectual property appears to be a matter of degree rather than of kind.

Also as in property, the simplicity and information-hiding function of exclusion rights allow officials and other nonowners to interact with the owner in the simplest of ways. Modules are only allowed to pass information to the outside world in fixed ways (i.e., interface conditions), in keeping with the *numerus clausus* principle under which the law limits in rem rights to a fixed and finite menu of forms.¹²¹ The basic building blocks of property can be combined in simple but highly generative ways, reducing the frustration costs that one might expect from a system based on a small number of (relatively) simple elements.¹²² Intellectual property exhibits the *numerus clausus*, albeit in somewhat attenuated form outside the core of intellectual property.¹²³

Property rules go along with broad property rights because they solve complementary information problems. Broad rights of exclusion call for simple signals.¹²⁴ Because these signals are on/off, potential violators are not in

121. See Merrill & Smith, *supra* note 28.

122. See *id.* at 35-38.

123. Intellectual property has partially departed from the *numerus clausus* principle in the parts of intellectual property closest to tort law: the right of publicity and quasi-property in hot news under *International News*. Core intellectual property rights are quite standardized, as are property rights more generally under the *numerus clausus*. See *id.* at 19-20. Federal preemption, whether intentionally or as a byproduct, makes it difficult to create core patent- or copyright-like intellectual property rights.

124. See Smith, *Property and Property Rules*, *supra* note 5. The use of relatively modular exclusion sometimes calls for rules as opposed to standards, but it need not; exclusion relates to precision and optimal complexity, instead of directly calling for an *ex ante* or *ex post* determination. See Louis Kaplow, *Rules Versus Standards: An Economic Analysis*, 42 DUKE L.J. 557, 568-88 (1992) (analyzing rules versus standards in terms of the timing of decision-making).

equipoise; crude signals are good at identifying those subject to sanctions, which theoretically aim at eliminating violations (as opposed to prices, which induce some specific positive level of activity).¹²⁵ There is no need to calibrate the level of liability for any particular use, and injunctions can be used. The injunction does not require costly valuation, and it provides robust protection in delegating to the owner the choice among uses. Liability rules represent a partial withdrawal of this delegation and make sense when we do not trust the owner to make the right choice or when we worry about holdouts and other high-transaction-cost scenarios in the presence of potential valuable use by multiple parties.¹²⁶ For example, in certain high-stakes, high-transaction-cost nuisance situations, we may decide to soften the exclusionary regime by withholding injunctions for violations of the entitlement.¹²⁷ It is ultimately an empirical question at what point the uncertainty in the contours of intellectual property rights leads to serious enough holdout problems to justify a move away from injunctions (property rules) toward damages (liability rules).¹²⁸ But the benefits of the simple on/off signal suggest that the presumption for injunctions should be stronger than that suggested by the traditional realist wisdom, which tends to focus on the benefits of tailoring and use by multiple parties.¹²⁹

Although the very contested (and current) question of what the standard should be for injunctions in intellectual property, and patent law in particular, responds to many factors (including the problem of inadvertent violation),¹³⁰ the overlooked benefits of exclusion are one factor suggesting correspondingly

125. See Robert Cooter, *Prices and Sanctions*, 84 COLUM. L. REV. 1523, 1524-25 (1984) (distinguishing prices and sanctions according to their aims and mechanisms).

126. See Smith, *Exclusion and Property Rules*, *supra* note 5, at 975-90; Smith, *Property and Property Rules*, *supra* note 5, at 1755-64, 1770-74.

127. See *Boomer v. Atl. Cement Co.*, 257 N.E.2d 870 (N.Y. 1970).

128. See Mark A. Lemley & Philip J. Weiser, *Should Property or Liability Rules Govern Information?*, 85 TEX. L. REV. 783 (2007) (arguing that liability rules in the form of compulsory licenses are needed when intellectual property rights are inherently unclear).

129. See Smith, *Exclusion and Property Rules*, *supra* note 5, at 1037-45.

130. The problem of inadvertent violation with large sunk costs occurs in the context of standard-setting, in which a patent holder tries to get a patented technology incorporated into a standard (or sits by as this happens) and then reveals the patent. See, e.g., Mark A. Lemley, *Ten Things To Do About Patent Holdup of Standards (and One Not To)*, 48 B.C. L. REV. 149, 154-55 (2007) (describing the holdup problem as a motivation for proposed solutions); David J. Teece & Edward F. Sherry, *Standards Setting and Antitrust*, 87 MINN. L. REV. 1913, 1939-41 (2003) (endorsing a limited role for antitrust in standard-setting, and discussing some limits of the holdup problem).

overlooked benefits of injunctions.¹³¹ In other words, when property rules protect the delegation we make to owners because their use of rival inputs to information is difficult to second-guess, judges should be more likely to find irreparability of harm under the traditional test for injunctions.¹³² By not requiring detailed evaluation and not being dependent on values, the routine use of injunctions increases modularity but at the cost of overinclusion. From a court's point of view, decision-making is less context-dependent. As for duty-holders, although "keeping off" is not as easy as in the case of tangible property, no detailed knowledge of uses, even of a rough actuarial sort, is needed in order to know where one stands with respect to the owner's rights.

Indirect evidence suggests that the modularity of the intellectual property system may be one of its greatest strengths. Organizational forms dealing with the design and production of technologically innovative products (computer hardware and software being prime examples) tend to be modular.¹³³ In these situations, those creating the organization face most of the costs and benefits of the organizational form. Although firms and markets are different, intellectual property facilitates organizational efforts—involving development and commercialization of innovation and accompanying appropriability—outside of the corporation or other business organizations. Intellectual property may serve a similar coordinating function in a similarly modular way.

II. EXCLUSION AND GOVERNANCE IN INTELLECTUAL PROPERTY

This Part contrasts two strategies for delineating rights, as applied to rights in information. Property rights are often focused on a thing from which the owner has the right to exclude, and the central role of the exclusion strategy is to increase the modularity of the system of legal entitlements. In other contexts, when some use is particularly beneficial or harmful, the system of entitlements, deriving from the law of property or constructed by affected parties, shifts to a governance regime focusing more directly on the use itself. I present a simple model of exclusion versus governance and derive several propositions that are of particular relevance to rights in information.

131. See Smith, *Exclusion and Property Rules*, *supra* note 5, at 1022-43.

132. The Supreme Court has weighed in on the standard for injunctions, holding that the traditional four-part test for injunctions generally should apply in patent cases, but it remains unclear how many injunctions this standard will produce. See *eBay Inc. v. MercExchange, L.L.C.*, 126 S. Ct. 1837 (2006).

133. See sources cited *supra* note 13.

A. *A Simple Model of Entitlement Delineation*

Property is the area of law concerned with those rights most based on exclusion. In our terms, this means that property law tends to define rights based on informational variables that bunch attributes and uses together and to treat them as a modular component of the legal system. Previously, I have argued that there are two strategies for delineating rights, which I term “exclusion” and “governance,” and that these strategies fall on the poles of a spectrum of methods of informational variables (or, to use the term from neoinstitutional economics, measurement, which must be by proxy).¹³⁴ For example, in the case of land, we use either simple on/off signals like boundary crossings (in trespass and some nuisance law) or more tailored variables involving the evaluation of conflicting uses (in other nuisance law). By distinguishing exclusion and governance based on their different cost structures at different levels of precision, we can explain a wide range of features of property law and its relations to adjacent areas.

The exclusion strategy delegates decisions about resource use to an owner who, as gatekeeper, is responsible for deciding on and monitoring how the resource will be used.¹³⁵ To set up such rights, informational variables (or proxies) like boundaries and the *ad coelum* rule are used.¹³⁶ Crossing the boundary does somewhat correlate with whether a person is imposing costs through use, but only in a very rough sense. Being on the land is necessary to engage in a wide range of such uses, such as picking fruit or parking cars. Those present on the land may or may not be causing harm (or could be causing more or less harm), but a rule based on a boundary does not distinguish these cases, leading to the possibility of spillovers. In the case of land, the main informational variable relevant to the action of trespass (and much of the law of nuisance) is locational: has a party invaded the column of space around the land? The right to exclude protects the owner with respect to a wide range of potential and actual uses, without the law’s ever having to delineate these use privileges separately. Indeed, many uses, such as using air to blow away chimney smoke, are not really rights at all; they are privileges in the owner that are implicitly and indirectly protected by the basic gatekeeper right, the right to exclude.¹³⁷

134. See Smith, *supra* note 15.

135. See, e.g., PENNER, *supra* note 8, at 74 (using the gatekeeper metaphor for exclusion in property).

136. See *supra* notes 6, 21.

137. See Smith, *Exclusion and Property Rules*, *supra* note 5, at 978-79.

In the case of intellectual property, as we will see shortly, patent law relies heavily on the right to exclude. For example, in a chemical invention, the applicant can claim a substance by stating its structure.¹³⁸ Any use of the substance, whether foreseen by the applicant at the time of the application or not, is protected by this right to exclude. The right to exclude others from using the substance bunches together a wide range of uses that the law need never specify individually. The law delegates to the patentee the choice among these uses. As a result, there is a wide range of activities that the patentee can undertake to promote the invention—including advertising, marketing, and further development not resulting in improvement patents—the returns of which the patentee will be able to capture. Under certain circumstances, the patentee can also use the functionally broad right to exclude in its efforts to coordinate further innovation.¹³⁹

For low levels of precision, rough informational variables (i.e., proxies) like the boundary in the *ad coelum* rule or the chemical structure of a substance are the cheapest method of delineating rights, but they would be very expensive if employed to pick out individual levels of use. As Robert Ellickson has noted, dogs can be taught to police boundaries but not to detect stealing by those with the privilege of access.¹⁴⁰ Similarly, enforcing the right to exclude from a type of molecule or apparatus is much easier than enforcing a right to specific types of uses of these “things.” Generally, exclusion proxies are overinclusive and underinclusive of the harms caused by individual uses.

The exclusion strategy also has implications for the correlative duty-holders. Exclusion rights are used when the audience of duty-holders is large

138. See *infra* notes 172-175 and accompanying text.

139. Perhaps because of the emphasis in the reward theory on innovation rather than (nonpatentable) commercialization, critics of Edmund Kitch's prospect theory, see Kitch, *supra* note 4, have focused on the difficulties that patentees will have in coordinating further innovation when others can get improvement patents, leading to a situation of blocking patents, see, e.g., Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 1047 (1997) (noting that the patentee does not have exclusive control over further improvements); Merges & Nelson, *supra* note 95, at 875-77 (expressing skepticism, based on empirical analysis, about the ability of a holder of a broad patent to coordinate further research and development through “tailored licensing”). John Duffy has shown that when others have a small enough incentive to engage in follow-on work or when the patentee can save on transaction costs, the prospect patent holder can coordinate (but not slow down) further innovation, usually through integration rather than licensing, and so avoid duplication. See John F. Duffy, *Rethinking the Prospect Theory of Patents*, 71 U. CHI. L. REV. 439, 483-91 (2004). As Duffy has pointed out, development activities that do not (or might not) result in improvement patents are even more firmly under the original patentee's control. See *id.*

140. Ellickson, *supra* note 111, at 1327-28.

and indefinite (in rem), and its simplicity reduces the processing costs, which would otherwise be high for such an extensive audience.¹⁴¹ Recall the example of the anonymously parked cars.¹⁴² When large numbers of duty-holders can contribute to the value of the resource by keeping off, rough informational variables of exclusion will be used to send this simple message.

If exclusion bunches uses together, the governance strategy, by contrast, picks out uses and users in more detail, imposing a more intense informational burden on a smaller audience of duty-holders.¹⁴³ For example, a group of herdsmen may have rights to graze animals, but the rights among themselves may be limited to a certain number of animals, a certain time for grazing, and so on. In the case of land, if governance rules are those that pick out more specific activities for measurement, then a wide range of rules—from contractual provisions, to norms of proper use, to nuisance law and public environmental regulation—can be seen as reflecting the governance strategy.

Similarly, in intellectual property law, the governance strategy fine-tunes the basic exclusionary regime by further specifying the interface between property modules. Continuing with the patented chemical invention, the law provides a very narrow use-based exception for experimental use;¹⁴⁴ the exception focuses on the type of use and requires detailed evaluation of the experimental user's motivations. (For example, these days commercial motivation will usually disqualify a use as experimental.¹⁴⁵) As another example, the law of patent misuse—as its name suggests—singles out particular uses that are thought to extend the patent beyond its lawful scope and withdraws enforceability from the patent.¹⁴⁶ As we will see, copyright law

141. See Henry E. Smith, *The Language of Property: Form, Context, and Audience*, 55 STAN. L. REV. 1105, 1151-53 (2003); see also Smith, *supra* note 15, at S468-69.

142. See *supra* text accompanying note 9.

143. See Smith, *supra* note 15, at S455, S468, S471-74.

144. See 5 CHISUM, *supra* note 95, § 16.03[1].

145. The Federal Circuit has recently taken an expansive approach to what counts as commercial. See *Madey v. Duke Univ.*, 307 F.3d 1351 (Fed. Cir. 2002).

146. See 5 CHISUM, *supra* note 95, §§ 17.02[4], .05; 6 *id.* § 19.04. The trend in patent misuse is to rely less on per se rules and more on rule-of-reason analysis, which increases the governance-like aspect of patent misuse:

Under the rule of reason, “the finder of fact must decide whether the questioned practice imposes an unreasonable restraint on competition, taking into account a variety of factors, including specific information about the relevant business, its condition before and after the restraint was imposed, and the restraint’s history, nature, and effect.”

Va. Panel Corp. v. MAC Panel Co., 133 F.3d 860, 869 (Fed. Cir. 1997) (quoting *State Oil Co. v. Khan*, 522 U.S. 3, 10 (1997)); see also *Brulotte v. Thys Co.*, 379 U.S. 29, 31 (1964) (“[A]

makes even greater use of governance rules than does patent law.¹⁴⁷ In copyright, the rights themselves tend to be built up stick by stick, more so than in patent law, and modifications (most prominently the fair use doctrine) focus on particular types of uses. In addition to these off-the-rack rules, supplied by the law as a package, a governance regime might emerge privately through licensing: another party might be given the right to use a patented substance for some purposes (or in some markets but not in others), with royalties to be paid for different amounts of use.¹⁴⁸

Compared to basic trespass and property law, all of these governance rules require the specification of proper activities.¹⁴⁹ Unlike exclusion rules, governance rules would be very expensive to use when all that is needed are low levels of desired precision: consider the costs of specifying Hohfeldian legal relations, based on proper use, between each pair of persons in society.¹⁵⁰ But governance rules become more cost-effective when individual activities need to be measured—again, fences and dogs are good with highly salient and sweeping informational variables but cannot be used to police tailored rules of governance.

Consider now a simple model of the supply and demand for property rights. As usual, demand can be thought of as marginal benefit, and supply as marginal cost. In the case of property rights, we are interested in the extra benefit of expending efforts at delineating, enforcing, and processing property rights, in terms of added internalization of spillovers from particular uses and the facilitation of use by multiple parties. On the supply side, consuming wealth in this endeavor should be done in the least costly way, and we have choices between rough methods of delineation (fences, etc.) or more precise ones (measuring the duration that someone parks on the land, the space taken

patentee's use of a royalty agreement that projects beyond the expiration date of the patent is unlawful *per se*.”).

147. See *infra* Section III.A.

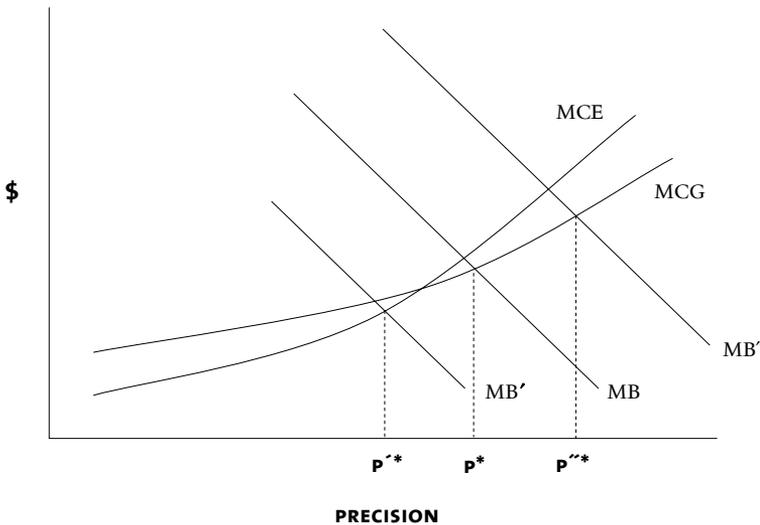
148. See, e.g., ROBERT P. MERGES ET AL., *INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE* 327-28 (4th ed. 2006).

149. “Governance” here just refers to a high degree of delineation of rights to resources in terms of use, and governance can be supplied by norms, regulation, or contract. This dovetails with prior usage because we often use the term “governance” to refer to the norms of use in common pool regimes, to the exercise of the power of the state, and to organization of economic activity through contractual restrictions. On the latter, see, for example, Oliver E. Williamson, *Transaction-Cost Economics: The Governance of Contractual Relations*, 22 *J.L. & ECON.* 233 (1979).

150. Information and other delineation costs are the reason that Hohfeldian analysis is incomplete; breaking legal relations down into their smallest units says little about how they are constructed, and in particular how tailored they should be.

up, some combination thereof, etc.). As a first cut, consider the optimal level of property rights (assuming for now that some process or some actor such as an entrepreneur or a judge will have an incentive to come close to this point¹⁵¹). This will occur when supply and demand intersect, or marginal cost equals marginal benefit. That is, one should engage in efforts at delineating, enforcing, and processing property rights up to the point at which the value of an additional unit of such efforts is equal to the extra value wrung from the resource. A graphical version of this model with the cost structures of exclusion and governance is illustrated in Figure 1, with wealth (\$) depicted on the y-axis and precision depicted on the x-axis.¹⁵²

Figure 1.
EXCLUSION AND GOVERNANCE FOR A RESOURCE



The marginal cost of exclusion (MCE) starts out low at low levels of precision, but it increases rapidly. First cuts at defining a resource and preventing the most basic forms of theft by all sorts of pilferers and trespassers will use informational variables (i.e., proxies) with this cost structure. But fences and such measurement devices are not good at regulating uses in a fine-grained way. By contrast, informational variables of the governance type start out with high marginal costs (MCG). Thus, to define the *ad coelum* rule

151. On the incentive of judges and other decision-makers to reduce information costs, see Smith, *supra* note 141, at 1157-60.

152. For a discussion of how to operationalize precision, see Smith, *supra* note 15, at S467-79.

synthetically by specifying the right-duty relationships among the members of society (or even among all those who might have an impact on the asset's value) would be prohibitively costly. But for more fine-tuned rights, such as limited sheep grazing, eventually the governance strategy is at least cost in Figure 1 (its marginal cost curve, MCG, is the lower of the two marginal cost curves only to the right of the intersection with MCE). The "supply" curve is the envelope of the marginal cost curves of the various methods of the proxy measurement; that is, for any given level of precision (on the x -axis), pick the lowest of the values of the various marginal cost curves (y) at that x -value, and the supply curve is the set of such y -values.¹⁵³

Potential informational variables are numerous and drawn from a spectrum defined by poles of exclusion and governance. Figure 1 simply depicts the cost curves for two informational variables that are relatively close to the ends of the spectrum. The optimal degree of precision is determined by the point at which the curve for marginal benefit (MB) of precision in delineation—in terms of incentives to invest, reduced transaction costs, and internalization—intersects with the supply curve of delineation. Notice that if the MB curve shifted downward or the supply curve shifted upward far enough, then MB would always be less than all of the marginal cost (MC) curves (and therefore less than the overall envelope of those MC curves), and we would predict open access—i.e., an absence of property rights. In contrast to open access, even "common property" requires some delineation, at least to define the asset and to exclude non-commoners, if not to govern use among those with access.

In the case of land, exclusion and governance are often used in tandem. Fences and boundary stones are used to define the asset and to exclude most of "the world," and fine-grained rules of conditional access and proper use are set up by contract to govern the behavior of the few with permitted access.¹⁵⁴ The law may also supply off-the-rack governance rules through the law of nuisance, zoning, and other forms of regulation.¹⁵⁵

From the different cost structures of these measurement strategies, we can derive several propositions about the shape that property rights will take. First, holding resource definition constant, we expect greater precision through

153. See *id.* at S476-77.

154. See *id.* at S467-74; see also William Hubbard, *Communicating Entitlements: Property and the Internet*, 22 YALE L. & POL'Y REV. 401, 404-07 (2004) (discussing the audience for, and technologies of, boundaries); Lior Jacob Strahilevitz, *Information Asymmetries and the Rights To Exclude*, 104 MICH. L. REV. 1835, 1838-82 (2006) (providing a typology of exclusion strategies, all but one of which involve access by others).

155. Further precision eventually may call for defining the asset with more fine-grained proxies of exclusion. See Smith, *supra* note 15, at S471-79.

governance-type rules with rising marginal benefits from internalization. Thus a shift in the marginal benefit curve from MB to MB'' in Figure 1 will lead to an increase in the precision of the regime, from p^* to p''^* . (Conversely, a downward shift from MB to MB' will lead to a less precise property rights regime, from p^* to p'^* .) The additional precision may be supplied by different actors. Thus, the basic trespassory regime in land law has been supplemented with a body of judge-made law that delineates proper use. Nuisance law is in large part a governance regime.¹⁵⁶ Neighbors (or an originating developer) can set up systems of interlocking mutual covenants to govern use in a more fine-grained way than in basic trespass. Zoning, too, is more detailed than any judicial land use doctrine.¹⁵⁷ Whether or not any of these regimes gives the right type of precision from a social point of view, they do conform to the Demsetzian expectation that rising stakes—e.g., higher land values and more intensive use—will call forth efforts at finer governance of use.¹⁵⁸ On a more macro scale, Carol Rose's theory that pollution controls have evolved with greater intensity of resource use toward the adoption of higher-cost measures—from basic property exclusion, to nuisance, zoning, and command-and-control regulation, and (partially) to a finer definition of property as transferable rights—likewise follows the pattern expected under the present model.¹⁵⁹

This Article focuses on the theoretical cases for and against exclusion on the grounds of cost in intellectual property, and it derives another relevant proposition on the cost side. If the marginal cost (i.e., supply) of property rights is described by the envelope of the marginal cost curves for exclusion and governance, we can extend the Demsetz thesis to state that as information costs increase, we should expect less precision of rights, and the new equilibrium point on the spectrum of proxy measurement should be farther to

156. See Merrill & Smith, *supra* note 20, at 394-97; Smith, *Exclusion and Property Rules*, *supra* note 5, at 990-92, 1024-27.

157. See, e.g., Epstein, *supra* note 75, at 1222-23 (arguing that because of courts' modest remedial powers, their "definition of rights is therefore apt to be made along certain 'natural lines'; there will be broad general propositions that can apply to all against all, and there will be no reference to the numbers or formulas . . . that can be generated by direct administrative controls, such as zoning").

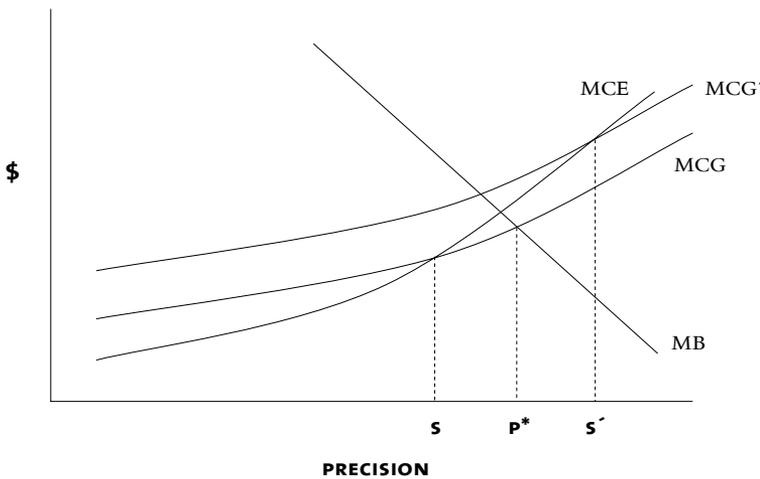
158. See Demsetz, *supra* note 14, at 350. Demsetz hypothesized that rising stakes in resource conflict would lead to the emergence of property rights, without specifying what form these rights might take (and hinting that they would be exclusive private rights). Rising stakes can lead to increases in efforts at exclusion or governance. See Smith, *supra* note 15, at S471-74, S478-86.

159. See Carol M. Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 1991 DUKE L.J. 1, 9-36.

the left. Likewise, a decrease in information costs should lead to more precision of rights and an equilibrium point farther to the right. Thus, in Figure 1, if the supply curve of delineation shifts inward (i.e., upward) reflecting higher measurement cost, the supply curve will intersect the marginal benefit curve farther toward the left, toward the rougher, exclusion end of the spectrum. Likewise, if the supply curve shifts outward (i.e., downward), the intersection point will reflect more precision, toward the more governance end of the spectrum. To illustrate, if an innovation such as the cell phone caused the marginal cost of all the methods of delineation (the entire supply curve) to fall, we would expect more precision of rights, in a rightward movement down the MB curve with the intersection of supply and demand (optimal precision) further to the right in Figure 1.

A second cost-related proposition we can derive is that the shape of this envelope (the supply curve for property rights) will change if individual components (such as the MCE and MCG curves) do *not* move in tandem. Thus, to take one example, if information technology allowed for better measurement of use but did not affect the cost of fencing, we might expect a more elaborate governance regime—even if the benefits of entitlement delineation did not change. This is illustrated in Figure 2, in which the marginal costs of governance have shifted upward relative to the marginal costs of exclusion, but everything else has remained constant.

Figure 2.
RELATIVE INCREASE IN MARGINAL COST OF GOVERNANCE



Because the individual informational variables' cost curves have shifted—here the marginal cost of governance—we can expect changes in the “switch

point” at which a new strategy becomes the least costly. Under the first marginal cost curve for governance (MCG), this switch point is at s , whereas with the shift upward in marginal cost to MCG' (a more costly supply of governance, especially relative to exclusion), this shift would occur later, at s' . That is, as governance becomes relatively more costly, exclusion remains the least costly over a larger range. Here a switch from exclusion to governance is expected to occur at higher levels of desired precision (to the right in Figure 2), as long as conditions give us some reason to believe that the system has some tendency to move in the direction of efficiency.¹⁶⁰

In the present framework, rights employ informational variables, like boundaries, or more precise indicia of use, like time or amounts of substances such as water. These informational variables can be thought of as signals of use, and they vary in their degrees of indirectness and the extent to which they are subject to deterioration. Thus, at the exclusion end of the spectrum, mere presence inside the boundary signals a violation of the right. As a signal for harm, it is very rough and indirect because it is quite overinclusive: not everyone on a parcel is up to no good. By contrast, in the governance strategy, the signals relied upon are much more direct signals of harm. Whether a sheep is grazed at the proper time and in the proper manner is a fairly (but not completely) accurate signal of how much harm it is causing to the grass.

Accurate signals involve higher information costs, for static and dynamic reasons. Statically, evaluating whether a governance rule is being followed is, again, more difficult than tracking simple boundary crossings and other violations of the right to exclude. Dynamically, it will often be difficult to come up with stable signals that narrow in on specific uses: actors subject to the rule can change their activity in order to increase in their favor the divergence between the signal and the underlying harm. One advantage of the cruder signals of exclusion is that actors are not in equipoise: small changes in their activities will not affect the amount of harm they cause (and the benefit they can appropriate) for a given amount of the violation signal produced. For example, someone stealing grain from a field will not find it easy to engage in much theft without actually entering the field and thereby sending the boundary-crossing signal that would allow the owner to complain of a violation.

An informational variable (a signal) deteriorates when its indirectness calls forth efforts by primary actors to manipulate the variable to their advantage. A classic hypothetical example concerns the redness of apples.¹⁶¹ If redness

160. See, e.g., LIBECAP, *supra* note 113, at 29-34, 36-37.

161. See Barzel, *supra* note 51, at 42-46.

correlates in the initial state with tastiness, apples that are very red will fetch a higher price. Consumers have limited ability to test the apples, and color is a low-cost proxy for the attribute—taste—in which they are interested. Given this state of affairs, there is an incentive on the part of growers and sellers to increase the redness of apples, say by using a certain chemical, even if it does not increase their tastiness. If an apple's redness can be changed cheaply enough to mimic the appearance of tasty apples and changes in color are cheaper than changes in taste, apples will get redder but less tasty at every level of redness. This deterioration of the signal causes two problems. First, consumers (users of the signal) must use resources to constantly update their estimates of the correlation between redness and taste. Second, if the use of the chemical increases the redness of untasty apples more than that of already tasty apples, the compression in the range of color reduces the informational value of the signal.¹⁶²

The signals employed by the exclusion and governance strategies are subject to different dangers of deterioration. Behavior by actors will influence the accuracy of signals at the margin. With exclusion, uses falling in the center of a broad exclusionary right are likely to be captured regardless of such behavior, but manipulation may cause more peripheral uses not to be captured. For example, trespass will capture uses requiring presence on the land, such as stealing crops. Because trespass's signal of boundary crossing is overinclusive, it is unlikely that actors will be able to adjust their behavior to engage in any part of the prohibited activity without sending the violation signal. But trespass does not deal as well with conflicting uses by those on adjacent parcels or use by people merely trying to look in.¹⁶³

With governance, on the other hand, more fine-grained measurement means that more uses will be near the edge of the signal. For example, a governance regime prescribing the proper numbers and method of grazing sheep can be vulnerable to the breeding of faster-eating sheep.¹⁶⁴ Thus

162. *Id.* at 43. This is similar to the real problem with “grade inflation.” Grades lose their informational value when they are compressed at the upper end (near A or A+). Pure grade inflation, in which grades higher than A+ could be added, would not lead to a lessening of information if all grades shifted upward in tandem and users of the grades continually updated their information about the scale.

163. See, e.g., *Phillips Petroleum Co. v. Cowden*, 241 F.2d 586 (5th Cir. 1957); *Detroit Base-Ball Club v. Deppert*, 27 N.W. 856 (Mich. 1886); *Victoria Park Racing & Recreation Grounds Co. v. Taylor* (1937) 58 C.L.R. 479 (Austl.); Kevin Gray, *Property in Thin Air*, 50 CAMBRIDGE L.J. 252 (1991); Gary Washburn & Matt O'Connor, *Cubs Hurl Federal Suit at Rooftop Owners*, CHI. TRIB., Dec. 17, 2002, at 1.

164. See, e.g., GLENN G. STEVENSON, COMMON PROPERTY ECONOMICS: A GENERAL THEORY AND LAND USE APPLICATIONS 215-16 (1991) (noting that, because the amount of grass consumed

governance regimes have more to police, both statically and dynamically.¹⁶⁵ If, however, the optimal degree of precision is high because of high stakes, then at some point it becomes worth policing governance-style signals or tolerating some deterioration (or both). That is, when high measurement cost is worthwhile, this can take the form of (i) delineating uses and users in a fine-grained way, (ii) policing the rights delineated, or (iii) tolerating residual losses from manipulation and deterioration of the signals used.

Seeing governance as a strategy as based on tailored, direct signals allows us to revisit the notion of rivalness in property. Signals are keyed to groups of attributes of an asset. When we say that a good is rival, the use of these attributes conflicts in some way with use by someone else. This can take several forms. The attributes themselves may be rival, and the same attributes cannot be used by two people—for example, two people cannot eat the same bite of an apple. Or the uses may conflict, but the conflict is partial, so that there is some crowding effect. A highway may not be rival in this sense until many people are on the road. Sometimes different attributes in the same “asset” may be used without conflict, at least through a certain range. Thus someone can grow certain robust crops on a parcel and allow hunting on it at the same time. Too many hunters, however, might trample the plants. In some indigenous property systems based on rights to use, someone may have the right to the fruits of trees and others the right to hunt birds.¹⁶⁶ As long as resource use of this sort is not very intense, the uses are not rival. And in indigenous property systems, use rights tend to be narrow and tailored to specific uses rather than sweeping in the broad right to determine a wide range of uses (i.e., the right to exclude).

In intellectual property, the nonrival nature of use makes rights more difficult to delineate and enforce. In the case of tangible property, use conflict itself can trigger the violation of a right or can at least bring the violation to the attention of the right-holder. When uses do not conflict in this way, mere use by another does not announce itself in the same way. If so, this is a reason to think that signals tailored to use—governance-type signals—tend to be more costly in the case of intellectual property than in tangible property. All else equal, this can push us toward no property rights (open access) or toward

does not significantly increase if animals are left on a field longer, regulating the number of animals fixes the intensity of the harvest in all but the easily-adjusted-to long run).

165. Liability rules are focused on particular uses and tend to accompany a governance regime, and I have argued elsewhere that liability rules are more subject to this type of deterioration than are property rules. See Smith, *Property and Property Rules*, *supra* note 5.
166. See, e.g., Stuart Banner, *Two Properties, One Land: Law and Space in Nineteenth-Century New Zealand*, 24 *LAW & SOC. INQUIRY* 807 (1999).

more reliance on exclusion. At the same time, nonrivalness implies benefits of open access. Thus, in a sense, it is nonrivalness that has some tendency to *polarize* the choices of delineation for intellectual property rights. Likewise, improvements in technology can make uses more complex or easier to track, and can favor either exclusion or governance.¹⁶⁷ The ambiguous implications of nonrivalness and technological change can go some way toward explaining the sharp disagreements over the proper strength and scope of intellectual property.

Uses do not always conflict, and more than one ownership regime can govern an asset. Multiple overlapping regimes that can accommodate use by multiple parties are particularly likely in intellectual property (and are less modular than having a single regime).¹⁶⁸ Intellectual property rights are likely to be semicommons around their edges.¹⁶⁹

When we focus on property law as opposed to property rights in general, issues of institutional competence are central. The pattern of property law will depend in part on the relative cost of delineation of rights by courts as opposed to participants. Thus, the question is not just the Demsetzian one of whether additional definition and enforcement activity is worth the cost, but whether formal or informal contracting, with or without ex post judicial enforcement, is cheaper than ex ante specification of rights by property law.

Property law serves two purposes, both of which are consistent with viewing property as generally more based on rough signals of exclusion and access than is contract. Property can either assign an entitlement in contexts in which further bargaining to modify or transfer the entitlement is not likely to take place, or it can furnish the starting point for private bargains. In the latter case, it is likely that contracting will add to the precision of the rights; in addition to simple transfers, parties can contract to subdivide, to modify rights, or to allow access under limited conditions. Parties can also contract over specific uses to which resources can be put. Anything beyond a contract for a simple transfer is likely to add to the precision of the set of rights to the resource and hence to increase reliance on the governance strategy. If, however, no further bargaining takes place, property law has the last word. This can

167. See *infra* text accompanying note 262.

168. See, e.g., Heverly, *supra* note 73, at 1164-88; Smith, *supra* note 71, at 131-32, 138-42. Robert Merges has described a semicommons-like arrangement under which scientists share with each other for research purposes but enforce rights against commercial entities. See Robert P. Merges, *Property Rights Theory and the Commons: The Case of Scientific Research*, SOC. PHIL. & POL'Y, Summer 1996, at 145.

169. See *supra* note 73 and accompanying text.

happen because the gains from further precision are outweighed by the costs of further delineation by contract.

B. “Exclusive” Rights in Information

In the case of intellectual property, the “things” that are the objects of the right to exclude need to be constructed, but the problems of delineation costs are not fundamentally different from those prevailing in property generally—despite frequently expressed worries to the contrary.¹⁷⁰ Consider patents on inventions. Some inventions are relatively easy to conceive of as the kind of “things” required by property law. In the formative period of U.S. patent law, the state of technology meant that most inventions were embodied in some apparatus, a physical thing.¹⁷¹ Beginning with a burst of chemical invention in the early twentieth century, cutting-edge technology has been less tied to these kinds of objects. But I argue that the delineation of exclusion rights proceeds in a surprisingly similar fashion in these less concrete cases. Two illustrative areas are chemical inventions and industrial processes.

Chemical inventions present characteristic problems of delineation. Although it is thought that they are not as thing-like as some types of apparatus, some chemical inventions are quite easy to describe and thus to subject to exclusion rights.¹⁷² A patent can claim a given compound, and this will give the patent holder the right to exclude others from using the

170. See, e.g., HOHFELD, *LEGAL ESSAYS*, *supra* note 2, at 30 (“Much of the difficulty, as regards legal terminology, arises from the fact that many of our words were originally applicable only to physical things; so that their use in connection with legal relations is, strictly speaking, figurative or fictional.” (footnote omitted)).

171. See, e.g., John Hoxie, *A Patent Attorney’s View*, 47 J. PAT. OFF. SOC’Y 630, 636 (1965) (“The patent system as we have it today was really very little changed by the Patent Act of 1952; it goes back to a period when invention was largely mechanical, followed by an electrical era. In both, invention was chiefly of physical objects. The language and much of the judicial treatment of the statutes is geared to that sort of invention. When chemical invention became more frequent . . . a problem arose of fitting chemical invention into a mold of words and a habit of thinking that were not developed with it in mind.”); see also Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 581-82 (1999) (discussing the traditional hostility to patents not tied to a physical apparatus and its decline in the twentieth century).

172. This becomes more difficult when compositions of matter are only practically describable in terms of their ingredients and the conditions for mixing them. Such “recipe” claims are controversial. Compare *Exxon Chem. Patents, Inc. v. Lubrizol Corp.*, 64 F.3d 1553 (Fed. Cir. 1995), *with id.* at 1563 (Nies., J., dissenting).

compound.¹⁷³ Importantly, the patent holder controls even uses that she did not foresee or disclose at the time of the application, and this has been one of the most controversial aspects of patent law.¹⁷⁴ So, for example, if an inventor receives a patent on a substance after having disclosed its use as a lubricant, and it is later discovered that it is even more useful as a fuel additive, the patentee can exclude others from the new use as well.¹⁷⁵ Patent law gives the owner rights with a large degree of what I call “functional breadth”: the right is simply measured by the informational variable of whether the potential infringer is “using” the compound.¹⁷⁶ No evaluation of the benefits and costs of the use or the deservingness of the owner versus the infringer is required. The right is largely on/off, employing the relatively easily delineated chemical specification as the basis for a right to exclude.

As inventions, industrial processes are even more difficult to describe, and there is an ever-present danger that claims will describe the goals of a process while leaving too much vagueness in the description of the actual process being claimed. To take a famous example, the holder of the patent on a process for separating fats into glycerine and fatty acids through the use of heat, pressure, and water can exclude others from using the process with any apparatus (and at any temperature)—even if the apparatus that turns out to be best was not contemplated by the inventor at the time of application.¹⁷⁷ Commentators have mostly focused on the problem that such claims might be too broad—for

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173. At the time of application, the would-be patentee must show some use, not all uses, and in the area of chemical invention, the main controversy has surrounded what kind of utility must be shown. For a recent case setting out a two-step procedure for evaluating the utility of chemical inventions, see *In re Brana*, 51 F.3d 1560 (Fed. Cir. 1995).
174. See, e.g., *In re Thuau*, 135 F.2d 344, 347 (C.C.P.A. 1943) (“[A] patentee is entitled to every use of which his invention is susceptible, whether such use be known or unknown to him.”); Kitch, *supra* note 4, at 269; cf. Paul H. Eggert, *Uses, New Uses and Chemical Patents—A Proposal*, 51 J. PAT. OFF. SOC’Y 768 (1969) (criticizing this doctrine as applied to chemical inventions). Notice that functional breadth is a double-edged sword: upon the expiration of the patent the public has the right to use the invention, and one cannot obtain a new use for an old product. See *Old Town Ribbon & Carbon Co. v. Columbia Ribbon & Carbon Mfg. Co.*, 159 F.2d 379, 382 (2d Cir. 1947) (Hand, J.).
175. This example is taken from Kitch, *supra* note 4, at 269.
176. Functionally broad rights are similar to what Yoo has called “intense” rights. Yoo, *supra* note 4, at 65.
177. See *Tilghman v. Proctor*, 102 U.S. 707 (1880). The traditional concern with “functional” claims is largely a reflection of high delineation costs as well as applicants’ efforts to maximize the amount claimed and to minimize the cost of claiming it. See *Markman v. Westview Instruments, Inc.*, 517 U.S. 370, 373 (1996) (“A claim covers and secures a process, a machine, a manufacture, a composition of matter, or a design, but never the function or result of either, nor the scientific explanation of their operation.” (quoting 6 ERNEST BAINBRIDGE LIPSCOMB III, LIPSCOMB’S WALKER ON PATENTS § 21:17, at 315-16 (3d ed. 1985))).

example, that claims will cover too many types of apparatus that might be used in the process but the applicant will not be required to disclose what these types of apparatus might be.¹⁷⁸ This concern, which I call “substantive breadth,” may be especially severe with respect to processes, but it forms the core of critics’ case against excessive patent scope more generally. Nevertheless, as with chemical inventions, patent law also gives rights to processes—like all other types of inventions—with *functional* breadth: the patent holder has a right to exclude others from using the process, for whatever purpose.

The functional breadth of patent rights, I argue, reflects the high costs of delineating rights in the patent area, in which one invention may interact with many others to create a valuable product that is priced in a market.¹⁷⁹ The range of possible actions that a patent holder can take to develop inventions further—and especially to commercialize them—is subject to high delineation costs, making property-like rough rights of exclusion based on simple informational variables more attractive. As this Article shows, copyright law exhibits these delineation cost problems to a somewhat lesser degree and provides correspondingly greater delineatory precision.

C. *The Central Question for Property Rights in Information*

The role of modularity in property (as well as its core exclusion strategy in particular) allows us to recast the central dilemma of intellectual property. Because information can be enjoyed at low marginal cost but requires investment to create and commercialize it, intellectual property is sometimes said to be a compromise between these two considerations. But framing the problem this way in some sense stacks the deck against intellectual property because intellectual property skeptics are really also arguing about the forms that compensation should take. Should property rights be replaced with rewards, or rights subject to exceptions and compulsory licenses, or something else? Or are intellectual property rights inherently too costly?

To answer these questions, it is not enough to point to the nonrival aspect of information. An exclusive focus on the nonrival informational output points toward the possibility of other methods of compensating inventors and

178. But commentators do not limit their objections about breadth to the area of processes. The functional breadth of patent law has also been the subject of longstanding and widespread disapproval. See, e.g., Eggert, *supra* note 174, at 774; see also Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1043-44 (1989) (arguing that prospect theory at best provides only occasional support for patents broad enough to prevent unauthorized research).

179. See *infra* Section III.A.

commercializers—or highlights the advantages of relying on nonlegal incentives, such as academic tenure and fame. Rather, one should ask whether, among the possible forms of compensation, any single form is better than nothing, and if so, which is the least bad.

There is an additional irony. Precisely because information and use by multiple parties are more important than ever, the problem of coordinating the commercialization of information is even more complex. If so, we might need more modularity, not less, and exclusion might be more cost-effective than before. While it is true that the benefits of use by multiple parties have likely increased, that does not automatically mean that off-the-rack law needs to be more complex. Modularity is a means for managing complexity, and exclusion rights solve coordination problems cheaply, albeit less thoroughly than governance rules. Nor does the law of property have the last word on what uses will be accommodated; property serves as the baseline for contracting. It may well be that as overall complexity increases in the system of relations between actors using information, the modular feature of property permits a greater degree of overall complexity than do legal regimes more tailored to use.

If intellectual property benefits from the indirectness and modularity of the exclusion strategy, then intellectual property does indeed look like property. That intellectual property countenances some waste in terms of precluded use is the price for securing the benefits of indirectness and modularity. Resources subject to the law of “regular” property may be rival, but the establishment of exclusion rights is not beneficial for its own sake and involves wasted resources (sometimes a degradation of the protected resource itself¹⁸⁰). So, too, intellectual property compensates those who invent, develop, and commercialize informational resources in a way that manages complexity at low cost, but we may have to incur the (one hopes) lower cost of having exclusive rights in a nonrival resource. The answer to the question of whether this effort is worthwhile cannot come from theorizing, whether about the nonrival nature of information on the one hand or about the importance of incentives for creators on the other. The question is whether a modular indirect exclusion strategy is the most cost-effective method of coordinating efforts and allocating compensation to inputs. We may be able to make guesses to this effect, but the search for the Philosopher’s Stone in nonrivalness or in incentive theory is bound to prove fruitless.¹⁸¹

180. See *supra* note 39 and accompanying text.

181. Cf. Harold Demsetz, *Professor Michelman’s Unnecessary and Futile Search for the Philosopher’s Touchstone*, in *NOMOS XXIV: ETHICS, ECONOMICS, AND THE LAW* 41 (J. Roland Pennock & John W. Chapman eds., 1982).

III. INFORMATION COSTS IN PATENT AND COPYRIGHT LAW

Intellectual property is a natural area to test the information-cost theory of property, for two reasons. First, we are accustomed to thinking in terms of physical boundaries, but any account of exclusion and governance should be expected to accord with our intuitions about access to and use of nonphysical resources. Second, and more tentatively, we may be able to begin to explain some differences among areas of intellectual property law as a response to different costs of measuring the use of information.

A. Patent Versus Copyright Law

Exclusion and governance can be contrasted with respect to nonphysical attributes and assets as well as to the more familiar tangible “things.” In the case of a nonphysical and nonrival resource such as information, the right to exclude is the right to deny access to a large collection of uses (and hence attributes), as in the case of a physical resource. But unlike with a physical resource, the lowest-cost boundary is not a spatial one. In the case of a nonphysical asset, governance still refers to norms of use defined over activities involving the asset.¹⁸²

One problem in comparing patent and copyright is that the nature of the resource is sufficiently different between and within the two areas that commentators have disagreed as to whether the costs of delineating property rights in patent are higher or lower than in copyright. For example, Clarisa Long has argued that because the resource in copyright is more ethereal than in patent, the delineation costs are higher.¹⁸³ But this view fails to consider that inventions come in many different varieties, some of which are easy to define (e.g., chemicals) and others much less so (e.g., processes). The same can be said of copyright: policing at the level of word-for-word expression is easy, but defining a protected literary character or style is difficult.¹⁸⁴ And, as we will see,

182. Unlike with a spatial asset, it may be the case that attributes are easier to separate out; separating them may not involve the physical obstacles of intermingling. At the same time, there may be significant measurement costs to separating out the attributes and uses, and, as we will see, when these costs are high we expect the bundling of attributes characteristic of exclusion here too.

183. See Clarisa Long, *Information Costs in Patent and Copyright*, 90 VA. L. REV. 465 (2004).

184. See, e.g., *Nichols v. Universal Pictures Corp.*, 45 F.2d 119, 121 (2d Cir. 1930) (Hand, J.) (“Upon any work, and especially upon a play, a great number of patterns of increasing generality will fit equally well, as more and more of the incident is left out. . . . [T]here is a point in this series of abstractions where they are no longer protected, since otherwise the playwright could prevent the use of his ‘ideas,’ to which, apart from their expression, his

the literatures on intellectual property valuation and invention economics suggest high delineation costs in the case of patent.¹⁸⁵

It is useful to distinguish two kinds of information costs associated with the exclusion and governance strategies, respectively. Exclusion relies on finding signals that correspond roughly with use but more tightly with some “thing,” whether pre-carved by our conventions or delineated specially for legal purposes. Governance relies on signals tightly tied to use but not keyed to things or their attributes. In this Section, I claim first and foremost that it is the *relative* costs that are different in the cases of patent and copyright. If we hypothesize, consistent with the literature on valuation, that use is costly to separate out and measure in the case of inventions, relative to exclusion-like delineation based on other attributes (e.g., their basic features, such as chemical composition or the steps involved in a process), this helps explain patent law’s reliance on exclusion despite the high stakes involved. Conversely, in copyright, uses appear to be relatively less costly to delineate. Whether or not, as some have claimed, thing-attributes are more costly to delineate in copyright than in patent, the relative ease of delineating uses can explain the ways in which copyright is more regulatory and less property-like than patent—i.e., more of a governance regime.

Rules of physical access involve rough signals that are cost-effective when a large number of uses are to be prevented or protected. Exclusion in intellectual property likewise prevents and protects a large class of uses. As with physical resources, if enough uses are bunched together in this way, most of those uses are protected, and it becomes economical to speak of rules as regulating access to attributes; that is, the rules become exclusion rules implementing the layperson’s right to a “thing.” The more uses are bunched together, the more exclusion-based the right appears and the more property-like the right becomes. A right to a thing *could* be regarded as a collection of use rights, but this misses something: a rule that employs cheap and rough signals like boundaries can leave implicit various privileges to a large and indefinite class of uses as against a large and indefinite class of users.¹⁸⁶ As William Markby has analogized, ownership “is no more conceived as an aggregate of distinct rights

property is never extended. Nobody has ever been able to fix that boundary, and nobody ever can.”); *Steinberg v. Columbia Pictures Indus., Inc.*, 663 F. Supp. 706, 712 (S.D.N.Y. 1987) (“No rigid principle has been developed, however, to ascertain when one has gone beyond the idea to the expression, and [d]ecisions must therefore inevitably be ad hoc.” (quoting *Peter Pan Fabrics, Inc. v. Martin Weiner Corp.*, 274 F.2d 487, 489 (2d Cir. 1960) (Hand, J.))).

185. See sources cited *supra* note 104.

186. See Smith, *supra* note 15, at S468-71.

than a bucket of water is conceived as an aggregate of separate drops.”¹⁸⁷ This idea is an old one, going back at least to the Austinian notion that “indefiniteness” is the essence of property.¹⁸⁸ In terms of modularity, for many purposes, the individuation of drops (or molecules or even further) is not relevant; the fluid can be treated as an aggregate. A reservoir of unspecified uses under the control of an owner is the result of the use of rough signals of exclusion, and such signals are cheap precisely because they sweep in these uses without needing to spell them out.

The question is whether it is less costly to measure use by signals very directly related to use or by signals that bundle so many uses together that we speak of exclusion. Patent and copyright differ in many ways, but especially in the costliness of delineating and evaluating use. And the two areas of law differ in the ways one would expect on the information-cost model.

Traditional criteria for distinguishing the realms of patent and copyright, such as utilitarian versus artistic values, correspond closely to how difficult the uses of the information are to separate and evaluate. Utilitarian use often involves problems of attributing the value of interacting inputs and choosing among indefinite, novel, and therefore hard-to-assess uses. This distinction is reflected in the respective scopes of the two great nineteenth-century conventions on intellectual property, the 1883 Paris Convention for the Protection of Industrial Property¹⁸⁹ and 1886 Berne Convention for the Protection of Literary and Artistic Works.¹⁹⁰ These two conventions helped to define the function/expression divide.¹⁹¹

Patents on average give rise to greater information costs than do copyrights — i.e., greater costs of devising and monitoring informational signals of the use of information as a resource. First, and most familiarly, patents

187. WILLIAM MARKBY, *ELEMENTS OF LAW* 158 (6th ed. 1905).

188. 2 JOHN AUSTIN, *LECTURES ON JURISPRUDENCE* 827 (Robert Campbell ed., London, John Murray 4th ed. 1873) (“[I]ndefiniteness is of the very essence of the right; and implies that the right . . . cannot be determined by exact and positive circumscription.”); see also *RESTATEMENT OF THE LAW OF PROP.* §§ 5 cmt. e, 10 cmt. c (1936) (defining “complete” ownership in terms of the maximum set of allowable interests, and noting that one can be an “owner” despite some decrease in interests); Bernard E. Jacob, *The Law of Definite Elements: Land in Exceptional Packages*, 55 S. CAL. L. REV. 1369, 1388 (1982) (discussing how the *Restatement’s* definition of complete ownership requires “not only reasonably exclusive present control, but also an indefinite reservoir of potential uses”).

189. Mar. 20, 1883, revised July 14, 1967, 21 U.S.T. 1583, 828 U.N.T.S. 305.

190. Sept. 9, 1886, revised July 24, 1971, 25 U.S.T. 1341, 1161 U.N.T.S. 3.

191. On the Paris and Berne Conventions as representing two approaches to intellectual property, see J.H. Reichman, *Legal Hybrids Between the Patent and Copyright Paradigms*, 94 COLUM. L. REV. 2432, 2434-36 (1994).

involve a great deal of uncertainty.¹⁹² Inventions protected by patent law are often subject to multiple uses, many of which are not foreseeable. Second, and relatedly, the range of actions taken to increase the value of the patent seems to be far greater in the case of patents than in the case of copyrights. Correspondingly, there is a rationale to employ signals of access to define the entrepreneur's residual claim.

Third, it is a well-known problem that the contribution of a patent to an overall product is very difficult to measure; this has not historically been as large a problem with copyrights.¹⁹³ One product may embody a large number of inventions and innovations. Furthermore, tracing the many further contributions of an invention like the light bulb to other products and activities would be very costly, even for the length of the patent term.¹⁹⁴ Relatedly, there is a large economics literature on spillovers, external benefits from one research and development project to another, suggesting a major measurement problem in isolating the value of various activities with respect to inventions.¹⁹⁵ Again, the problem is like team production in that various contributors affect each other's productivity and their inputs are hard to disentangle.¹⁹⁶ Furthermore, the productive uses of an invention typically require a great deal of expertise, making it even more difficult for judges to evaluate those uses.

Fourth, combining these last two points, patents interact with each other, making officials' evaluations all the more difficult in patent than in copyright. Even for private parties who likely have an advantage in delineating fine-grained use rights, measuring the individual contribution of a single patent to a product is evidently so difficult that licenses between sophisticated parties are

192. See, e.g., Kitch, *supra* note 4, at 267-71; Robert P. Merges, *Uncertainty and the Standard of Patentability*, 7 HIGH TECH. L.J. 1 (1992).

193. See, e.g., Russell Hardin, *Valuing Intellectual Property*, 68 CHI.-KENT L. REV. 659, 660 (1993); Kitch, *supra* note 4, at 271 (noting that “[e]ach significant innovation affects related aspects of the technology with which it interacts,” and discussing how one innovation can alter the possibility set for the development of other related inventions, such that “the realization of the possibilities may have a significance that dwarfs [that of] the original invention considered alone”); Robert P. Merges, *The Law and Economics of Employee Inventions*, 13 HARV. J.L. & TECH. 1, 21 & n.69 (1999) (discussing measurement problems in R&D team production, and citing literature on managing complementary components of R&D projects); see also Giles S. Rich, *The Principles of Patentability*, 42 J. PAT. OFF. SOC'Y 75, 84-85 (1960) (noting that patent law need not determine the size of the reward because the popularity of the invention will be measured by the market).

194. See, e.g., John P. Dawson, *The Self-Serving Intermeddler*, 87 HARV. L. REV. 1409, 1412 (1974); Wendy J. Gordon & Sam Postbrief, *On Commodifying Intangibles*, 10 YALE J.L. & HUMAN. 135, 157-58 (1998) (book review).

195. See Kamien et al., *supra* note 103; Suzumura, *supra* note 103.

196. See *supra* notes 48-57 and accompanying text.

rarely tailored to individual licensees.¹⁹⁷ The problem is not just undervaluation but the multidimensional nature of the activities that are the concern of patent law.¹⁹⁸ In our terms, it is difficult in patent to move beyond access-based rules to use-based rules.

Copyright, by contrast, raises these problems to a lesser degree. In copyright, the set of such interlocking uses has historically been smaller, and often it is easier to attribute value to a copyrighted work, either because it corresponds more closely to a product demanded and sold on the market or because the copyright use does not involve expertise. Before turning to the statutory schemes for evaluating types of uses of protected works, it is worth remembering that judicial apportionment of profits from the use of a copyrighted work in a further work is more readily undertaken in copyright law, even though, as Judge Learned Hand put it, “[s]trictly and literally, it is true that the problem is insoluble.”¹⁹⁹ Also, in part because copyright relies on use-based rather than access-based signals to define the right, copyright comes even less close than patent to protecting ideas themselves. But if copyright *did* protect ideas, many patent-like valuation problems would arise because new works typically incorporate many old ideas.²⁰⁰ In sum, “industrial” exploitation of information involves different and more costly measurement than does cultural exploitation—at least before new forms of electronic communication arrived on the scene.²⁰¹

The differences between patent and copyright law do not stem mainly from differences in the benefits of precision. On the benefit side, one would expect

197. See Merges & Nelson, *supra* note 95, at 874 & n.148; see also Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, in 1 INNOVATION POLICY AND THE ECONOMY 119 (Adam B. Jaffe et al. eds., 2001) (discussing how overlapping patents lead to difficulties in licensing).

198. Other countries do make some use of compulsory licenses in their patent laws, in situations such as blocking patents, see Merges, *supra* note 95, at 104-05 (noting that the law provides for compulsory licenses for blocking patents in Australia, China, France, Japan, the Netherlands, New Zealand, and Switzerland), cases of public interest, and essential intellectual property rights, see Consolidated Version of the Treaty Establishing the European Community arts. 81(3), 82, Dec. 24, 2002, 2002 O.J. (C 325) 33, 64-65 (providing for compulsory licensing of essential intellectual property rights). The argument here is just that copyrights are comparatively more amenable to this approach than are patents.

199. *Sheldon v. Metro-Goldwyn Pictures Corp.*, 106 F.2d 45, 48 (2d Cir. 1939) (apportioning only 20% of the profits from a movie to the holder of the copyright on a play, of which only a small part was used in the movie, when the movie’s success was mainly attributable to its stars rather than to its script), *aff’d*, 309 U.S. 390 (1940).

200. Creating a new work involves new expression and old ideas. See William M. Landes & Richard A. Posner, *An Economic Analysis of Copyright Law*, 18 J. LEGAL STUD. 325, 332 (1989).

201. See *infra* notes 223-226 and accompanying text.

more precision when the stakes are higher, as reflected in Figure 1, and there is reason to believe that the stakes are, if anything, higher in patent law. This is reflected in, for example, the expensiveness of obtaining and defending a patent. Private parties often do delineate separate uses very finely in their licenses, suggesting benefits from doing so. Much delineation effort goes into each patent and into numerous licenses. And the literature on valuing intellectual property has an overwhelming focus on patents rather than copyrights.²⁰² Furthermore, questions of anticommons and the possibility of bargaining breakdown in the presence of multiple, tightly interrelated patent rights has been a focus in recent commentary on patent law, in a different way and to a greater extent than in copyright.²⁰³ In patent, the fear is that the holders of narrow patents that need to be used together for further research or to develop a project will each engage in holdup behavior and that assembling permissions will be costly and time-consuming. This was a major concern with patents over gene fragments before the Patent and Trademark Office promulgated guidelines. The evidence on the significance of the anticommons effect comes primarily from surveys; it is mixed and provides little guidance as to how costly the problem is or how much it can be attributed to the patent system.²⁰⁴

202. See sources cited *supra* note 104.

203. See Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998); Michael S. Mireles, *An Examination of Patents, Licensing, Research Tools, and the Tragedy of the Anticommons in Biotechnology Innovation*, 38 U. MICH. J.L. REFORM 141, 230-34 (2004).

204. See, e.g., Eric G. Campbell et al., *Data Withholding in Academic Genetics: Evidence from a National Survey*, 287 J. AM. MED. ASS'N 473, 477 (2002) (reporting that 47% of academic geneticists said that another academic had refused at least one of their requests for data or materials associated with a published article in the preceding three years); Stephen Hilgartner & Sherry I. Brandt-Rauf, *Data Access, Ownership, and Control: Toward Empirical Studies of Access Practices*, 15 KNOWLEDGE 355, 359, 363-66 (1994) (discussing strategic issues involved in decisions to grant access to data); Shapiro, *supra* note 197, at 119; John P. Walsh et al., *Effects of Research Tool Patents and Licensing on Biomedical Innovation*, in PATENTS IN THE KNOWLEDGE-BASED ECONOMY 285 (Wesley M. Cohen & Stephen A. Merrill eds., 2003) (noting that a survey of industry participants found that patents on research tools generally have not caused much breakdown or even restricted access as anticommons theory would suggest, and documenting various solutions to the fragmentation problem, including licensing, inventing around, infringing, public disclosure, and litigation); John P. Walsh et al., *Patents, Material Transfers and Access to Research Inputs in Biomedical Research 2* (Sept. 20, 2005), <http://tigger.uic.edu/~jwalsh/WalshChoCohenFinal050922.pdf>. Problems seem to be greater in the case of materials transfer than sharing of data. John P. Walsh et al., *View from the Bench: Patents and Materials Transfers*, 309 SCIENCE 2002, 2002 (2005); see also Rebecca S. Eisenberg & Arti K. Rai, *Harnessing and Sharing the Benefits of State-Sponsored Research: Intellectual Property Rights and Data Sharing in California's Stem Cell Initiative*, 21

Even commentators who are optimistic about the ability of private transactions to lead to efficient exploitation recognize that patents are often highly complementary²⁰⁵ in a way that copyrights seldom are.²⁰⁶ Nor is it only the breadth of patent rights that is the sole problem here: multiple narrow rights are thought to be problematic precisely because of their high degree of interrelatedness.²⁰⁷ Given all this evidence of the potential benefits of delineating uses, one would expect that patent law would focus more on specific uses—that it would present a more nuisance-like and less trespass-like regime. So the puzzle is why patent takes a more sweeping and indefinite strategy in this respect than does copyright law. I argue that high measurement cost leads to a more exclusionary, more strongly property-like regime in patent than the more governance-style regime in copyright.

Commentary that does compare patent and copyright law tends to see them as more similar than they are.²⁰⁸ In particular, copyright serves as a model for those commentators who would like to see officials intervene more to solve patent transacting problems. The tendency is to see copyright as a model for patent law, precisely because it separates out various uses for special treatment. Once information costs are taken into account, however, we can

BERKELEY TECH. L.J. 1187, 1200 n.47 (2006) (discussing studies surveying geneticists on the sharing of data and materials).

205. See, e.g., John J. Doll, *The Patenting of DNA*, 280 SCIENCE 689 (1998) (analogizing the proliferation of patents on expressed sequence tags in genetics to earlier polymer chemistry in which initial patents were widely licensed); Shapiro, *supra* note 197, at 122-23; see also Richard A. Epstein, *Steady the Course: Property Rights in Genetic Material* (Chi. Working Paper Series, Paper No. 152, 2002), available at <http://www.law.uchicago.edu/faculty/epstein/resources/rae.genome.new.pdf> (noting the existence of a “patent thicket” and interdependency, and arguing against compulsory licensing but also against patents for expressed sequence tags).
206. Someone making a movie will rarely have to use a particular piece of music, but someone wishing to parody a given work will need access to that particular work. Notice that here copyright avoids the apportionment problem as between the original author and the parodist by allowing the parodist a certain amount of free access. See *Campbell v. Acuff-Rose Music, Inc.*, 510 U.S. 569 (1994) (holding that a commercial parody can fall within section 107 fair use).
207. Interconnectedness would strengthen the anticommons argument against many fragmented rights. See Heller & Eisenberg, *supra* note 203; see also David E. Adelman, *A Fallacy of the Commons in Biotech Patent Policy*, 20 BERKELEY TECH. L.J. 985 (2005) (discussing the anticommons argument, and arguing that research opportunities in biotech are not currently a scarce resource).
208. See, e.g., Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 COLUM. L. REV. 1177 (2000); John Shepard Wiley Jr., *Copyright at the School of Patent*, 58 U. CHI. L. REV. 119 (1991).

explain some of the sharp differences between patent and copyright, differences that are otherwise somewhat mysterious.

Consider first the legal rules, which may or may not lead to further contracting. Patents and copyrights both give rights relating to information, and both areas can involve situations of high transaction costs. For a variety of reasons, the scope of the right is broader in patent than in copyright. The different information-cost strategies in patent and copyright are reflected in the contours of the law.

1. *Definition of Rights*

Most basically, the rights in patent and copyright are defined differently. Patent law grants the exclusive right to “make[], use[], or . . . sell[]” an invention,²⁰⁹ which means that many uses are bundled together, so much so that commentators often adopt the metaphors of fencing, boundaries, and access.²¹⁰ Although it is sometimes overlooked, patent law is explicitly based on exclusion rather than on rights to use (governance, in our terms).²¹¹ Thus, patents give a right that relies heavily on the access-type proxies in a strategy we call exclusion.²¹²

Some of the differences between patent and copyright stem from patent law’s effort to internalize the benefits and costs of the wider range of uses discussed earlier as well as the special information costs to which this extra

209. 35 U.S.C. § 271 (2000). To these traditional rights have been added the right to offer to sell and to import the patented invention into the United States. *Id.*

210. See, e.g., Nard, *supra* note 119, at 759 (“Patent law is about building fences.” (citing Mitchell, *supra* note 119, at 51)); see also Patrick Croskery, *Institutional Utilitarianism and Intellectual Property*, 68 CHI.-KENT L. REV. 631, 648-56 (1993) (discussing “fencing” in intellectual property); Kitch, *supra* note 4, at 273-74 (comparing the limits of claims in patents to the physical boundaries of mineral claims); Merges & Nelson, *supra* note 95, at 845 (analogizing patent claims to metes and bounds); *Patent Rights and Licensing*, 6 B.U. J. SCI. & TECH. L. 3, ¶ 31 (2000) (remarks of Thomas Meyers).

211. See *Bloomer v. McQuewan*, 55 U.S. (14 How.) 539, 549-50 (1852) (emphasizing that a patent simply furnishes “the right to exclude every one from making, using, or vending the thing patented, without the permission of the patentee”).

212. See, e.g., Kenneth W. Dam, *Some Economic Considerations in the Intellectual Property Protection of Software*, 24 J. LEGAL STUD. 321, 336 (1995) (noting that patents rarely confer monopoly power in any market and that, “[i]f this is true of patents, it seems even clearer in the case of copyrights where no power to exclude is granted, where only the power to preclude copying is granted, and where independent creation by competitors is a complete defense” (emphasis added)); see also *id.* at 337 (discussing the absence of the power to exclude independently created works in copyright, as well as the copyright doctrine of merger of expression and idea as a limitation on the scope of the right).

effort gives rise. The greater costs of delineating and policing use in patent are a factor pushing in the direction of the exclusion strategy for delineating rights.²¹³

Consistent with the exclusion strategy is today's "peripheral" approach to patent claims: the definition of claims focuses on the outer bounds of what is claimed as an invention, without the need to specify the interior. The earlier central claiming method, in which the central case of the invention was specified and the boundaries were worked out *ex post*, is more of a governance regime (in our terms), as is its pale reflection in the doctrine of equivalents, under which the scope of a claim can be extended beyond the literal reading.²¹⁴ Also, a primary focus on the patent specification rather than on outside sources such as dictionaries tends to decrease the use of context and to increase the relative reliance on the exclusion strategy.²¹⁵

By contrast, copyright law enumerates various use rights, making it more of a governance regime from the outset. It gives certain specific exclusive rights to reproduce, to prepare derivative works, and to distribute, perform, and display the work.²¹⁶ Copyright law does not simply define a work or an idea and then give rights to exclusive access to such a resource. Copyrightable works must be fixed in a tangible medium of expression, and the statute explicitly denies protection for any "idea, procedure, process, system, method of operation, concept, principle, or discovery."²¹⁷

For this reason, copyright is sometimes even argued not to be property in the full sense. Historically, in English law, a statutory limited-term exclusive right over publishing and selling competed with a more robust common law

213. Notice that the marginal benefit of specifying rights in patent is unlikely to be lower than in copyright, and that, if so, a greater degree of legal definition in terms of use in copyright cannot be explained by different levels of the marginal benefit of precision.

214. See *Warner-Jenkinson Co. v. Hilton Davis Chem. Co.*, 520 U.S. 17, 26, 27 & n.4 (1997).

215. For an argument that relying on the specification over outside sources reduces third-party information costs, see Christopher A. Cotropia, *Patent Claim Interpretation and Information Costs*, 9 LEWIS & CLARK L. REV. 57 (2005).

216. 17 U.S.C. §§ 106-106A (2000).

217. *Id.* § 102. Under the useful article doctrine, an object with aesthetic elements that are not conceptually severable from its utilitarian aspects is not copyrightable. See Robert C. Denicola, *Applied Art and Industrial Design: A Suggested Approach to Copyright in Useful Articles*, 67 MINN. L. REV. 707, 741-48 (1983) (proposing a test of conceptual separability); see also *Brandir Int'l, Inc. v. Cascade Pac. Lumber Co.*, 834 F.2d 1142 (2d Cir. 1987) (applying a modified form of Denicola's test, and holding that a bicycle rack was not copyrightable because the designer modified a sculpture to serve as a bicycle rack). *But see Brandir*, 834 F.2d at 1151 (Winter, J., dissenting in part) (proposing as a test whether a reasonable observer would "perceive an aesthetic concept not related to the article's use").

right that gave property in the work itself.²¹⁸ In our terms, common law copyright is more based on the exclusion strategy. One argument against recent trends toward a broader and stronger copyright law is based on the theory that the Founders were aware of the two approaches to copyright and chose the more limited approach based on delineating certain uses of a work.²¹⁹ The notion that federal copyright “exclusion” sweeps less broadly than it did at common law continues to influence the courts.²²⁰

Nevertheless, some recent trends in copyright law have indeed had the effect of broadening the right. On the theory here, this could be because the benefits of doing so are higher—or at least because the benefits inure to those with an organized interest capable of lobbying Congress. Or it could be because the cost of “fencing” has become lower.²²¹ Evaluating these costs and benefits is beyond the scope of this Article, but one feature of this phenomenon deserves mention. As more uses are swept into the right, the fencing metaphor is more likely to be used. Copyright may be moving some way toward the exclusion pole of the spectrum of strategies for delineating rights. Often any tendency to draw from copyright a right to deny access to published material is criticized as inconsistent with copyright law or policy, or with the First Amendment.²²² Even such criticisms of excessively strengthening copyright, or calls for patent rights to be attenuated along the lines of copyright, all

218. See, e.g., L. Ray Patterson, *Copyright Overextended: A Preliminary Inquiry into the Need for a Federal Statute of Unfair Competition*, 17 U. DAYTON L. REV. 385, 396-403 (1992).

219. See *id.* at 401-03.

220. See *Suntrust Bank v. Houghton Mifflin Co.*, 268 F.3d 1257, 1260-63 (11th Cir. 2001) (discussing the history and types of copyright).

221. See, e.g., Trotter Hardy, *Property (and Copyright) in Cyberspace*, 1996 U. CHI. LEGAL F. 217, 238 (noting that the lower cost of monitoring or “fencing” using computer technology pushes in the direction of more “parcelization” of information, as in the case of barbed wire and land). Many authors have decried this tendency. See, e.g., BOYLE, SHAMANS, *supra* note 38, at 38; Benkler, *supra* note 38, at 420-21 (using the fence analogy, and arguing against information enclosure); Julie E. Cohen, *Lochner in Cyberspace: The New Economic Orthodoxy of “Rights Management,”* 97 MICH. L. REV. 462 (1998).

222. See, e.g., Shyamkrishna Balganesh, *Copyright and Free Expression: Analyzing the Convergence of Conflicting Normative Frameworks*, 4 CHI.-KENT J. INTELL. PROP. 45 (2004); Benkler, *supra* note 38; Paul Goldstein, *Copyright and the First Amendment*, 70 COLUM. L. REV. 983 (1970); Lawrence Lessig, *Copyright’s First Amendment*, 48 UCLA L. REV. 1057 (2001); L. Ray Patterson, *Free Speech, Copyright, and Fair Use*, 40 VAND. L. REV. 1, 5-7 (1987). *But see, e.g.*, Christopher L. Eisgruber, *Censorship, Copyright, and Free Speech: Some Tentative Skepticism About the Campaign To Impose First Amendment Restrictions on Copyright Law*, 2 J. ON TELECOMM. & HIGH TECH. L. 17 (2003); David McGowan, *Why the First Amendment Cannot Dictate Copyright Policy*, 65 U. PITT. L. REV. 281 (2004).

implicitly take for granted that patents fall further toward the full property end of the spectrum.

For copyright, the fencing metaphor tends to be used when commentators argue that authors can in effect protect ideas—making copyright into an exclusion-like rule of access—especially in the electronic domain.²²³ But unlike in patent law, this exclusion may take the form of legal protection against the activities of others. For example, the Digital Millennium Copyright Act (DMCA) of 1998 prohibits an activity—namely, circumventing “a technological measure that effectively controls access to a [copyrighted] work.”²²⁴

This regime is reminiscent of trade secret, which focuses on activities that circumvent the efforts of the trade secret holder to keep the secret. Trade secret itself is perched between a property-like regime of exclusion and a more tort-like, activity-based governance regime rooted in notions of fair competition. Like tort law, trade secret sometimes focuses on activities and applies an evaluative standard to them, but it sometimes applies more modular bright-line rules to create an exclusive zone within which secrets may be kept.²²⁵

223. See, e.g., Dan L. Burk, *Muddy Rules for Cyberspace*, 21 CARDOZO L. REV. 121, 168 (1999) (discussing new “technological fences”); Ejan Mackaay, *The Economics of Emergent Property Rights on the Internet*, in *THE FUTURE OF COPYRIGHT IN A DIGITAL ENVIRONMENT* 13, 21 (P. Bernt Hugenholtz ed., 1996); Neil Weinstock Netanel, *Copyright and a Democratic Civil Society*, 106 YALE L.J. 283, 285 (1996) (“[S]uch technological fences would raise the specter of all-consuming copyright owner control.”); Maureen A. O’Rourke, *Fencing Cyberspace: Drawing Borders in a Virtual World*, 82 MINN. L. REV. 609 (1998); see also Julie E. Cohen, *A Right To Read Anonymously: A Closer Look at “Copyright Management” in Cyberspace*, 28 CONN. L. REV. 981, 983-89 (1996) (discussing technologies for monitoring and controlling access to information); cf. Wendy J. Gordon, *Asymmetric Market Failure and Prisoner’s Dilemma in Intellectual Property*, 17 U. DAYTON L. REV. 853, 855 (1992) (analogizing any right to exclude to fences in real property).

224. 17 U.S.C. § 1201(a)(1)(A) (2000) (emphasis added); see *id.* § 1201(a)(3)(B) (“[A] technological measure ‘effectively controls access to a work’ if the measure, in the ordinary course of its operation, requires the application of information, or a process or a treatment, with the authority of the copyright owner, to gain access to the work.”). The DMCA includes provisions concerning manufacturing, importing, offering to the public, providing, or otherwise trafficking in technology that is “primarily designed or produced for the purpose of circumventing,” has “only limited commercially significant purpose or use other than to circumvent,” or “is marketed . . . for use in circumventing a technological measure that effectively controls access to a work protected under this title.” *Id.* § 1201(a)(2).

225. The leading case of making of trade secret an in rem right is *E.I. duPont deNemours & Co. v. Christopher*, 431 F.2d 1012 (5th Cir. 1970), in which the court held that the company could sue photographers who had been hired by a competitor and had aerielly photographed a plant under construction without committing any independent crime or tort. For a discussion of the two traditional approaches to trade secret, sounding in tort and property,

Nonetheless, trade secret only provides protection for information that the owner can feasibly keep secret (typically processes and customer lists).²²⁶

Copyright is also less exclusionary and more governance-like than patent when it comes to refinement of the basic rights. This emerges in some of the main differences between patent and copyright law with respect to independent invention or creation and compulsory licensing.

2. *Independent Invention or Creation*

Patent law, but not copyright law, gives a right against independent inventors that can be crucial in areas such as software, in which both forms of protection are in principle available, at least for different program elements (e.g., function, structure, various interfaces, code).²²⁷ Denying a defense of independent invention causes the right to rely on a more exclusion-like signal. The signal is bright-line and rough and does not require detailed evaluation of activities with respect to the invention. Also, as Norman Siebrasse has pointed out, a defense of independent creation makes protection of the original more costly; the holder of a right in the original faces a claim that the defendant copied an independent creation.²²⁸ Ruling out a defense of independent invention causes property rights to be clearer, which can be seen as a byproduct of employing the exclusion strategy. Various possible versions of an independent invention defense would be refinements characteristic of a governance regime. While they would address the problem of inadvertent infringement with its attendant surprises and would reduce an arguably excessive reward for some inventions, they would make rights more difficult to

see *Rockwell Graphic Systems, Inc. v. DEV Industries, Inc.*, 925 F.2d 174 (7th Cir. 1991) (Posner, J.).

226. The primary difficulty is defining what degree of secrecy suffices; absolute secrecy would prevent any dealings with outside contractors. See, e.g., *Metallurgical Indus., Inc. v. Fourtek, Inc.*, 790 F.2d 1195, 1200 (5th Cir. 1986) (noting that “[a]lthough the law requires secrecy, it need not be absolute,” and upholding a finding that the plaintiff’s particular modification of a well-known process was secret); RESTATEMENT OF THE LAW OF TORTS § 757 cmt. b (1939) (stating that the holder of a secret may communicate it to employees and others pledged to secrecy without losing protection, but that “a substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring the information”).

227. See, e.g., Dam, *supra* note 212; Pamela Samuelson et al., *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308 (1994); cf. Reichman, *supra* note 191 (proposing a hybrid regime).

228. See Norman Siebrasse, *A Property Rights Theory of the Limits of Copyright*, 51 U. TORONTO L.J. 1, 22-42 (2001).

define and transfer.²²⁹ Also, the more commercialization (as opposed to initial invention) is important to the patent system, the more moving from exclusion toward governance through an independent inventor defense will decrease the modularity of the rights involved.²³⁰ As usual, whether the benefits of this tailoring outweigh the costs—especially if it involves any variation according to context, such as the particular industry or features of the invention itself—is an empirical question.

3. *Compulsory Licenses*

Even more strikingly, patent and copyright differ in their degree of reliance on compulsory licenses. Patent law in the United States has never made much use of compulsory licenses.²³¹ Copyright is another story: the right to exclude in copyright is subject to a number of exceptions in which the statute provides for compulsory licenses.²³² These exceptions cover secondary transmission by cable television, production and distribution of phonorecords of musical works, use by noncommercial broadcasters, satellite retransmission, and manufacturing and importing of digital audiotape devices.²³³ Commentators

229. See Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475 (2006) (arguing for an independent invention defense); see also Mark A. Lemley, *Should Patent Infringement Require Proof of Copying?*, 105 MICH. L. REV. 1525, 1531-32 (2007) (pointing out that an independent invention defense would lessen the marketability of patent rights).

230. Samson Vermont's proposal presumes that the reward for invention is the key to the patent system. See Vermont, *supra* note 229, at 479. To the extent that commercialization is important, this would counsel caution. See Lemley, *supra* note 229, at 1530-31 (arguing that commercialization concerns are a reason for caution, but that commercialization is important only in some industries like pharmaceuticals).

231. See *Dawson Chem. Co. v. Rohm & Haas Co.*, 448 U.S. 176, 215 & n.21 (1980) (noting that "[c]ompulsory licensing is a rarity in our patent system" and that compulsory licensing of patents has often been proposed but never enacted); W.R. CORNISH, *INTELLECTUAL PROPERTY: PATENTS, COPYRIGHT, TRADE MARKS AND ALLIED RIGHTS* 254 (3d ed. 1996) (remarking on "[t]he hostility of the United States to the very idea of compulsory patent licensing").

232. On the four compulsory license provisions of the 1976 Copyright Act, see Paul Goldstein, *Preempted State Doctrines, Involuntary Transfers and Compulsory Licenses: Testing the Limits of Copyright*, 24 UCLA L. REV. 1107, 1127-39 (1977). The jukebox compulsory license of an earlier section 116 of the 1976 Copyright Act was considered incompatible with the Berne Convention and was repealed and replaced with a voluntarily negotiated system. See 17 U.S.C. § 116 (2000).

233. 17 U.S.C. § 111(c)-(e) (cable licenses); *id.* § 115 (phonorecords); *id.* § 118 (public broadcasting); *id.* § 119 (satellite retransmission); Audio Home Recording Act of 1992, Pub. L. No. 102-563, 106 Stat. 4237 (codified at 17 U.S.C. §§ 1001-1010) (digital audio tape devices).

have been divided over whether compulsory licenses really do provide significant benefits in terms of reducing transaction costs.²³⁴ At least on the cost side, however, we can say that copyright is more susceptible to compulsory licenses than is patent law because the measurement problems are not as great. Patent law is far less tailored to particular technologies,²³⁵ and the use-based exceptions that do exist in patent law, such as for experimental use, are few and not favored.²³⁶

4. Further Exceptions

Other exceptions to copyright are likewise framed in terms of use and do not have counterparts in patent law. Most prominently, the doctrine of fair use is another limitation on copyright, and, as its name implies, it involves the measurement or evaluation of uses.²³⁷ Gordon has argued that fair use is a response to “market failure” in the sense that, given the copyright holder’s rights, the copyright holder and other interested parties (including the public at large) may be unable to serve certain interests.²³⁸ One might ask, as Maureen

234. See, e.g., 2 PAUL GOLDSTEIN, *COPYRIGHT: PRINCIPLES, LAW AND PRACTICE* 19 (1989) (describing and partially endorsing the conventional wisdom).

235. The Trade-Related Aspects of Intellectual Property Rights (TRIPS) agreement contains a requirement that countries offer patents for inventions regardless of the field of technology, subject to a few exceptions. Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) art. 27(1), Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, pmbl., Legal Instruments—Results of the Uruguay Round, 33 I.L.M. 1197, 1208.

236. See Eisenberg, *supra* note 178, at 1074-78 (arguing for a broad experimental use exception); Kenneth W. Dam, *Intellectual Property and the Academic Enterprise* 7-8 (Chi. Working Paper Series, Paper No. 68, 2d ser., 1999). As these authors have noted, courts are likely to reject the defense whenever the researcher might profit from the experimental use—a situation that is increasingly common.

237. See 17 U.S.C. § 107. The statute defines fair use in terms of purposes “such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research.” *Id.* It also calls for evaluation of the use mainly on the basis of use-based factors, which include:

- (1) the purpose and character of the use, including whether such use is of a commercial nature or is for nonprofit educational purposes;
- (2) the nature of the copyrighted work;
- (3) the amount and substantiality of the portion used in relation to the copyrighted work as a whole; and
- (4) the effect of the use upon the potential market for or value of the copyrighted work.

Id.

238. See Wendy J. Gordon, *Fair Use as Market Failure: A Structural and Economic Analysis of the Betamax Case and Its Predecessors*, 82 COLUM. L. REV. 1600, 1601 (1982) (“[T]he courts and

O'Rourke has, whether such an exception should be exported to patent law.²³⁹ On the benefit side, as O'Rourke has shown, such an approach might well serve some interests, including those of a public good character such as basic research, that receive inadequate protection from the narrow and uncertain experimental use defense in patent law.²⁴⁰ But on the cost side, the separation and evaluation of individual uses is likely to be costlier in patent than in copyright; in patent law, the scope of the right is broader and more exclusion-like in the presence of multiple, indefinite uses that are difficult to evaluate.

Other exceptions in copyright are provided for performances at agricultural fairs, horticultural fairs, or exhibitions;²⁴¹ educational copying;²⁴² first sale;²⁴³ and public performances for educational, religious, or charitable purposes.²⁴⁴ Fair use and these other exceptions can be thought of as a compulsory license with a zero royalty rate.²⁴⁵ Most recently, the DMCA provides a procedure whereby the Librarian of Congress can make exceptions, for certain classes of users, to the Act's prohibition on any circumvention of a "technological measure that effectively controls access";²⁴⁶ in other words, even in its strongest, most exclusion-like (and most controversial) form, copyright features a detailed governance regime of fine-tuned balancing between access and use.

Although these exceptions can be viewed as the product of interest group activity,²⁴⁷ the argument here is that interest groups succeeded in copyright as

Congress have employed fair use to permit uncompensated transfers that are socially desirable but not capable of effectuation through the market.").

239. See O'Rourke, *supra* note 208.

240. See *id.* at 1198-1211. This is all the more so after the Federal Circuit's decision in *Madey v. Duke University*, 307 F.3d 1351, 1361-62 (Fed. Cir. 2002) (holding that the "very narrow and strictly limited experimental use defense" does not apply when allegedly infringing conduct is in furtherance of "the institution's legitimate business objectives, including educating and enlightening students and faculty participating in these projects," and that the nonprofit status of the defendant university was not determinative).

241. 17 U.S.C. § 110(6).

242. This is an outgrowth of fair use. See *id.* § 107.

243. *Id.* § 109.

244. *Id.* § 110(4).

245. Hardy, *supra* note 221, at 253 n.96; see also MERGES ET AL., *supra* note 148, at 268-73 (discussing compulsory licenses and excuses as exceptions to intellectual property rights); Burk, *supra* note 223, at 140 (analyzing fair use as a muddy entitlement).

246. 17 U.S.C. § 1201.

247. See, e.g., Jessica D. Litman, *Copyright, Compromise, and Legislative History*, 72 CORNELL L. REV. 857, 870-79 (1987) (detailing the role of interest groups in the legislative history of the 1976 Copyright Act).

opposed to patent law in part because the costs of separating out and policing uses in copyright are lower in the first place. Notice that if the range of uses is lower or the measurement of types of uses is easier in copyright, this is likely to facilitate legislative bargaining. Many have argued that the legislative process in copyright is characterized by interest groups responding to technological change with proposals for an ad hoc addition to the law, such as a new compulsory license. This legislation is complicated, and industry groups are so involved that some have argued that Congress delegates the fashioning of copyright law to representatives of these industries.²⁴⁸ On the information-cost theory, if the range of uses is narrow, then fewer, more concentrated interests will be involved and their heterogeneity will be lower. These are among the factors that promote deals concerning institutional change.²⁴⁹ Likewise, if there is a range of relevant uses but they are easy to separate, narrow deals can be made without the expansion to additional groups of heterogeneous (and hence especially transaction-cost-increasing) interests. Interestingly, on notable occasions when potential deals did have such wider implications, copyright negotiations have broken down.²⁵⁰

B. Rewards and Prospects

These differences between patent and copyright are also reflected in the range of theories of each area. Both patent and copyright have been justified on a wide variety of partially overlapping grounds.²⁵¹ In this Section, I use information costs to explain why “rewards” for invention or “encouragement” for creation have been invoked in both areas, but “prospects” for development and commercialization-based theories are largely limited to patent law.²⁵² These patent-specific theories of prospects or commercialization are heavily

248. See Jessica Litman, *Copyright Legislation and Technological Change*, 68 OR. L. REV. 275 (1989).

249. See LIBECAP, *supra* note 113.

250. Litman, *supra* note 248, at 279.

251. See, e.g., Wendy J. Gordon, *An Inquiry into the Merits of Copyright: The Challenges of Consistency, Consent, and Encouragement Theory*, 41 STAN. L. REV. 1343 (1989); Oddi, *supra* note 3.

252. The incentive to disseminate is sometimes offered as an additional rationale for copyright. See 1 PAUL GOLDSTEIN, GOLDSTEIN ON COPYRIGHT § 1.0 (3d ed. 2006) (explaining that copyright law seeks to “encourag[e] the production of the widest possible array of literary, musical and artistic works”); Robert A. Kreiss, *Accessibility and Commercialization in Copyright Theory*, 43 UCLAL. REV. 1 (1995).

based on the high cost of measuring uses—making the governance strategy relatively more costly than the exclusion strategy.²⁵³

Patents have been justified as rewards for invention. But others have argued that they are also “prospects” that promote a variety of actions to increase the value of the invention and, in particular, to commercialize it. Copyright is more straightforwardly a reward for creation; investment in improvement and commercialization do not seem to be as important in copyright—at least as compared to patent—as reasons for granting property rights, and free speech concerns are raised by a very broad copyright.²⁵⁴ The entitlement in copyright is correspondingly narrower; it includes the right to copy and related rights.

Commentators in the reward tradition have focused on tailoring the reward to the value of the inventor’s or creator’s contribution, and this concern has led to calls for the use of liability rules, buy-outs, and cash rewards.²⁵⁵ Other, more “property-oriented” commentators have stressed the role of the patent as a prospect, allowing the patent holder (who need not be the inventor) to take actions to raise the value of the patent prospect—for example, through further research or through marketing efforts.²⁵⁶ Just how much of a reward for invention is required, or how strong the property rights for commercialization should be, is beyond the scope of this Article. But the information-cost theory suggests an important role for exclusion, especially in patent law.

In terms of the model developed here, the decision to include a wide and indeterminate range of multidimensional, difficult-to-measure uses in patent favors access-based rather than use-based rules. However one resolves issues such as the size of rewards, market power (if any), and the facilitation of

253. Another theory of patent is based on rent-seeking, *see, e.g.*, Yoram Barzel, *Optimal Timing of Innovations*, 50 *REV. ECON. & STAT.* 348 (1968); Mark F. Grady & Jay I. Alexander, *Patent Law and Rent Dissipation*, 78 *VA. L. REV.* 305 (1992); Jack Hirshleifer, *The Private and Social Value of Information and the Reward to Inventive Activity*, 61 *AM. ECON. REV.* 561 (1971), although one of the functions of the patent prospect on Kitch’s theory is to communicate claims and reduce duplicative effort, *see* Kitch, *supra* note 4, at 278.

254. This is not to say that commercialization is of no concern in copyright. Copyright is sometimes justified on grounds of dissemination as well as creation. *See, e.g.*, *Eldred v. Ashcroft*, 537 U.S. 186, 188, 207, 228 (2003) (noting that Congress had a rational purpose in extending the term of copyright to promote the restoration and dissemination of old works). *But see id.* at 239, 260 (Stevens, J., dissenting) (arguing that restoration and dissemination cannot justify the extension and that overall dissemination is best promoted by the end of a copyright term). And, as copyright law is amended to cover more acts, critics cite its property-like and trespass-like features and the enclosure of the information commons. *See supra* notes 221, 223 and accompanying text.

255. *See* sources cited *supra* note 38.

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

bargaining,²⁵⁷ the wide range of interlocking and indefinite uses covered by patents leads to information-cost problems that push the system toward exclusion and a more property-like right. At any rate, it is striking that a prospect theory—under which broad rights facilitate coordination of development through control by the owner—has been proposed and debated extensively for patents but not for copyrights.²⁵⁸ Moreover, the prospect theory responds to the information problems inherent when an “asset” requires costly measurement along many margins at once—a situation that has generally received less attention than it deserves.²⁵⁹

The information-cost theory also sheds some light on the tension between the reward and prospect theories of patent law. Patents may both reward the inventor and provide property rights in order to secure a prospect. But information-cost concerns mean that this prospect (or reward) cannot be too finely tailored to the nature and value of the activity; part of the point of granting prospects is that it is difficult for officials to value the contributions that someone commercializing an invention makes to the value of a product. Finely tailored rewards for inventors require exactly this kind of valuation when it comes to the inventor’s contribution to the product. Both types of measurement—of the value of inventive and commercializing activities—will be very difficult, for many of the same reasons; separating out the contributions of inputs to novel products will consume resources. Thus, when inventive, and especially commercializing, activity presents these information problems, rewards for inventive activity will be correspondingly costly. And, to the extent that prospect theory is strong, the reward theory will tend to be weak. There is a tradeoff between the benefits of accurate measurement for rewards and the costs of measurement that are reduced by prospect-like property rights.

The information-cost theory also suggests that certain advantages to the patent owner are more important than others. Reward theory does not,

257. See, e.g., Ian Ayres & Eric Talley, *Distinguishing Between Consensual and Nonconsensual Advantages of Liability Rules*, 105 YALE L.J. 235 (1995); Ian Ayres & Eric Talley, *Solomonic Bargaining: Dividing a Legal Entitlement To Facilitate Coasean Trade*, 104 YALE L.J. 1027 (1995) (arguing that liability rules facilitate bargaining); Rachel Croson & Jason Scott Johnston, *Experimental Results on Bargaining Under Alternative Property Rights Regimes*, 16 J.L. ECON. & ORG. 50 (2000); Louis Kaplow & Steven Shavell, *Do Liability Rules Facilitate Bargaining? A Reply to Ayres and Talley*, 105 YALE L.J. 221 (1995); see also Carol M. Rose, *The Shadow of The Cathedral*, 106 YALE L.J. 2175 (1997) (noting the preference for property rules to protect certain classes of entitlements).

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

259. See Henry E. Smith, *Ambiguous Quality Changes from Taxes and Legal Rules*, 67 U. CHI. L. REV. 647, 649-53 (2000).

without more, tell us much about whether rights that are substantively broader, or longer, or greater in other dimensions are the way to achieve the optimal reward. The information-cost theory highlights the benefits of functionally broad rights, particularly when uses are interlocking and indefinite, as they typically are in patent law.²⁶⁰ The exclusion strategy's delegation of the gatekeeping function to owners is particularly important when the uses behind the gate are costly to delineate or even to foresee. Thus, among the various "levers" at the disposal of those designing an intellectual property system,²⁶¹ functionally broad rights to exclude are likely to be comparatively cost-effective.

Finally, the model here is consistent with the observation by many commentators that electronic communication and other technological advances can decrease transaction costs and lead to contractual provisions that effectively extend intellectual property protection. Whether this is a problem has been very controversial,²⁶² but the fact that it might occur follows from the model. As bargaining costs decrease, the marginal cost curve for use-based contractual devices could fall, leading to a likely substitution away from more property-like devices and to an overall more precise level of delineation and enforcement of rights. (In terms of Figure 2, the optimal switchover from exclusion to governance, denoted by s , would shift rightward.) With new technology, a bundle of in personam rights could be substituted for off-the-rack in rem rights.

C. Intellectual Property and the Mix of Exclusion and Governance

Because the model offered here makes the mixture of exclusion and governance a matter of degree, it is not surprising that neither patent nor copyright—nor real property, for that matter—instantiates an absolute or ideal right to exclude. Nonetheless, in light of the massive information-cost

260. Criticism of the prospect theory often assumes that it calls for substantively broad rights. See, e.g., Grady & Alexander, *supra* note 253, at 317; Merges & Nelson, *supra* note 95, at 875. This is less than clear, see Kitch, *supra* note 4, at 273 ("The mineral claim system restricts the area that can be claimed through rules that specify maximum boundaries in relation to the location of the mineralization. In the patent system, the applicant must limit his claims to his invention." (footnote omitted)), but both the mineral claim system and the patent system use a basic exclusionary approach to allow the holder of the claim or patent to choose among a wide variety of actions in developing the asset. Functional breadth is characteristic of rights under both systems, making Kitch's mineral analogy apt in this respect.

261. See, e.g., Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575 (2003).

262. See, e.g., sources cited *supra* note 223. For example, much controversy surrounds the DMCA.

problems presented by sorting out issues involving returns, positive and negative, from assets and related inputs, the model here sees exclusion as playing an otherwise unexpectedly large role in the worlds of both tangible and intangible assets. As in the case of real property, exclusion is predictably used as a first cut in handling problems of appropriation (in both intellectual property and property) and use conflict (mainly in property) because of its advantages in dealing in a rough way with many uncertain uses by delegating decisions to owners. The central empirical question in both property and intellectual property is when—and how easily—to overcome the basic presumption in favor of exclusion.²⁶³

What separates the information-cost theory from those of the legal realists and their successors is this basic presumption. Intellectual property commentators are quite correct in observing that there are exceptions to exclusion in property law, and analogies to these exceptions furnish grounds for thinking about cabining intellectual property rights, or for believing that injunctions should not automatically be available in all cases.²⁶⁴ Consider building encroachments. Courts have long struggled with the problem of good-faith improvers who build over the line believing that they are building on their own property. Courts and statutes have moved to a regime of damages in cases of good-faith building encroachment—but not in cases of deliberate encroachment—in part because we do not want people to expend excessive resources (multiple surveys, large buffer zones) in order to avoid trivial encroachments.²⁶⁵ Likewise, commentators have been understandably worried about inadvertent infringement in patent law, in which the edges of the claim are not always well defined *ex ante*.²⁶⁶ I leave detailed consideration of these questions for further work, but I note here that if, in certain contexts, the problem of good-faith “encroachment” became serious enough in patent law, a limited good-faith user defense with damages rather than injunctive remedies would be appropriate. Another candidate might be cases in which the literal bright-line “boundary” of the claim acquired an uncertain penumbra under the doctrine of equivalents; one could lower the protection from injunction to

263. See Smith, *Exclusion and Property Rules*, *supra* note 5, at 1021-45 (setting out a framework of presumptive exclusion and refinement through governance in the context of nuisance law).

264. See, e.g., Carrier, *supra* note 73 (surveying property doctrines that limit the right to exclude, and drawing on them for proposals to cabin intellectual property law); Lemley & Weiser, *supra* note 128 (arguing for the application of liability rules in a case-by-case analysis using traditional tests for equitable relief).

265. See, e.g., Carrier, *supra* note 73, at 74-75 (discussing building encroachments); Merrill & Smith, *supra* note 28, at 50-56, 62-67.

266. See Lemley & Weiser, *supra* note 128, at 793-96 (arguing that the uncertainty of the definition of entitlements in intellectual property is a factor favoring liability rules).

damages when there was no literal infringement but only a violation of rights under the doctrine of equivalents.²⁶⁷ In intellectual property as in property, moving from property rules to liability rules is but one method of softening the basic presumptive exclusion regime, but the information-cost advantage of basic exclusion points toward greater strength of the presumption in favor of exclusion and property rules than is often argued.²⁶⁸

Normatively, a shift from exclusion to governance is desirable in a context of both high stakes and comparative advantage for a court's *ex post* solutions. Again, at what point the switch should occur is an empirical question. Moreover, if exclusion has the information-cost advantages I describe, the switch ought to be *from* exclusion *to* governance. This setup—a basic regime of exclusion with refinement, extension, and partial override through governance—follows from the model offered here as well as some basic factual assumptions about information costs. Descriptively, such a structure seems roughly to fit both property and intellectual property—and on a smaller scale, patent and copyright—and is hard to capture from a pure legal realist point of view.

IV. DYNAMIC IMPLICATIONS

The conventional skeptical view of intellectual property rights implies an anti-Demsetzian view of their evolution. According to Demsetz's famous thesis, rising resource values should result in the emergence and development of property rights.²⁶⁹ I have argued elsewhere that the rights that emerge need not be exclusion rights; under some circumstances, an increase in value can lead to more elaborate rules governing use.²⁷⁰ For example, increased congestion on a commons can lead to stints and other norms or formal rules of proper use.²⁷¹ Increases in pollution externalities led to the development of nuisance law and later pollution controls.²⁷² If, as seems to be the case, information is becoming more important in the economy and the subject of more commercial activity, what new types of rights, if any, should we expect to emerge?

267. See *supra* note 31 and accompanying text.

268. See *supra* notes 124–132 and accompanying text.

269. See Demsetz, *supra* note 14, at 350.

270. See Smith, *supra* note 15.

271. See Rose, *supra* note 159, at 8–12.

272. See, e.g., *id.* at 9–36; see also Smith, *supra* note 15, at S482–83.

The conventional view offers a clear answer: we should anticipate more attenuation of exclusive rights and should anticipate that any increase in exclusive rights is the result of rent-seeking by producers. On this view, because information is nonrival, the more important it is, the more the nonrival aspect should dominate in the design of a legal regime for information.²⁷³ (In a sense, this view adopts the anti-Demsetzian or pessimistic Demsetzian story for the evolution of property rights in information.) More specifically, many who are skeptical of intellectual property make affirmative arguments for the increasing importance of the public domain. Exclusive intellectual property rights derogate from the public domain and thus suffer from presumptive illegitimacy.

Likewise, pointing to the importance of incentives does not by itself answer the question of whether more reliance on the exclusion strategy makes sense. The importance of the attribution of returns to rival inputs could call for greater precision in the delineation of rights to the use of those inputs—a more articulated governance regime.²⁷⁴

Regarding intellectual property as like regular property in solving coordination problems in a modular fashion makes both positions look too hasty. If information is more valuable, tracing its value is likely to be more complex than ever, particularly in the area of commercializing patentable information, in which the interaction of inventions is likely to be more intense. Each product will incorporate increasingly specialized innovations. Furthermore, the very nonrivalness of uses of information makes the problem of attributing returns for appropriation more difficult, because a nonrival use does not announce itself in the same way that a rival use does through its interference with other uses (think of classic crops and cattle). Coordinating all this activity and solving the appropriation problem may well call for *more* modularity through exclusive rights, not less. Only by ignoring the benefits of the modularity of the intellectual property system can its inferiority in a static or a dynamic sense be argued on theoretical grounds alone. The nonrival aspect of information does not preclude a need for a modular exclusion-based system to solve the coordination of commercialization when some of the inputs to the process are rival.

Thus, for more reliance on exclusion to make sense on the model presented here, we would have to be sure of two conditions. First, the benefits of exclusive rights must have risen faster than the costs of establishing them. Second, the relative costs of exclusion and governance must favor exclusion at

273. See sources cited *supra* note 38.

274. See *supra* note 15 and accompanying text.

the higher level of property rights delineation effort. Again, the essential empirical questions are how far the benefits carry us along the supply curve of property rights and how components of that curve for exclusion and governance may have shifted relative to each other, not simply the rising importance of incentives.

If it is modularity that makes intellectual property rights most like property rights, this opens up avenues for empirical guesswork. As organizational theorists apply modularity theory to the production of artifacts, we might look for analogs of the intellectual property system on smaller scales at which the designers of the system have incentives to get things right.²⁷⁵ One theme that emerges from the organizational literature is that modularity of the production process can be implemented by providing for modular design of the product itself: by specifying only how components must combine (the interface), the within-module decisions can be made independently. This keeps many options open because there is less need to commit to a decision for the sake of other decisions relevant to other components.²⁷⁶ There is a tendency for organizations to reflect the artifacts they design and produce. Furthermore, the question of whether firms should choose to bring a transaction within the firm or pursue it in a market—and, if within the firm, within a more finely articulated divisional structure or team—is parallel to the question of modularity in property. As noted earlier, the boundaries of a firm render the nexus of contracts more thing-like and partake of some of the information-cost advantages of the exclusion strategy.²⁷⁷ Once we better understand these areas and their similarities and differences, developments in one area—such as private contracting in the business organization setting—can provide some clue to the benefits and costs of exclusion and forms of governance in other areas—such as intellectual property.

I leave the development of such analogies in detail to further work. As with the most pressing public policy problems, we have to make do with the best information available. But looking for such analogies as suggested by a theory of wide applicability throughout human activity and cognition is likely to be an improvement over the current state of empirical knowledge.

275. The management and economics literature applying Simon's theory of modular systems to organizations is a start. See *supra* text accompanying notes 58-64.

276. See sources cited *supra* note 13.

277. See *supra* notes 46-57 and accompanying text.

CONCLUSION

Intellectual property is most like property when it is not viewed in isolation. Although the nature of the “resource” is very different—because it is nonrival—from the typical resource in the law of property, this is not the end of the story. Intellectual property, like property in general, can be seen as the solution of a complex coordination problem of attributing outputs to inputs. Regular property law faces this question most clearly in the law of accession. In the intellectual property area, different actors combine inputs with something that can be said to belong to the public. In accession and intellectual property we are even willing to compromise existing property rights in an identified owner or in the public, respectively, in the interests of simultaneously achieving restitution (rewarding improving inputs) and avoiding complex valuations.

As long as the innovator’s or commercializer’s rival input is valuable enough and the overall coordination problem of investment, appropriation, and consumption is complex enough, the theory of systems and our experience with human artifacts should lead us to expect a major role for modular solutions. Property, with its boundaries and rights of exclusion indirectly protecting an indefinite range of internally interacting uses, makes the system of commercializing innovation more modular. In both intellectual property and property more generally, exclusion rights—as modified by governance rules—furnish, at some positive cost, modularity to the system of providing inputs and appropriating benefits from assets. Ultimately, the desirability of intellectual property rights is an empirical question. The answer must take into account the crucial role of modularity in organizing the production of modular artifacts, which commercialized inventions themselves have increasingly become.